



Rhode Island Department of Environmental Management
Office of Water Resources – Shellfish Program

2021
Rhode Island
Shellfish
Growing Area
Classification
Report



For 2021 Calendar Year
May 2022

2021 RI Shellfish Growing Area Classification Report

Introduction

This shellfish growing area classification report and statistical evaluation summarizes 2021 pollution source surveys and fecal coliform monitoring of RI shellfish growing waters. Water samples were collected from shellfish growing areas by the RI DEM Office of Water Resources Shellfish Program and were analyzed by the RI Department of Health State Health Laboratory. The Shellfish Program monitors Rhode Island's shellfish growing waters as part of the effort to ensure the proper classification of shellfish growing waters and to ensure compliance with FDA and NSSP guidelines.

Shellfish Growing Area Fecal Coliform Monitoring

A total of 1,913 growing area fecal coliform samples and 125 pollution source samples were collected and analyzed during 2021 as part of the Shellfish Growing Area Monitoring (SGAM) Program (summary tables below). This report summarizes those data and compares growing area fecal coliform compliance statistics to NSSP fecal coliform standards.

Table 1: Summary of number of fecal coliform samples collected during monitoring of RI shellfish growing waters during 2021. Table sorted by number of samples analyzed in each growing area during each month of 2021.

Growing Area #	Growing Area Name	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Upper Narragansett Bay 1A and 1D	26	13	13	13		13	52		13		13	13
1B	Upper Narragansett Bay 1B	4	4	4	4			20		1		5	3
2	Barrington, Palmer, Warren Rivers								13				
3	East Middle Bay					22	22			22		22	22
4	Sakonnet River			21		21		21			21	21	21
5	Kickemuit River	10	9	10	10	10		10		10			19
6	East Pasasage			27			27			27			27
7	West Passage						13	13	13	13		13	
7-2	Narrow River	4	4		4		8	4	4	4	4	4	5
8	Greenwich Bay	18	17	20		18	20			20		20	40
9	West Middle Bay						13	13	13	12		13	
10	Pt. Judith & Potter Ponds				26		24	26	26	26	40		
11NG	Ninigret & Green Hill Ponds					24	24	24	24		24	24	
11QW	Quon. & Winn. Ponds					18	18	18	18		36		
12	Little Narragansett Bay					15	15	15		14			
13	Block Island Salt Pond	16	16	16	16	16	16	15	16	15	15		15
14	Offshore					7	14			16		6	2
16	Providence River	12	6	6	6		6	24		6		6	6
17	Mt. Hope Bay	16	16	16	16	16		16		5			32

Shoreline Surveys

Shoreline surveys of shellfish growing areas are conducted on a rotating basis to identify and evaluate fecal coliform and other potential pollution sources to RI shellfish growing waters. For 2021, comprehensive 12-year sanitary surveys of the Upper Bay (GA1) and the Lower Providence River (GA16) were completed. In addition, triennial update surveys or annual update surveys were completed in other shellfish growing areas as described in the table below. A total of 125 shoreline source samples were collected and analyzed during 2021 shellfish shoreline surveys (Table 2).

Table 2: Summary of number of fecal coliform samples collected during shoreline surveys of RI shellfish growing areas during 2021. Comprehensive 12-year shoreline sanitary surveys of GA1 and GA16 were completed during 2021. Annual and triennial surveys completed in other areas as noted. n/a indicates no formal shoreline survey completed for these areas that are classified as prohibited.

Growing Area	2021 Survey Type	# Source Samples Collected
1- Upper Bay	12-year	61
2-Barrington, Palmer, Warren Rivers	n/a	0
3-East Middle Bay	Annual	0
4-Sakonnet River	Annual	5
5-Kickemuit	Annual	9
6-East Passage	Triennial	2
7-West Passage	Annual	0
7-2-Narrow River	n/a	1
8-Greenwich Bay	Annual	11
9-West Middle Bay	Annual	0
10-Point Judith/Potters Ponds	Annual	3
11NG- Ninigret/Green Hill Ponds	Triennial	2
11QW-Quonnie/Winni Ponds	Triennial	4
12-Little Narragansett Bay	n/a	0
13-Block Island	Triennial	12
14-Offshore	Triennial	6
15-Seekonk River	n/a	0
16-Providence River	12-year	9
17-Mount Hope Bay	Annual	0
Total		125

HAB Phytoplankton Monitoring

RI DEM Office of Water Resources Shellfish Program and the RI Department of Health State Health Laboratory monitor RI shellfish growing waters for the presence of potentially harmful biotoxin-producing phytoplankton. The last chapter of this report is a summary of 2021 HAB phytoplankton monitoring of RI shellfish waters. There were no phytoplankton biotoxin shellfish closures in RI during 2021.

Upper Narragansett Bay (Growing Area 1)
12 Year Sanitary Shoreline Survey
Calendar Year 2021



Photo: RI DEM, Rocky Point Pier in Upper Narragansett Bay, RI.

Office of Water Resources – Shellfish Water Quality
Rhode Island Department
of
Environmental Management
Office of Water Resources
Shellfish Program

This 12-year sanitary shoreline survey was compiled with guidance of the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish 2019 Revision.

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Acronyms and Terms

<u>BMP:</u>	Best Management Practice
<u>CSO:</u>	Combined Sewer overflow
<u>FDA:</u>	Food and Drug Administration
<u>ISSC:</u>	Interstate Shellfish Sanitation Conference
<u>MPN:</u>	Most Probable Number
<u>NOAA:</u>	National Oceanographic and Atmospheric Administration
<u>NSSP:</u>	National Shellfish Sanitation Program
<u>OWTS:</u>	On-site Wastewater Treatment Systems (Formerly ISDS, Individual Sewage Disposal Systems)
<u>RIDEM:</u>	Rhode Island Department of Environmental Management
<u>RIPDES:</u>	Rhode Island Pollutant Discharge Elimination System
<u>SGAM:</u>	Shellfish Growing Area Monitoring
<u>SSCA:</u>	State Shellfish Control Authority
<u>SWMPP:</u>	Storm Water Management Program Plan
<u>TMDL:</u>	Total maximum Daily Load
<u>WWTF:</u>	Waste Water Treatment Facility

"Controlled relay" means the transfer of shellstock from a growing area classified as restricted or conditionally restricted to a growing area classified as approved or conditionally approved for the purpose of reducing pathogens as measured by the coliform indicator group or poisonous and deleterious substances that may be present in the shellstock by using the ambient environment as the treatment process.

1. Executive Summary

A comprehensive 12-year shoreline survey of Upper Narragansett Bay shellfish Growing Area 1 (GA1) was conducted during the summer and fall of 2021 by staff from RIDEM's Office of Water Resources Shellfish Program. The survey involved a shoreline reconnaissance of the entire study area to locate and catalog pollution sources and collect bacteriological samples from all sources actively flowing into the survey area. This survey was conducted following the guidance of the 2019 NSSP Model Ordinance.

The primary objective of the shoreline survey was to identify and characterize any new sources of pollution potentially impacting the shellfish in the growing area, to reevaluate point and non-point sources identified during previous surveys, and to update information regarding the sampling of previously identified sources. This report updates previous surveys and includes recent shoreline survey results and a statistical summary of recent shellfish growing area fecal coliform results for comparison with NSSP compliance criteria for safe harvest of molluscan shellfish.

The 2021 shoreline survey investigate eighty-one (81) shoreline sources that could potentially deliver fecal coliform pollution to the growing area. Analysis of water samples demonstrated that none of these sources compromise the microbial water quality of the shellfish growing area. A review of fecal coliform data indicated that the conditionally approved and approved portions of the growing area meet NSSP criteria for safe shellfish harvest. A review indicated that the growing area management plan, sampling schedule, and sampling station locations support the current classification of the growing area. The findings of the shoreline survey support the current classification and legal description of the growing area and no classification changes are recommended.

2. Description of the Growing Area

A. Location

Upper Narragansett Bay Growing Area 1(GA1) is the area of water south of a line from Conimicut Point in Warwick across the mouth of the Providence River to Nayatt Point in Barrington. The Upper Bay growing area continues southward to a line from the point of Warwick Neck eastward to the northern tip of Prudence Island and then southeastward to the southernmost tip of Poppasquash Point. The growing area includes the waters of the Warren River and Smith's Cove south of a line from the southern tip of Adams Point in Barrington to Jacobs Point in Bristol. This northern line coincides with the southern extent of the prohibited shellfish closure line for the Barrington, Palmer and Warren Rivers (Growing Area 2). Growing Area 1 includes the waters of Old Mill Cove/ Creek in Warwick and those waters referred to as "Mill Gut" in Colt State Park in the town of Bristol.

B. Physical Description

Narragansett Bay is New England's largest estuary covering approximately 106 square miles (275 km²). If contiguous Mount Hope Bay and the Sakonnet River are included then the combined area is almost 150 square miles (389 km²) of interconnected tidal waters which help define Rhode Island as the "Ocean State". The Upper Narragansett Bay Conditionally Approved shellfish growing area (GA1; Figure 1) is the northern-most and inland-most section of Narragansett Bay proper and is located approximately eight miles south of Providence, RI. The Upper Bay is approximately bounded on the north by the mouth of the Providence River near Conimicut Point, the Barrington shoreline, and the mouth of the Warren River near Jacob's Point. The south side of the Upper Bay is bounded by Prudence Island. The Upper Bay is bounded to the west by the shoreline of the City of Warwick, RI and to the east by the shore of the Town of Bristol, RI (Figure 1).

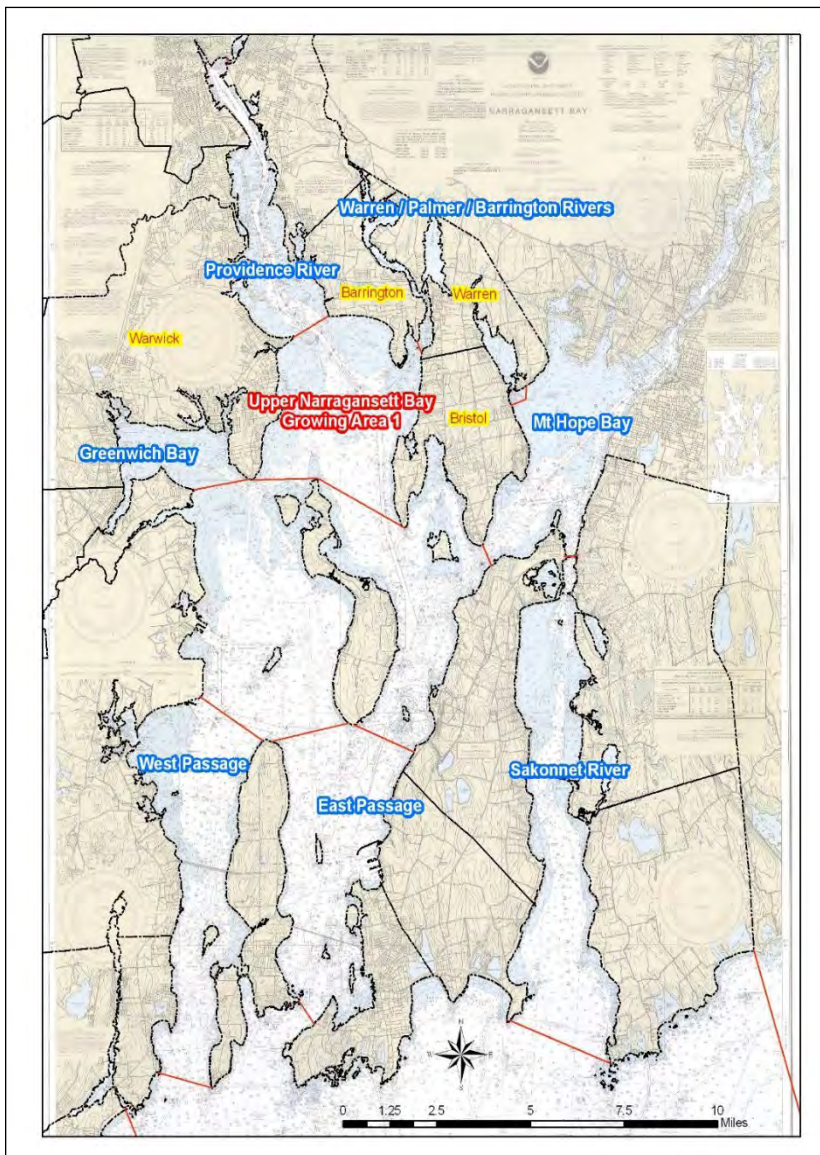


Figure 1. Location of Upper Narragansett Bay growing area 1 (GA1) showing surrounding towns and water bodies

Upper Narragansett Bay was formed as glacial melt-water accumulated behind terminal glacial moraines to form glacial Lake Narragansett approximately 20,000 years before the present (Oakley and Boothroyd, 2013). As the Laurentian ice sheet retreated and sea level rose, marine waters transgressed inland and flooded into freshwater Lake Narragansett such that the Upper Bay was similar to its current estuarine condition approximately 7,000 to 8,000 years before present (Boothroyd and August, 2008). Analysis of sediment cores taken in the Upper Bay have documented the presence of bivalve shellfish (Oysters) inhabiting the estuarine waters of the Upper Bay approximately 8,000 years before present (Peck and McMaster, 1991).

Upper Narragansett Bay Growing Area 1 is currently divided into two sub areas referred to as Conditional Area “A” (northern portion) and Area “B” (southern portion). The dividing line between the two sub-areas starts on the west shoreline at the southeast corner of the Rocky Point pier in Warwick to the southwest (landward) corner of the Colt State Park pier in Bristol. The Mill Gut at Colt State Park is considered to be within Conditional Area A.

Conditional Area A consists of approximately 5,925 acres (9.25 sq miles) while Area “B” is approximately 3,712 acres (5.8 sq. miles) (RIDEM/GIS). The longest reach is 5.1 miles from the Providence River to Poppasquash Point, while it is 3.76 miles wide. The Upper Bay contains the major shipping channel referred to as the Rumstick Neck reach that connects the Port of Providence to the East Passage and the Atlantic Ocean. The navigation channel, which has a depth of approximately 40 ft (11-12 meters), crosses the northeastern corner of the growing area.

The average depth of Area A is approximately 13 feet while Area B averages around 21 feet. These relatively shallow depths allow for commercial quahog handrakers, who use their own muscle power to harvest quahogs with bull rakes and tongs to work these waters with relative ease. Quahogs are the most economically important fishery resource harvested from Narragansett Bay. In 2020, 502 commercial fishers landed 342,010 pounds of bay quahog meats in Rhode Island worth \$3,392,338 (RIDEM 2022 Sector Management Plan). Sixty- to seventy percent of Rhode Island’s Bay Quahog landings are harvested from Upper Narragansett Bay Growing Area 1 (RIDEM 2018 Sector Management Plan).

i. Depth and bottom topography:

The Upper Narragansett Bay growing area (Figure 1) is a basin having a 25-30 foot deep central area fringed by shallow areas less than 20 feet deep along the Warwick coast to the west and the Barrington Beach – Rumstick Shoal area to the north and northeast (NOAA chart 13221). Several deeper holes of up to 50 feet deep are located north of Patience Island and south of Poppasquash Neck. The general basin shape of the Upper Bay is interrupted by Ohio Ledge, a 15-18 foot shallow bank located in the center of the Upper Bay. The Port of Providence is New England’s second largest deep-water port, and a 40 foot (12 m) depth, 650 foot (200 m) wide dredged ship channel transects GA1,

running approximately six miles through the Upper Bay from the mouth of the Providence near Conimicut Light to the East Passage on the eastern side of Prudence Island.

The bottom sediments in Upper Bay GA1 are generally silty sand and mud with a transition to a sandy bottom along the northwestern shore (Conimicut Point area) and the northern shore (Barrington Beach). Pockets of gravel and gravelly sediment are interspersed with the predominantly silty sand and mud bottom of the Upper Bay (USGS, 2003).

ii. Freshwater input, tides, and salinity:

The watershed for Upper Narragansett Bay comprises almost a thousand square miles and includes the watersheds for the Blackstone River, the Ten Mile River, the Woonasquatucket and Moshassuck Rivers, the Warren, Pawtuxet and Seekonk Rivers and the Providence River. Land use within the watershed is dominated by recreational, open, agricultural, water and wooded forest equaling approximately 70% of the overall watershed land use. The remaining 30% of the watershed is comprised of residential, urban, commercial, transportation and industrial land uses (NBEP, 2017). The majority of the urban land use is congregated around the major tributaries to the Upper Bay. This is a historical consequence of the area's industrial beginnings where water powered the mills and factories and the rivers served as major transportation routes throughout the region. The outlying areas were historically agricultural lands which as the population in the region grew, converted to residential and the accompanying commercial and transportation uses needed to support these new residents.

The largest sources of freshwater input to Narragansett Bay flow into GA1 via the Providence River. Approximately 68% (Spaulding and Swanson, 2008) to 85% (Pilson, 1985) of total freshwater flow to Narragansett Bay is from the Blackstone, Moshassuck, Woonasquatucket and Pawtuxet Rivers. These major freshwater rivers provide drainage to approximately 1,754 km² of the Blackstone, Woonasquatucket, Moshassuck and Pawtuxet watersheds and this drainage flows into the Providence River which flows into Upper Bay GA1. Upper Narragansett Bay has strong semi-diurnal tides, with an average tidal range of 1.16 meters at Conimicut Point (Spaulding and Swanson, 2008). Similarly, NOAA operates a real-time tide gauge at Conimicut Light in the northern section of GA1 near the mouth of the Providence River where the mean tidal range is 1.27 meters (4.17 feet; NOAA 2020). Tidal range during spring tides at Conimicut Point averages 1.43 meters (4.69 feet; Spaulding and Swanson, 2008).

Because of the riverine freshwater input to the north and strong tidal input from the south, salinity in Upper Bay GA1 increases from approximately 25 to 28 ppt at the surface near Conimicut Light to approximately 27 to 29 ppt at the surface just north of Prudence Island (FDA, 1970; Codiga, 2012). However, surface salinity can intermittently decline in response to freshwater input with values as low as 16.5 ppt (Conimicut Point) and 24 ppt (north of Prudence) recorded during wet weather periods having elevated river flow (Smayda and Borkman, 2008). Bottom salinity is less variable and tends to fall between 29 and 31 ppt (Codiga, 2012). The water column of the Upper Bay is often stratified due

to the input of buoyant freshwater (Hicks, 1959, FDA, 1970) and microbial pathogen indicators such as fecal coliform are consistently more abundant in the surface waters than the bottom waters (FDA, 1970, Watkins and Rippey, 1990).

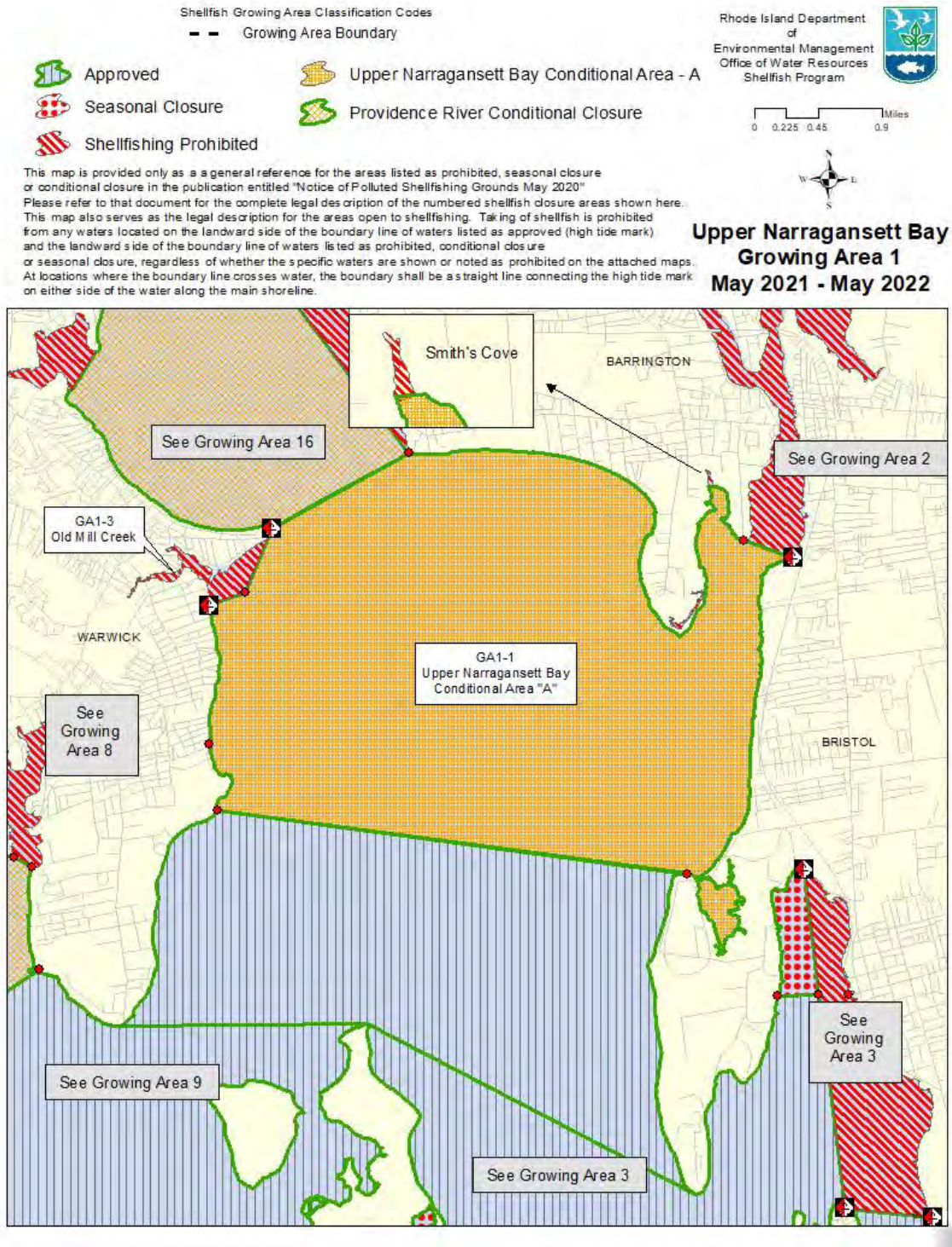
C. Latest Survey

RIDEM's Office of Water Resources personnel conducted the last comprehensive 12-year shoreline survey of the growing area in 2009. Triennial shoreline surveys of the growing area were completed in 2012, 2015, and 2018. Annual updates were completed in the intervening years. These prior shoreline surveys are available in the Program's permanent files. The 2021 shoreline survey is a comprehensive 12-year survey.

D. Current Classification Map

The current (May 2021 to May 2022) shellfish classification map for Upper Narragansett Bay (GA1) is below.

Figure 2: Upper Narragansett Bay Growing Area 1 (GA1) current (May 2021) classification map.



E. Legal Description

The current (May 2021) legal description of GA1 includes prohibited areas (GA1-3) and conditionally approved areas (GA1-1) as described below and as shown in Figure 2.

Prohibited areas, Growing Area 1 – Upper Narragansett Bay

GA1-3 All waters north and west of a line extending from the Rhode Island Department of Environmental Management range marker on a pole located on Conimicut Point, to the intersection of two lines (a line extending from the DEM marker at Conimicut Point to the extension of Sam Gorton Avenue in Warwick and a line extending east of the extension of Whipple Avenue in Warwick) marked by a DEM buoy to the DEM range marker on a pole located at the extension of Whipple Avenue in Warwick including Old Mill Creek in its entirety..

(See also: the conditional closures under Upper Narragansett Bay)

Conditionally approved areas, Growing Area 1 – Upper Narragansett Bay

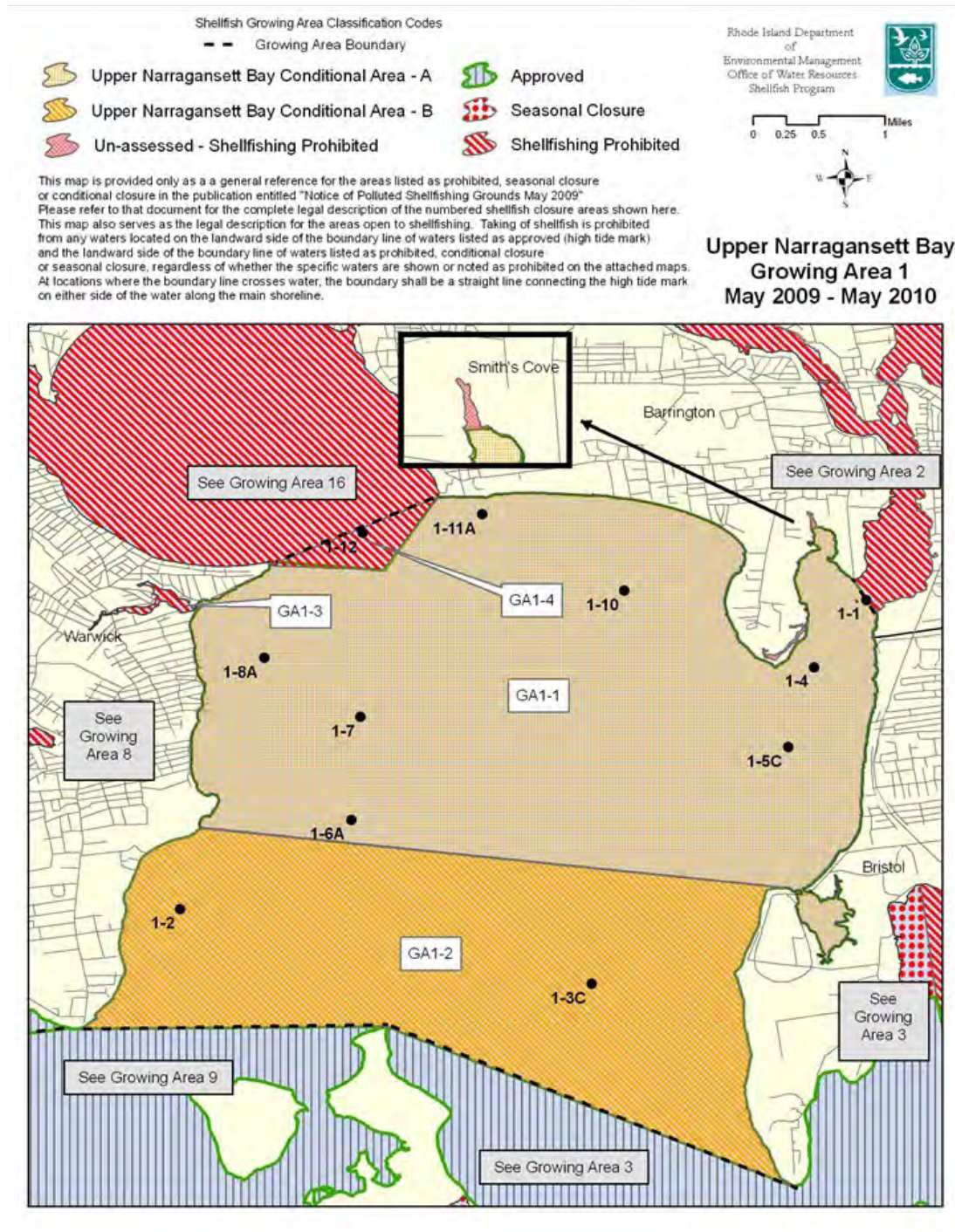
GA1-1 Upper Narragansett Bay Conditional Area A:

All waters north of a line from the southeast corner of the Rocky Point jetty in Warwick to the southwest corner of the Colt State Park pier in Bristol and south of a line from the Rhode Island Department of Environmental Management range marker at Jacobs Point in Warren, to the flag pole at #178 Adams Point Road on Adams Point in Barrington, and south of a line from the center of the Old Tower at Nayatt Point, to the Rhode Island Department of Environmental Management range marker on a pole located on Conimicut Point, and east and south of a line extending from that range marker on Conimicut Point, to the intersection of two lines (a line extending from the Rhode Island Department of Environmental Management range marker at Conimicut Point to the extension of Sam Gorton Avenue in Warwick, and a line extending east of the extension of Whipple Avenue in Warwick) marked by a DEM buoy, to the DEM range marker on a pole located at the extension of Whipple Avenue in Warwick.

F. Previous Classification Map

The shellfish classification map of GA1 in effect during the last 12-year survey (May 2009) is shown below.

Figure 3: May 2009 shellfish classification map.



G. Comparison of current and previous classification maps

There have been several classification changes in the Upper Bay growing area between the 2009 and the current (2021) classification. Continuous improvements in stormwater management and WWTF upgrades have allowed major upgrades in the classification of Upper Narragansett Bay Growing Area 1 since 2009, as summarized below.

2011: Classification of the ‘Conimicut Triangle’ area of GA1 changed from prohibited to conditionally approved with a 0.5” rain 7-day closure.

2017: Improvements in fecal coliform water quality of the Upper Bay were documented during 2014-2017 after the Narragansett Bay Commission (NBC) completed Phase I and II of a CSO project which captures combined sewage in a tunnel for pump back and treatment at the Fields Point WWTF. These improvements allowed several classification changes, as summarized below. The analyses supporting these classifications changes may be found in the relevant editions of the GA1 Conditional Area Management Plan.

- Conimicut Triangle was merged with Upper Bay Area A.
- Upper Bay Area A rain closure amount increased from 0.8” to 1.2” with a 7-day closure.
- Upper Bay Area B classification changed from conditionally approved with a 1.5” rain closure to approved

2019: Conditional Area D near the mouth of Buckeye Brook and Mill Cove was created in response to fecal coliform pollution entering Upper Bay GA1 via Buckeye Brook. Monitoring showed wet weather fecal coliform elevations. The area was managed with a 0.8” 7-day rain closure.

2021: Conditional Area D eliminated. Area D experienced dry weather fecal coliform elevations that resulted in exceedance of NSSP standards at stations closest to Buckeye Brook and Mill Cove. In response, a 52 acre area (GA1-3) at the mouth of Mill Cove was classified as prohibited and the remainder of former Conditional Area D was merged with Upper Bay Area A.

Table 1 (below) summarizes the growing area classification changes that have taken place between the 2009 and 2021 12-year shoreline surveys.

Table 1: Comparison of Growing Area 1 (GA1, Upper Narragansett Bay)classification at time of 2009 and 2021 12-year sanitary surveys.

	2009		2021	
	Classification	Conditional Criteria	Classification	Conditional Criteria
Area A	Conditionally approved	0.5" rain, 7-day closure	Conditionally approved	1.2" rain, 7-day closure
Area B	Conditionally approved	1" rain, 7-day closure	Approved	-
Conimicut Triangle	Prohibited (Conditionally approved May 2011)	-	Conditionally approved	1.2" rain, 7-day closure

3. Pollution Source Survey

A. Personnel

Steve Rogers, Steve Engborg and Anthony Crudale, Biologists, of the RIDEM Office of Water Resources coordinated and conducted a shoreline reconnaissance of Upper Narragansett Bay Growing Area 1 with the assistance of other staff members at RIDEM Office of Water Resources.

B. Survey procedures

Special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the growing area but may contribute to pollution), actual (discharging at the time of the survey), or potential (not actively discharging at the time of the survey but considered a possible source of pollution). Bacteriological samples were collected in sterile, four-ounce (125 mL) Nalgene bottles from all sources that were actively flowing at the time of the field study. Samples were stored on ice in a portable cooler and transported to the Rhode Island Department of Health Laboratory at the end of each field day following DOH time-temperature guidance. The mTEC method, as described in Standard Methods for the Examination of Water and Wastewater, was used for analysis.

The 2021 shoreline survey took place over several days during June through September 2021. The majority of the survey took place on August 2-4, 2021 (6 to 8 days after 0.16” rain at TF Green Airport; note that samples were collected on 8/4/2021 *before* rain started that night), and August 17-18, 2021 (11 and 12 days after 1.48” rain at TF Green Airport).

C. Summary of Sources and Locations

Eighty-one (81) actual or potential sources were visited or identified during this shoreline survey, excluding marinas. Fifty-two (52) of the eighty-one sources were not actively flowing or could not be located at the time of the shoreline survey. The remaining twenty-nine (29) sources having flows were sampled. Locations of all sources are shown in Figure 4 and Table 2 has both 2021 and 2009 fecal coliform results from all flowing sources.

Figure 4: Location map of shoreline sources sampled as part of the 2021 Upper Narragansett Bay (Growing Area 1) shoreline survey. Fecal coliform monitoring station locations are shown by boat symbols.

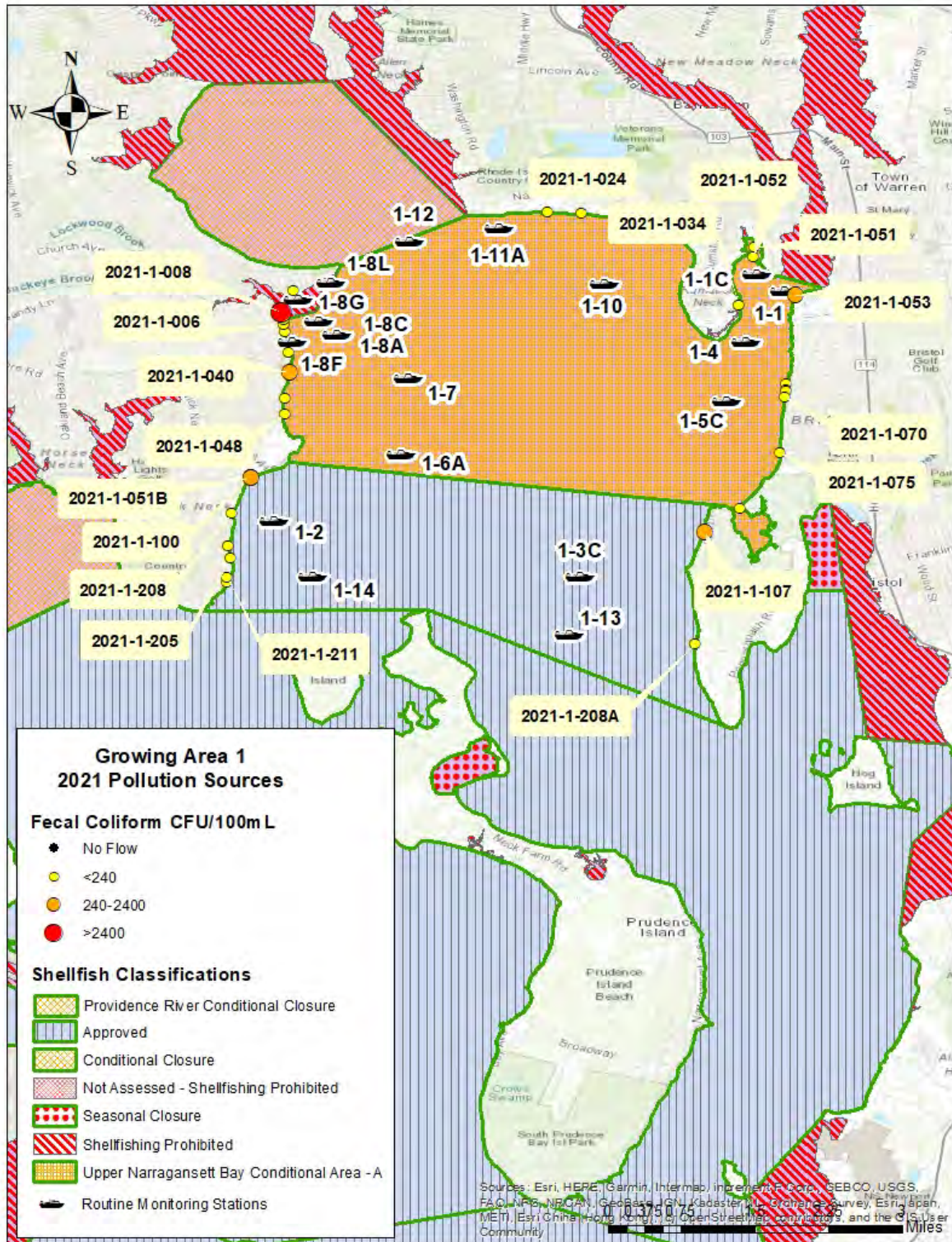


Table 2: Potential pollution sources sampled during 2021 shoreline survey with source location, fecal coliform results, and flow rates.

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2009 Results (MPN)	2021 Results mTEC (cfu/100ml)	2021 Volumetric Flow (cfs)
2021-1-001	6/24/2021	41.713845	-71.364543	Stream	P	A	I	430	2	-
2021-1-002	8/4/2021	41.72562	-71.32703	Western most tidal outflow draining marsh Barrington Beach	CA	A	D	930	200	0.306
2021-1-002A	8/4/2021	41.72535	-71.32207	Outflow from center marsh southeast of RI Country Club	CA	A	D	-	100	0.2805
2021-1-003	8/2/2021	41.704591	-71.364855	Outlet Wetland	CA	CNL		750	NS	-
2021-1-004	8/2/2021	41.704831	-71.365128	Outlet Marsh	CA	A	D	0	100	Trickle
2021-1-005	8/2/2021	41.70794	-71.365809	18' RCP	CA	A	D	2	100	-
2021-1-006	8/2/2021	41.708917	-71.365942	Stream from Upland Marsh	CA	A	D	2	100	0.07
2021-1-500	8/2/2021	41.709706	-71.365888	12" Concrete pipe, dissipates in sand before bay	CA	A	D	-	100	Trickle
2021-1-501	8/2/2021	41.7076536	-71.36558	Stream Draining Marsh	CA	A	D	-	100	0.1058
2021-1-007	8/2/2021	41.6997	-71.29176667	4" Black flexible pipe 200' S Beach Rd	CA	CNL		93	NS	-
2021-1-007A	8/18/2021	41.70047	-71.29163	18" CMP at end of Beach Road	CA	CNL		-	NS	-
2021-1-008	8/2/2021	41.710767	-71.366338	18 CPVC	P	A	D	4	4900 N 46 S <2	Trickle
2021-1-008 (Follow up)	3/14/2022				P	A	D		<2 N <2 S <2	

2021-1-017	8/4/2021	41.68678	-71.3697	Culvert draining pond at South End of Rocky Pt Beach	A	A	D	9	820 N <2 S <2	Trickle
2021-1-017 (Follow up)	3/14/2022				A	A	D		<2 N <2 S <2	2.3562
2021-1-020	8/4/2021	41.725331	-71.333973	12 cmp	CA	P	D	0	NF	-
2021-1-021	8/4/2021	41.725411	-71.333353	4 clay	CA	P	D	0	NF	-
2021-1-022	8/4/2021	41.725614	-71.327125	Outlet Marsh	CA	CNL		230	NS	-
2021-1-023	8/4/2021	41.725357	-71.322248	Outlet Marsh	CA	CNL		1100	NS	-
2021-1-025	8/3/2021	41.725079	-71.317777	ASSF SWALE	CA	P	I	0	NF	-
2021-1-026	8/3/2021	41.72476	-71.31568	ASSF SWALE	CA	P	I	0	NF	-
2021-1-027	8/3/2021	41.723507	-71.311432	ASSF SWALE	CA	P	I	0	NF	-
2021-1-030	8/17/2021	41.71632	-71.306758	18 inch RCP	CA	P	D	430	NF	-
2021-1-031	8/4/2021	41.715216	-71.3072	12 RCP STEADY TRICKLE	CA	P	D	9	NF	-
2021-1-032	8/17/2021	41.712016	-71.30729	8 IN CLAY	CA	P	D	2	NF	-
2021-1-033	8/17/2021	41.71172	-71.307269	5 IN IRON DRIP	CA	P	D	2	NF	-
2021-1-034	8/4/2021	41.711849	-71.298761	MARSH OUTLET 20'x3'	CA	A	D	2	100	15.3
2021-1-040	8/2/2021	41.70177	-71.365083	Stream	CA	A	D	460	300 N 40 S 80	0.1058
2021-1-040 (Follow up)	3/14/2022				CA	A	D		<2 N <2 S <2	.3264
2021-1-041	8/17/2021	41.700793	-71.365447	Stream	CA	CNL		930	NS	-
2021-1-043	8/2//2021	41.697993	-71.365801	12" RCP draining onto beach. Lots of green algae in pipe and stream bed	CA	A	D	2	100	0.04233
2021-1-044	9/15/2021	41.69704	-71.366144	STREAM TRICKLE	CA	CNL		1500	NS	-

2021-1-045	9/15/2021	41.697065	-71.365884	SEEP IN WALL	CA	CNL		2	NS	-
2021-1-046	9/15/2021	41.696528	-71.366026	5" Pipe in retaining wall	CA	P	D	9	NF	-
2021-1-047	9/15/2021	41.695425	-71.366178	4" PVC submerged in sand	CA	P	D	2	NF	-
2021-1-048	8/3/2021	41.695648	-71.365719	12" RCP partially submerged	CA	A	D	93	200	-
2021-1-049	9/15/2021	41.69288	-71.364075	ASSF	CA	CNL		0	NS	-
2021-1-050	8/3/2021	41.71349	-71.299182	Tidewater receding, no water flowing from marsh	CA	P	D	-	NF	-
2021-1-050A	9/15/2021	41.692356	-71.364436	ASSF	CA	CNL		0	NS	
2021-1-051	8/17/2021	41.720347	-71.29652	Stream	CA	A	D	-	7	-
2021-1-051A	9/15/2021	41.686842	-71.36973	Stream	CA	CNL		240	NS	-
2021-1-051B	8/3/2021	41.686222	-71.370731	Spring at edge of beach pooling along sand above high tide line. (Not reaching receiving waters)	CA	A	D	-	1000	Trickle
2021-1-051B	3/14/2022				CA	A	D		<2 N <2 S <2	.0529
2021-1-052	8/17/2021	41.719006	-71.296714	IN STREAM	CA	A	D	-	20	-
2021-1-053	8/17/2021	41.713187	-71.290387	Stream	CA	A	D	-	820 E 34 W 4	0.1821
2021-1-054	8/4/2021	41.703121	-71.291066	Stream	CA	CNL		-	NS	-
2021-1-060	8/4/2021	41.701261	-71.291355	24" CMP	CA	CNL		230	NS	-
2021-1-061	8/4/2021	41.700444	-71.291924	8" CMP	CA	CNL		0	NS	-
2021-1-062	8/4/2021	41.700552	-71.291212	3" PVC	CA	CNL		0	NS	-
2021-1-063	8/4/2021	41.700294	-71.291716	Several Small Pipes	CA	CNL		2	NS	-

2021-1-064	8/17/2021	41.70013	-71.291749	8" round PVC, Doesn't reach water	CA	P	I	4	100	Trickle
2021-1-066	8/4/2021	41.699914	-71.291777	GW SEEP	CA	CNL		0	NS	-
2021-1-067	9/15/2021	41.69977	-71.291812	4" CPP	CA	CNL		2	NS	-
2021-1-069	8/17/2021	41.699277	-71.291913	Heavy Flow over Rocks, GW Seep	CA	A	D	4	100	Trickle
2021-1-068	8/17/2021	41.699171	-71.291857	GW SEEP	CA	P	I	4	100	Trickle
2021-1-070	8/17/2021	41.698273	-71.292002	Stream, Pools before reaching water	CA	P	D	460	100	Trickle
2021-1-071	8/4/2021	41.697967	-71.292064	4" Steel (rusted in seawall)	CA	P	D	0	NF	-
2021-1-072	8/4/2021	41.697138	-71.292238	6" PVC	CA	CNL		0	NS	-
2021-1-073	8/4/2021	41.69609	-71.292251	Single 12" pipe by stairs	CA	P	I	0	NF	-
2021-1-074	8/4/2021	41.695901	-71.292287	6" CPP	CA	CNL		0	NS	-
2021-1-075	9/15/2021	41.690081	-71.292687	36" CMP STEADY	CA	A	D	460	100	-
2021-1-076	8/4/2021	41.689713	-71.292621	4" PVC	CA	P	D	0	NF	-
2021-1-077	8/4/2021	41.688804	-71.292749	4IN STEEL PIPE TRICKLE	CA	P	D	0	NF	-
2021-1-078	8/4/2021	41.688045	-71.292959	STREAM FROM UPLAND MARSH	CA	P	I	0	NF	-
2021-1-078A	8/4/2021	41.687568	-71.29313	STREAM FROM UPLAND MARSH	CA	P	I	0	NF	-
2021-1-100	8/3/2021	41.68625	-71.37068	Groundwater Seep	A	CNL		0	NS	-
2021-1-101	8/4/2021	41.686084	-71.294977	24" CPVC	CA	CNL		0	NS	-
2021-1-102	8/4/2021	41.686023	-71.294962	24" CPVC	CA	CNL		0	NS	-
2021-1-103	8/4/2021	41.683315	-71.297199	24" CPVC	CA	P	D	0	NF	-

2021-1-104	8/4/2021	41.683039	-71.297452	24" CPVC	CA	P	D	0	NF	-
2021-1-105	9/15/2021	41.681802	-71.298696	MILL GUT	CA	A	D	9	100	-
2021-1-106	8/4/2021	41.682089	-71.302404	12" PVC	CA	P	D	0	NF	-
2021-1-107	9/15/2021	41.678159	-71.303837	24" PVC	A	A	D	9	300 N 13 S 4	-
2021-1-108	9/15/2021	41.656966	-71.30481	DRY STREAM BED	A	P	I	0	NF	-
2021-1-200	8/3/2021	41.673081	-71.374859	Stream from upland	A	P	I		NF	-
2021-1-201	8/3/2021	41.671721	-71.374068	ASSF	A	CNL		0	NS	-
2021-1-202	8/3/2021	41.670962	-71.37427	24" RCP. Broken and overgrown.	A	P	I	24001	100	Trickle
2021-1-203	8/3/2021	41.669296	-71.375694	18" RCP	A	P	D	2	NF	-
2021-1-204	8/3/2021	41.667758	-71.376994	12" Clay Pipe	A	P	D	0	NF	-
2021-1-205	8/3/2021	41.674423	-71.373818	2" pipe from retention wall, does not reach receiving waters	A	P	I	2	100	-
2021-1-206	8/3/2021	41.674572	-71.373925	6" metal pipe in stone wall at 164 Beacon Ave, Warwick. Lots of vegetation.				2	CNL	-
2021-1-207	8/3/2021	41.676323	-71.374119	GW STREAM, dissipates across rocks	A	P	I	4300	100	Trickle
2021-1-208	8/3/2021	41.680994	-71.373592	8" Iron Pipe	A	A	I	23	100	Trickle
2021-1-209	8/3/2021	41.682113	-71.372984	6" CLAY AT BASE OF WALL BOAT HOUSE	A	P	D	43	NF	-
2021-1-210	8/3/2021	41.684628	-71.37198	Seep in wall	A	P	I	7	NF	-
2021-1-211	8/3/2021	41.671689	-71.374236	2" PVC on top of ground in vegetation.42 Broadview Ave, Warwick.	A	P	I	-	100	0.01114

D. Detailed Description of Major Sources

Of the eighty-one (81) sources visited during this survey, twenty-nine (29) were found to be flowing at the time of visit. The remaining fifty-two (52) sources either could not be located or had no flow at the time of visit and therefore could not be sampled. The DEM shellfish program uses the following criteria for categorizing shoreline pollution sources:

- > 2,400 cfu/100 ml and greater than a trickle flow: Investigation and at least annual resampling.
- 240 to 2,400 cfu/100 ml and greater than trickle flow: Resample each triennial survey.
- < 240 cfu/100 ml: Resample each 12-year survey.

Only one (1) source (2021-1-008) yielded a result of greater than 2,400 cfu/100 ml. Five (5) of the twenty-nine (29) sources sampled yielded fecal coliform results of 240 to 2,400 cfu/100 ml. Twenty-three (23) sources had fecal coliform levels of less than 240 cfu/100 ml. The six(6) sources having fecal coliform of >240 cfu./100 ml are described and evaluated below.

Source 2021-1-008 is an 18” corrugated plastic drain pipe which drains storm water from the extension of Lippitt Ave in Warwick (Fig.5) . When sampled in 2009 this source had a result of 4 MPN/100 ml. When sampled in 2021, the source had a fecal coliform concentration of 4,900 cfu/100 ml and a trickle flow. This was the highest fecal coliform result of the survey. However, in stream samples collected just north and south of the source came back with results of 46 cfu/100mL (North) and <2 cfu/100mL (South) showing rapid dilution of the source in the receiving waters. This source has not had elevated fecal coliform results in the past, with a result of 4 MPN/100 ml documented in 2009. A follow up sample collected on 3/14/2022 yielded a result of <2 cfu/100 mL. At the time of this follow up, the pipe was observed to have significant flow. The combination of increased flow and reduced fecal coliform observed on 3/14/2022 suggests that the elevated result observed on 8/2/2021 were likely caused by lack of flow and stagnation of the water near the outfall of the pipe.



Figure 5: Source 1-008, an 18” corrugated plastic drain pipe draining storm water from the extension of Lippitt Ave in Warwick.

Source 2021-1-017 is a culvert draining an upland pond at the south end of Rocky Point State Park beach. When sampled in 2021, the result from the source was 820 cfu/100 ml with a trickle flow. Companion instream samples had <2 cfu/100 ml in the receiving waters, demonstrating rapid dilution and little negative impact from this source on the microbial water quality of the growing area. The source was resampled on 3/14/2022 showing a result of <2 cfu/100 ml. Follow-up results indicate that elevated results observed on 8/4/21 are likely due to low flow and stagnation in the outflow from the upland pond



Figure 6: Source 1-017, a culvert fed by outflow of an upland pond at the south end of Rocky Point Beach.

Source 2021-1-040 is a small stream flowing from an upland *Phragmites*-dominated wetland at the end of Grove Avenue in the Longmeadow section of Warwick on the westerly shore of Conditional Area “A”. Sampling on 8/2/2021 showed a fecal coliform concentration of 300 cfu/100 mL and a flow of 0.1 cfs. In stream samples had results of 40 cfu/100ml to the north and 80 cfu/100ml to the south, demonstrating dilution in the receiving waters. This source has had intermittent fecal coliform elevations in past surveys. Follow-up sampling of source 1-040 on 3/14/2022, yielded a result of < 2 cfu/100 ml. Nearby growing area monitoring stations 1-6A and 1-8F have been continuously in compliance with NSSP criteria demonstrating that this intermittent fecal coliform source has a limited impact on the microbial water quality of the growing area.



Figure 7: *Source 1-040, a small stream flowing from a wetland area at the end of Grove Avenue in Warwick.*

Source 2021-1-051B (Fig. 8) is a spring located at the southern end of Rocky Point Beach fed from an upland pond. Water from this spring pools in the sand above the high tide line with some of the seepage flowing towards the receiving waters. August 2021 results from this source showed fecal coliform levels of 1,000 cfu/100 mL but little to no of the flow was reaching the receiving waters. The source was standing, stagnant water at the time of the August 2021 sample which likely contributed to the elevated results. The site was revisited on 3/14/2022 with observation of increased flow rate and a fecal coliform result of <2 cfu/100 ml. Growing area monitoring station 1-2, located approximately 2,500 feet from this source, has been in continuous compliance with NSSP criteria which indicates there is little impact from this source on the waters of the growing area.



Figure 8: *Source 1-051B, a spring located at the southern end of Rocky Point Beach.*

2021-1-053 is a stream draining the upland marsh of Jacobs Point Preserve in the northeastern-most corner of the growing area. Jacob's Point Preserve is an undeveloped tidal marsh conservation property managed by the Warren Land Conservation Trust. Sampling on (8/17/2021) yielded a result of 820 cfu/100 ml with a flow of 0.18 cfs. In stream samples showed results of 34 cfu/100 ml (East) and 4 cfu/100 ml (West), demonstrating rapid dilution of this source in the receiving waters. Further, routine growing area monitoring station 1-1 which is located approximately 700 feet west of this source has fecal coliform levels in compliance with NSSP criteria for these conditionally approved waters. Demonstration of rapid dilution and acceptable fecal coliform levels at nearby monitoring station 1-1 show that this source has little negative impact on the microbial water quality of the growing area.



Figure 9: Source 1-053 a stream draining Jacob's Point Preserve in Warren, RI.

Source 2021-1-107 is a 24 inch PVC pipe discharging storm water through the seawall at the north end of Colt State Park. A sample taken from the source on 9/15/2021 returned a result of 300 cfu/100 ml with an observed trickle flow. In stream samples yielded results of 13 cfu/100ml (North) and 4 cfu/100ml (South) demonstrating rapid dilution in the receiving waters and little negative impact on the growing area from this low-flow source.

E. Identification and Evaluation of Pollution Sources

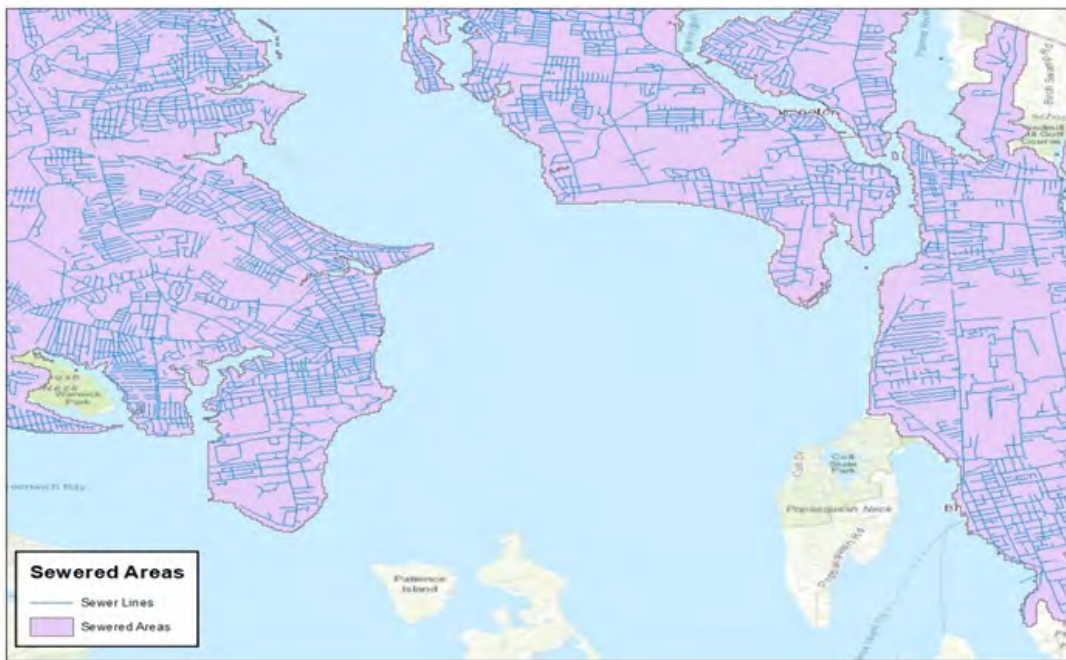
i. Domestic Wastes

The majority of the population living immediately adjacent to Growing Area 1 in the Towns of Warren, Warwick, Bristol, and Barrington are serviced by municipal sanitary sewer service (Figure 10). Two areas are an exception to this, with Poppasquash Point in Bristol, and a small section of the Bayside neighborhood (located between Conimicut Point south to Rocky Point) in Warwick being serviced by OWTS (On-Site Waste Treatment Systems). Poppasquash Neck is primarily low density residential with many large estate lots. The DEM Office of Compliance and Inspection (OCI) investigates complaints of malfunctioning OWTS. A review of OCI's complaints files showed no OWTS complaints during 2021 for Poppasquash Neck.

Since the 2009 12-year survey Warwick Neck has had significant increases in the percentage of the area adjacent to Growing Area 1 that is serviced by sewers. In 2009

approximately 15% of Warwick Neck was serviced by sewers while in 2021 approximately 90% of Warwick Neck is serviced by municipal sewers (Figure 10). The Warwick Sewer Authority is currently in the process of connecting approximately 935 residences in the Bayside neighborhood to municipal sewer service, with completion of the Bayside project expected by late 2023 (Warwick Sewer Authority Bayside Sewer Project informational meeting 9/16/2021). A review of OCI complaints identified three (3) OWTS complaints on Warwick Neck during 2021. OCI found that all three (3) of these complaints were of no impact to the water quality of the upper Bay. The number of OCI complaints for Warwick Neck has declined dramatically since the 2009 12-year survey. Over 100 OCI complaints for the area were reported in the 2009 survey; a sharp contrast with the three (3) complaints recorded during 2021. Extending municipal sewer service to all of Warwick Neck via the ongoing Bayside sewer tie-in project should improve the sanitary conditions of Growing Area 1, with potential to improve microbial water quality in the Mill Cove area that is currently classified as prohibited.

Figure 10: The majority of the population living adjacent to GA1 (Upper Narragansett Bay) is serviced by municipal sewers (purple shading).



In addition to increased municipal sewer service adjacent to the growing area, a cesspool phaseout act was approved and signed into law in June 2008 as the “Rhode Island Cesspool Act of 2007”. This act requires that any cesspool located within 200 feet of the inland edge of all shoreline features bordering tidal waters be replaced by January 1, 2013, with an expedited schedule (within 1 year) for any cesspool identified as “failing” to properly handle wastewater. This 200-foot no-cesspool buffer has virtually eliminated cesspools in the watershed immediately adjacent to the growing area.

No municipal WWTF discharge directly to the waters of Upper Bay Growing Area 1. However, the growing area is downstream of four (4) municipal WWTF that discharge treated effluent to the Seekonk River (Growing Area 15), Providence River (Growing Area 16) and Warren Rivers (Growing Area 2) which are contiguous with the Upper Bay growing area. The Providence and Seekonk Rivers receive treated effluent from the Narragansett Bay Commission (NBC) Bucklin Point WWTF, NBC Fields Point WWTF and the City of East Providence WWTF while the Warren River receives treated effluent from the Town of Warren WWTF. The NSSP MO requires assignment of the Prohibited classification to waters adjacent to a WWTF within an effluent dilution zone of less than 1,000:1 under normal, efficient operating conditions (Normal Operating Conditions, NOC; NSSP MO, Sect IV Guidance Documents – Chap. II, I, Guidance for Dilution Ratios). Waters beyond this zone can be classified as conditionally approved. RI has chosen a more conservative approach and has established prohibited WWTF dilution zones that are of sufficient size to allow proper dilution under WWTF minor upset conditions such as a limited loss of disinfection. Decades of WWTF upgrades (RI DEM, 2016) and CSO abatement in the Providence area (Narragansett Bay Commission, 2014) have resulted in increased WWTF efficiency and improved microbial water quality in the Providence River as described in the GA1 and GA16 Conditional Area Management Plans. An analyses of WWTF performance and dilution zones completed in 2021 (see analysis in the RI DEM document “Establishing the Closure Zones and Shellfish Water Classifications Adjacent to Waste Water Treatment Facilities (WWTF) in the Providence River (GA16)”, RIDEM February 2021) documented that there is sufficient dilution within the prohibited waters of GA15, GA16 and GA2 such that effluent discharged to the upper Providence River and the upper Warren River while the treatment plants are operating under normal treatment and permitted flow conditions will not degrade the microbial water quality of Upper Bay GA1.

The WWTF that discharge to the waters upstream of GA1 are modern, efficient, and well-run facilities that rarely exceed permitted effluent criteria . A review of WWTF performance for the WWTF discharging to the Providence and Seekonk Rivers may be found in the Providence River (GA16) shoreline survey and a review of Warren WWTF performance may be found in the GA2 shoreline survey. The Conditional Area Management Plan for the Upper Bay (GA1) includes conditional provisions for closure of the growing area in the event that these WWTF exceed permitted effluent discharge that could degrade the microbial water quality of the growing area.

ii. Stormwater

Upper Bay Conditional Area A: The microbial water quality of Upper Bay Conditional Area A (GA1A) has historically been impacted by rainfall and stormwater runoff from the urbanized greater-Providence area (FDA, 1970; Watkins and Rippey, 1990; Cabelli, 1990; Wright et al 1991). The rainfall amount at which the microbial water quality in Area A becomes unacceptable has increased as efficiency of CSO capture and treatment have improved since the late 1980s. Accordingly, the Area A rainfall closure amount has increased from 0.5” to 0.8” in 2011 and in May 2017 the rainfall closure amount increased to 1.2” following the completion of Phase II of the Narragansett Bay

Commission's (NBC) combined sewer overflow (CSO) project (described above). The water quality data supporting this increase in rain closure to 1.2" was analyzed in the document GA Conditional Area Management Plan (CAMP) Amendment #3" and the December 2021 GA1 CAMP available in the Program's permanent files. Those analyses are summarized briefly below.

RIDEM's Office of Water Resources conducted extensive wet weather monitoring in the Upper Bay during 2015-2017 targeting various wet weather conditions in order to establish new rainfall closure criteria consistent with the improved CSO capture and treatment due to completion of CSO Phase II. Upper Narragansett Bay Growing Area 1 was sampled 35 times between January 2015 and January 2017 within 7-days of rainfall ranging from 0.26" to 2.07". Fifteen (15) of the 35 sets of observations took place within 7-days of storms having greater than 1" rainfall. Sample collection occurred when the growing area was in both the open (n= 17) and closed (n=18) status under the 0.8" rainfall closure. Bacterial levels were in compliance (<14 cfu/100 ml) at all conditionally approved areas when they were open to shellfishing. Regression analysis of the rainfall and fecal coliform data for GA1A indicated that microbial water quality in the growing area is acceptable following rainfall of up to 1.2" (see GA1 CAMP). Based on these analyses, the rainfall closure amount for Upper Bay Area A was increased to 1.2" in May of 2017. All stations in the growing area have remained in compliance since the increase to a 1.2" conditional rain closure in 2017. Compliance with NSSP criteria for conditionally approved areas has been demonstrated for five continuous years (2017 to 2021) since the increase to a 1.2" conditional area rain closure. Compliance statistics for the growing area during 2021 (Table 8) demonstrate continued compliance under the 1.2" rain closure criteria.

Upper Bay Area B (Approved classification): The microbial water quality of Upper Bay Area B has also historically been negatively impacted by stormwater runoff from the greater Providence urban area (FDA, 1970; Watkins and Rippey, 1990; Cabelli, 1990; Wright et al 1991). However, improvements in the capture and treatment of CSO stormwater have resulted in a decrease in fecal coliform loading to Area B after typical rainstorms (less than 3" rain in a 24-hour period) such that the area was reclassified as Approved waters in May 2017. (see "Operating Procedures for the Conditionally Approved Upper Narragansett Bay Shellfish Growing Area 1, Amendment #3" and December 2021 revision). A summary of the analyses supporting that reclassification is presented below. Similar to the analyses for Area A, described above, focused wet-weather sampling in Area B was completed during January 2015 to January 2017 to document the response of Area B to wet weather after the completion of Phase II of the Narragansett Bay Commission's (NBC) combined sewer overflow (CSO) project. Samples were collected during 41 sampling days over 35 separate rain events ranging from 0.10 inches to 2.96 inches. The data were analyzed using a linear regression of fecal coliform (cfu/100 ml) versus rainfall (inches) during the previous 7 days and to determine the amount of rainfall at which bacteria concentrations exceed NSSP criteria. The regression analysis showed that there were minor rain/runoff effects on bacteria levels in Area B and the adjacent approved areas following the Phase II CSO and WWTF improvements with no difference in the response between "Area B" and adjacent

approved waters located just south of Area B (GA3, stations 3-1 and GA9 station 9-6). The wet weather sampling results of Upper Narragansett Bay Growing Area 1 subarea “B” met NSSP shellfish growing water quality criteria even under ‘worst-case’ wet weather conditions during 2015-2017. Based on these results, Area B was reclassified as ‘Approved’ in May of 2017. All stations in Area B have meet NSSP criteria for Approved waters in the five years (2017 to 2021) since the reclassification to Approved waters. 20201 fecal coliform compliance statistics are shown in Table 9.

iii. Marinas and Mooring Areas

There are no marinas located within the Upper Narragansett Growing Area 1 area proper. However, it is a heavily used commercial and recreational boating area. Rhode Island coastal waters are federally designated as “No Discharge” mandating that the discharge of *treated* and *untreated* boat sewage is prohibited (not including greywater or sink water) in these designated areas. These designated areas encompass the entire Upper Narragansett Bay growing area. Although there are no pumpout facilities located within the growing area there are at least nine pumpout facilities in nearby, adjacent growing areas within a short sail from the area.

iv. Agricultural Waste

The Upper Bay watershed is an urban, significantly developed watershed comprised of primarily residential, commercial, and industrial development. A review of RI DEM Division of Agriculture data indicated that there were no animal agriculture operations in the area immediately adjacent to the growing area.

v. Wildlife

A variety of terrestrial wildlife such as birds, raccoons, fox, deer, muskrat, and rodents that inhabit the open space lands, as well as urban and suburban lands, adjacent to the Upper Bay, may contribute pathogens through stormwater runoff or direct deposition. No accurate information as to the magnitude and geographic dispersion of these animals is available. Marine birds and mammals are also present in the Upper Bay. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of waterfowl it is very difficult to assess their impact on water quality. Shoreline sources such as streams and culverts that may potentially convey wild animal fecal coliform contamination to the growing area are routinely assessed as part of the shoreline survey.

vi. Industrial Wastes

The Rhode Island Pollution Discharge Elimination System Program (RIPDES) is responsible for permitting any and all industrial and municipal waste discharges to waterbodies of the state. A review of RIPDES permits showed that there were no facilities discharging directly to the growing area. WWTF have permitted discharge to adjacent growing areas (described in section 4A, Domestic Waste).

vii. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing

area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan (RI DEM November 2021).

At the time of the shoreline survey, identified sources and immediately adjacent upland areas were visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation was conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation was conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved or conditionally approved waters of the growing area due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

4. Hydrographic and Meteorological Characteristics

A. Tides

Tides in Rhode Island are semi-diurnal with a period or cycle of approximately one-half day (12.84 hrs.) characterized by two similar high waters and two similar low waters each tidal day. Upper Narragansett Bay has strong semi-diurnal tides, with an average tidal range of 1.16 meters at Conimicut Point (Spaulding and Swanson, 2008). Similarly, NOAA operates a real-time tide gauge at Conimicut Light in the northern section of GA1 near the mouth of the Providence River where the mean tidal range is 1.27 meters (4.17 feet; NOAA 2020). Tidal range during spring tides at Conimicut Point averages 1.43 meters (4.69 feet; Spaulding and Swanson, 2008).

The shoreline survey was scheduled to coincide with ebb and/or low tide, which is the most opportune time for observing stormwater outfalls that may otherwise be hidden by tidal water. Additionally, potential pollution effects such as runoff are generally more noticeable during low tide. Sampling of streams and pipes during low tides should represent actual stream flows rather than the retreating tidal waters that they may receive.

B. Rainfall

Upper Narragansett Bay GA1 is approximately eight miles south of Providence, RI and approximately 4 miles east of the NOAA/ National Weather Service meteorology station at TF Green Airport. The rainfall patterns at this NOAA weather station (KPVD) are summarized below. There is no strong seasonal pattern in rainfall in the Upper Narragansett Bay (GA1) region (Table 3). Rainfall is fairly evenly distributed in each month of the year, although spring months of March – April and the autumn months of November – December tend to have increased rainfall (Table 3).

Table 3: Average monthly rain and wind in the GAI area (1904-2018 averages from NOAA KPVD weather station at TF Green Airport). The KPVD weather station is located approximately 4 miles west of GAI.

Month	Avg	Minimum	Maximum	Avg. Windspeed (mph)	Prevailing Wind Direction
	Rainfall (inches)	Rainfall (inches & year)	Rainfall (inches & year)		
January	3.79	0.51 (1970)	11.66 (1979)	11.2	NW
February	3.32	0.39 (1987)	7.2 (1984)	11.5	NNW
March	4.06	0.07 (1915)	16.34 (2010)	12.1	WNW
April	3.86	0.72 (1942)	12.74 (1983)	12.2	SW
May	3.33	0.57 (1939)	10.58 (1948)	10.8	SW
June	3.25	0.05 (1949)	11.08 (1982)	9.9	SW
July	3.11	0.32 (1952)	10.52 (2009)	9.5	SW
August	3.67	0.71 (1984)	12.24 (1946)	9.3	SSW
September	3.58	0.48 (1914)	10.99 (2008)	9.4	SW
October	3.41	0.15 (1924)	15.38 (2005)	9.7	NW
November	3.92	0.31 (1917)	11.01 (1983)	10.6	SW
December	3.97	0.58 (1955)	10.75 (1969)	10.9	WNW
Annual total (rain)					
Annual avg (wind)	43.25	25.44 (1965)	67.52 (1983)	10.6	SW

Storms that occur between October and May are primarily extra-tropical cyclones. The most famous are the "nor-easters:" low-pressure systems that typically develop off the North and South Carolina coasts and move northeast along the Atlantic seaboard, occasionally colliding with colder and drier air (from Canada) in the New England region. This results in the development of heavy rain and/or snow. These storms are more widespread in their range. The second type of storm, occurring between June and October, are primarily tropical cyclones. The biggest storms are hurricanes, which have hit Rhode Island 71 times during the last 350 years. In the summer, most precipitation results from thunderstorms and smaller convective systems. These typically produce short-duration high-intensity precipitation events and are more localized than regional nor-easters.

The shoreline survey dates for the Upper Bay were June 24th, August 2nd, 3rd, 4th, and 17th, and September 15th, 2021. Daily rainfall observed at the NOAA weather station located at T.F. Green Airport in Warwick (KPVD) in the days preceding shoreline survey sampling are shown in Tables 4-6.

Table 4: Rainfall at TF Green Airport (NOAA KPVD) during June 2021; shoreline survey dates in yellow highlight.

Date	Max temp (°F)	Min Temp (°F)	Avg Temp (°F)	Precipitation (Inches)
6/1/2021	78	53	65.5	0
6/2/2021	76	55	65.5	T
6/3/2021	71	58	64.5	0.02
6/4/2021	77	60	68.5	0.77
6/5/2021	87	58	72.5	0
6/6/2021	93	65	79	0
6/7/2021	91	68	79.5	0
6/8/2021	89	69	79	T
6/9/2021	92	69	80.5	T
6/10/2021	77	58	67.5	0
6/11/2021	72	53	62.5	T
6/12/2021	71	57	64	0.11
6/13/2021	82	57	69.5	0
6/14/2021	68	57	62.5	0.53
6/15/2021	79	64	71.5	T
6/16/2021	77	59	68	0
6/17/2021	78	53	65.5	0
6/18/2021	83	55	69	T
6/19/2021	90	66	78	0.2
6/20/2021	85	66	75.5	T
6/21/2021	81	67	74	0
6/22/2021	84	62	73	1.05
6/23/2021	76	57	66.5	0
6/24/2021	74	53	63.5	0.01
6/25/2021	77	61	69	0.16
6/26/2021	82	66	74	0
6/27/2021	85	73	79	0
6/28/2021	93	72	82.5	0
6/29/2021	97	76	86.5	0
6/30/2021	96	73	84.5	T
Sum	2461	1860	-	2.85
Average	82	62	72	-
Normal	77.7	58.8	68.2	3.81

Table 5: Rainfall at TF Green Airport (NOAA KPVD) during August 2021; shoreline survey dates in yellow highlight.

Date	Max Temp (F)	Min Temp (F)	Avg Temp (F)	Precipitation (Inches)
2021-08-01	78	55	66.5	T
2021-08-02	82	62	72.0	T
2021-08-03	77	59	68.0	0.00
2021-08-04	74	63	68.5	0.91
2021-08-05	72	64	68.0	1.48
2021-08-06	84	63	73.5	0.00
2021-08-07	89	66	77.5	0.00
2021-08-08	83	69	76.0	T
2021-08-09	78	69	73.5	0.01
2021-08-10	80	68	74.0	0.00
2021-08-11	90	69	79.5	0.01
2021-08-12	94	73	83.5	T
2021-08-13	91	74	82.5	0.14
2021-08-14	91	74	82.5	0.00
2021-08-15	83	67	75.0	0.00
2021-08-16	81	64	72.5	0.00
2021-08-17	82	63	72.5	0.00
2021-08-18	83	68	75.5	0.00
2021-08-19	84	72	78.0	0.44
2021-08-20	84	72	78.0	0.00
2021-08-21	84	71	77.5	0.00
2021-08-22	75	72	73.5	0.51
2021-08-23	82	71	76.5	0.40
2021-08-24	90	72	81.0	0.00
2021-08-25	90	71	80.5	0.00
2021-08-26	93	70	81.5	0.00
2021-08-27	91	74	82.5	0.87
2021-08-28	77	66	71.5	T
2021-08-29	73	61	67.0	0.06
2021-08-30	86	68	77.0	0.00
2021-08-31	85	69	77.0	0.00
Sum	2586	2099	-	4.83
Average	83.4	67.7	75.6	-
Normal	82.2	63.9	73.0	3.59

Table 6: Rainfall at TF Green Airport (NOAA KPVD) during September 2021; shoreline survey dates in yellow highlight.

Date	Max Temp (F)	Min Temp (F)	Avg Temp (F)	Precipitation (inches)
2021-09-01	71	61	66.0	1.14
2021-09-02	77	59	68.0	2.75
2021-09-03	75	57	66.0	0.00
2021-09-04	78	57	67.5	0.00
2021-09-05	74	60	67.0	0.01
2021-09-06	83	63	73.0	0.01
2021-09-07	80	59	69.5	0.00
2021-09-08	84	62	73.0	0.00
2021-09-09	75	67	71.0	0.50
2021-09-10	78	56	67.0	T
2021-09-11	78	53	65.5	0.00
2021-09-12	81	63	72.0	0.00
2021-09-13	82	62	72.0	0.00
2021-09-14	75	61	68.0	0.00
2021-09-15	86	70	78.0	0.00
2021-09-16	75	66	70.5	0.08
2021-09-17	72	65	68.5	T
2021-09-18	78	65	71.5	T
2021-09-19	75	57	66.0	0.00
2021-09-20	75	52	63.5	0.00
2021-09-21	77	52	64.5	0.01
2021-09-22	76	69	72.5	0.02
2021-09-23	81	70	75.5	0.01
2021-09-24	76	64	70.0	0.13
2021-09-25	76	62	69.0	0.01
2021-09-26	76	57	66.5	0.35
2021-09-27	77	53	65.0	0.00
2021-09-28	74	59	66.5	0.16
2021-09-29	67	50	58.5	0.00
2021-09-30	66	50	58.0	T
Sum	2298	1801	-	5.18
Average	76.6	60.0	68.3	-
Normal	74.8	56.5	65.6	4.17

C. Winds/Climate

The Providence area has a strong seasonal temperature cycle, with mean air temperatures varying from below freezing during January and February to greater than 70 °F during July and August (Table 7). These observations are based on observations made at TF Green Airport (located approximately 3.5 miles west of Growing Area 1). Within the general temperature pattern there is considerable variability in that any season can have much colder or warmer mean temperatures than usual in a given year. For example, in the past twenty years mean air temperature during February varied from a low of 18.4 °F during 2015 to a maximum of 39.6 °F during 2006 – a 21.2 °F difference. Similarly, summer air temperatures can vary by 9 °F between a cool summer (July 2001, 69.8 °F) and a warm summer (July 2013, 78.4 °F). Overall, the mean air temperature in the region is 51.7 °F.

Table 7: Mean, maximum and minimum monthly air temperature at TF Green Airport (NOAA station KPVD) during 2000 to 2019. The KPVD weather station is located approximately 3.5 miles west of GA1.

Month	Air Temperature (F)				
	Mean	Max	Year	Min	Year
Jan	30.0	37.2	2006	21.4	2004
Feb	31.9	39.6	2018	18.4	2015
Mar	39.1	46.3	2012	32.7	2015
Apr	49.3	53.8	2010	45.4	2003
May	59.0	63.0	2018	53.4	2005
Jun	68.0	71.3	2008	64.4	2009
Jul	74.4	78.4	2013	69.8	2001
Aug	73.3	77.0	2018	70.2	2000
Sep	66.2	69.1	2015	63.0	2009
Oct	54.8	61.2	2017	51.7	2003
Nov	44.6	49.2	2006	40.5	2019
Dec	35.4	46.0	2015	28.9	2000
Annual mean	51.7	53.8		43.6	

Water temperature in Upper Narragansett Bay (GA1) also has a strong seasonal pattern and considerable annual variability (Figure 11). The NOAA PORTS system maintains a real-time water temperature sensor at the Conimicut Point lighthouse, in the northern side of Growing Area 1. Data from this sensor were compiled to illustrate the range of water temperature in the growing area during recent years. As with air temperature, there is a strong seasonal variation in water temperature, with an approximately 50 °F range in winter versus summer water temperature (Figure 11). Winter water temperature can vary annually from years having prolonged periods of <32 °F water with formation of sea ice in the growing area, as was seen during 2015, to warm winters such as 2019 in which the water temperature never dropped below 35 °F. Similarly, maximum summer water temperature at Conimicut Point can vary from approximately 76 °F during a cool summer

to up to 80.7 °F during a warm summer (Figure 11). Annual average water temperature at Conimicut Point during recent years (2015-2019) was 54.8 °F.

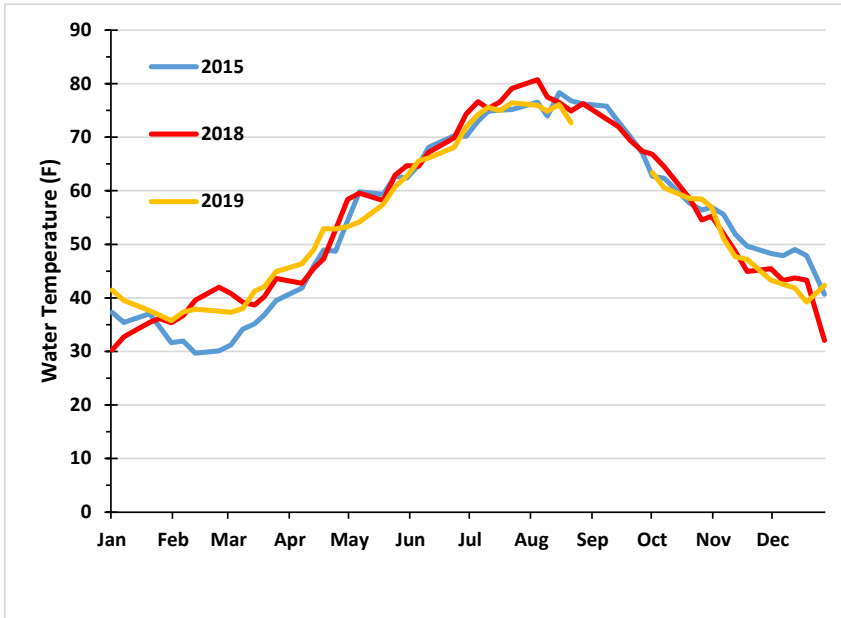


Figure 11: Surface water temperature (F) at Conimicut Point Lighthouse during 2015 (a cold winter), 2018 (warm winter) and during 2019. Temperatures taken every 6 minutes at NOAA PORTS station 8452944 Conimicut Light, RI.

Winds: Winds in the region follow a seasonal shift from winds predominantly from the northwest during winter and southwest winds dominant during spring and summer (April through September; Table 3 in section 5B). Summer winds tend to be calmer, but occasional tropical storms or hurricanes can bring elevated wind speeds during summer and early autumn.

D. River Discharges

The largest sources of freshwater input to Narragansett Bay flow into GA1 via the Providence River. Approximately 68% (Spaulding and Swanson, 2008) to 85% (Pilson, 1985) of total freshwater flow to Narragansett Bay is from the Blackstone, Moshassuck, Woonasquatucket and Pawtuxet Rivers. These major freshwater rivers provide drainage to approximately 1,754 km² of the Blackstone, Woonasquatucket, Moshassuck and Pawtuxet watersheds and this drainage flows into the Providence River which flows into Upper Bay GA1. Upper Narragansett Bay has strong semi-diurnal tides, with an average tidal range of 1.16 meters at Conimicut Point (Spaulding and Swanson, 2008).

Because of the riverine freshwater input to the north and strong tidal input from the south, salinity in Upper Bay GA1 increases from approximately 25 to 28 ppt at the surface near Conimicut Light to approximately 27 to 29 ppt at the surface just north of Prudence Island (FDA, 1970; Codiga, 2012). However, surface salinity can intermittently decline in response to freshwater input with values as low as 16.5 ppt (Conimicut Point) and 24

ppt (north of Prudence) recorded during wet weather periods having elevated river flow (Smayda and Borkman, 2008). Bottom salinity is less variable and tends to fall between 29 and 31 ppt (Codiga, 2012). The water column of the Upper Bay is often stratified due to the input of buoyant freshwater (Hicks, 1959, FDA, 1970) and microbial pathogen indicators such as fecal coliform are consistently more abundant in the surface waters than the bottom waters (FDA, 1970, Watkins and Rippey, 1990).

The combination of freshwater input and strong tidal flow result in a rapid flushing time of approximately 0.9 to 1.0 day for the portion of Upper Bay GA1 near the mouth of the Providence River (Spaulding and Swanson, 2008).

5. Water Quality Studies

A. Overview

The water quality of Upper Narragansett Bay is monitored through several state and local agencies and academic institutions. The primary source of fecal coliform data used for classification of Upper Bay Growing Area 1 shellfish waters is the RI DEM OWR Shellfish Program monitoring data described in section B, below. However, ancillary bacteria and related water quality data from other monitoring programs is also taken into consideration. Two Upper Narragansett Bay monitoring programs used as sources of additional data are described briefly below.

RI DEM and URI Graduate School of Oceanography Fixed Site Monitoring Program. This program maintains a network of monitoring buoys at 15 locations in Narragansett Bay 15, including three (3) monitoring buoys located in Upper Narragansett Bay Growing Area 1. Instruments collect near-real time data on water temperature, salinity, chlorophyll fluorescence and dissolved oxygen at near-surface and near-bottom depths. For details and to access data please see <http://www.dem.ri.gov/programs/emergencyresponse/bart/stations.php>.

Narragansett Bay Commission, Bay Monitoring Bacteria Sampling (part of 'Snapshot of Upper Narragansett Bay' program). The Narragansett Bay Commission conducts approximately 16 fecal coliform and *Enterococci* sampling cruises per year in the Seekonk and Providence Rivers. These sampling trips measure near surface fecal coliform and *Enterococci* levels approximately once per month in winter and approximately every two weeks during summer. Samples are collected at eight (8) stations spanning from Division Street in Pawtucket southward to Conimicut Point in Warwick. While sampling is not done directly in Upper Bay GA1, this monitoring program provides data on the microbial water quality in the Providence and Seekonk Rivers just upstream of GA1. Details of the program and monitoring data can be found at <http://snapshot.narrabay.com/WaterQualityInitiatives/PathogenMonitoring>.

B. RI DEM Fecal Coliform Monitoring 2021 Review and Statistical Summary

The RIDEM Shellfish Program maintains a Shellfish Growing Area Monitoring (SGAM) program, as part of an agreement between the State of Rhode Island and the Food and Drug Administration (FDA) as described in the National Shellfish Sanitation Program (NSSP). The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island conducts regular bacteriological monitoring of shellfish harvesting waters. Below is a summary of 2021 fecal coliform monitoring compliance statistics for Upper Narragansett Bay Growing Area 1.

HIGHLIGHTS

GAI Upper Bay – Area A

- * Classified as Conditionally Approved with a 1.2” rain closure in May 2017.
- * Area A sampled 14X in 2021, 11 times while open and 3 times while in the closed status.
- * Statistics represent most recent data collected 8/17/2020 to 12/13/2021 when the area was open (n = 15).
- * All conditionally approved areas in compliance.
- * Conditional Area 1D discontinued May 2021.
- * Data run 12/21/2021.

GAI Upper Bay – southern section (Area B)

- * Classified as approved in May 2017.
- * Area B sampled 10X during 2021 (9X while open, 1X while in the closed status).
- * Statistics for stations 1-2, 1-3C, 1-13 and 1-14 represent recent 30 samples collected during 5/23/2018 or 6/25/2018 to 12/15/2021 under all weather conditions (11 wet and 19 dry weather samples).
- * All approved stations in area in compliance.
- * Data run 12/21/2021.

COMMENTARY

Area 1A: Upper Narragansett Bay Conditional Area A (Growing Area 1A) was sampled fourteen times (11X while open and 3X while closed) during 2021 which exceeds minimum sampling requirements for conditionally approved areas. The summer of 2021 was much wetter than usual resulting in extended closures of Area A. For example, rainfall at the National Weather Service KPVD station at TF Green Airport during July 2021 was 3.73” above normal with 7.12” of rain falling compared to long-term average July rain of 3.39”. This wet weather resulted in Area A being closed 26 of 31 days during July 2021. The area received greater than usual rainfall during August through October 2021 but returned to near-normal rainfall amounts for the remainder of the year. Overall, Upper Bay Conditional Area A was in the open status for 257.5 days during 2021 (open 70.5% of the year).

The classification of a small area near the mouth of Buckeye Brook in the northwest corner of Area A was changed in May of 2021. This area was formerly designated as 'Area D' and was managed as a conditional area with a 0.8" rain closure. However, fecal coliform levels in former Area D were not meeting criteria under this rain closure and were also exceeding criteria at some stations during dry weather (less than 0.5" rain). Sampling indicated that Buckeye Brook is the source of fecal coliform contamination. Accordingly, in May 2021 a small (51.9 acre) prohibited zone (GA1-5) was created near the mouth of Buckeye Brook and the remainder of former Area D was merged with Upper Bay Conditional Area A.

The 2021 statistical review demonstrated that all conditionally approved stations in Upper Bay Area A met NSSP fecal coliform water quality criteria while the area was in the open status and that the area is properly classified.

Area 1B: Upgrades of wastewater treatment and storm water facilities in the Providence area resulted in improved fecal coliform water quality and a change in the classification of the southern portion of the Upper Bay (formerly known as Upper Bay Conditional Area B) from conditionally approved to approved in May 2017. Subsequent sampling of the four stations (1-2, 1-3C, 1-13, 1-14) in the southern portion of the Upper Bay followed the systematic random sampling protocol recommended by the NSSP for approved areas.

The southern portion of the Upper Bay (Area 1B) was sampled ten times (3 wet weather and 7 dry weather) during 2021, exceeding minimum sampling requirements for approved areas. Nine of the 2021 samples were collected while the area was open, and one set of samples was collected while the areas was in the closed status. Hurricane Ida dropped 3.89" of rain in the area in 24 hours which required an emergency 10-day closure of Area B during September 2-12, 2021.

As described above, the summer of 2021, especially July 2021 (received 7.12" of rain compared to an average of 3.39" rain) was much wetter than usual. A single set of moderately elevated fecal coliform results (collected 7/14/2021, 5 days after 2.05" rain) resulted in the 90th percentile variability statistic being moderately elevated, but still well below NSSP variability criteria at stations 1-2 and 1-3C. The southern portion of the Upper Bay (Area 1B) has met criteria for approved waters during each year (2017-2021) since its reclassification as Approved. The 2021 statistical summary demonstrated that the southern portion of the Upper Bay (former Area B) is properly classified as Approved.

RECOMMENDATIONS

- * All conditionally approved stations in compliance and conformance when open.
- * All approved stations in compliance.
- * Continue monitoring Buckeye Brook to quantify changes in water quality in response to improvements in wastewater treatment in the watershed.

* When possible, continue optional wet weather sampling to track fecal coliform concentration response and to monitor effects of upgrades in wastewater and storm water treatment on Upper Bay water quality.

Table 8: Upper Narragansett Bay Conditional Area A (GA1A) fecal coliform compliance statistics. Upper Bay Area 1A when open (8/17/2020 to 12/13/2021, all mTEC)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>% greater than 31</u> <u>cfu/100 ml</u>
1-1	CA	15	4.5	0.0
1-4	CA	15	5.2	6.7
1-7	CA	15	2.8	0.0
1-10	CA	15	3.1	0.0
1-12	CA	15	4.0	0.0
1-11A	CA	15	6.1	6.7
1-5C	CA	15	4.1	0.0
1-6A	CA	15	2.1	0.0
1-8A	CA	15	2.6	0.0
1-8C	P	15	3.5	6.7
1-8F	CA	15	2.7	0.0
1-8G	CA	15	3.1	0.0
1-8L	P	15	4.8	20.0

Table 9: Upper Narragansett Bay Area 1B (Area B) fecal coliform compliance statistics. Upper Bay Area B 5/23/2018 or 6/25/2018 to 12/15/2021; 11 wet and 19 dry weather samples, all mTEC.

<u>Station</u>	<u>Classification</u>	<u>N</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
1-2	A	30	3.5	14.1
1-3C	A	30	3.4	14.2
1-13	A	30	3.1	12.6
1-14	A	30	2.8	10.5

C. Sampling Plan and Justification

i. Frequency of Monitoring

The growing area has both conditionally approved (Area A) and approved (Area B) waters. The bacteriological water quality of Conditionally Approved Upper Narragansett Bay (Growing Area 1) is potentially impacted by point and non-point sources of pollution such as rainfall events, stormwater runoff, and WWTF performance in nearby growing areas. Program guidance requires that in WWTF performance impacted areas, water samples are collected on a monthly basis when the growing area is in the open status per Section II. Chapter IV @.03(3)(b)(ii) of the FDA guidance document. Therefore, the conditionally approved waters of GA1 are sampled once per month. If due to environmental constraints the monthly sample cannot be collected, an additional sample may be collected in the following month (two samples in that month).

Upper Bay Area B has an approved classification for which the minimum sampling frequency is six (6) sets of samples collected while the area is in the open status (NSSP MO Section II. Chapter IV @.03(3)(b)(iv)). Sampling is by the systematically random sampling strategy with sampling dates pre-selected at the beginning of each calendar year.

ii. Monitoring Stations

There are eighteen (18) monitoring stations in the Upper Narragansett Bay Growing Area (GA1). Eleven (11) stations are in Conditionally Approved waters, three (3) stations in the area near the mouth of Mill Cove (closure 1-D) are classified as Prohibited and four (4) stations in the southern portion of the growing area ('Area B') are in Approved waters (Figure 4). Station 1-1C in Smith Cove (see Figure 4) was added in 2021 to track fecal coliform in this shallow portion of the conditionally approved area. Water quality monitoring station locations (Figure 4) and number of stations were selected to be representative of all conditions in the growing area.

Water samples for fecal coliform monitoring are collected following the standard operating procedures described in the "RI DEM Shellfish Program Growing Area Monitoring Standard Operating Procedures, updated August 2021" on file in the Programs permanent files. Briefly, water samples are collected 0.5 m (1.5 feet) below the water surface (using 125 ml sterile Nalgene bottles or other acceptable sample bottles provided by RI DOH). The water temperature at time of collection of the first sample is recorded. Samples are immediately placed on ice in insulated coolers and are transported to the Rhode Island Department of Health (RIDOH) Laboratory for analysis. Since August of 2012 water samples have been analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria using the standard fecal coliform membrane filtration method (sm48 mTEC; American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" APHA, 1995). Prior to August 2012 the multiple tube fermentation test (sm01 MPN) method was used for estimation of fecal coliform abundance.

D. RIDEM TMDL Studies

Upper Narragansett Bay (GA1) contains two WBID waterbody segments. WBID RI0007024E-01A corresponds to shellfish conditional Area A and WBID RI0007024E-01B corresponds to the approved waters of Area B. The conditionally approved waters of Upper Bay Conditional Area A (WBID RI0007024E-01A) are listed as impaired due to excess fecal coliform and a fecal coliform TMDL for Area A is scheduled for 2025. Area B was formerly listed as fecal coliform impaired, but the fecal coliform impairment was removed from Area B (WBID RI0007024E-01B) when improvements in the fecal coliform water quality of the area were demonstrated, and Area B was reclassified as approved in May 2017.

Both Upper Bay Conditional Area A and the approved waters of Area B are listed as impaired with respect to nitrogen and dissolved oxygen and TMDLs for these impairments are planned for the Upper Bay Area A (WBID RI0007024E-01A) and Area B (RI0007024E-01B) for 2026.

6. Interpretation of Data Relevant to Classification

A. Effects of Meteorological and Hydrographic Conditions

As described above and as documented in the Upper Narragansett Bay Conditional Area Management Plan (GA1 CAMP), there have been improvements to the microbial water quality of the Upper Bay during wet weather due to decades of upgrades to WWTF and improved CSO capture and treatment. This has resulted in a progressive increase in the rain closure amount for Upper Bay Conditional Area A and a reclassification of Upper Bay Area B as approved waters.

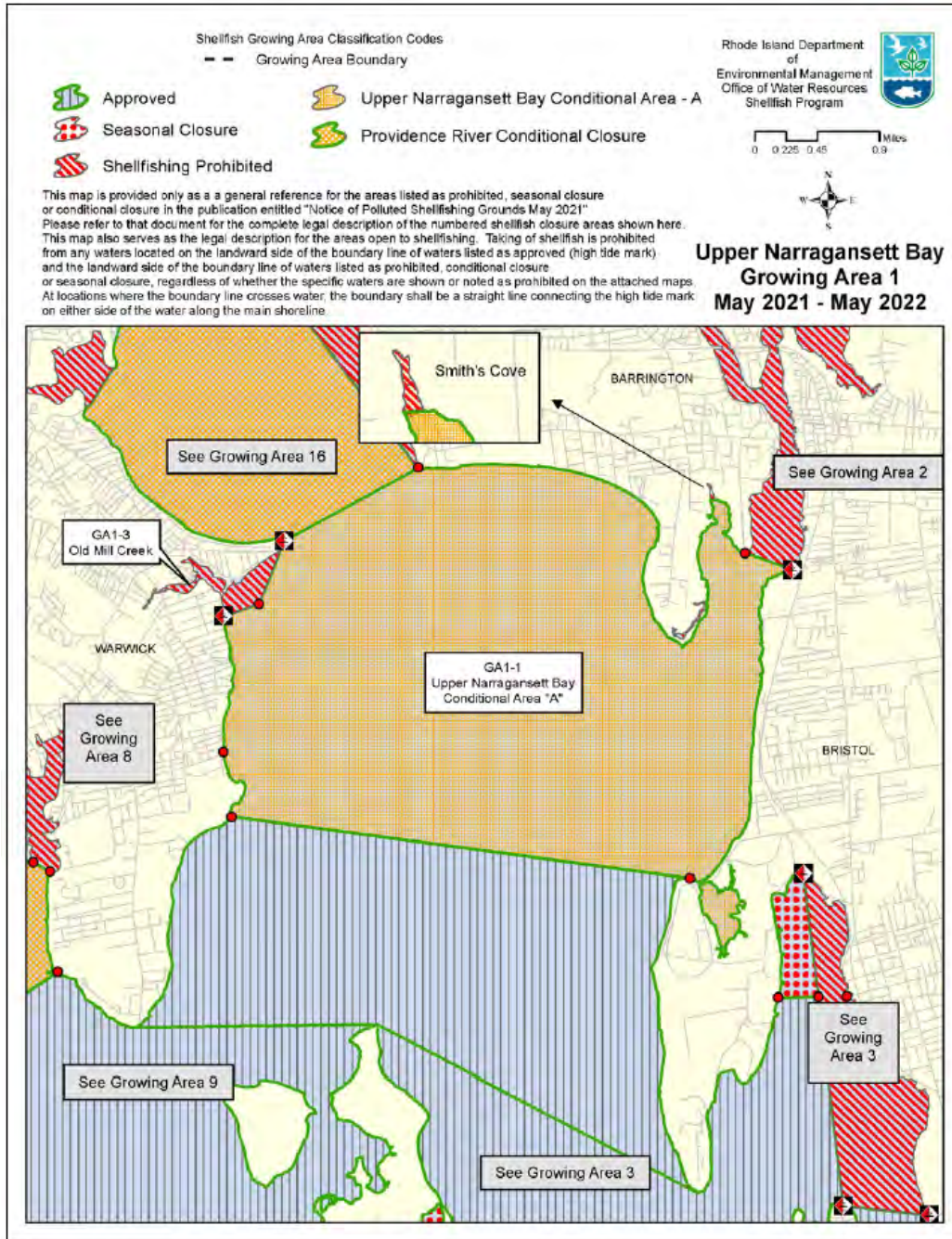
The growing area has been managed under the current strategy of a 1.2” rain closure for Area A and as approved waters with a 3” emergency rain closure in Area B since 2017. Annual reviews have demonstrated that the waters of Upper Narragansett Bay (Growing Area 1) have met NSSP fecal coliform criteria and is protective of public health during the five years (2017 to 2021) since the upgrade in rain closure amounts and shellfish classification management strategy.

7. Conclusions

A. Classification Map

No changes are recommended for the current Upper Narragansett Bay (GA1) classification map (Figure 10).

Figure 12: Current (May 2021) Upper Narragansett Bay (GA1) shellfish classification map.



B. Legal Description

Based on regular RIDEM Shellfish Program monitoring data and the data acquired during this 12-year shoreline survey, ***it is recommended that the current legal description of the growing area be maintained.*** The current (May 2021) legal description of GA1 includes prohibited areas (GA1-3) and conditionally approved areas (GA1-1) as described below: and as shown in Figure 10.

Prohibited areas, Growing Area 1 – Upper Narragansett Bay

GA1-3 All waters north and west of a line extending from the Rhode Island Department of Environmental Management range marker on a pole located on Conimicut Point, to the intersection of two lines (a line extending from the DEM marker at Conimicut Point to the extension of Sam Gorton Avenue in Warwick and a line extending east of the extension of Whipple Avenue in Warwick) marked by a DEM buoy to the DEM range marker on a pole located at the extension of Whipple Avenue in Warwick including Old Mill Creek in its entirety..

(See also: the conditional closures under Upper Narragansett Bay)

Conditionally approved areas, Growing Area 1 – Upper Narragansett Bay

GA1-1 Upper Narragansett Bay Conditional Area A:

All waters north of a line from the southeast corner of the Rocky Point jetty in Warwick to the southwest corner of the Colt State Park pier in Bristol and south of a line from the Rhode Island Department of Environmental Management range marker at Jacobs Point in Warren, to the flag pole at #178 Adams Point Road on Adams Point in Barrington, and south of a line from the center of the Old Tower at Nayatt Point, to the Rhode Island Department of Environmental Management range marker on a pole located on Conimicut Point, and east and south of a line extending from that range marker on Conimicut Point, to the intersection of two lines (a line extending from the Rhode Island Department of Environmental Management range marker at Conimicut Point to the extension of Sam Gorton Avenue in Warwick, and a line extending east of the extension of Whipple Avenue in Warwick) marked by a DEM buoy, to the DEM range marker on a pole located at the extension of Whipple Avenue in Warwick.

C. GA1 Management Plan

A review of the current conditional area management plan for Growing Area 1 indicated that it accounts for the effects of weather, hydrography, domestic wastes, and stormwater on the microbial water quality of the growing area. This management plan incorporates the increased rain closure amount (currently a 1.2” rain, 7-day closure) that improvements in WWTF efficiency and stormwater (CSO) capture have allowed for Upper Narragansett Bay. ***Monitoring and annual statistical evaluations of fecal coliform data have demonstrated that the area conforms to NSSP requirements for Conditionally Approved growing areas when the area is in the open status (Area A) and for approved areas (Area B). There are no recommendations for changes in classification.***

D. Monitoring Schedule and Sample Stations

i. Monitoring Schedule

The current monitoring schedule is adequate for maintaining the current classification. As resources allow, the program will complete optional wet weather sampling to characterize the responses of Upper Bay water quality to continued upgrades in WWTF efficiency and CSO capture and treatment. In addition, fecal coliform data for the prohibited area near Buckeye Brook and Mill Cove will be collected and evaluated to quantify potential improvements in water quality after sanitary sewer service is extended into the Bayside neighborhood of Warwick. Amendments to the Upper Bay (GA1) conditional management plan will be made in the event that wastewater management upgrades allow changes in classification or increases in the closure rainfall amount of the conditionally approved waters of the growing area.

ii. Monitoring Stations

Monitoring station locations were originally established with assistance from the FDA and are believed to be adequate in distribution and location to represent the overall water quality of the growing area. As needed, “emergency” or additional stations are added on a temporary basis should situations arise due to unexpected or newly identified pollution sources.

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**GA 2
Barrington, Palmer and Warren Rivers
2021 Annual Update**

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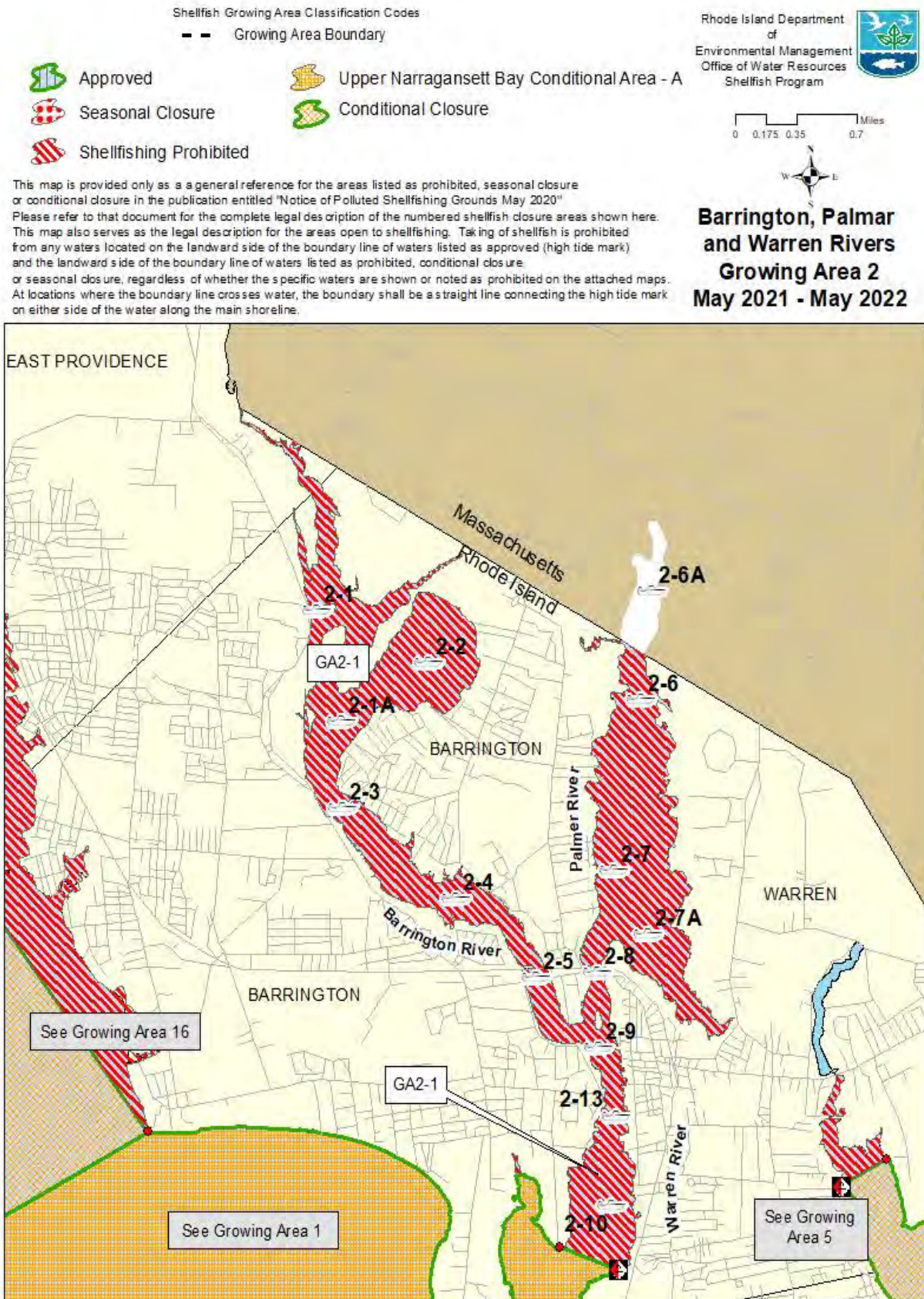
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1. Introduction

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 (Figure 1), are currently classified as prohibited to shellfishing. Sampling of this area has been limited due to the prohibited classification. However, DEM OWR shellfish staff sample the area as program resources allow. The area was sampled two (2) times during 2017 (both during wet weather), (5) times during 2018 (1 dry weather, 4 wet weather), twice (2 times) during 2019 (one dry, one wet), and once during 2021 (dry weather sample). Results from recent sampling and statistical evaluation (based on the most recent 30 samples collected under all weather conditions; an ‘Approved’ status scenario) indicate that seven (7) of fourteen (14) stations (~50%) are in compliance. Under a ‘Conditionally Approved’ scenario with a 0.5” rainfall closure trigger, seven (7) of fourteen (14) stations (50%) comply with NSSP criteria for harvest of molluscan shellfish for direct human consumption. There is no consistent, predictable regional pattern of compliance in the up-river segments of this growing area. Stations that are in compliance during dry weather (i.e., stations 2-2, 2-4 in the Barrington River and station 2-8 in the Palmer River) are adjacent to or surrounded by stations that are out of compliance during dry weather. A change from ‘Prohibited’ status will not be possible until fecal coliform concentrations decline and there is a consistent and predictable regional pattern of stations meeting NSSP criteria in the Barrington and Palmer River portions of Growing Area 2.

Figure 1. 2021-2022 Shellfish Classification Map of GA 2 with Routine Monitoring Stations



A bi-state monitoring effort of the lower Palmer River watershed in Massachusetts, was begun in 2012 and three dry weather surveys of the entire Palmer River watershed were conducted in 2012 and 2013. More recent sampling led by RIDEM and MADEP has targeted specific areas with elevated bacteria concentrations. This included several canoe trips on the lower Palmer River below Shad Factory Pond and targeted sampling along both the main stem lower Palmer River, Torrey Creek, and Rocky Run. In 2015, multiple samples were taken at different tides at eight stations in this target area. While these monitoring efforts have helped to identify specific reaches of the river and its tributaries associated with elevated bacteria levels, they have not been helpful in identifying specific sources. In December 2015, EPA coordinated a meeting between MADEP, RIDEM, EPA, and MA office of NRCS to update organizations on the project and to plan next steps to identify bacteria sources. The discussion of 2016 field work focused on identifying agriculturally related source areas of nutrients and bacteria to help target the NWQI (National Water Quality Initiative) outreach efforts. In the Upper reaches of this growing area extensive study and focus has been initiated, and further work by RIDEM in cooperation with EPA and NRCS still needs to be done to address the impacts noted in the bi-state TMDLs with regards to non-point discharges and agricultural BMPs.

The above-mentioned efforts have resulted in completion of several agricultural BMPs in the upstream watershed. These mitigation efforts should help to reduce bacteria loadings to the watershed and result in improved water quality. However, a recent analysis concluded that multiple bacteria sources contribute to degraded water quality of the shellfish growing area and that it will take a considerable effort to remediate these sources such that water quality can support safe shellfish harvest (Save the Bay, 2021). Efforts will be made to sample the growing area more frequently to document changes in water quality.

2. Waste Water Treatment Facilities

The receiving waters of the Warren Wastewater Treatment Facility are within Growing Area 2. An analysis to determine the necessary dilution zone for compliance with the NSSP MO is contained in the program's permanent files. EPA's PLUMES model was utilized in determining the extent of impacts of the WWTF discharge in the event of an upset in treatment at the plant should it occur. Performance records of plant treatment quality and records of any unusual events at the plant that would cause a discharge of partially treated sewage are maintained by the department's operations and maintenance division and reported immediately to shellfish staff should such an unlikely event occur. There were no reports of permit violations warranting re-evaluation of the prohibited zone during 2021.

Upgrades to the Warren WWTF are outlined in the towns Consent Agreement with the state in 2011, which will bring the facility into compliance with its new discharge permit. Construction has been completed and the RI DEM RIPDES program is tentatively waiting for a "substantially complete" date from the Town of Warren. Reevaluation of the dilution analysis previously establishing the prohibited zone for this plant discharge will be completed using any newly permitted design parameters.

In addition to the Warren WWTF there are numerous marinas and mooring fields located within the confines of GA-2, mostly concentrated in the lower reaches of the Warren and Barrington Rivers. As you travel north beyond the bridges of Route 103 water depths and access heights limit the accessibility of larger vessels in the Palmer River and the large shallower coves of the Barrington River. Numerous day use vessels are docked or moored along the riparian shorelines of both rivers. The potential impacts from the existing commercial docks and marinas have been

evaluated and waters adjacent to these facilities are within the closed prohibited zones providing adequate protection in the case of any accidental discharges associated with marine vessels. Details of this analysis can be found in the program document entitled “Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017.” All waters within GA2 are designated as a “No Discharge Zone”.

3. Water Quality Studies / Annual Statistical Analysis

HIGHLIGHTS

- * Growing Area 2 was sampled once during 2021.
- * Area is currently classified as prohibited; statistics calculated for informational purposes only, not for compliance.
- * Statistics calculated for Approved scenario: recent 30 combined wet and dry weather data 8/13/2010 to 8/17/2021, 16 wet weather and 14 dry weather samples; 8 MPN and 22 mTEC samples (variability criteria = 35 mpn/100 ml).
- * Statistics also calculated for Conditionally Approved scenario: recent 15 samples collected during dry weather only (<0.5” rain in prior 7 days) during (8/13/2010 to 8/17/2021); 3 mpn and 12 mTEC (variability criteria = 34 mpn/100 ml).
- * Data run 12/21/2021.

COMMENTARY

Areas of the Barrington River (stations 1-5) and the Palmer River (stations 6-8) were downgraded from conditionally approved to prohibited in May of 1998 due to declining water quality. A TMDL study of the area was completed in 2002, with a recommendation to monitor shellfish growing waters to track changes in water quality. The Barrington, Palmer and Warren Rivers (Growing Area 2) were sampled once during 2021 during dry weather (12 days after 2.73” rain at TF Green Airport). Although this area is prohibited for the harvest of shellfish, compliance statistics were run under two scenarios: approved (recent 30 observations under all weather conditions) and conditionally approved (recent 15 observations during dry weather of <0.5” rain 7-days prior to sampling).

Approved scenario: Seven stations (stations 2-2, 2-4, 2-5, 2-8, 2-9, 2-10, 2-13) of 14 met criteria under the approved scenario. Most of the stations that met NSSP criteria are located in the southern-most Barrington River and in the Warren River in marina areas or are adjacent to the Warren WWTF outfall which keeps the area classified as prohibited to shellfish harvest. Station 2-2 in Hundred Acre Cove met criteria but is bounded up- and down-river by areas that do not meet criteria.

Conditionally Approved scenario: Under dry weather conditions (less than 0.5” rain in prior 7 days), seven of fourteen stations (stations 2-2, 2-4, 2-5, 2-8, 2-9, 2-10, 2-13) of 14 met criteria. As with the Approved scenario (above), the stations that met NSSP criteria are predominantly located in the southern-most Barrington River and in the Warren River in marina areas or are adjacent to a WWTF outfall which keeps the area classified as prohibited to shellfish harvest. Station 2-2 in Hundred Acre Cove met criteria but is surrounded by adjacent waters that do not meet NSSP criteria during dry weather. TMDL work in RI and MA portions of the watershed continues in an effort to improve water quality. Given current water quality and the unpredictable fecal coliform response after rainfall, the area is properly classified as Prohibited.

RECOMMENDATIONS

- * Maintain closure of the Barrington River and Hundred Acre Cove.
- * Maintain closure of the Palmer River.

* As resources allow, complete six (6) systematic random sampling trips per year to support TMDL efforts and to track water quality changes.

Table 1: Fecal coliform summary statistics under Approved scenario based on recent 30 samples collected under all weather conditions (8/13/2010 to 8/17/2021; 16 wet and 14 dry weather; 8 MPN / 22 mTEC). Area is classified as Prohibited, statistics for informational purposes only, not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
2-1	P	30	43.0	391.9
2-1A	P	30	12.5	110.4
2-2	P	30	5.1	22.9
2-3	P	30	7.9	38.2
2-4	P	30	5.3	24.7
2-5	P	30	5.5	24.0
2-6	P	30	59.1	660.6
2-6A	P	30	163.6	1753.0
2-7	P	30	9.3	67.5
2-7A	P	30	9.8	70.4
2-8	P	30	5.5	20.8
2-9	P	30	4.8	18.1
2-10	P	30	4.3	16.3
2-13	P	30	4.3	14.6

Table 2: Fecal coliform summary statistics under Conditionally Approved scenario based on recent 15 samples collected during dry weather (<0.5” rain prior 7 days) during 8/13/2010 to 8/17/2021; 12 mTec, 3 mpn). Area is classified as Prohibited, statistics for informational purposes only, not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 34 cfu/100 ml</u>
2-1	P	15	33.7	60.0
2-1A	P	15	10.5	33.3
2-2	P	15	4.3	6.7
2-3	P	15	6.8	13.3
2-4	P	15	4.7	6.7
2-5	P	15	4.9	6.7
2-6	P	15	36.7	46.7
2-6A	P	15	116.2	86.7
2-7	P	15	7.0	13.3
2-7A	P	15	7.4	13.3
2-8	P	15	5.9	0.0
2-9	P	15	3.9	0.0
2-10	P	15	3.9	0.0
2-13	P	15	4.7	0.0

4. Summary and Conclusions:

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 (Figure 1), are currently classified as prohibited to shellfishing. Monitoring of prohibited areas is not required, but as resources allow DEM Shellfish staff will continue to complete limited monitoring of the growing area. The 2021 review and calculation of compliance statistics indicated that the waters of the Barrington, Palmer and Warren Rivers (Growing Area 2) do not reliably meet NSSP fecal coliform criteria for safe harvest and consumption of molluscan shellfish. The growing area is properly classified as prohibited.

5. Literature Cited:

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GA 3 Annual Update: East Middle Bay

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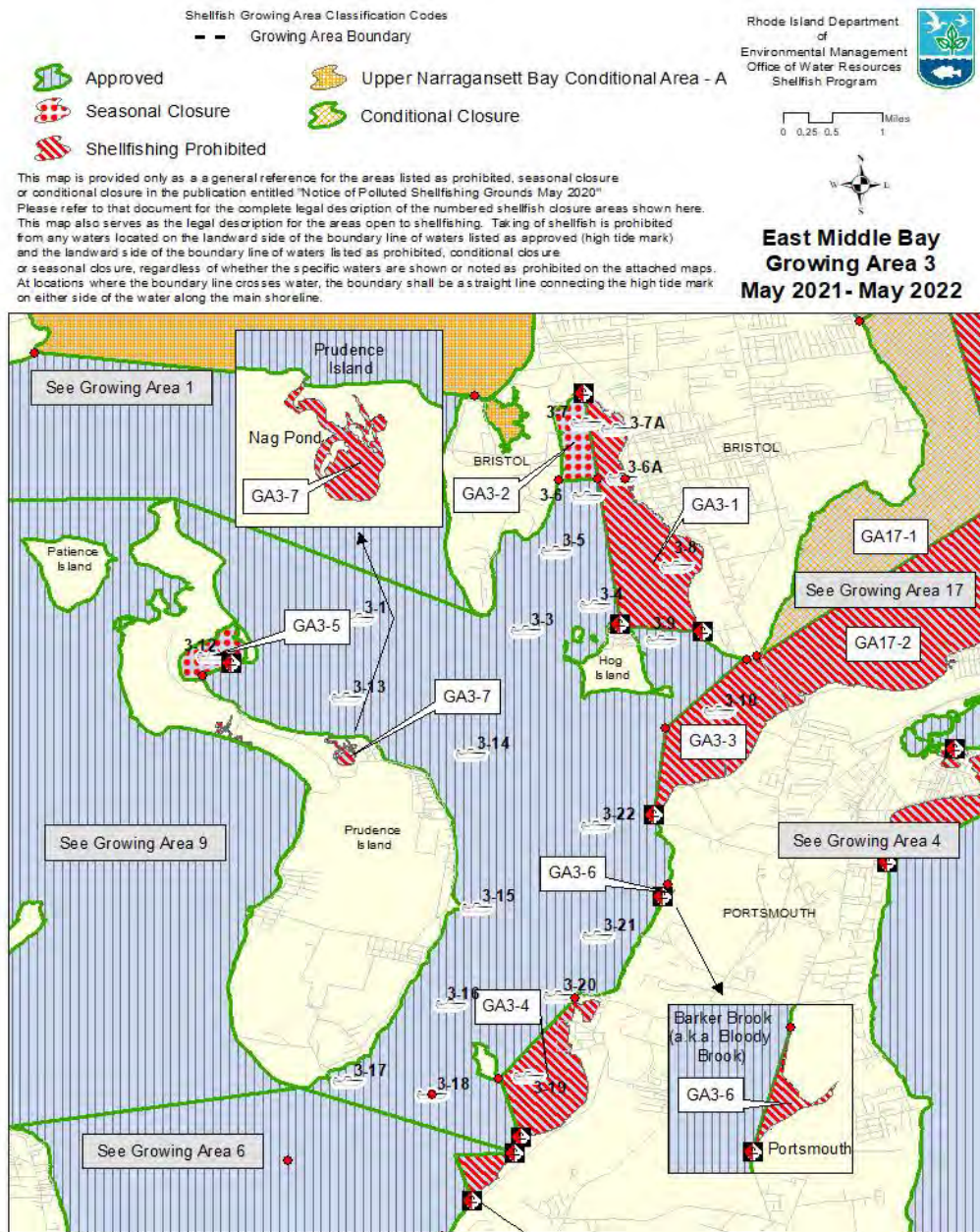
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A. Introduction

An annual update survey of the East Middle Bay (Growing Area 3, Figure 1) was completed in 2021. The last 12-year sanitary shoreline survey of the area was conducted in 2010. A total of sixty-one (61) actual or potential sources were identified during that 12-year shoreline survey. Forty-five (45) of the sources were not actively flowing at the time of the survey with the remaining sixteen (16) having flows warranting sampling. Of the sixteen (16) sources sampled in 2010, only eight (8) sources exceeded the 240 MPN/100 ml threshold. Triennial surveys of Growing Area 3 were completed in 2013, 2016, and 2019 with annual updates completed in the intervening years. A comprehensive 12-year survey is scheduled for GA3 in 2022. Results of the 2021 annual update are below.

Figure 1: GA3 Classification map with water quality monitoring station locations.



B. 2021 Shoreline Survey

During the 2021 shoreline survey one (1) source, which had bacteria levels above 2,400 cfu/100ml in the 2010 12-year survey was revisited. Source 2021-3-018 was observed to have no flow at the time of the 2021 survey, so no fecal coliform water sample was collected. Results from six (6) sources that had elevated fecal coliform in prior shoreline surveys are summarized below. Most of these moderately elevated sources flow into prohibited waters and many of the sources have a trend of reduced flow and reduced fecal coliform in recent years (Table 1). All shoreline sources will be reexamined and sampled in flowing during the 2022 12-year survey. A shoreline survey of Hog Island was completed in 2018 and all sources had moderate to low fecal coliform levels. Hog Island will be surveyed as part of the 2022 12-year survey.

Table 1: Summary of recent fecal coliform results from GA3 shoreline sources.

Middle Bay														
mple, NF - No flow, IS- In-stream														
Lat	Long	Description	Classification	2010 Results (MPN)	2011 Results (MPN)	2012 Results (CFU)	2013 Results (CFU)	2014 Results	2016 Results	2017 Results	2018 Results	2019 Results	2020 Results	2021 Results
41.60793	-71.2729	Bloody Brook (Barkers Creek)	P	(Prohibited zone added around mouth of creek)										
41.67161	-71.2798	36" Dia RCP stormdrain from under condo building	P	15,000, 0.01 cfs						Could not				
41.67652	-71.279	18" RCP outfall in rip rap wall from stormdrain	P	23,000						NF	NF			NF
41.63827	-71.2809	Stream draining saltwater marsh on south side of Hog Island	A	2400, 3.72 cfs	23	0	<2	3	0		36		CNL	
41.57333	-71.2881	Stream at R/R tressel Burma (Defense Dr) Road. In 2017, stream was not flowing into receiving waters. Ended ~50' from shore in a "pond" on beach. Possibly seeping underneath sand.	P	4600, 3.9 cfs					0	1000	440	100	100	
41.58155	-71.3211	24" dia RCP 50 yards north of #301	A	2400, 0.01 cfs 23, IS= <3	43, IS= <4	0	<2	50	0					

C. Marinas and Mooring Fields

There are several recreational and commercial boating areas that have the potential to negatively impact the ambient waters of East Middle Bay (GA3). The portions of GA3 most heavily used for boating activities have either permanent closures (Bristol Harbor, GA3-1) or have seasonal closures (GA3-2, western side of Bristol Harbor and GA 3-5, Potter Cove on Prudence Island) to protect public health in the event of illicit sewage discharges. Dilution calculations have been completed for all marinas and destination mooring fields in the growing area. For details on these calculated dilution areas and the rationale for assumptions made to complete these calculations, refer to the RIDEM Office of Water Resources Shellfish Program document entitled *Marina Dilution Analysis Background* (June 2017).

Eight (8) of the marinas in the GA3 are located within the prohibited waters of Bristol Harbor, with the closure area more than adequate in size to dilute fecal coliform to acceptable levels in the event of an accidental discharge from vessels. The two (2) remaining marinas within Bristol Harbor are within the seasonally closed area in the western part of the harbor, this additional seasonal closure provides adequate dilution for the summer boating season. Finally, the two remaining marinas within East Middle Bay are located within prohibited waters and have ample area for dilution.

There are currently three (3) pump-out facilities located within the area of Bristol Harbor: Stone Harbor Marina, Rockwell Town Pier, and the Bristol Town pump-out boat. For additional information refer to the 2021 RIDEM Pump-out Facilities Report which evaluates the area's compliance with Rhode Island's "No Discharge" policies.

D. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 3 (East Middle Bay) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

E. Wastewater Treatment Facilities

The most significant point source discharge into this growing area is from the Bristol wastewater treatment facility (NPDES IS RI0100005) located in Bristol Harbor discharging to Walker Cove. The facility is permitted to discharge a maximum monthly average flow of 3.79 MGD (million gallons/day). The average daily flow for 2021 was 3.46 MGD which is well below the permit limits. In 2021 this facility reported two (2) permit violations, both for exceeding the monthly average flow limit. In April 2021 a monthly average of 3.96 MGD was observed, an approximately 4% increase above the permitted flow. During September 2021 a monthly average flow of 4.3 MGD was recorded, an approximately 13% increase above the permitted level. However, fecal coliform in the effluent remained low during both of these months of elevated flow, with a geometric mean of 1.4 cfu/100 ml fecal coliform in the effluent during April 2021 and a fecal coliform geometric mean of 6.6 cfu/100 ml during September 2021. These results that the Bristol WWTF continued to operate efficiently even during periods of high flow through the facility.

The Bristol WWTF discharge dilution zone was established using the EPA's PLUMES model which established an area in the prohibited classification meeting the minimum dilution requirements provided for in guidance within the NSSP MO. The established prohibited safety zone around the Bristol WWTF outfall is adequate to dilute the design flow at an effluent fecal concentration equal to a complete loss of disinfection (100,000 cfu/100 ml fecal coliform in the effluent). Routine monitoring at station 3-8 which is located at this discharge location indicates

that waters within the prohibited zone routinely have fecal coliform concentration of < 14 cfu/100 ml (Table 3).

The Bristol WWTF and associated infrastructure has experienced several sanitary sewer overflows due to wet weather conditions and infiltration overloads throughout the facilities catchment area. These overflows and treatment interruptions are documented in the shellfish program's permanent files and associated emergency closures and re-opening records relating to each event are filed chronologically. RIDEM shellfish program evaluated each incident of permit violation or SSO and appropriately closed impacted shellfish waters in accordance with the guidance contained within the NSSP Model Ordinance. Shellfish waters did not reopen to harvest until waters returned to pre-event conditions and sufficient time had elapsed for shellfish to self-depurate. In the case of a discharge of raw untreated sewage, MSC was used to ensure viral loads had dissipated in shellfish prior to re-opening in addition to FC levels in the shellfish waters returning to approved conditions or for a minimum of 21 days.

F. Annual Statistical Analysis

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1995) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012 and/or the multiple tube fermentation test (sm01 MPN) method utilized prior to August 2012. All samples in the current statistical evaluation were analyzed by the mTEC method. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (copy in the Program's permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation.

GROWING AREA 3 – EAST MIDDLE BAY

HIGHLIGHTS

- * Sampled 6X during 2021 season (5X during 2021, 1X January 2022) with 3 wet weather and 3 dry weather samples.
- * Statistics represent recent 30 combined wet (n=18) and dry (n=12) weather data 1/26/2017 or 4/3/2017 to 1/13/2022 for approved stations (Table 2).
- * Statistics represent recent 15 combined wet (n=10) and dry (n=5) weather data when the area was open 11/6/2018 to 1/13/2022 for seasonally approved stations (Table 3).
- * All approved and conditionally/seasonally approved stations in compliance and conformance.
- * All samples analyzed by mTEC method (90th percentile criteria= 31 cfu / 100 ml).
- * Data run 1/18/2022.

COMMENTARY

All stations in Growing Area 3 (East Middle Bay) were sampled 6 times during the 2021 season, in compliance with systematic random sampling monitoring requirements. The 2021 statistical evaluation includes the most recent 30 samples collected during both wet and dry weather (18 wet weather, 12 dry weather) since 1/26/2017. Two stations in GA3 (3-7 and 3-12) are classified as seasonally approved. The statistical analysis for these seasonally approved stations includes the most recent 15 samples collected during wet and dry weather (10 wet and 5 dry weather) since 1/16/2018.

All approved stations met criteria during the 2021 evaluation. Results of the 2021 statistical evaluation also indicated that all conditionally approved / seasonally approved stations in Growing Area 3 are in compliance and that the area is properly classified.

RECOMMENDATIONS

- * No action recommended based on 2021 monitoring results.

Table 2: Fecal coliform compliance statistics for Approved stations in GA3. Recent 30 samples all weather (1/26/2017 or 4/3/2017 to 1/13/2022; all mTEC, 18 wet and 12 dry weather). Station locations shown in Figure 1.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
3-1	A	30	2.9	9.2
3-3	A	30	2.5	5.7
3-4	A	30	2.2	4.7
3-5	A	30	2.8	10.7
3-6	A	30	2.7	8.9
3-6A	P	30	3.9	17.4
3-7	SA	30	2.9	8.3
3-7A	P	30	4.2	21.1
3-8	P	30	3.3	9.8
3-9	A	30	3.5	13.1
3-10	P	30	2.9	8.9
3-12	SA	30	2.5	5.8
3-13	A	30	2.2	4.1
3-14	A	30	2.9	8.8
3-15	A	30	2.6	6.5
3-16	A	30	2.3	4.1
3-17	A	30	2.6	6.5
3-18	A	30	2.3	4.9
3-19	P	30	2.4	5.0
3-20	A	30	2.4	4.7
3-21	A	30	2.0	2.8
3-22	A	30	2.6	7.2

Table 3: Fecal coliform compliance statistics for Seasonally Approved stations in GA3. Recent 15 samples when open (11/16/2018 to 1/13/2022, all mTEC, 10 wet and 5 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
3-7	SA	15	2.9	0.0
3-12	SA	15	2.4	0.0

G. Summary and Conclusions

The 2021 annual evaluation of the East Middle Bay (GA3) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. The one (1) WWTF in the growing area was shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform levels indicated that all approved and seasonally approved stations in the growing area met NSSP criteria and are in compliance.

The 2021 annual review demonstrated that the East Middle Bay growing area (GA3) is in program compliance and is properly classified. No classification changes are recommended.

GA4 Sakonnet River 2021 Annual Update

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1. Introduction

A twelve (12) year sanitary shoreline survey of Growing Area 4, the Sakonnet River (Figures 1 & 2), was conducted in 2013 and triennial updates was performed in 2016 and 2019. A total of one hundred and sixty-seven (167) actual or potential sources were identified during the 2013 shoreline survey, excluding marinas. One-hundred and eight (108) of the sources were not actively flowing at the time of the shoreline survey with the remaining fifty-nine (59) having flows warranting sampling. Fourteen (14) of the sources from the 2013 survey had results greater than 240 cfu/100 ml and of those sources five (5) were located in prohibited areas of the growing area. The remaining sources did not have bacteria counts exceeding 2,400 cfu/100 ml, which would warrant follow-up sampling. Two (2) potential sources were investigated as part of the 2021 annual update of the Sakonnet growing area (GA4).

Figure 1: Growing Area 4 (North) Current Classification Map.

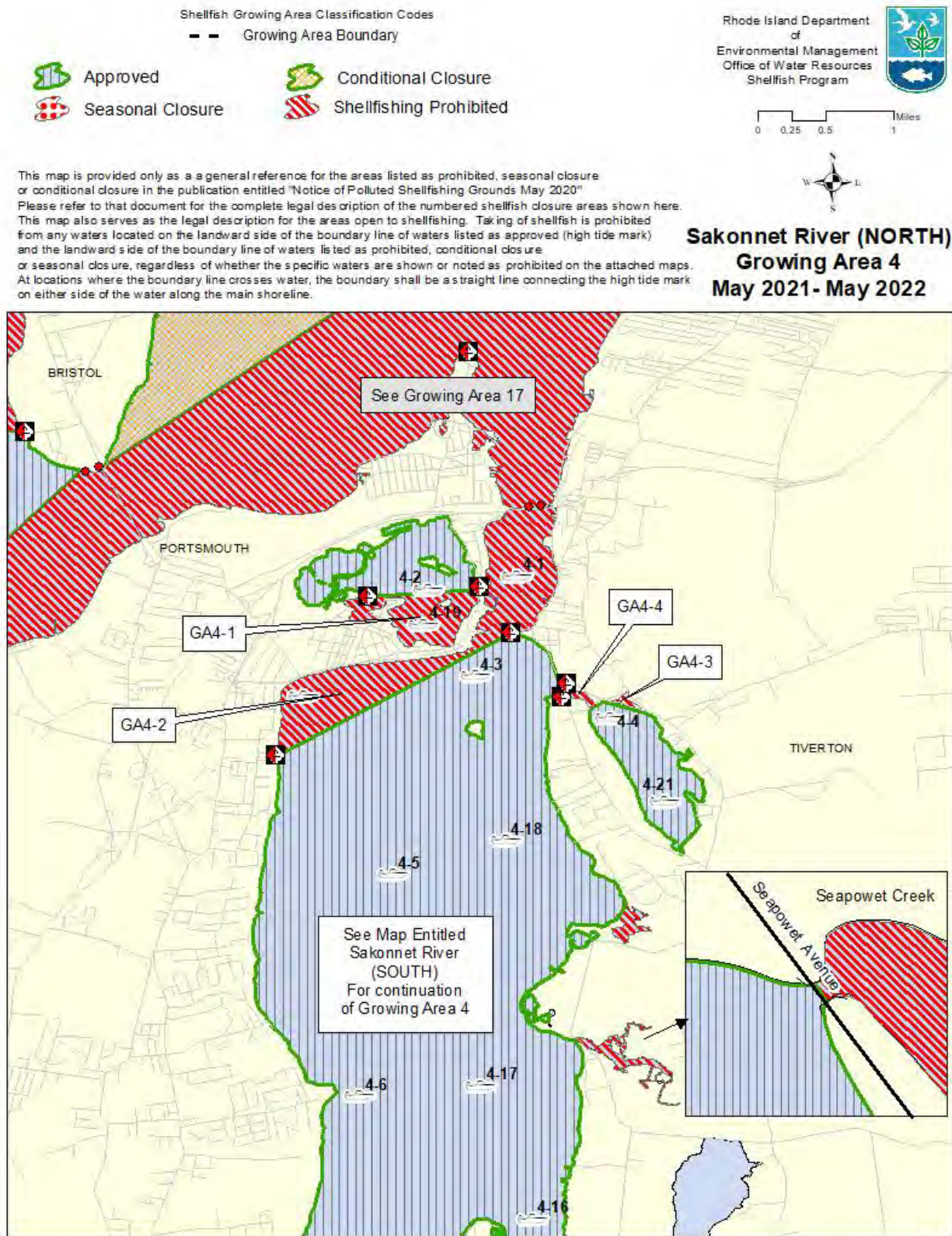
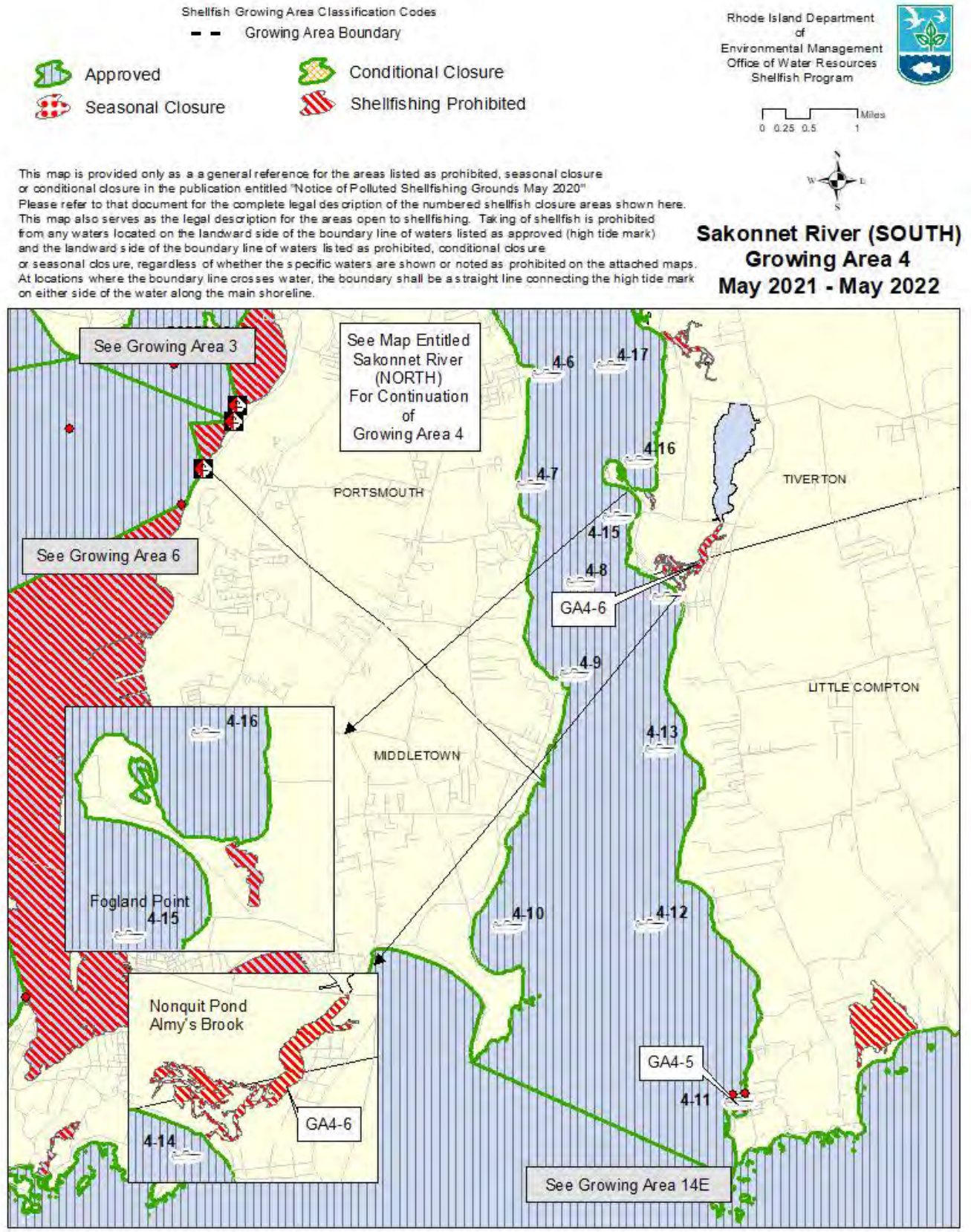


Figure 2: Growing Area 4 (South) Current Classification Map



2. 2021 Shoreline Survey

During the 2021 annual update a total of two (2) sources were revisited (Table 1, Figure 3). Sources 2021-4-710 and 2021-4-711 were sampled twice (once during July and once during October) during 2021. Both sources discharge to Nanaquaket Pond and the sources were flowing at both times they were sampled. The fecal coliform results for the sources sampled during the 2021 survey are summarized in Table 1.

Figure 3: 2021 Sakonnet River Growing Area 4 Pollution Sources

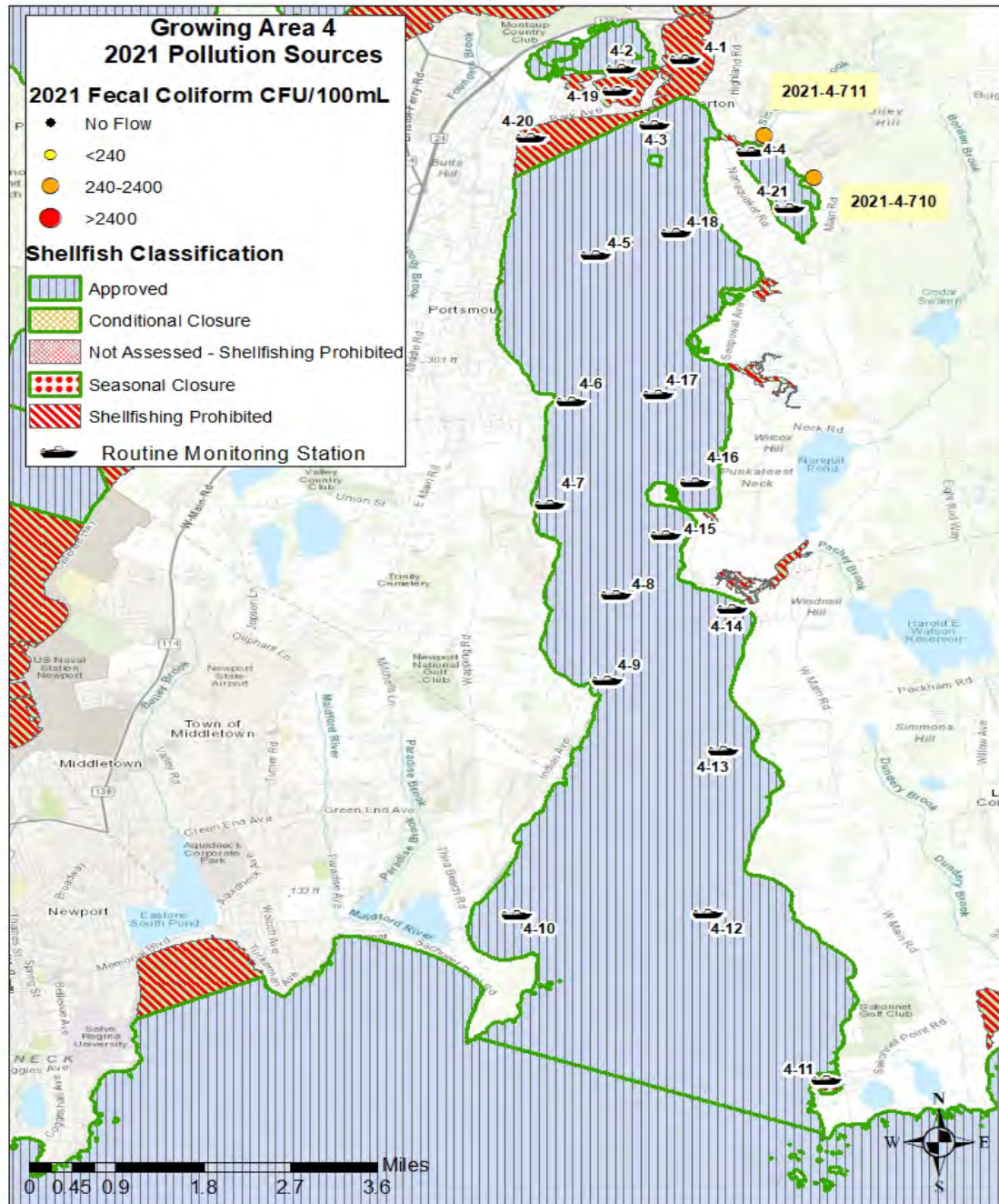


Table 1: Summary of 2021 Shoreline Results for Growing Area 4 Sakonnet River

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2018 Results mTEC cfu/100ml	2019 Results mTEC cfu/100ml	2020 Results mTEC cfu/100ml	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-4-710	7/19/2021	41.61236	-71.19585	White Wine Brook at road crossing 24" dia CMP	Approved	A	D	1600	3500	3000	1500 IS 100	-
2021-4-710 (Follow-up)	10/19/2021	-	-	-	Approved	A	D	-	-	-	2000 IS 120	-
2021-4-711	7/19/2021	41.61925	-71.2033	Sin and Flesh Brook	Prohibited	I	D	1600	100	-	1400 N 340 S 130	0.952
2021-4-711 (Follow-up)	10/19/2021	-	-	-	Prohibited	I	D	-	-	-	540 N 8 S 36	-

Source 2021- 4-710 is White Wine Brook, which drains through a 24-inch CMP into Nanaquaket Pond in Tiverton. The source had an elevated fecal coliform result of 1,600 cfu /100 ml in 2018 but the volumetric flow was a trickle. The source waters must exit the CMP pipe and cross a dense *Phragmites* stand and travel over 100 feet before reaching the receiving waters of GA4. A follow-up sample was taken on 5/8/2018 with a result of 100 cfu/100 ml and an instream of 31 cfu/100 ml. In 2019 this source had a result of 3,500 cfu/100 mL thus requiring a resample in 2020. The 2020 results were 3,000 cfu/100 mL at the pipe and an instream sample of 700 cfu/100 mL.

Source 4-710 was sampled twice as part of the 2021 annual update. On July 17, 2021 (3 days after 1.52” rain at TF Green Airport), the actual source showed levels of 1,500 cfu/100 ml with in-stream result of 100 cfu/100ml. The site was revisited on October 19, 2021 (2 days after 0.34” rain at TF Green Airport), with a result of 2,000 cfu/100ml and an instream result of 120 cfu/100ml. The source had a low flow rate (trickle) on both dates sampled during 2021. While fecal coliform was elevated in this source, it has a low flow rate (trickle) that minimizes impact on the growing area waters. Growing Area 4 monitoring station 4-21, located approximately 1,800 feet south of source 4-710 had acceptable fecal coliform levels during 2021. Upstream sources contributed to fecal coliform elevations in source 4-710 will be investigated.



Figure 4: Source 2021- 4-710 White Wine Brook. The Brook was a trickle running through the dense *Phragmites* stand (left photo on 9/19/2018). The mouth of the brook is barely visible through the *Phragmites* as it enters Nanaquaket Pond (right photo).

Source 2021-4-711 is Sin and Flesh Brook which runs approximately 4.8 km (~3 miles) through the upland area of Tiverton RI and enters the prohibited estuarine waters of ‘the Gut’ at Highland Road. The gut is a tidal basin of approximately three (3) acres area adjacent to Nanaquaket Pond. Tidal flow from the Gut (prohibited waters) discharges through a culvert to the approved waters of GA4 at the northeastern side of Nanaquaket Pond. Sampling in 2018 observed elevated fecal coliform bacteria of 1,600 cfu/100ml requiring a revisit in 2019 where results came back at <100 cfu/100ml. This source was sampled twice in 2021. On 7/19/2021 (3 days after 1.52” rain at TF Green Airport) results of 1,400 cfu/100 ml with instream results of 340 cfu/100 ml and 130 cfu/100 ml were observed. It is to be noted that July 2021 was an exceptionally wet month, totaling up to 7.12” of rainfall at TF Green Airport (weather station KPVD) compared to the long-term July average rainfall of 2.91”. The source was sampled again on 10/19/2021 (2 days after 0.34” rain at TF Green Airport) and with a result of 540 cfu/100ml. Sin and Flesh Brook is on the State of Rhode Islands impaired waters list (303d list) for bacterial (*Enterococcus*) contamination with a TMDL plan scheduled for 2030. DEM Shellfish staff have talked with the Tiverton Harbor Commission and the Harbor Commission is aware of the

elevated fecal coliform in Sin and Flesh Brook and is beginning to develop best management practices to prevent fecal coliform contamination in the watershed. DEM Shellfish Program station 4-4 is located approximately 500 feet southwest of the culvert that is continuous with the prohibited waters of 'the Gut'. Station 4-4 is currently in compliance but the elevated fecal coliform in nearby Sin and Flesh Brook is a concern, and this station will have to be monitored closely for continued compliance with NSSP standards for approved waters.



Figure 5: Source 2021-4-711 Sin and Flesh Brook. Upstream view (towards freshwater, left photo) and downstream view looking towards prohibited waters of 'the Gut' (right photo). Tidal flow between the Gut (prohibited waters) and the approved waters of GA4 must pass through the culvert opening visible in the right photo.

3. Marinas and Mooring Fields

The Sakonnet River growing area has several marinas and mooring fields as detailed in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters adjacent to these marinas have either a year-round prohibited area or a seasonal closure to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state. Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found on our website (<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>).

4. Waste Water Treatment Facilities

Public sewers service only a small portion of the growing area watershed in a portion of Middletown near the Sachuest Point area. All other areas of the watershed are serviced by on-site wastewater treatment systems (OWTSs). There are currently no RIPDES permitted facilities that discharge into the general area. Formerly permitted minor sanitary discharges at Tiverton High School (permitted terminated in 2013) and Josephine Wilber School (permit terminated in 2007) have been eliminated.

5. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area.

Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Sakonnet River (Growing Area 4) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

6. Water Quality Annual Statistical Summary: GA4 Sakonnet River

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is the result of an agreement between the State of Rhode Island and the Food and Drug Administration (FDA) and managed by the National Shellfish Sanitation Program (NSSP). The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at (23) monitoring stations throughout the growing area (Figs 1 & 2). Samples are collected on six randomly selected dates annually following NSSP guidance for systematic random sampling of approved waters.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1995) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012 and/or the multiple tube fermentation test (sm01 MPN) method utilized prior to August 2012. All samples in the current statistical evaluation were analyzed by the mTEC method. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (copy in the Program's permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM

Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation. A statistical summary of recent fecal coliform data is below.

HIGHLIGHTS

- * Sampled 6X during 2021 (5 wet weather, 1 dry weather).
- * Statistics represent recent 30 samples collected 3/21/2017 to 12/30/2021 during wet (n = 17) and dry (n = 13) weather for approved stations; all samples analyzed by mTEC method.
- * Statistics represent recent 15 samples (8 wet weather, 7 dry weather) collected 11/1/2017 to 12/30/2021 when seasonally approved station 4-11 (Sakonnet Harbor) was in the open status; all samples analyzed by mTEC method.
- * All approved and seasonally approved stations were in compliance and conformance.
- * Data run 1/5/2022.

COMMENTARY

The Sakonnet River (Growing Area 4) was sampled six times during 2021 which meets minimum systematic random sampling requirements for approved areas. The statistical evaluation of approved areas includes the recent 30 samples collected since 3/21/2017 during both wet (n=17) and dry (n=13) weather conditions. All approved stations are in program compliance and properly classified.

While all approved stations in GA4 are in compliance, the station located in the northern end of Nanaquaket Pond (station 4-4; south of Nanaquaket Bridge) had a fifth consecutive year of increased frequency of elevated fecal coliform observations. Two of the six samples collected at station 4-4 during 2021 exceeded the NSSP variability standard of 31 cfu/100 ml. Both of these elevated samples were collected during wet weather conditions of 2-4 days after rainfall of 1.6” to 2”. The 90th percentile variability criteria calculated for station 4-4 was 29.1 cfu/100 ml for 2021 which is approaching the compliance statistic of 31 cfu/100 ml. Continued elevated fecal coliform observations in Nanaquaket Pond may require a downgrade in classification. Station 4-4 is subject to freshwater input from nearby Sin and Flesh Brook flowing through ‘the gut’ and through a culvert into Nanaquaket Pond approximately 125 yards from station 4-4. Shoreline sampling has indicated that fecal coliform levels are elevated in Sin and Flesh Brook and ‘the gut’ during wet weather. DEM shellfish program staff will continue to monitor fecal coliform sources in the area.

Station 4-14 near the mouth of Almy Brook has also experienced increased fecal coliform levels recently. Two of the six samples collected during 2021 exceeded the 31 cfu/100 ml variability criterion and pushed the variability compliance statistic up to 25.0 cfu/100 ml compared to the NSSP variability standard of 31 cfu/100 ml. As resources allow, DEM shellfish program staff will sample nearby marshes and Almy Brook to identify potential sources of fecal coliform bacteria.

Classification of station 4-11 in Sakonnet Harbor was upgraded from prohibited to seasonally approved in 2016 due to improvements in water quality. The 2021 update indicated that seasonally approved station 4-11 was in compliance during the open season and that the area is properly classified.

RECOMMENDATIONS

- * Maintain Sakonnet Harbor (station 4-11) seasonal closure.
- * Investigate sources of recent increase in fecal coliform concentration at the northern end of Nanaquaket Pond (near station 4-4) and near Almy Brook (station 4-14).

Table 2: Fecal coliform statistical summary of 30 recent samples collected during 3/21/2017 to 12/30/2021; all mTEC analysis, 17 wet and 13 dry weather. See Figures 1 & 2 for station locations.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
4-1	P	30	2.3	3.5
4-2	A	30	2.3	3.6
4-3	A	30	2.4	4.2
4-4	A	30	5.4	29.1
4-5	A	30	2.3	4.1
4-6	A	30	2.3	4.2
4-7	A	30	2.2	3.8
4-8	A	30	2.1	3.4
4-9	A	30	2.3	4.5
4-10	A	30	2.5	6.1
4-11	SA	30	2.1	3.0
4-12	A	30	2.1	3.6
4-13	A	30	2.3	4.6
4-14	A	30	4.6	25.0
4-15	A	30	2.1	3.3
4-16	A	30	2.2	3.7
4-17	A	30	2.3	4.2
4-18	A	30	2.2	3.5
4-19	P	30	2.2	3.8
4-20	P	30	2.6	7.0
4-21	A	30	3.7	15.8

Table 3: Fecal coliform statistical summary for seasonally approved station 4-11 in Sakonnet Harbor based on 15 recent samples collected during 11/1/2017 to 12/30/2021; all mTEC, 8 wet and 7 dry weather. See Figure 2 for station location.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>% greater than</u> <u>31 cfu/100 ml</u>
4-11	SA	15	2.0	0.0

7. Summary and Conclusions

The 2021 annual evaluation of the Sakonnet River (GA4) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A statistical review of water column fecal coliform observations indicated that all approved and seasonally approved stations in the growing area met NSSP criteria and are in

program compliance. However, both Nanaquaket Pond (station 4-4) and the area near the mouth of Almy Brook (station 4-14) have experienced increasing fecal coliform levels over the past five years and are in jeopardy of a classification downgrade.

The 2021 annual review demonstrated that the Sakonnet River growing area (GA4) is in program compliance and is properly classified. No classification changes are recommended.

**GA5
Kickemuit River
2021 Annual Update**

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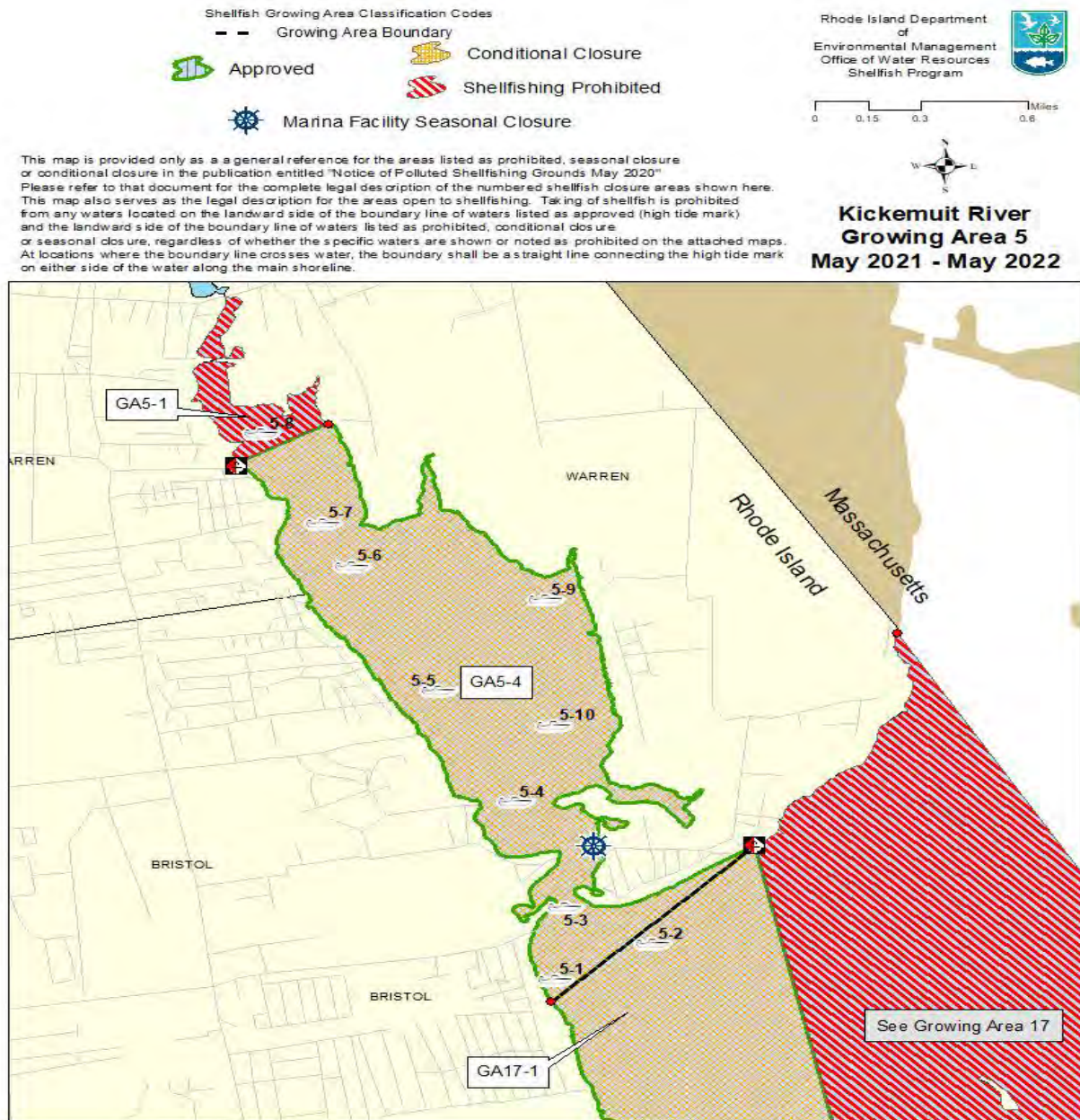
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1. Introduction

Initial shoreline surveys of the Kickemuit River (GA5) were performed in 1994 and 1997. Comprehensive 12-year shoreline surveys of the Kickemuit River (conditionally approved Growing Area 5) were conducted during the summer of 2008 and most recently during 2020 by staff from RIDEM's Office of Water Resources Shellfish Program. Triennial surveys of the growing area were completed in 2011, 2014, and 2017 with annual updates completed in the intervening years.

This report is an annual update of growing area GA5 completed in 2021. Sampling was conducted for all known GA5 pollution sources found to have fecal coliform results exceeding 2,400 cfu/100ml in the 2020 12-year survey. Three (3) sources (5-001, 5-007, 5-008) were sampled for fecal coliform as part of the 2021 annual update.

Figure 1: Current (May 2021) Kickemuit River (GA5) shellfish classification map.



2. Pollution Source Survey

All three elevated sources sampled as part of the 2021 annual update flow into prohibited waters in the northern end of GA5. Details on the three (3) sources examined as part of the 2021 annual update are below.

Figure 2: Location of pollution sources in GA5 . Growing area monitoring stations indicated by boat symbols.

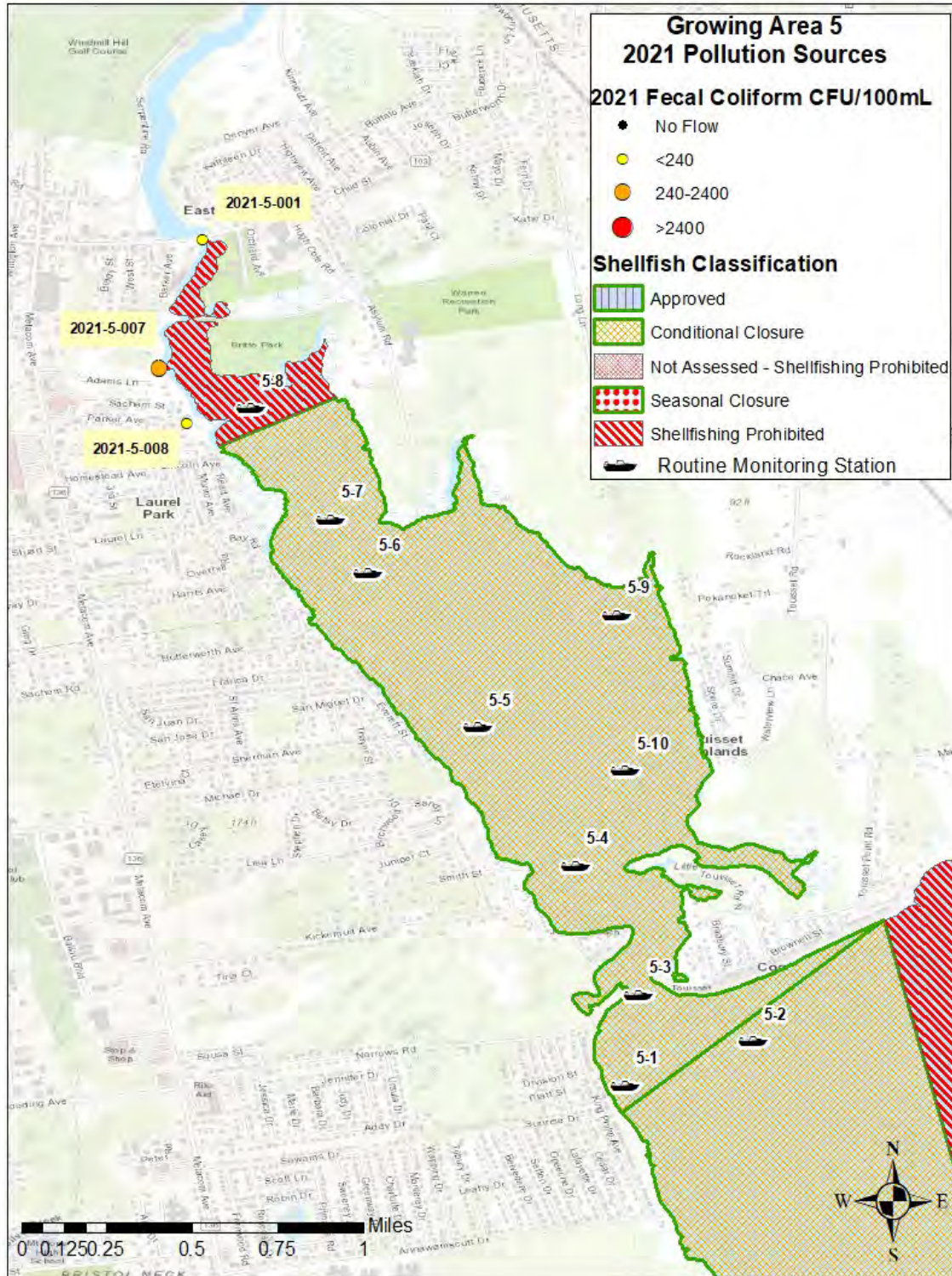


Table 1: 2021 summary of pollution sources in GA5

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2020 Results mTEC cfu/100ml	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-5-001	7/22/2021	41.7294	-71.26271	Kickemuit River freshwater source @ dam	Prohibited	Actual	Direct	6000	100 E 160 W 100	-
2021-5-007	7/22/2021	41.7241	-71.26457	Small stream from dammed pond at cow farm	Prohibited	Actual	Direct	1100	800 N 940 S 500	<.001 Trickle
2021-5-008	7/22/2021	41.7218	-71.2634	(2) discharges at end of Parker St (1) not flowing	Prohibited	Actual	Indirect	1400	100 N 260 S 120	<.001 Trickle

Source 2021-5-001 (Figure 3) is the outfall of the Kickemuit River Dam at Child Street in Warren, RI that separates the freshwater upper reaches of the Kickemuit River and the Warren Reservoir from the tidal waters of the Kickemuit River growing area. When visited in 2020 the source yielded a result of 6,000 cfu/100 mL with a low flow rate of approximately 0.04 cfs at the outflow of the Warren Reservoir dam to the Kickemuit River. In 2021 the source was sampled on 7/22/2021 (1 day after 0.11” rain at Taunton Airport) with results of 100 cfu/100 ml and in-stream results of 160 cfu/100ml (East) and 100 cfu/100ml (West). Source 5-001 (Figure 2) is located approximately 3,500 feet (1.07 km) upstream from the conditionally approved waters of Growing Area 5. The waters between source 5-001 at the Child Street dam and the Conditionally Approved waters of the area are classified as Prohibited. This Prohibited area acts as a dilution zone before the freshwater input of the Kickemuit River enters Conditionally Approved waters. The low flow rate and the large Prohibited zone provide adequate dilution of potential fecal coliform contamination from source 5-001 as evidenced by sentinel station 5-8 (Prohibited classification) which met NSSP criteria for conditionally approved waters during 2021 (Table 2). A plan to remove this dam is currently under review by RI DEM. DEM shellfish staff will monitor changes in the microbial water quality of the growing area during and after dam removal.

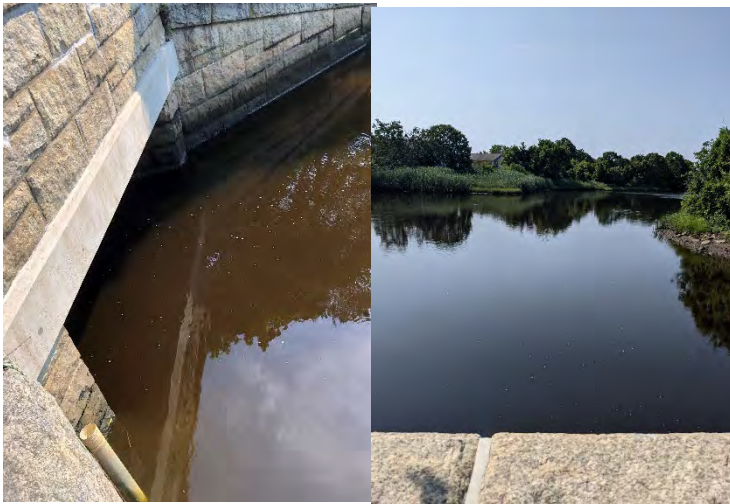


Figure 3: Source 5-001, flow over the Kickemuit Reservoir dam at Child Street in Warren, RI..

Source 2021-5-007 (Figure 4) is a small stream that drains a pond within a cow grazing pasture located on the northwestern shore of the growing area. The stream discharges to prohibited waters. The stream splits the property line between the pasture located at the end of Adams Lane in Warren, RI and a 3-acre property of 113 Libby Lane in Warren, RI. The water flows from the pond into a concrete trench before exiting out through a stone retaining wall and flowing across a marshy shoreline before entering the prohibited waters of the growing area. Source 5-007 had a low (trickle) flow and a fecal coliform concentration of 1,100 cfu/100 mL during the 2020 shoreline survey. The source was sampled on 7/22/2021 (1 day after 0.11” rain at Taunton Airport) with a fecal coliform results of 800 cfu/100ml and in-stream results of 940 cfu/100ml (North) and 500 cfu/100ml (South).

This source flows into Prohibited waters approximately 1,300 feet (0.4 km) from the northernmost Conditionally Approved waters of the growing area. The low flow rates observed for this source and the dilution provided within the Prohibited zone this source discharges to are protective of the microbiological water quality of the Conditionally Approved waters of the growing area. As discussed above, monitoring station 5-8 in prohibited waters adjacent to this

source met NSSP criteria for conditionally approved waters during 2021. Given the proximity of livestock to the growing area, this source will be monitored regularly to ensure that there continues to be no impact on the fecal coliform water quality of the growing area.



Figure 4: Source 5-007, a small stream flowing through a field and Phragmites marsh.

Source 2021-5-008 (Figure 5) is a set of two drainpipes at the extension of Parker Avenue in Warren, RI that drain into prohibited waters. In 2012 this source had fecal coliform concentrations of 1,400 cfu/100 ml. In 2021 the source yielded fecal coliform results of 100 cfu/100ml with a trickle flow on 7/22/2021 (1 day after 0.11” rain at Taunton Airport). Companion in-stream samples in the prohibited waters had fecal coliform concentration of 260 cfu/100ml (to the north) and 120 cfu/100 ml (to the south). This source flows into prohibited waters which provide sufficient dilution to protect the fecal coliform water quality of the conditionally approved waters of the growing area.



Figure 5: Source 5-008, drainpipes at the extension of Parker Avenue in Warren RI.

3. Marinas and Mooring Areas

The Kickemuit River growing area has one marina and several mooring fields as detailed in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters adjacent to this marina have a seasonal closure (May to October) to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state.

Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found at:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Waste Water Treatment Facilities

There are currently no wastewater treatment facilities that discharge directly to the Kickemuit River (GA5). This conditionally approved growing area is managed with precipitation based closure of the growing area as outlined in the area's Conditional Area Management Plan (CAMP). As is the case of all areas that may have sewer systems or infrastructure within their watersheds a notification of any sewage overflow that may impact these waters could require an emergency closure.

A review of Onsite Wastewater Treatment System (OWTS) complaints and failures was conducted as part of the shoreline survey. There are currently no open complaints within 200 ft of the Kickemuit River growing area. In February 2017, DEM investigated a complaint at 82 King Philip Ave in Bristol (on the western shoreline just south of Bristol Narrows) in which over time, the structure settled and the septic connection at the foundation separated from the discharge line, causing a chronic failure. The system was immediately reconnected to the septic system and a new septic pump installed as a short-term solution. The property has since been connected to the public sewer system and is no longer dependent on an OWTS.

In January 2018, a break in a sewer line caused by work on a water main in the general vicinity resulted in 265,000 gallons of untreated sewage to enter a stream and discharge into the conditionally approved Mt. Hope Bay (GA17) receiving waters just south of the Kickemuit River growing area. The discharge was discovered by town officials and DEM was notified immediately and the necessary repairs to the sewer line were made on January 25. The Kickemuit River growing area was closed throughout the overflow event due to its seasonal January closure. An extension to the closure was made until February 15 (resulting in a full 21-day closure from the end of the SSO event on January 24). The RI Department of Health verified that no shellfish product from these waters entered the market during the closure period.

5. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful

algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted.

There were no indications that any of the sources identified during this survey have the potential to impact the conditionally approved waters of the Kickemuit River (Growing Area 5) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

6. Water Quality Studies

A. RIDEM Shellfish Program

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1995) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012 and/or the multiple tube fermentation test (sm01 MPN) method utilized prior to August 2012. All samples in the current statistical evaluation were analyzed by the mTEC method. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (copy in the Program's permanent file).

Water samples for fecal coliform monitoring are collected at ten (10) monitoring stations throughout the growing area. Nine (9) of the stations are in Conditionally Approved waters and one (1) station is located in prohibited waters. GA5 is monitored in conjunction with GA17 (Mt. Hope Bay) at a once per month frequency which exceeds the NSSP requirements for conditionally approved waters not impacted by point source pollution. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data is analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

B. Statistical summary and review of GA5 fecal coliform data

HIGHLIGHTS

- * Sampled 10X during 2021 season.
- * Statistics represent recent 15 dry-weather samples collected 5/21/2020 or 6/23/2020 to 2/2/2022 when the Kickemuit conditional area was open.
- * All samples analyzed by the mTEC method.
- * All conditionally approved stations are in compliance and program conformance.
- * Data run 2/4/2022.

COMMENTARY

The conditionally approved Kickemuit River (Growing Area 5) was sampled ten (10) times during the 2021 season (9X during 2021 and once during February 2022). All samples were collected during dry weather (less than the closure threshold of 0.5" rain in prior 7-days) while the area was in the open status. Wet weather during the summer of 2021 delayed sampling efforts. For example, 7.85" of rain fell at Taunton Airport (location of the KTAN weather) during August of 2021. This compares to a long-term mean August rainfall of 3.55", a surplus of 4.30" rain compared to normal that resulted in the Kickemuit growing area being open and available for monitoring on only seven weekdays during August 2021. The recent 15 samples used for calculation of compliance statistics spanned from May of June of 2020 through February of 2022.

Previously (2016 through 2020) there was a January closure of the Kickemuit River (GA5) due to fecal coliform water quality exceeding the NSSP fecal coliform variability criteria during that month. Improved January fecal coliform water quality results were documented during January 2017 through January 2020 such that this seasonal (January) closure was removed in the May 2020 reclassification. January results were therefore included in calculation of the current compliance statistics. The 2021 statistical review demonstrated that all conditionally approved stations in the growing area are in program compliance. The single Prohibited station (station 5-8) located near the dominant freshwater source to the Kickemuit River also had acceptable water quality during dry weather. The 2021 statistical review demonstrated that the Kickemuit River growing area is properly classified and that all conditionally approved stations are in program compliance.

RECOMMENDATIONS

- * All stations are in program compliance and conformance.
- * Water quality continues to meet NSSP criteria during January since the removal of the seasonal (January) closure in 2020.
- * No other recommendations based on the 2021 review of monitoring data.

Table 2: Statistical summary of GA5 fecal coliform observations. Statistics based on recent 15 observations collected while the area was in the open status, all dry weather, samples collected during 5/21/2020 or 6/23/2020 to 2/2/2022. All samples analyzed by mTEC method.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
5-1	CA	15	4.0	6.7
5-2	CA	15	3.9	0.0
5-3	CA	15	3.5	6.7
5-4	CA	15	2.7	0.0
5-5	CA	15	3.1	0.0
5-6	CA	15	3.5	6.7
5-7	CA	15	4.7	6.7
5-8	P	15	4.4	6.7
5-9	CA	15	4.2	6.7
5-10	CA	15	3.4	0.0

7. Conclusions and Recommendations

The 2021 annual update demonstrated that all monitoring stations in the growing area meet NSSP criteria while in the open status. The 2021 review also documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. A review of the current GA5 Conditional Area Management Plan (CAMP) was conducted and the management plan was found to account for meteorological and hydrological influences on the water quality of the growing area. The current CAMP was updated in December 2021 and provides shellfish growing area management guidance and procedures to safeguard public health.

Removal of the Kickemuit Dam is currently in the permitting stage. DEM Shellfish staff will monitor GA5 fecal coliform data in the event that dam removal alters the flushing time and fecal coliform loading of the growing area, perhaps requiring changes in the conditional area management plan.

The 2021 annual update has demonstrated that the area is properly classified. No changes in classification are recommended.

East Passage
Growing Area 6 (GA6)
Triennial Evaluation
2021



Rhode Island
Department of Environmental Management
Office of Water Resources
Shellfish Program

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1. Introduction

This report is a triennial update of the East Passage shellfish growing area (GA6; Figure 1) that was completed during 2021. The primary objective of the survey was to identify and characterize sources of pollution and to reevaluate point and non-point sources of pollution potentially impacting the microbial water quality of the growing area. Comprehensive twelve-year sanitary shoreline surveys of the East Passage Growing Area 6 were completed in 2006 and 2015. Triennial updates of the growing area were completed in 2009, 2012 and 2018 and annual updates have been completed during each intervening year.

The 2015 comprehensive 12-year survey identified seventy-two (72) actual or potential sources. Fifty-four (54) of the sources were not actively flowing at the time of the shoreline survey with the remaining eighteen (18) having flows warranting sampling. During the 2021 triennial update, follow-up visits were made to ten (10) of the eighteen (18) sources that previously had greater than 2,400 cfu/100 ml results. Of the ten (10) sources visited during the 2021 shoreline survey, four (4) had no flow, four (4) could not be located and, two (2) sources were flowing and were sampled.

2. Description of the Growing Area

The East Passage growing area (GA6; Figure 1) is a tidal passage connecting the Atlantic Ocean with Upper Narragansett Bay. The passage is a deep gorge that was formed by glacial action, creating depths as deep of up to 188 feet near the mouth of the East Passage, with depths of 100 feet as far north as the Sandy Point area of Prudence Island. The East Passage is bound by three large islands: Aquidneck Island to the east with the towns of Portsmouth, Middletown and the City of Newport, Conanicut Island otherwise known as the Town of Jamestown lies to the west, and Prudence Island to the north marks the northern boundary of the growing area. The southern extent of the growing area is the waters of RI Sound along a line from Fort Wetherill in Jamestown to a point approximately half way along the western shoreline of Newport south of Fort Adams State Park (Figure 1).

The majority of the growing area has an Approved classification (Figure 1). There are no conditionally approved or seasonally approved waters in GA6. However, there are extensive Prohibited areas in GA6 due to recreational and commercial vessel activity in Newport Harbor and Coaster's Island (GA6-2) and Jamestown Harbor (GA6-3) and due to present-day and past US Navy activities at Carr Point (GA6-1) and Gould Island (GA6-4). The Prohibited areas are described below:

GA6-1 (Carr Point): The waters of the East Passage, south of a line from the Rhode Island Department of Environmental Management range marker located approximately 900 feet south of Carr Point to buoy "Gr C" located at Fiske Rock, and north and east of an intersecting line from the Rhode Island Department of Environmental Management range marker located approximately 2,300 feet north of the rock jetty formerly known as the Blue Gold Pier opposite Vigilant Street in Middletown, to nun buoy "22".

GA6-2 (Newport Harbor and Navy base): The waters of the East Passage and Newport Harbor encompassed by a line from the northwest corner of the concrete bulkhead at Fort Adams

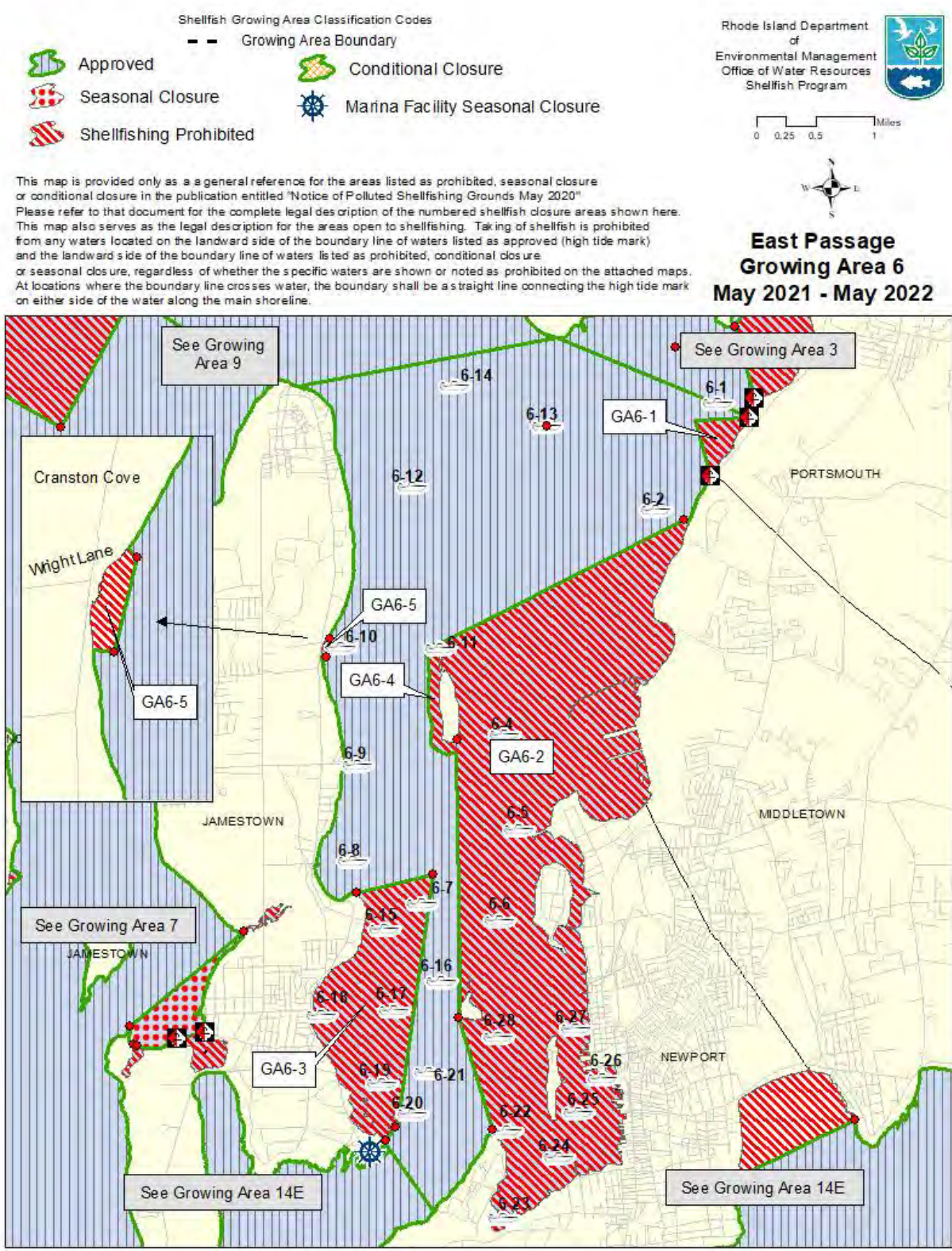
State Park to the Rose Island light, a line from the Rose Island light to the center of the rectangular structure located on the southeast corner of Gould Island, the entire eastern shoreline of Gould Island and eastern side of the firing pier and a line from 500 feet north of the Firing Pier at the US Navy Torpedo Testing station on Gould Island to the northwest corner of the rock jetty formerly known as the Blue and Gold Pier, located approximately 800 feet north of Greene Lane in Portsmouth.

GA6-3 (Jamestown Harbor): The waters on the east shore of Jamestown, in the vicinity of East Ferry and Taylor Point, west of a line from Bull Point in Jamestown to the house on the rocks located in The Dumplings to Bell Buoy F1 (2 +1) G6s and south of an intersecting line from the northern most tip of Taylor Point to Bell Buoy F1 (2 +1) G6s.

GA6-4 (Gould Island): The waters within 500 feet from any point on the shoreline of Gould Island starting at the center of the rectangular structure located on the southeast corner of Gould Island and continuing 500 feet from any edge of the firing pier at the U.S. Navy Torpedo Testing Station at the northern end of Gould Island.

GA6-5 (Cranston Cove) The waters of Cranston Cove on the eastern shoreline in Jamestown, south and west of a line from the most southeastern in water structure of CRMC dock # 771 located offshore of 530 East Shore Road, to the most northeastern in water structure of CRMC dock # 1924 located offshore of 486 East Shore Road, including all waters bounded by said docks to the north and south.

Figure 1: 2021-2022 Shellfish Classification Map of GA 6 with Routine Monitoring Stations



3. Pollution Source Survey

On July 20th, 2021, Steve Rogers (Biologist with DEM OWR Shellfish) completed a follow-up survey of ten (10) sources that had elevated fecal coliform during the 2015 twelve-year sanitary shoreline survey. The 2021 survey was completed 3 days after 1.52 inches of rain recorded at TFG NOAA station. Of the ten (10) sources visited, four (4) had no flow and four (4) could not be located. The remaining two (2) sources were flowing and were sampled. Results of 2021 source sampling are in Table 1 and the locations of sources are shown in Figure 2.

Source 6-001 is a stream that flows through a thick *Phragmites* stand before draining across a cobble beach into Cranston Cove on the eastern shore of Jamestown. 2021 sampling showed a fecal coliform level of 1,000 cfu/100 ml and a flow rate of 1.7 cfs (Table 1). This result is similar to those recorded over the past several years. In May 2016 a small, prohibited zone (GA6-5) was placed around this source because of the elevated fecal coliform pollution entering the growing area from source 6-001. Monitoring since that time has indicated no change in source 6-001 fecal coliform concentration. Therefore, closure GA6-5 in Cranston Cove, Jamestown must remain in place to safeguard public health.

Source 6-209 is the outflow from a retention pond near the toll plaza at the western end of the Newport Bridge. While this source has occasionally had elevated fecal coliform in the past (2,600 cfu/100 ml in 2015), it has had low flow (trickle) or no flow during each sampling since 2015. Source 6-209 was sampled on 7/20/2021 (3 days since 1.52" rain at TF Green Airport) with a fecal coliform result of <200 cfu/100 ml and a trickle flow rate. Given the consistently low flow rate and relatively moderate fecal coliform concentration, this source is not a threat to the microbial water quality of the growing area.

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 6 (East Passage) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

Figure 2: 2021 Shoreline Survey Pollution Sources

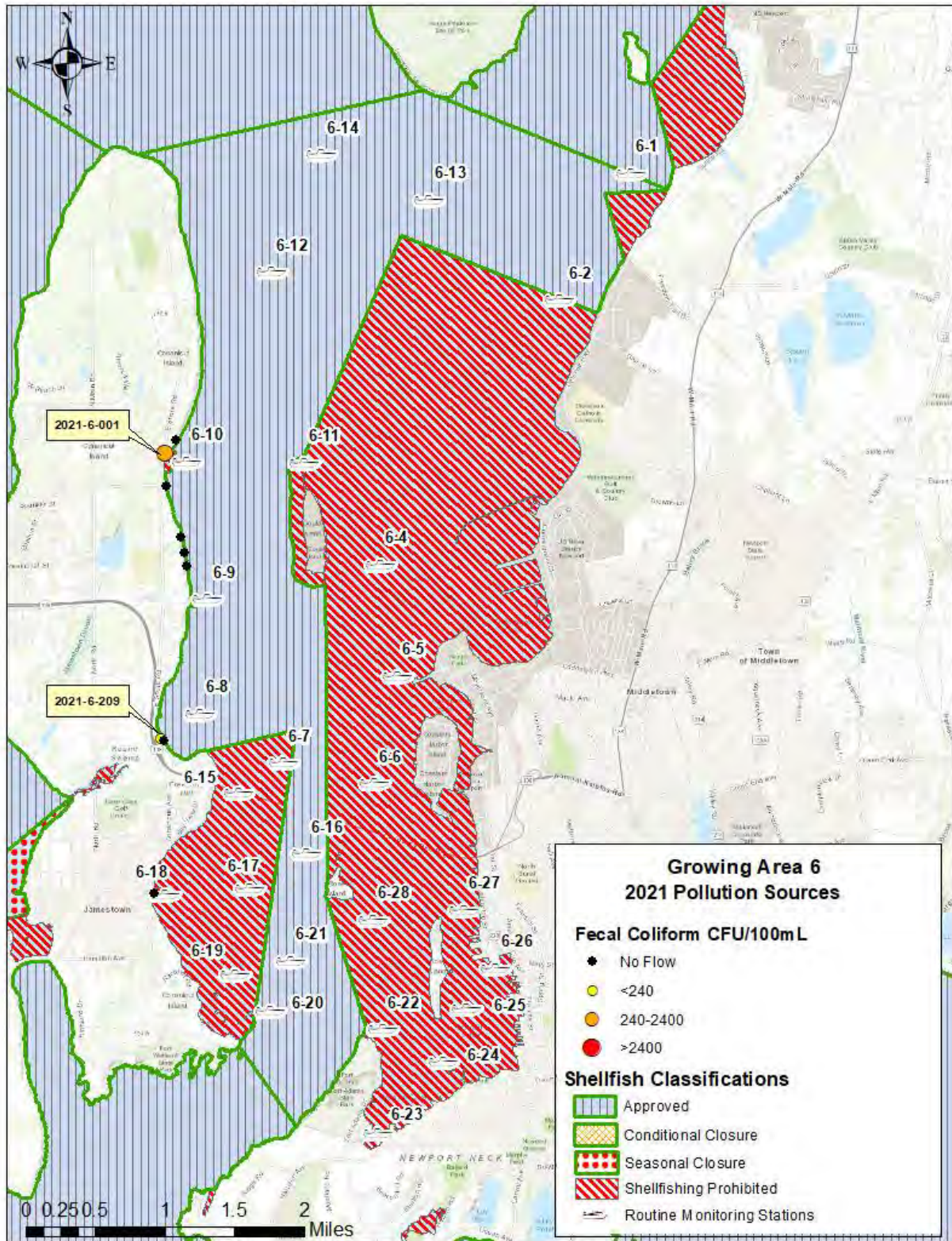


Table 1: Growing Area 6 Sources

Source ID	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-6-001	41.54162	-71.36502	Stream north of Wright Lane	Prohibited	Actual	Indirect	1,000	1.7
2021-6-003	41.54297	-71.36346	Stream thru woods	Approved	Potential	Indirect	NF	
2021-6-102	41.53825	-71.36486	Small stream over rocks from uplands	Approved	Potential	Indirect	NF	
2021-6-103	41.53822	-71.36488	Small stream maybe split of source #102 south of #102	Approved	Actual	Direct	NF	
2021-6-106	41.53295	-71.36284	Very small stream from upland woods heavy iron bacteria	Approved	Actual	Direct	CNL	
2021-6-107	41.53127	-71.36239	Small stream thru woods	Approved	Actual	Direct	CNL	
2021-6-109	41.52988	-71.36212	Groundwater seepage fades out above tide line	Approved	Actual	Indirect	CNL	
2021-6-209	41.51197	-71.36557	Outfall from retention pond at base of Newport Bridge can't	Approved	Actual	Direct	200	<.001 Trickle
2021-6-210	41.51173	-71.36533	Stone headwall w/ standing water most likely from retention	Approved			CNL	
2021-6-301	41.49587	-71.36665	24" dia CMP storm drain at corner of concrete seawall	Prohibited	Actual	Direct	NF	

NF = no flow, CNL = could not locate

4. Wastewater Treatment Facilities (WWTF)

Public sewers service the majority of the Newport shoreline and a small portion of the Jamestown harbor area. All other areas of the watershed are serviced by individual sewage disposal systems (ISDSs). There are currently two municipal WWTFs discharging to GA6: the City of Newport WWTF and the Town of Jamestown WWTF.

The City of Newport WWTF was constructed in 1955 to provide primary treatment. The Newport WWTF was upgraded to secondary treatment in 1991 and was required to meet reduced residual chlorine criteria on September 2002. The WWTF provides wastewater treatment for approximately 41,600 residents of the Newport area and has a design flow of 16 MGD. The Newport WWTF outfall discharges treated effluent to a large, prohibited area (GA6-2) surrounding the Newport Naval Base and Newport Harbor. A review of EPA ECHO WWTF performance data indicated that monthly mean flow through the WWTF was 7.13 MGD during 2021, well below the design flow of 16 MGD. Three minor *Enterococci* violations were noted in 2021. Fecal coliform in the effluent averaged 48 mpn/100 ml during 2021, but was skewed high by elevated August 2021 monthly average value of 469 mpn/100 ml. August 2021 was much wetter than usual in the Newport area, with 6.40” of rain falling at Newport (Newport state Airport NOAA weather station) compared to a long-term mean August rainfall of 3.05”. This heavy rain likely contributed to elevated fecal coliform during August 2021. The 2021 average Newport WWTF effluent fecal coliform was 10 mpn/100 ml if one removes the elevated August 2021 observations. In addition to improvements in the Newport WWTF, the City of Newport has recently completed a CSO consolidation project. This has virtually eliminated the discharge of untreated stormwater to Newport Harbor via the Wellington Ave and Washington Street CSOs.

The Town of Jamestown WWTF was constructed in 1980 as an extended aeration secondary treatment facility. The facility received upgrades in 1995 to divert some effluent to irrigate a town-owned golf course during summer months. Additional facility upgrades were completed in 2007. The WWTF serves approximately 2,100 residents in the area of Jamestown Harbor and has a design flow of 0.73 MGD. The Jamestown WWTF discharges treated effluent to a prohibited area (GA6-3) of Jamestown Harbor. A review of EPA ECHO data indicated a single violation during 2021. A TSS daily maximum of 155 kg/day was recorded in September 2021, a minor exceedance over the permitted 138 kg/day TSS. Flow through the Jamestown WWTF during 2021 averaged 0.32 MGD, well-below the design flow of 0.73 MGD and the average fecal coliform in the treated effluent during 2021 was 1.6 mpn/100 ml.

The review of WWTF discharging to GA6 indicated that both facilities are operating within permitted discharge limits for flow and bacteria and that these WWTF are efficient and well-run.

5. Water Quality Studies: Shellfish Program fecal coliform monitoring

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1995) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (copy in the Program's permanent file). There are 27 monitoring stations in the growing area (Figure 1).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation. Fecal coliform statistics for the growing area are summarized below.

HIGHLIGHTS

- * Sampled 5X during 2021 season (4X during 2020 and 1X in January 2022; 2 wet weather, 3 dry weather).
- * Statistics represent recent 30 samples collected during wet (n = 12) and dry (n = 18) conditions during 11/9/2016 to 1/24/2022.
- * All samples analyzed by the mTEC method.
- * All approved stations are in compliance.
- * Data run 1/26/2022.

COMMENTARY

The East Passage (Growing Area 6) was sampled five times during the 2020 sampling season (4 times in 2021 and once during January 2022). The recent 30 samples used in the evaluation were collected during both wet (greater than 0.5" rain during prior 7 days; n=12) and dry (n=18) weather conditions. All approved stations met NSSP criteria. In addition, 10 of 11 stations located in Newport Harbor which are classified as prohibited due to marina and harbor activities also met fecal coliform criteria. This improvement in Newport Harbor fecal coliform water quality likely reflects recent CSO and stormwater control upgrades completed by the City of

Newport. Results of the 2021 statistical evaluation indicate that all approved stations are in program compliance and that the area is properly classified.

RECOMMENDATIONS

- * Continue to collect and evaluate Newport Harbor fecal coliform data for potential reclassification of outer Newport Harbor.
- * No other recommendations based on the 2021 review of monitoring data.

Table 2: GA6 Fecal coliform statistical summary for 2021 based on 30 recent samples collected during 11/9/2016 to 11/24/2022; 12 wet weather and 18 dry weather samples.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
6-1	A	30	2.3	4.7
6-2	P	30	2.3	4.8
6-4	P	30	2.4	6.3
6-5	P	30	2.3	5.0
6-6	P	30	2.2	3.7
6-7	P	30	2.2	3.9
6-8	A	30	2.0	2.6
6-9	A	30	2.2	3.8
6-10	A	30	2.1	3.1
6-11	P	30	2.1	3.8
6-12	A	30	2.3	4.7
6-13	A	30	2.2	3.5
6-14	A	30	2.0	2.5
6-15	P	30	2.4	5.3
6-16	A	30	2.3	5.2
6-17	P	30	2.1	2.8
6-18	P	30	2.1	3.6
6-19	P	30	2.2	4.2
6-20	A	30	2.1	3.6
6-21	A	30	2.0	2.6
6-22	P	30	2.3	3.8
6-23	P	30	2.7	5.9
6-24	P	30	2.6	6.1
6-25	P	30	3.6	14.9
6-26	P	30	6.8	39.0
6-27	P	30	3.0	9.6
6-28	P	30	2.2	3.8

6. Conclusions and Recommendations

The 2021 Triennial Re-evaluation of the East Passage (GA6) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area's Approved waters. In addition, the two (2) WWTF in the growing area was shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform data indicated that all approved stations met NSSP criteria and that the East Passage Growing Area (GA6) is in program compliance and is properly classified.

No classification changes are recommended for the East Passage shellfish growing area (GA6) at this time.

Growing Area 7: West Passage 2021 Annual Update

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1 Introduction

An annual update of the West Passage growing area (GA7) was completed during 2021. The West Passage of Narragansett Bay (Growing Area 7) is presently comprised of sections classified as approved, seasonally approved and prohibited for shellfishing. Six (6) distinct areas of this growing area are prohibited to shellfishing: Wickford Cove (GA7-2), Bissel Cove (GA7-3), a portion of the upper West Passage abutting the Quonset Point area (GA7-1), the area around the docks at the University of Rhode Island’s Bay Campus (GA7-4), and Sheffield Cove and Fox Hill Pond (GA7-7 and GA7-8) in Jamestown. In addition, the smaller upland waters landward of the green assessed line are also delineated as prohibited as shown on the GA7 classification map (Figure 1). There are two seasonally closed areas: one in outer Wickford Harbor including Fishing Cove (GA7-6), and the other in the Dutch Harbor- West Ferry (GA7-5) area of Jamestown.

Twelve-year sanitary shoreline surveys of the West Passage Growing Area 7 were completed in 2005 and 2016. Triennial surveys of the growing area were completed in 2008, 2011, 2014 and 2019. A total of 110 sources were identified during the 2016 12-year shoreline survey, excluding marinas. A total of sixty-seven (67) of the 110 sources were not actively flowing at the time of the shoreline survey with the remaining forty-three (43) having flows warranting sampling.

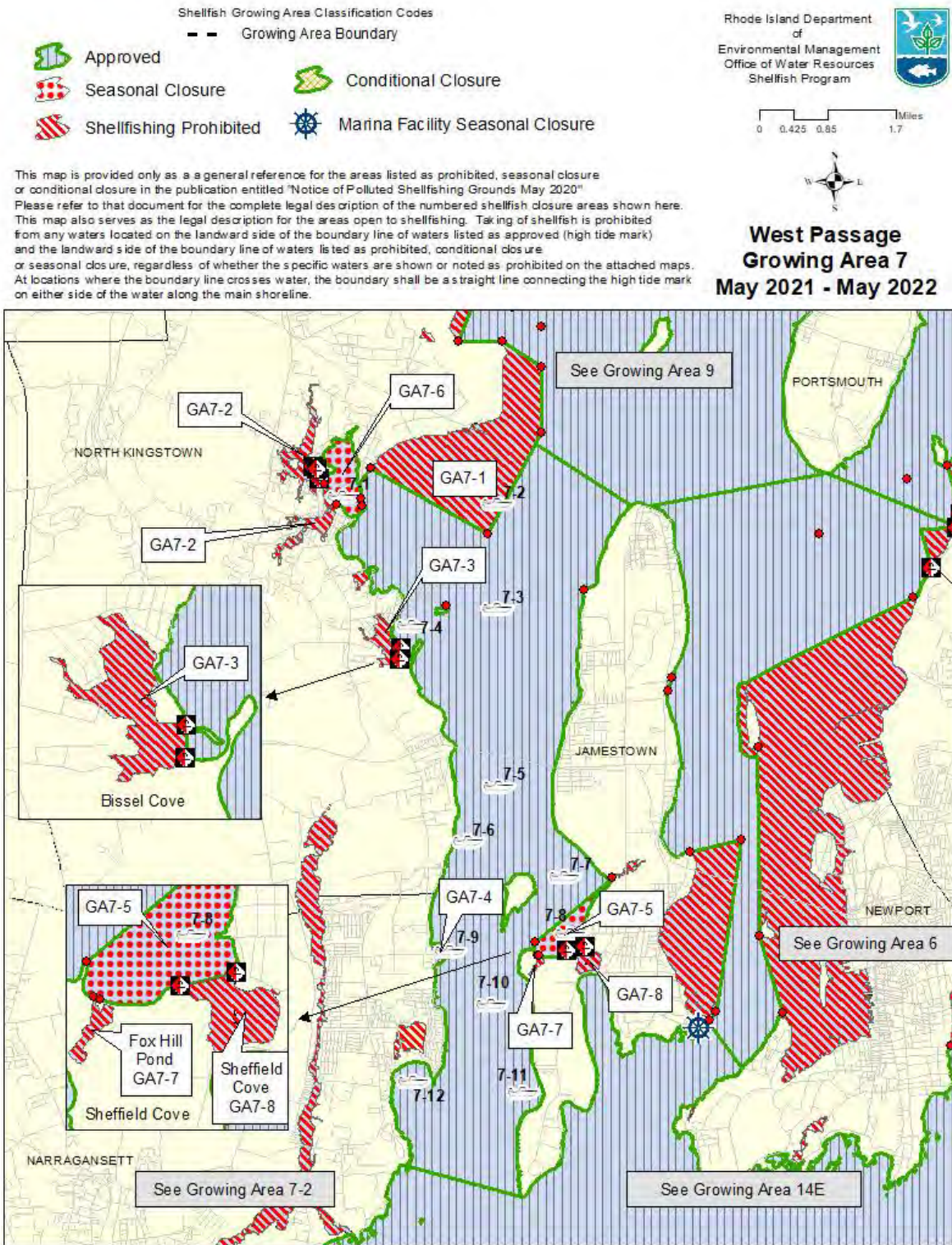
2 2021 Shoreline Survey

Rhode Island Department of Environmental Management Office of Water Resources staff completed a review of the 2016 12-Year Survey and the more recent triennial and annual re-evaluations. The review of the 12-year survey showed that only one GA7 source exceeded the 2,400 cfu/100 ml criteria for annual sampling. Source 7-306 (a groundwater seep flowing over rocks in Bonnet Shores, Narragansett) was found to have reduced fecal coliform in 2018 and had no flow in 2020. Therefore, this source did not warrant resampling in 2021. Recent fecal coliform results for source 7-306 are compiled in Table 1.

Table 1: Recent fecal coliform results for source 7-306.

Year	Fecal coliform (cfu/100 ml)	Flow
2005	230	Seep
2016	8,000	Seep
2017	99	Trickle
2018	8	Seep
2020	-	No flow

Figure 1: Growing Area 7 Current Classification Map



In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 7 (West Passage) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

3 Marinas and Mooring Fields

The West Passage (GA7) growing area has several marinas and mooring fields such as those located in Wickford Harbor, the commercial port at Quonset Point in North Kingstown and Dutch Harbor on Jamestown as detailed in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters adjacent to these marinas have either a year-round prohibited area or a seasonal closure to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state.

Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found on our website by following this link:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4 Wastewater Treatment Facilities

Public sewers service three areas adjacent to the growing areas of the West Passage: (1) the Bonnet Shores neighborhood of Narragansett, east of the Narrow River; (2) a 752 acre area just east of Dutch Harbor and Sheffield Cove in Jamestown; and (3) the area surrounding Quonset Point is also serviced by sewers. All other areas of the watershed are serviced by Onsite Wastewater Treatment Systems (OWTS). There are currently twenty-six RIPDES issued permits that discharge into the growing area. A majority are permitted minor discharge facilities. The EPA Atlantic Ecology Laboratory on South Ferry Road in Narragansett has the southern most direct discharge in the growing area. Currently a radial prohibited safety zone is in place around this discharge and related minor discharges at the URI GSO Bay Campus dock. Routine monitoring station 7-9 is a sentinel station located just outside of this closed safety zone and results from the most recent thirty samples indicate that these waters meet NSSP standards for fecal coliform concentration in Approved waters (see Table 1 for the 2021 statistical summary).

Nine permitted facilities are in the Quonset Point/Davisville area. Eight of these facilities are minor discharges such as the discharge from a private well desalinization plant on Fox Island and a non-

sanitary discharge from the Jamestown Water Treatment Plant to Jamestown Brook which flows into GA7 north of Dutch Harbor. The RI Economic Development's Quonset Point Wastewater Treatment Plant is the only major sanitary discharge in the growing area. A review of Quonset Point WWTF performance data (echo.epa.gov) indicated that there were no fecal coliform violations during 2021. The facility had a reported avg flow of 0.64 MGD, well below their permit of 1.78 MGD. The discharge dilution zone around this outfall was established using the EPA's PLUMES model which established an area in the prohibited classification meeting the minimum dilution requirements provided for in guidance within the NSSP MO. The established prohibited safety zone around the WWTF outfall is adequate to dilute the design flow at an effluent fecal concentration equal to a complete loss of disinfection (100,000 cfu/100 ml fecal coliform in the effluent). Routine monitoring at nearby stations have demonstrated that waters within the prohibited zone routinely have fecal coliform concentration of < 14 cfu/100 ml.

5 Water Quality Monitoring

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures, August 2021 update (copy in the Program's permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation

The West Passage of Narragansett Bay (Growing Area 7) is monitored six times per year following the systematic random sampling schedule indicated by the NSSP for areas not subject to adverse pollution conditions (no point sources). The microbial water quality of GA7 is assessed by monitoring fecal coliform concentration at 13 monitoring stations located in the growing area (Figure 1).

A Annual Statistical Summary: West Passage (GA7)

HIGHLIGHTS

- * Sampled 6X during the 2021 season (5X during 2021 and once during January 2022).
- * For approved stations, statistics represent recent 30 samples collected during wet (n = 16) and dry (n = 14) conditions during 1/30/2017 to 1/25/2022.
- * For seasonally approved stations 7-1 and 7-8, statistics represent recent 15 samples collected 11/17/2016 to 1/25/2022 when these seasonally approved stations were open.
- * All approved stations are in compliance.
- * All seasonally approved stations are in compliance.
- * All samples analyzed by the mTEC method.
- * Data run 1/31/2022.

COMMENTARY

The West Passage (Growing Area 7) was sampled six times during the 2021 season (5X during 2021 and once during January 2022) with four wet weather and two dry weather samples collected during the 2021 season. The recent 30 samples used in the 2021 statistical evaluation of approved stations were collected during 1/30/2017 to 1/25/2022 and included samples collected during wet (n=16) and dry (n=14) weather conditions. Statistics for seasonally approved stations 7-1 and 7-8 were calculated based on the recent 15 samples (9 wet weather, 6 dry weather) collected when these stations were in the open status.

Results of the 2021 statistical evaluation demonstrated that all approved stations are in program compliance. 2021 compliance statistics for seasonally approved stations 7-1 (Wickford Harbor) and 7-8 (Dutch Harbor) also demonstrated that these stations are in compliance and that the seasonal closures in these areas are effective. Station 7-1A in the prohibited area of Mill Cove (inner Wickford Harbor) was added in 2018 to assess water quality changes in response to recent wastewater treatment upgrades in the Wickford area.

RECOMMENDATIONS

- * No actions required based on 2021 ambient monitoring results.
- * Continue monitoring station 7-1A to track water quality changes in inner Wickford Harbor.

Table 2: GA7 Fecal coliform summary statistics based on recent 30 samples collected under all weather conditions during 1/30/2017 to 1/25/2022 (all mTEC, 16 wet and 14 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
7-1	SA	30	4.4	19.9
7-1A**	P	21	20.9	155.4
7-2	P	30	2.0	2.6
7-3	A	30	2.3	5.6
7-4	A	30	3.3	10.7
7-5	A	30	2.1	3.4
7-6	A	30	1.9	2.0
7-7	A	30	2.0	2.6
7-8	SA	30	2.0	2.6
7-9	P	30	2.0	2.3
7-10	A	30	2.0	2.6
7-11	A	30	2.0	2.4
7-12	A	30	2.2	5.1

** new station 7-1A added for Mill Cove, Wickford Harbor in 2018; number of observations is low (n=21) and insufficient data to calculate representative statistics for compliance with criteria for approved waters.

Table 3: GA7 Fecal coliform summary statistics for seasonally approved stations based on recent 15 samples collected when the area was in the open status (11/17/2016 to 1/25/2022, all mTEC, 9 wet and 6 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>% greater than 31</u> <u>cfu/100 ml</u>
7-1	SA	15	2.4	0.0
7-1A**	P	9	5.3	0.0
7-8	SA	15	1.9	0.0

** new station 7-1A added for Mill Cove, Wickford Harbor in 2018; number of observations is low (n=9) and insufficient data to calculate representative statistics for compliance with criteria for conditionally (seasonal) approved waters.

6 Summary and Recommendations

The 2021 annual evaluation of the West Passage (GA7) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. In addition, the WWTF in the growing area was shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform collected while the conditionally approved (seasonal) area was in the open status indicated that all approved and seasonally approved stations met NSSP criteria and are in compliance.

The 2021 annual review demonstrated that the West Passage growing area (GA7) is in program compliance and is properly classified. No classification changes are recommended.

GA 7-2 Annual Update: Narrow (Pettaquamscutt) River

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1. Introduction

Due to elevated fecal coliform concentration, portions of the Narrow River, Growing Area 7-2 has been classified as prohibited to shellfishing since August 28, 1979. This partial closure was followed by the current classification of the entire Narrow River as prohibited which began on July 15, 1986. Because the area has been classified as prohibited to shellfishing for decades, a shoreline survey of the growing area has not been completed since 1979. However, during July 2018 DEM Shellfish staff completed a comprehensive shoreline survey of the southernmost section of GA7-2, the area south of Sprague Bridge to the confluence of the Narrow River with the open waters of Rhode Island Sound (GA14). In addition, DEM Shellfish staff regularly sample four stations in the Narrow River to track changes in fecal coliform concentration. Follow up source sampling was completed as part of the area’s shoreline survey update in 2019, 2020 and 2021.

2. 2021 Shoreline Survey of Lower River

A shoreline survey of the southernmost portion of the Narrow River (GA 7-2) was completed on July 21st, 2021, by DEM Shellfish staff. The area surveyed is approximately 4,500 feet of tidal river length extending from the crossing of Route 1 at Sprague Bridge south to where the Narrow River joins RI Sound (Figure 1). The area surveyed comprises approximately 39 acres of Narrow River tidal waters

currently classified as prohibited to shellfish harvest. The area is a popular recreational site visited by small boats (kayaks, skiffs) during the warmer months of the year. The tidal waters are surrounded by a fringing *Spartina*-dominated saltmarsh and upland forest with some residential housing. There are approximately twenty (20) private residences and two (2) beach clubs within 1,500 feet of the surveyed area of the Narrow River. Based on sampling from 2020, follow up sampling of one source was warranted in 2021.

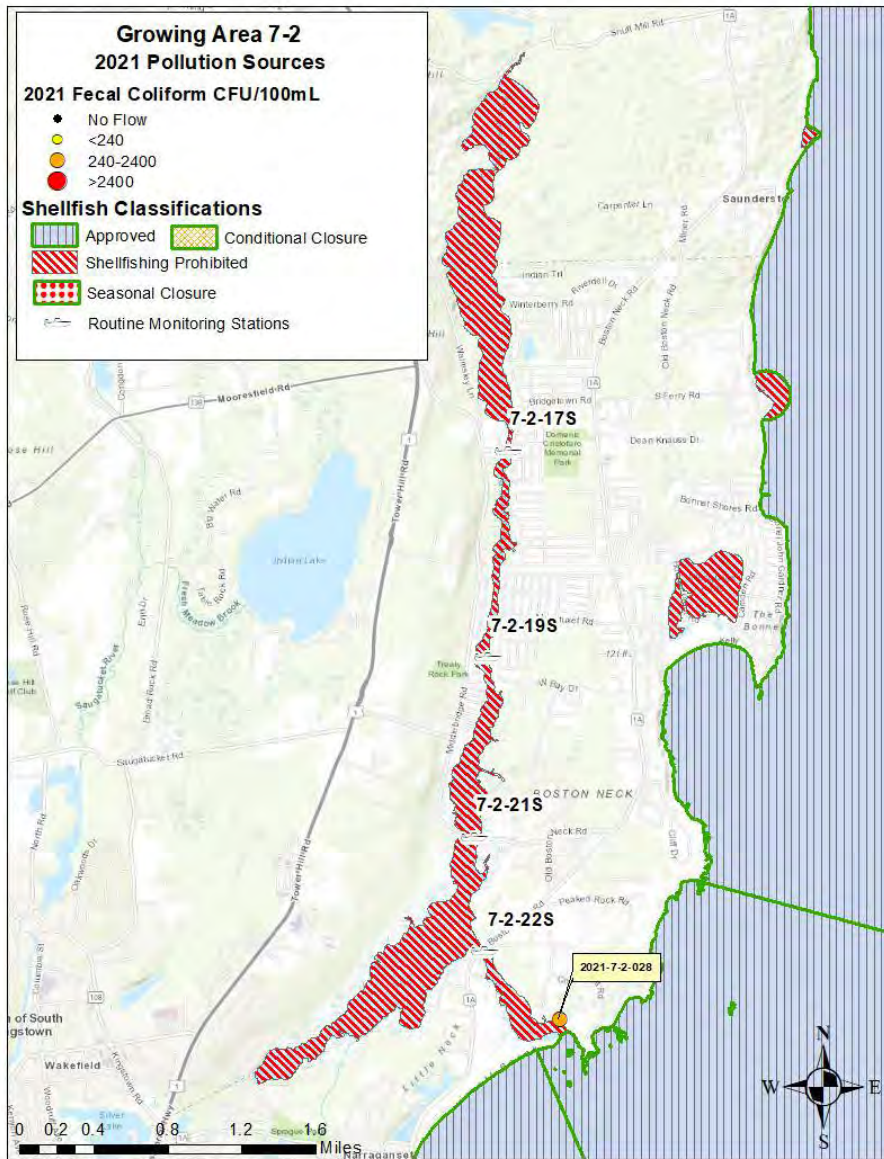


Figure 1: Site examined during shoreline survey of the lower Narrow River (GA7-2) during 2021

Twenty-seven (27) potential sources were identified with seven (7) sources found to be dry during the 2018 survey. No large-flow sources were identified, with most potential sources having only a trickle of flow on the survey dates. Nineteen (19) of the twenty (20) sources found to have some flow, had fecal coliform results of less than 240 cfu/100 ml. Source 7-2-028 was the only source resampled in 2019, 2020 and now 2021.

Source 7-2-028 is a small seep (approximately 1 foot wide by 1 inch deep) flowing from an upland *Phragmites* spp. stand and across a small beach. In 2019 this source had a fecal coliform concentration of 500 cfu/100 ml, when followed up in 2021, this source again had a fecal coliform concentration of 500 cfu/100 mL. In stream samples were taken at the time of sample, with the east instream having a result of 11 cfu/100mL and a west instream having a result of 16 cfu/100mL, demonstrating rapid dilution of this source. The entirety of GA7-2 Narrow River is classified as prohibited and the low flow rate and the strong tidal flushing in the waters that this source discharges to are expected to minimize the impact of this source on the fecal coliform water quality of the growing area.

Figure 2: Source 7-2-028 a small seep flowing out of uplands, through a *Phragmites* stand.



Table 1: GA 7-2 sources exceeding 240 cfu/100 ml.

Source ID	Latitude	Longitude	Description and Location	Receiving Waters Classification	Act/Pot	Dir/Indir	2019 Results cfu/100 mL	2020 Results cfu/100 mL	2021 Results cfu/100 mL	Flow (cfs)
7-2-028	41.4351	-71.441625	GW stream, through phragmites	Prohibited	A	D	581	1000	500	trickle

3. Water Quality Monitoring

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island’s agreement with the United States Food and Drug Administration’s National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in “Standard Methods for the Examination of Water and Wastewater” (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedures for water sample holding times and temperature control are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures, August 2021 update (copy in the Program’s permanent file).

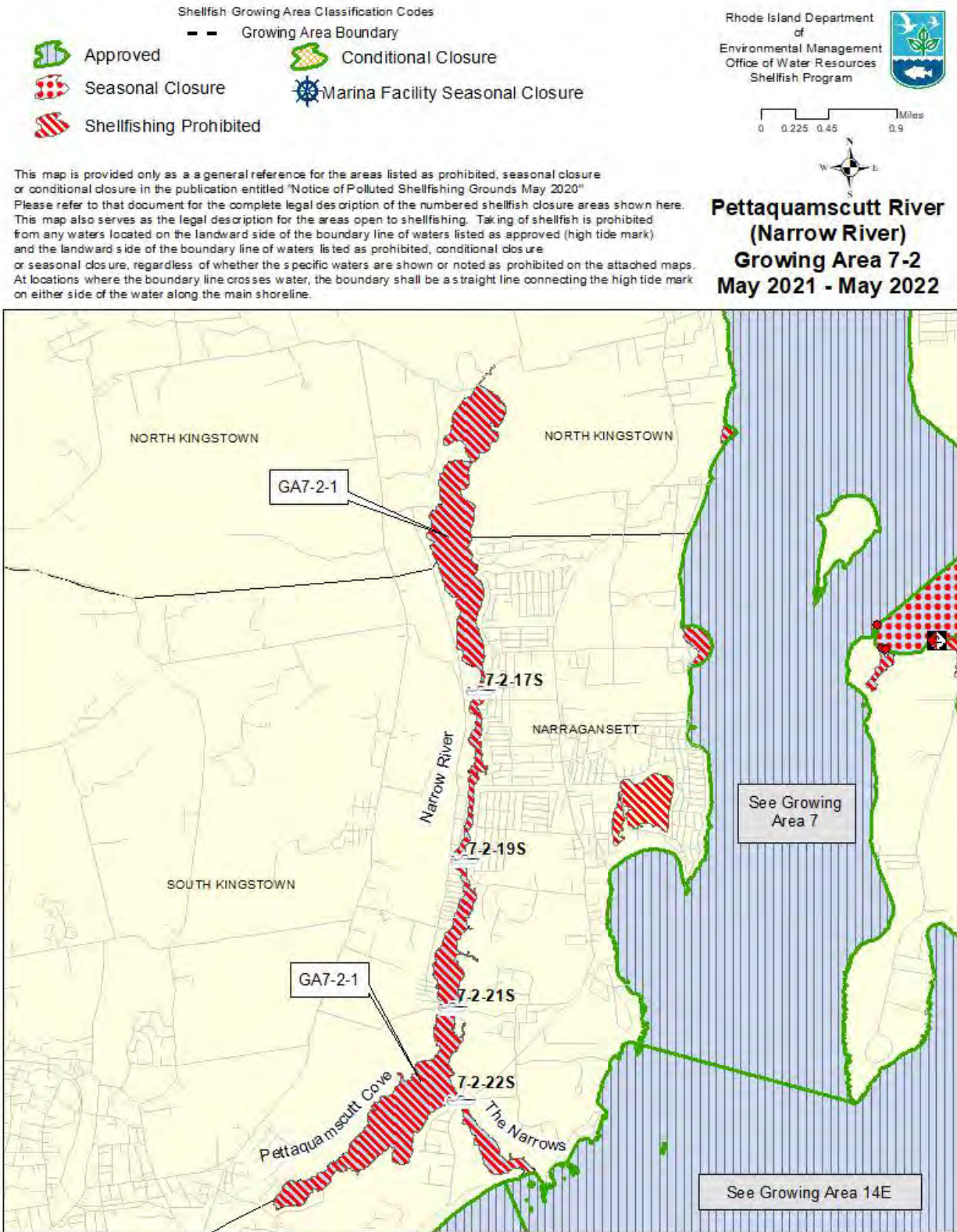
The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation

4. Marinas and Mooring Fields

There are two marinas located within the waters of this growing area. Both marinas have mainly small vessels because the waters of the river are shallow and low bridges limit the size of boats capable of navigating to these marinas. The waters of the entire river are currently classified as prohibited which includes the marina proper and further provide more than ample dilution to be protective of shellfishing in adjacent approved waters at the confluence of the river with open waters of Rhode Island Sound approximately a mile and a half to the southeast. Refer to the report entitled RIDEM “Evaluation of

Waters Adjacent to Marinas: Marina Dilution Analysis Background, June 2017” which is located in the program’s permanent files for further details and the relative dilution calculations.

Figure 3: 2021-2022 classification map and routine monitoring stations.



5. Annual Statistical Summary

Growing Area 7-2, Pettaquamscutt River (Narrow River)

HIGHLIGHTS

- * Sampled 11X during 2021.
- * Shellfishing is prohibited in growing area 7-2. Statistics were calculated for informational purposes of tracking water quality changes.
- * Statistics represent recent 30 samples collected during wet (n= 16) and dry (n= 14) weather 3/29/2018 to 12/15/2021.
- * Statistics also calculated under dry weather scenario (less than 0.5” rain in prior 7 days) for recent 15 samples collected 1/12/2018 to 12/15/2021.
- * All samples analyzed by the mTEC method.
- * Data run 12/22/2021.

COMMENTARY

The Pettaquamscutt River (Growing Area 7-2) was sampled 11 times from shore-access stations during 2021. The area in its entirety has been classified as prohibited to shellfishing since 1986 so there is no minimum sampling requirement. The 2021 statistical evaluation for the Pettaquamscutt River includes an approved scenario (recent 30 samples collected under all weather conditions) and a conditionally approved scenario (recent 15 samples collected during dry weather). The area has been closed to shellfish harvest for direct human consumption since 1986 due to unpredictable and elevated fecal coliform levels. A TMDL was completed for the area in 2002, with recommendations for monitoring to follow long-term changes in fecal coliform water quality.

Approved scenario: The recent 30 samples collected under all weather conditions were from 3/29/2018 to 12/15/2021 with 16 collected under wet (greater than 0.5” rain in prior 7 days) weather conditions and 14 collected during dry weather. The review of 2021 observations demonstrated that fecal coliform levels were greater than NSSP criteria for safe harvest of filter-feeding molluscan shellfish at all four Narrow River stations (Table 2).

Conditionally Approved scenario (0.5”, 7-day closure): Evaluation of the recent 15 samples collected during dry weather conditions (< 0.5” rain in 7-days prior to sampling) demonstrated that fecal coliform levels in the Narrow River exceed NSSP criteria for safe shellfish harvest during dry weather (Table 3).

Although fecal coliform levels are lower than those observed decades ago, the 2021 update showed that all stations in the Narrow River exceeded NSSP fecal coliform criteria under both approved and conditionally approved scenarios. The 2021 evaluation demonstrated that the Narrow River continues to exceed fecal coliform levels that support safe harvest of molluscan shellfish. The area is properly classified a Prohibited. DEM Shellfish Program staff will continue to monitor the fecal coliform water quality of the Narrow River growing area to track any potential improvements in water quality.

RECOMMENDATIONS

- * Continue approximately monthly shore-based sampling under all weather conditions to track water quality and to support TMDL efforts in the watershed.
- * No other action recommended.

Table 2: GA7-2 fecal coliform summary statistics calculated under an Approved scenario – for informational purposes only. Recent 30 samples collected in all weather (3/29/2018 to 12/15/2021; all mTEC, 16 wet and 14 dry weather)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
7-2-17S	P	30	41.5	380.4
7-2-19S	P	30	28.2	301.7
7-2-21S	P	30	19.4	176.8
7-2-22S	P	30	23.2	144.6

Table 3: GA7-2 fecal coliform summary statistics calculated under a Conditionally Approved scenario – for informational purposes only. Recent 15 samples collected during dry weather (<0.5” rain in previous 7 days; 1/12/2018 to 12/15/2021; all mTEC, 15 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
7-2-17S	P	15	34.3	46.7
7-2-19S	P	15	23.3	53.3
7-2-21S	P	15	18.9	40.0
7-2-22S	P	15	21.5	33.3

6. Summary and Conclusions

The 2021 update demonstrated that fecal coliform water quality in Growing Area 7-2 (Pettaquamscutt or Narrow River) did not meet NSSP criteria under either an Approved or a Conditionally Approved (0.5”, 7-day rain closure) scenario. The 2021 update has demonstrated that the area is properly classified as Prohibited. No changes in classification are recommended.

GA8 Annual Update: Greenwich Bay

2021

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1. Introduction

12-year shoreline surveys of the Greenwich Bay Growing Area 8 (Figure 1) were completed in 2005 and 2017. Triennial updates were completed during 2008, 2011, 2014, 2017 and 2020 while annual updates were completed during each intervening year. A total of 206 potential or actual sources were identified during the 2017 shoreline survey. Eighty-four (84) of these sources had flows while the remaining one hundred twenty-two (122) were not flowing at the time of the 2017 survey. None of the flowing sources had results greater than 2,400 MPN /100 ml therefore did not warrant follow-up as per the program’s standard operating procedures for this annual review. Although no source was identified that exceeded the 2,400 MPN/100 ml criteria for follow-up sampling, out of an abundance of caution several sources that had previously elevated counts were re-sampled in 2021.

Figure 1: 2021-2022 GA 8 Shellfish Classification Map

- Shellfish Growing Area Classification Codes
-  Approved
 -  Seasonal Closure
 -  Shellfishing Prohibited
 -  Growing Area Boundary
 -  Conditional Closure
 -  Marina Facility Seasonal Closure

Rhode Island Department
of
Environmental Management
Office of Water Resources
Shellfish Program

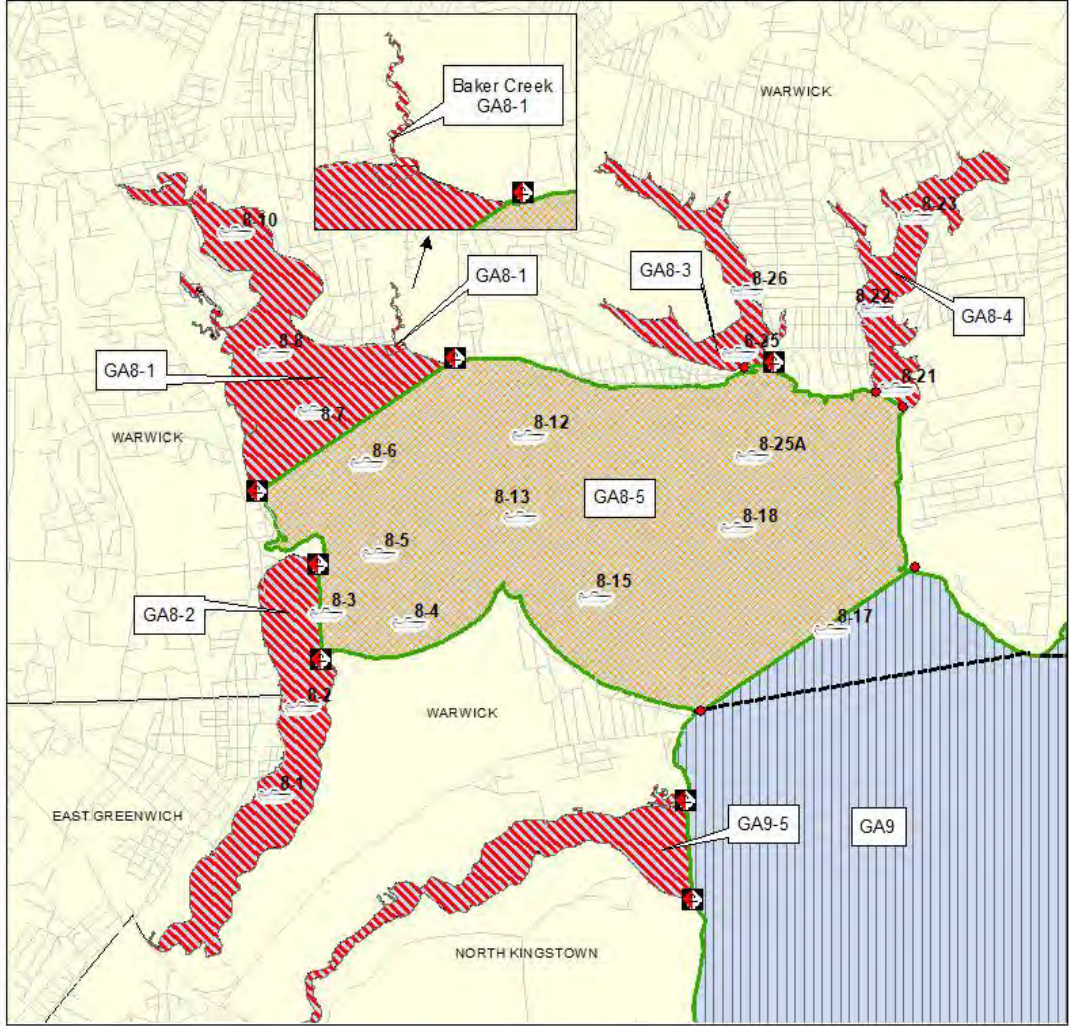


0 0.25 0.5 1 Miles



This map is provided only as a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2020". Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

**Greenwich Bay
Growing Area 8
May 2021 - May 2022**



2. 2021 Shoreline Survey

Five (5) sources that had shown elevated fecal coliform levels were sampled in 2021 to ensure they were not impacting the growing area (Table 1). All five sources were flowing at the time of 2021 inspection and therefore were sampled. All sources were sampled on 10/18/2021 (1 day after 0.34" rain at TF Green Airport, KPVD).

Source 8-2-213 is a 30" concrete pipe located below the deck of the waterfront restaurant Blu On The Water. The restaurant is located between two marinas in East Greenwich cove which has a permanent closure due to the outfall of the East Greenwich WWTF in combination of the numerous marinas and mooring areas located in the cove. This source had an extremely high result of 50,000 cfu/100mL when sampled in 2021. The pipe enters a small area of water that is almost entirely enclosed in by a sandbar, making it difficult to flush out. In stream samples of the water outside of the "bowl" had a result of 80 cfu/100mL showing rapid dilution before entering the prohibited waters of the growing area. The source is approximately 2,500 feet from the conditionally approved water of the growing area, providing adequate dilution.

Figure 2: Source 8-2-213, 30" concrete pipe below Blu On The Water



Source 8-4-400 is Hardig Brook at the headwaters of Apponaug Cove. This source had a fecal coliform result of 1,200 cfu/100ml during the 2017 12-year survey. When this source was followed up in 2021, it had a fecal coliform level of 600 cfu/100 ml, still elevated above the 240 cfu/100mL threshold. This source flows into prohibited waters of Apponaug Cove (GA8-1), approximately 1.2 miles upstream of the conditionally approved waters of the growing area. There is ample dilution prior to entering the conditionally approved waters as demonstrated by the fecal coliform levels at sentinel station 8-6 which meets NSSP fecal coliform criteria while in the open status.

Source 8-6-602 is a stream that flows through Warwick City Park and enters the prohibited waters of Buttonwoods Cove (GA8-3). This source had a result of 1,900cfu/100 mL and a trickle flow during the 2021 inspection. The low flow rate of this source and dilution within the prohibited zone (GA8-3) are protective of the microbial water quality of the conditionally approved waters of the growing area.

Source 8-5-504 is a 4ft canal draining a wetland area that is adjacent to a heavily developed residential area. Source 8-6-672 is a 36" pipe at the end of Shand Ave. Both of these sources had results of 100 cfu/100mL or less and had minimal flow (trickle) when sampled during 2021. Both of these sources have low flow rates and flow into prohibited waters which provide adequate dilution to be protective of the water quality of GA8 conditionally approved waters.

Figure 3: 2021 Shoreline survey pollution sources in GA 8. Routine monitoring stations indicated by boat symbols.

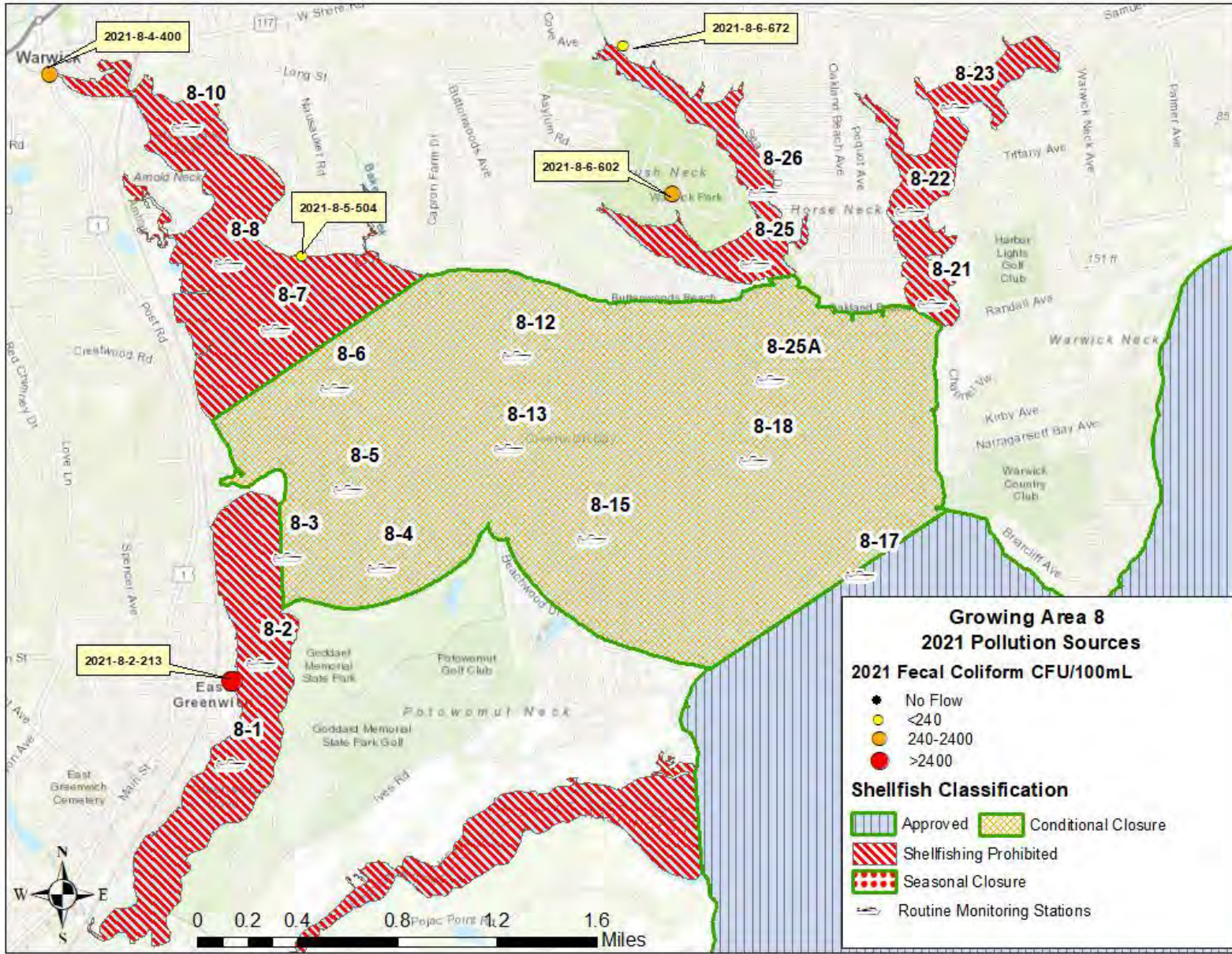


Table 1: 2021 Summary of Pollution Sources in GA 8

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2017 Results mTEC cfu/100ml	2021 Results mTEC cfu/100 ml	Volumetric Flow (cfs)
8-2-213	10/18/2021	41.6623	-71.445267	30" concrete pipe under south end of 20 Water St deck. Visited at low tide and water was still up to and slightly flooding pipe.	Prohibited	Potential	Direct	1200	50000	Trickle
8-4-400	10/18/2021	41.697467	-71.459383	Hardig Brook at Rt 1	Prohibited	Actual	Indirect	1200	600	13.6
8-5-504	10/18/2021	41.686967	-71.43985	4' wide concrete canal draining upstream wetlands	Prohibited	Potential	Direct	1120	100	Trickle
8-6-602	10/18/2021	41.690483	-71.411133	Stream upstream of culvert under bike path at Warwick City Park	Prohibited	Potential	Indirect	420	1900	Trickle
8-6-672	10/18/2021	41.699117	-71.414933	36" concrete pipe at end of Shand Ave	Prohibited	Actual	Direct	1270	100	0.176

*Red highlighted sources >2400 cfu/100ml; Yellow highlighted sources > 240 cfu/100ml NF = No flow, NS = No source

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Greenwich Bay (Growing Area 8) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

3. Marinas and Moorings

Greenwich Bay is home to thirty-three (33) marinas with over forty-four hundred (4,400) slips and moorings available to boaters. These marinas vary in size and capacity from the small private yacht club in Brushneck Cove with less than 10 slips to the large, full-service marina such as Safe Harbor Greenwich Bay. All of these marinas are located in prohibited waters and dilution calculations have been performed to ensure that the prohibited zone is of sufficient size to provide ample dilution zones to be protective of water quality in the adjacent waters. These calculations can be found in the programs permanent file and are tabulated in the document entitled "Marina Dilution Analysis Background, June 2017". All the marinas have sufficient dilution waters for the slip counts and usage rates currently existing. Additional pump out facilities that are privately owned may be available and would complement the public facilities.

There are currently 10 pump-out facilities in the Greenwich Bay area to service the boating public. An inventory of pump-out facilities (both private and CVA-funded) is available for review in the Program's permanent files.

4. Wastewater Treatment Facilities (WWTF)

The East Greenwich WWTF is a modern "Rotating Biological Contactors" secondary treatment plant that was converted to UV disinfection in February of 2004. Additional construction was completed in 2006 to meet a seasonal Total Nitrogen limit of 5 mg/l. A recent upgrade (in 2017) was the new UV system control panel. They are currently replacing their RBC (Rotating Biological Contactors) units and rehabbing their secondary clarifiers. Plant operators immediately report any permit violations or failure events to RIDEM's Office of Operations and Maintenance (or DLE after hours) which is then conveyed directly to the shellfish program for any necessary actions according to the CAMP. The plant has a design flow of 1.7 MGD and serves approximately 6,000 customers. The plant currently has a RIPDES permitted discharge (RI0100030) that discharges into Greenwich Cove.

The facility is permitted to discharge a maximum daily of 1.70 MGD (million gallons/day) of treated effluent. The average flow for 2021 was 0.87 MGD, well within the permit limits. While fecal coliform is not a permit criterion, it is monitored, and average monthly geometric mean fecal coliform was 5.4 cfu/100 ml during 2021.

This review of the East Greenwich WWTF indicated that the facility is well-run and was operating well-below permitted bacteria discharge levels during 2021.

A dye study was completed in Greenwich Cove in 1986 to determine the travel time and dilution of effluent from the wastewater treatment facility. The flow rate of the effluent from the plant was 0.8-1.05 mgd. Results of the study concluded that it takes approximately 14.5 hours for the effluent from the plant to exit Greenwich Cove (Turner 1986). This portion of the growing area is classified as prohibited, and so it takes that amount of time for the discharge from the plant to enter the conditionally approved section of Greenwich Bay. In addition, prior to reaching the current defined edge of the prohibited area, the effluent is diluted by a factor of 1,700, meeting the NSSP requirements that a dilution ratio of 1,000:1 be reached within the prohibited zone.

The flow rate of effluent has not changed significantly since the completion of the dye study (2018 average flow of 0.98 MGD and past years' flows generally between 0.8 and 1.0 MGD), and therefore, these dilution values would still apply. However, significant improvements have been made to the plant over the years, such as the installation of RBCs in 1989 and a UV disinfection system in 2004, which ultimately reduce viral loads and more efficiently eliminate pathogens in the effluent.

Finally, in the event of a wastewater treatment facility failure, the plant operator is required to inform DEM immediately so that appropriate action can be taken. This allows shellfish staff to close the conditionally approved area within 12 hours (within the 14.5-hour travel time of the effluent) and reopen when conditions have returned to normal. Per NSSP requirements if an extended failure to treat event outside of these design parameters should occur at the plant, the conditionally approved area would be closed for 21 days or until shellfish samples collected after 7 days are tested and show male-specific coliphage levels below 50 PFU/100 grams.

5. Water Quality Studies

RIDEM Shellfish Program

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is the result of an agreement between the State of Rhode Island and the Food and Drug Administration (FDA) as codified in the National Shellfish Sanitation Program (NSSP). The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at eighteen (18) monitoring stations throughout the growing area. Nine (9) of the stations are in Conditionally Approved waters and nine (9) stations are located in Prohibited waters.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedures for water sample holding times and temperature control are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures, August 2021 update (copy in the Program's permanent file).

Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

i. Annual Statistical Summary: GA8 (Greenwich Bay)

HIGHLIGHTS

- * Sampled 10X during 2021 season.
- * Statistics represent recent 15 samples collected between 5/20/2020 or 6/20/2020 and 2/2/2022 for most stations
- * Statistics represent recent 15 samples collected between 11/14/2019 and 2/2/2022 for stations 8-25 and 8-26 which are in shallow coves that cannot be sampled at low tide.
- * All samples analyzed by the MTEC method.
- * All conditionally approved stations are in compliance.
- * Data run 2/7/2022.

COMMENTARY

Greenwich Bay (GA8) was sampled ten times during the 2021 sampling season (9X during 2021 and once in February 2022) with nine samples collected while the area was in the open status. Samples were not collected during April, July, August, and October of 2021 and two sets of samples were collected during December 2021. The summer of 2021 was extremely wet in the RI area, with a total of 11.95” of rain recorded at TF Green Airport during July and August 2021 compared to an average July & August total of 6.89”. This excess rain kept GA8 closed most of July and August 2021, with the area open on only five weekdays in which sampling was possible during July 2021 and open only 10 weekdays during August 2021. October 2021 sampling was delayed due to engine trouble on the monitoring boat.

The 2021 statistical evaluation showed that all conditionally approved stations in Greenwich Bay were in compliance with NSSP criteria. ‘Sentinel stations’ located in prohibited areas of Greenwich Cove (station 8-3), Apponaug Cove (station 8-7) and Warwick Cove (station 8-21) adjacent to conditionally approved areas also met criteria for conditionally approved waters. This indicated that the Prohibited areas of Greenwich Bay provide adequate dilution from potential fecal coliform sources and are protective of public health.

Wet weather samples were collected during June 2021 (0.5 days after 1.05” rain) while the area was in the closed status to evaluate water quality in the growing area during wet weather. 19 of 20 (95%) of these wet weather samples exceeded 14 cfu/100 ml, indicating unacceptable water quality after a 1” rain storm. Conversely, all conditionally approved stations were in compliance with NSSP criteria when open (<0.5” rain in prior 7-days) demonstrating that the current 0.5” rain, 7-day closure continues to be appropriate for the growing area.

The 2021 statistical review demonstrated that the Greenwich Bay Conditionally Approved shellfish area (GA8) is in program compliance and is properly classified.

RECOMMENDATIONS

- * Maintain Greenwich Bay as conditionally approved year-round (December seasonal closure ended in May 2017).
- * Continue to sample prohibited areas in Greenwich, Apponaug, Buttonwood, Brushneck and Warwick Coves to track water quality changes in support of TMDL work in the watershed.
- * As resources allow, conduct wet weather sampling to collect data on fecal coliform response after greater than 0.5” rain (current closure rain) storms.

Table 2: Fecal coliform summary statistics for GA8 (Greenwich Bay) conditionally approved stations based on recent 15 samples collected when the area was in the open status (all dry weather; 5/20/2020 or 6/20/2020 to 2/2/2022; all mTEC)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
8-1	P	15	9.3	13.3
8-2	P	15	3.8	0.0
8-3	P	15	3.6	0.0
8-4	CA	15	3.1	0.0
8-5	CA	15	4.6	6.7
8-6	CA	15	4.4	6.7
8-7	P	15	4.7	0.0
8-8	P	15	5.2	13.3
8-10	P	15	13.8	40.0
8-12	CA	15	4.5	0.0
8-13	CA	15	3.3	6.7
8-15	CA	15	3.1	0.0
8-17	CA	15	2.6	0.0
8-18	CA	15	2.8	0.0
8-21	P	15	4.2	0.0
8-22	P	15	6.6	6.7
8-23	P	15	10.4	26.7
8-25A	CA	15	2.5	0.0

Table 3: Fecal coliform summary statistics for GA8 (Greenwich Bay) stations 8-25 and 8-26 based on recent 15 samples collected during dry weather (11/14/2019 to 2/2/2022; all mTEC).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
8-25	P	15	9.0	13.3
8-26	P	15	8.6	20.0

6. Summary and Conclusions

The 2021 annual update of Greenwich Bay (GA8) demonstrated that no shoreline sources are negatively impacting the microbiological water quality of the growing area when this conditionally approved area is in the open status for shellfish harvest. In addition, the single WWTF in the growing area was shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform collected while the conditionally approved area was in the open status indicated that the Greenwich Bay (Growing Area 8) is in program compliance and is properly classified.

Growing Area 8 is a conditionally approved growing area, impacted by precipitation events, and also containing a discharge from a sewage treatment facility. Therefore, the RIDEM Shellfish Program manages Growing Area 8 in accordance with the guidelines set forth in the Greenwich Bay Conditional Area Management Plan (CAMP). This CAMP was initiated in January 1996 and was updated in 2003. In 2019 a major revision was made to the GA8 CAMP to incorporate recommendations made during the 2017 FDA PEER review. The GA8 was updated in 2021 to reflect changes (addition of a listserve notification) in the conditional area closure process. The CAMP for Greenwich Bay Growing Area 8 was re-evaluated as part of the 2021 annual review and the monitoring and management of GA8 were consistent with the current conditional area management plan.

No classification changes are recommended for GA8 at this time.

**GA9
West Middle Bay
2021 Annual Update**

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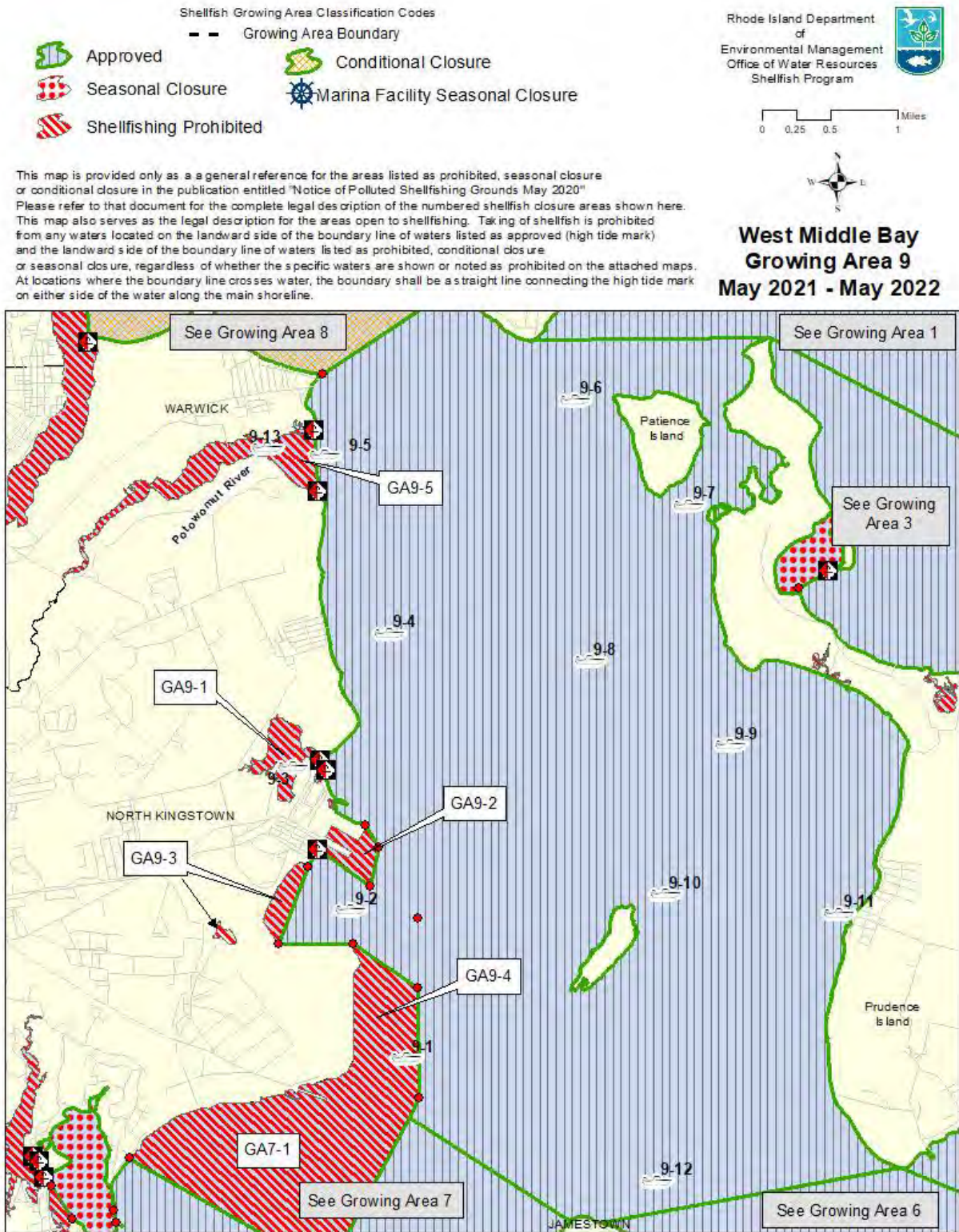
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1. Introduction

An annual update shoreline survey of the West Middle Bay was conducted during the summer of 2021 by staff from RIDEM’s Office of Water Resources. Comprehensive 12-year surveys of the growing area were completed in 2007 and 2019. The comprehensive 12-year surveys involve a shoreline reconnaissance of the entire study area to locate and catalog pollution sources and collect bacteria samples from all sources actively flowing into the survey area. Triennial updates of the area were completed in 2010, 2013, and 2016. Annual updates were completed in each intervening year between triennial and 12-year surveys. The 2021 survey was an annual update.

The primary objective of the shoreline survey was to identify and characterize any new sources of pollution potentially impacting the growing area, to reevaluate point and non-point sources identified during previous surveys, and to update information regarding the sampling of previously identified sources and to reevaluate the current classifications of shellfish waters of Growing Area 9.

Figure 1. Current (2021-2022) Shellfish Classification Map of GA9 with Routine Monitoring Stations



2. 2021 Shoreline Survey

No sources sampled during the 2019 12-year survey exceeded 2,400 cfu/100 ml, and therefore no sources required resampling during the 2021 annual shoreline survey update.

A. Description of Sources

No sources sampled during the 2019 12-year survey exceeded 2,400 cfu/100 ml and therefore no sources were resampled as part of the 2021 annual update.

B. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 9 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

C. Marinas

There are five (5) marinas / mooring fields located within the waters of the West Middle Bay growing area (GA9). All are located within the prohibited waters of Allen Harbor in North Kingstown. Details of these marinas can be found in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters of the marina proper and waters adjacent to marinas have either a year-round prohibited area or a seasonal closure to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state. Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found on our website:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

D. Wastewater Treatment Facilities

There are no major sanitary discharges in GA9 (West Middle Bay). However, there is one (1) major sanitary discharge near GA9. The Quonset Point wastewater treatment facility located at 150 Zarbo Avenue, Quonset Point, North Kingstown, RI is operated by the RI Economic Development Corporation. The facility is permitted to discharge 1.78 MGD of treated effluent and the outfall is located in GA7 (West Passage) approximately 1,500 feet south of the boundary between GA9 (West Middle Bay to the north) and GA7 (West Passage, to the south). The average flow of this facility during 2021 was 0.64 MGD, well within the permit limits. A review of this WWTF DMR data indicated zero daily maximum *Enterococci* violations during the year of 2021. No fecal coliform or flow violations occurred during 2021. The Quonset Point WWTF services the Quonset Point and Davisville Depot areas and the Quonset Point WWTF discharge is located in the prohibited Quonset Point industrial area safety zone. The closed safety zone (prohibited to shellfish harvest) provides sufficient dilution to be protective of adjacent approved waters. Description and dilution calculations for the Quonset WWTF closed safety zone are located in the program's permanent files. The remaining areas adjacent to the West Middle Bay Growing Area rely on OWTS.

There are two (2) non-sanitary discharges permitted by the Rhode Island Pollutant Discharge Elimination System (RIPDES) within Growing Area 9 (West Middle Bay). American Mussel Harvesters discharges an average flow of 36,000 gallons per day of processing water used in their shellfish processing plant (RIPDES Permit RI0110094). The facility is required to monitor and report fecal coliform concentration in the effluent once per week. This discharge enters GA9 in the prohibited safety zone around the docks just to the north of Fry Cove and should not impact the microbiological quality of GA9. The second non-sanitary discharge in GA9 is a non-sanitary water release pipe from the V & G Sea Products facility.

3. GA9 Annual Statistical Evaluation

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the SM48 and SM01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (updated August 2021; copy in the Program's permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation. 2021 fecal coliform monitoring data for GA9 are summarized below.

HIGHLIGHTS

- * Sampled 6X during 2021 season (5X during 2021 and once in January 2022).
- * Statistics represent combined wet (n= 16), and dry (n= 14) weather data collected between 1/30/2017 or 5/17/2017 to 1/25/2022.
- * All samples analyzed by the MTEC method.
- * Data run 1/31/2021.
- * All approved stations in compliance.

COMMENTARY

The West Middle Bay (Growing Area 9) was sampled six times during the 2021 sampling season (5X during 2021 and once during January 2022), meeting the minimum systematic random sampling guidelines for approved areas. Statistics were calculated from the most recent 30 samples which were collected under both wet (n= 16) and dry (n= 14) weather conditions. All stations in Approved waters of this growing area met NSSP criteria during 2021.

The Potowomut River (stations 9-13 and 9-5) has elevated fecal coliform levels during wet weather. A TMDL study for fecal coliform impairment in the growing area is scheduled for 2023. Station 9-13 near the freshwater end of the Potowomut River was established in 2007 to evaluate whether that area of was suitable for approved harvest of shellfish. The 2021 statistical evaluation indicated that the freshwater end of the Potowomut River (station 9-13) met, but nearly exceeded the 90th percentile variability criteria and that shellfish harvest should remain prohibited for that region. ‘Sentinel station’ 9-5 at the mouth of the Potowomut River and at the transition from prohibited to approved waters continues to meet criteria for approved waters indicating that the current prohibited zone at the mouth of the Potowomut River is appropriate and protective of public health. The 2021 statistical review indicated that all approved stations in the growing area were in program compliance and that the area is properly classified.

RECOMMENDATIONS

- * Maintain closure of upper Potowomut River.
- * Continue to monitor Potowomut River (stations 9-13 and 9-5) to follow changes in water quality.
- * No other actions recommended based on ambient monitoring results.

Table 1: Fecal coliform summary statistics for GA9 based on recent 30 samples collected under all weather conditions 1/30/2017 or 5/17/2017 to 1/25/2022 (all mTEC, 16 wet and 14 dry weather sets of samples).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
9-1	P	30	2.2	3.1
9-2	A	30	2.0	2.7
9-3	P	30	3.2	10.7
9-4	A	30	2.9	8.4
9-5	A	30	4.6	26.4
9-6	A	30	2.9	7.4
9-7	A	30	2.3	4.2
9-8	A	30	2.0	2.6
9-9	A	30	2.1	2.8
9-10	A	30	2.2	3.5
9-11	A	30	2.0	2.6
9-12	A	30	2.1	2.9
9-13	P	30	6.0	24.8

4. Summary and Conclusions

The 2021 annual update of the West Middle Bay growing area (GA9) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A review of the one (1) WWTF adjacent to the growing area has shown that it is operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform samples collected in the growing area demonstrated that all Approved stations met NSSP criteria and that the West Middle Bay Growing Area (GA9) is in program compliance and is properly classified.

No classification changes are recommended for the West Middle Bay growing area (GA9) at this time

GA10
Point Judith & Potters Pond
2021 Annual Update

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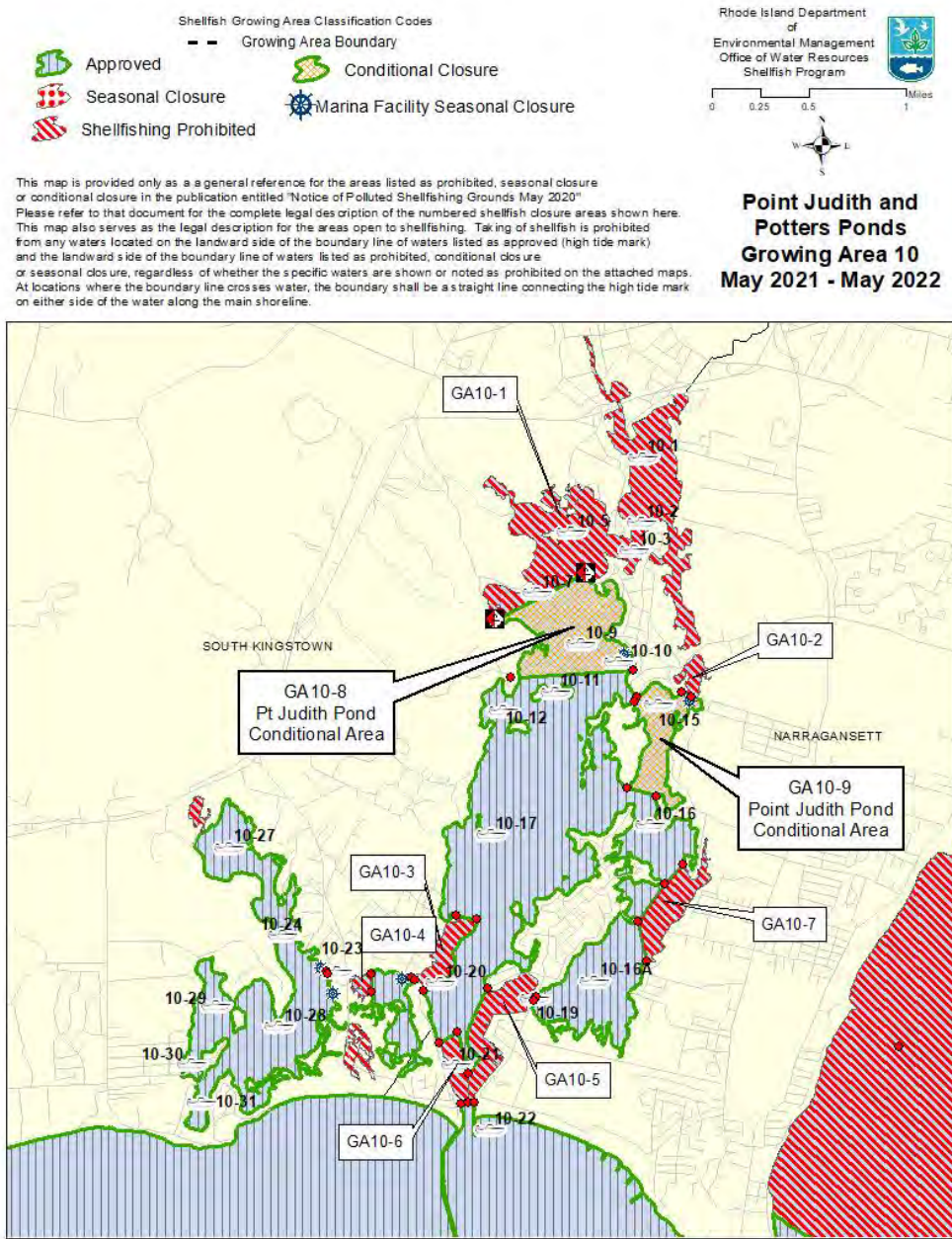
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1. Introduction

12-year sanitary shoreline surveys of the Point Judith Pond and Potters Pond Growing Area (GA10; Figure 1) were completed in 2002 and 2011. Triennial surveys were completed in 2005, 2008, 2014, 2017, and 2020. During the 2011 12-year survey a total of ninety-seven (97) actual or potential sources were identified. A total of forty-seven (47) were not actively flowing at the time of the shoreline survey with the remaining fifty (50) having flows warranting sampling. All sources in which flow was observed were sampled. During the 2020 triennial survey ten (10) potential pollution sources were sampled. The 2021 survey of this growing area was an annual update, and three (3) potential pollution sources were sampled.

Figure 1: 2021-2022 Shellfish Classification Map of GA10



2. 2021 Shoreline Survey

The 2021 shoreline survey annual update of GA10 was conducted on July 21, 2021, by DEM Shellfish Program staff. The 2021 shoreline survey update was completed during dry weather (12 days since 1.83" rain at NWS Westerly Airport, KWST). In 2021 three (3) sources were revisited, two of which have potential to flow into receiving waters currently classified as Conditionally Approved, while the third source flows into Prohibited waters. Results from sampling are shown in Table 1. Of the sources sampled during the 2021 reevaluation, none had results greater than the 2,400 cfu/100ml threshold for follow up sampling for this annual review. Figure 2 indicates the location of potential pollution sources in GA10.

Figure 2: 2021 Pollution Sources in GA10 with Routine Monitoring Stations

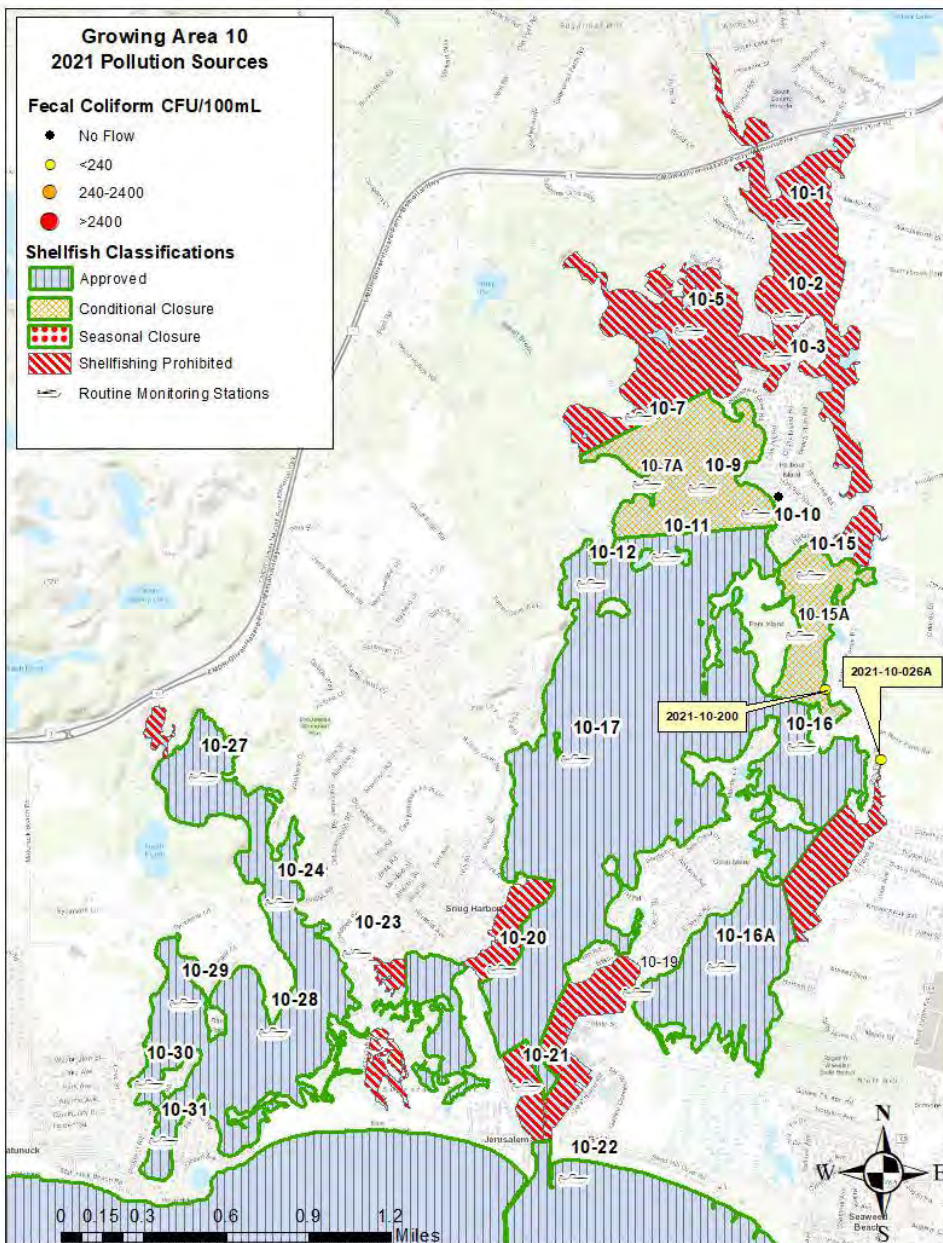


Table 1: 2021 Summary of Pollution Sources in GA 10

Source ID	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-10-011	41.410233	-71.497317	RCP outfall-near Cedar Island, Harbor Island, Narragansett	Conditionally Approved	Potential	Indirect	NF	N/A
2021-10-026A	41.39645	-71.49015	Rye Cove, In stream sample	Prohibited	Actual	Direct	<2	1.42
2021-10-200	41.400088	-71.494024	Culvert draining pond at Kenyon Farm	Conditionally Approved	Actual	Direct	100	<.001

IS = In stream sample NS = Not sampled NF = No flow CNL = Could not locate NA = Measurements not taken

A. Description of Sources

i. Pt. Judith Pond

No sources sampled during the 2021 survey exceeded 240 cfu/100 ml (Table 1). A brief description of the source sampled can be found below. Source 10-011 was not flowing and was not sampled during the 2021 inspection.



Figure 3: Source 2021-10-26A, a small stream entering Rye Cove.

Source 2021-10-26A is a small stream on the eastern shore of Pt. Judith Pond that drains into Rye Cove (Figure 3). The receiving waters are classified as Prohibited to shellfishing. The 2020 sample collected on 11/24/2020 (one day after 1.54" rain) had an elevated bacterial level of 1,100 CFU/100 ml. The 2021 sample was collected during dry weather (collected on 7/21/21, 12 days after 1.83" rain at Westerly) and had a fecal coliform result of 100 cfu/100 ml and a trickle flow (<.001cfs). This source is a small stream that passes through a marsh and there is an approximately 1,800 feet (549 m) distance through a Prohibited zone (closure 10-7; Figure 1) between this source and the Approved waters of Growing Area 10. Acceptable fecal coliform levels observed at nearby monitoring stations 10-16 and 10-16A in Approved waters demonstrate the effectiveness of the Prohibited zone in diluting the fecal coliform loading from source 10-26A.



Figure 4: Source 2021-10-200 a small stream flowing through a culvert at Kenyon Farm, Narragansett, RI.

Source 10-200 (Figure 4) is a culvert draining a pond at Kenyon Farm in Narragansett, RI and discharging into the Conditionally Approved waters of Upper Pt. Judith Pond. The 2020 survey was conducted during wet weather (1 day after 1.54" rain) and the Conditionally Approved receiving waters were in the closed status. During the 2020 survey source 10-200 had a fecal coliform result of 1,600 cfu / 100 ml and a flow rate of only 0.094 cfs. An in-stream bacteria result of 960 cfu / 100 ml indicated some dilution during wet weather. The 2021 observation of this source took place during dry weather (12 days since 1.83" rain) and yielded a much lower fecal coliform result of 100 cfu/100 ml. Nearby monitoring station 10-15 (Conditionally Approved waters) and 10-16 (Approved waters) had acceptable fecal coliform levels for 2021 demonstrating that source 10-200 has minimal impact on fecal coliform levels in the Approved waters and the conditionally approved waters of the growing area when in the open status.

ii. Potter Pond

A shoreline survey update was completed for the Potter Pond portion of GA10 during September 2021. This shoreline survey update was in response to an illness outbreak due to *Campylobacter*-contaminated shellfish harvested at an aquaculture lease in Potter Pond. Details and documentation of the RI shellfish program (DEM, DOH, CRMC) response to the illness outbreak are in the report "Illness Outbreak Summary and Growing Area Evaluation of Rhode Island Shellfish Growing Area 10 PP (Potter Pond) Completed in Response to a *Campylobacter*-related Illness Outbreak, dated December 2021" and available in the Program's permanent files. Highlights of the 2021 shoreline survey update of Potter Pond are below:

- DEM Shellfish staff conducted a shoreline survey of Potter Pond on 9/27/2021 (3 days after 0.69" rain at Westerly KWST weather station). The survey included follow-up sampling of all previously identified potential sources and an investigation of any new potential sources in the growing area.
- No new potential sources were identified.
- One previously identified shoreline source (source 10-58; a tidal stream draining a salt marsh; Fig. 5) was sampled.
- September 2021 results for source 10-058 were consistent with previous results (Table 2): the stream had fecal coliform of < 100 cfu/100 ml and companion in-stream sample results showed dilution to low levels (8 cfu/100 ml).
- The 9/27/2021 shoreline survey evaluation indicates that there are no shoreline sources that are negatively impacting the microbial water quality of growing area 10PP (Potter Pond).
- In addition, two small coves (Perch Cove and Fresh Pond) that are tidally connected with the northern section of GA10PP were investigated on 10/8/2021 (4 days after 1.09" rain at Westerly KWST weather station). Fecal coliform levels at the entrance to Perch Cove (<100 cfu/100 ml) and Fresh Pond (<100 cfu/100 ml) were <100 cfu/100 ml (the minimum detection level for shoreline survey dilutions) suggesting that these small water bodies are not major fecal coliform sources.

Source 10-058 (Fig. 5) is a small tidal stream flowing out of a salt marsh. In 2011 this source had a fecal coliform value of 240 mpn/100 ml on a sample taken at slack tide in a Prohibited area of the tidal creek. The 2011 survey concluded that for source 10-058 there were "no impacts from anthropogenic sources and elevated bacteria counts are most likely due to wildlife

influences.” Samples collected at source 10-058 during the 2020 triennial survey showed that source 10-058 had a fecal coliform result of <100 cfu/100 ml for a sample collected on 11/24/2020 during wet weather (1 day after 1.54” rain at Westerly Airport). A companion in-stream sample taken ~25 feet to the east of where the source entered the waters of the growing area showed a value of 4 cfu/100 ml demonstrating rapid dilution of this source.

Similarly, source 10-058 samples collected on 9/27/2021 had a fecal coliform result of < 100 cfu/100 ml (the minimum detection level for shoreline survey source dilutions) and companion in-stream samples showed rapid dilution of 8 cfu/100 ml in the receiving waters. This tidal stream has no direct freshwater input and flows from the marsh to the waters of the growing area only on ebbing tides. The mouth of source 10-058 is approximately 250 feet from DEM monitoring station 10-30 which is classified as Approved and is in current compliance. Recent fecal coliform results for source 10-058 (Table 2) demonstrate that it is not a major source of fecal coliform to the growing area.



Figure 5: Source 10-058, a small tidal stream draining a salt marsh (2011 photo).

Table 2: Source 10-058 fecal coliform results. In-stream samples were taken in the receiving waters approximately 25 feet from the source.

Date	Days after rain	Rain at Westerly (“)	Source fecal coliform (cfu/100 ml)	In-stream fecal coliform (cfu/100 ml)
2011			240	
11/24/2020	1	1.54	< 100	4
9/27/2021	3	0.69	< 100	8

B. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area.

Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 10 (Pt. Judith and Potter Ponds) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

3. Marinas and Moorings

There are numerous recreational boating facilities within the growing area that have the potential to have negative impacts upon water quality. Closed safety zones have been established around these marinas. As of 2021 there are four pumpout facilities servicing the numerous marinas, two at the head of Point Judith Pond at Ram Point and the other two located in the Snug Harbor area near the channel between the two ponds. Both ponds are within the states no-discharge zone, making the discharge of marine sanitation devices illegal.

The Port of Galilee in the Town of Narragansett is the major commercial fishing center in Rhode Island. The port is located on the eastern side of Point Judith Pond immediately north of the breachway. There are also commercial fishing boats harbored in Snug Harbor immediately south of High Point in South Kingstown. The areas immediately surround these ports are closed to shellfishing. The potential impacts from the existing commercial docks and marinas have been evaluated and waters adjacent to these facilities are within the closed prohibited zones providing adequate protection in the case of any discharges associated with marine vessels. Details of this analysis can be found in the program document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017."

4. Wastewater Treatment Facilities

There are no wastewater treatment facilities that discharge directly into either Point Judith Pond or Potters Pond. There are six (6) RIPDES permitted discharges into the harbor area in Galilee. They are all water release pipes associated with fish processing and distribution plants and discharge into waters that are currently classified as prohibited providing sufficient dilution prior to mixing with adjacent approved shellfish waters.

5. Water Quality Studies

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program

(NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in “Standard Methods for the Examination of Water and Wastewater” (APHA, 1995) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedure, August 2021 (copy in the Program’s permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RI DOH. Any unusual or exceptionally elevated values are immediately evaluated to determine the need for additional sampling and/or investigation.

The fecal coliform water quality in Pt. Judith and Potter Ponds (GA10) is monitored at 24 stations in the growing area (Figure 1). The growing area is sampled six times per year under a systematic random sampling strategy following NSSP guidance for growing areas not affected by point sources. A statistical summary and commentary on recent fecal coliform data for the growing area is below.

A GROWING AREA 10PJ – PT. JUDITH POND

HIGHLIGHTS

- * Sampled 6X (3 wet weather, 3 dry weather) during 2021 while the area was in the open status.
- * For Approved stations, statistics represent recent 30 samples collected when the area was open during both wet (n= 17) and dry (n= 13) weather during 8/4/2016 or 9/21/2016 to 10/20/2021.
- * For Conditionally Approved stations, statistics represent recent 15 samples collected when the Conditional area was in the open status during 9/26/2018 to 10/20/2021 (9 wet weather and 6 dry weather).
- * GA10 management changes were put into effect on 2/1/2020:
 - All stations: emergency rain closure (2.5”, 7-day closure)
 - Northern Pt. Judith Pond (stations 10-9, 10-10, 10-15): reclassified as Conditionally Approved with 1.4” rain, 7-day closure.
- * All samples analyzed by the mTEC method.
- * All approved stations in compliance.
- * Data run 12/20/2021.

COMMENTARY

Fecal coliform levels during wet weather in portions of Pt. Judith Pond have been increasing in recent years. This required a reclassification of portions of Upper Pt. Judith Pond to Conditionally Approved with a 1.4" rain 7-day closure in February of 2020. Pt. Judith Pond (GA10PJ) was sampled 6X during 2021, with three of the samples collected during wet weather (greater than 0.5" rain in prior 7 days) and three samples collected during dry weather. The conditionally approved portions of the pond were in the open status on five of the six sampling runs completed during 2021.

2021 fecal coliform statistics were calculated consistent with the Pt. Judith and Potter Ponds (GA10) conditional area management plan adopted in early 2020. This included the creation of Conditionally Approved area in upper Pt. Judith Pond and a 2.5" excess rain closure for the entire growing area. For Approved stations, the recent 30 samples included 13 dry weather and 17 wet weather samples collected during 8/4/2016 or 9/21/2016 through 10/20/2021. The 2021 statistical review demonstrated that all Approved stations in the growing area met NSSP fecal coliform criteria. However, stations 10PJ-16 located in Bluff Hill Cove had a 90th percentile variability statistics of 28.5 cfu/100 ml which is approaching the NSSP variability criteria of 31 cfu/100 ml. Investigation of shoreline fecal coliform sources contributing to elevated fecal coliform in Bluff Hill Cove will continue during 2022.

The Conditionally Approved station in Pt. Judith Pond (10PJ-9, 10PJ-10, 10PJ-15) met NSSP criteria when in the open status. Note that two of these stations (10PJ-9, 10PJ-15) did not meet criteria under an Approved classification scenario, demonstrating the continued necessity for the Conditionally Approved classification in Upper Pt. Judith Pond. The 2021 statistical evaluation demonstrated that all Approved and Conditionally Approved areas of Pt. Judith Pond meet NSSP criteria and that the area is properly classified.

RECOMMENDATIONS.

- * Maintain 2.5" rain emergency closure for entire growing area.
- * Maintain 1.4" rain conditional closure in upper Pt. Judith Pond.
- * When practical, continue wet-weather sampling to further refine extent of conditional closure areas and closure rainfall amounts.
- * Continue work to identify fecal coliform sources contributing to recent increases in fecal coliform concentration in Pt. Judith Pond.

Table 3: Fecal coliform summary statistics for Pt. Judith Pond (GA10PJ) based on recent 30 samples collected when the area was in the open status (with 2.5” emergency rain closure);8/4/2016 or 9/21/2016 to 10/20/2021; 17 wet and 13 dry weather); all mTEC analysis. Conditionally Approved stations shown for informational purposes only, not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
10PJ-1	P	30	82.2	954.8
10PJ-2	P	30	43.4	489.1
10PJ-3	P	30	29.4	252.0
10PJ-5	P	30	13.5	96.4
10PJ-7	P	30	9.2	54.3
10PJ-9	CA	30	6.7	36.5
10PJ-10	CA	30	5.2	28.9
10PJ-11	A	30	4.1	14.3
10PJ-12	A	30	3.9	11.5
10PJ-15	CA	30	6.8	57.4
10PJ-16	A	30	5.0	28.5
10PJ-16A	A	30	5.6	23.2
10PJ-17	A	30	3.3	9.7
10PJ-19	P	30	6.1	27.8
10PJ-20	P	30	4.5	13.2
10PJ-21	P	30	5.8	22.2
10PJ-22	A	30	2.9	7.3

Table 4: Fecal coliform summary statistics for Pt. Judith Pond (GA10PJ) conditionally approved stations. Statistics based on recent 15 samples collected when area was in the open status (1.4” Conditional Approved area rain closure; 9/26/2018 to 10/20/2021; all mTEC, 6 wet and 9 dry weather). Conditionally Approved stations only

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
10PJ-7A	CA	10**	5.6	0.0
10PJ-9	CA	15	7.6	6.7
10PJ-10	CA	15	4.3	6.7
10PJ-15	CA	15	5.7	6.7
10PJ-15A	CA	10**	3.0	0.0

** new station added in 2020; number of observations is low (n= 10) and insufficient data to calculate representative statistics for compliance.

B GROWING AREA 10PP –POTTER POND

HIGHLIGHTS

- * Sampled 8X during 2021; 5 times while open and three times while in the closed status.
- * Area closed from 9/11/2021 to 11/2/2021 (52 days) due to an illness outbreak and investigation.
- * GA10 management changes were put into effect on 2/1/2020:
 - All stations: emergency rain closure (2.5”, 7-day closure)
- * For Approved stations, statistics represent recent 30 samples collected when the area was open during both wet (n= 17) and dry (n= 13) weather during 8/14/2016 to 10/20/2021.
- * All samples analyzed by the MTEC method.
- * All approved stations in compliance.
- * Data run 12/20/2021.

COMMENTARY

Potter Pond (GA10PP) was sampled eight times (5 wet weather, 3 dry weather) during 2021, exceeding minimum sampling requirements for approved areas. Five sets of samples were taken while the area was in the open status while three sets of samples were collected while the area was in the closed status. The growing area was in the closed status for 52 days (9/11/2021 to 11/2/2021) due to an illness investigation related to consumption of *Campylobacter* contaminated shellfish. An investigation by RI DOH, RI DEM and RI CRMC identified birds roosting on floating aquaculture gear as the source of *Campylobacter* contamination of shellfish. Several weeks after the floating aquaculture gear was removed, samples confirmed the absence of *Campylobacter* and fecal coliform contamination in oysters raised on the aquaculture lease. Wild shellfish (Quahaugs) harvested in Potter Pond were demonstrated to be free of *Campylobacter* and fecal coliform contamination throughout the closure period. Details and documentation of the RI shellfish program (DEM, DOH, CRMC) response to the illness outbreak are in the report “Illness Outbreak Summary and Growing Area Evaluation of Rhode Island Shellfish Growing Area 10 PP (Potter Pond) Completed in Response to a *Campylobacter*-related Illness Outbreak, dated December 2021” and available in the Program’s permanent files.

Fecal coliform levels in Potter Pond, especially the northern part of the Pond (stations 10-24 and 10-27), have been increasing over the past several years. Shoreline surveys conducted in 2020 and 2021 did not identify any significant shoreline sources of fecal coliform contamination. Part of the fecal coliform increase may be related to frequent wet weather experienced in the area during the past several summers. For example, during June to August 2019 the area received 17.5” of rain compared to a long-term average June to August rainfall of 10.3” at Westerly (KWST weather station at Westerly Airport). September of 2021 was also much wetter than usual, with 6.6” of rain received (KWST weather station) compared to the average September rain of 3.8”. As a result of this frequent wet weather, seventeen of the recent 30 samples used to calculate NSSP compliance statistics were collected under wet weather conditions (greater than 0.5” rain in prior 7-days) and 14 of the recent samples were collected within five days or less of storms of 1” or greater rainfall.

The recent statistical evaluation demonstrated that all Approved stations in Potter Pond met NSSP fecal coliform criteria during 2021. However, four of six Approved stations had 90th percentile variability statistics in the twenties (compared to a NSSP criteria of 31 cfu/100 ml) and station 10PP-24 had a 90th percent variability statistic of 29.3 cfu/100 ml which is approaching the NSSP variability criteria of 31 cfu/100 ml. In the past (1998) the ‘narrows’

portion of Potter Pond near station 10-24 has been closed to shellfishing due to water quality exceeding NSSP criteria for Approved waters. Should the pattern of elevated fecal coliform levels continue, the northern portion of Potter Pond (stations 10-24 and 10-27) is in jeopardy of exceeding NSSP criteria which could require a classification downgrade of this portion of the growing area.

RECOMMENDATIONS.

- * Maintain 2.5” rain emergency closure for entire growing area.
- * Continue work to identify fecal coliform sources contributing to recent increases in fecal coliform concentration.

Table 5: Fecal coliform summary statistics for Potter Pond (GA10PP) based on recent 30 samples collected while the area was in the open status (with 2.5” emergency rain closure); (8/4/2016 to 10/20/2021; 17 wet and 13 dry weather); all mTEC analysis.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
10PP-23	P	30	5.2	21.6
10PP-24	A	30	6.6	29.3
10PP-27	A	30	5.4	26.7
10PP-28	A	30	4.0	16.8
10PP-29	A	30	3.5	11.7
10PP-30	A	30	4.7	21.5
10PP-31	A	30	4.6	22.3

6. Summary and Conclusions

The 2020 annual evaluation of Pt. Judith Pond and Potter Pond growing areas (GA10) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area’s Approved waters or Conditionally Approved waters when they are in the Open status. A statistical review of water column fecal coliform data collected while the area was in the open status indicated that all Approved and Conditionally Approved stations met NSSP criteria and that the Pt. Judith and Potter Pond Growing Area (GA10) is in program compliance and is properly classified. The Potter Pond portion of the growing area (GA10PP) was closed for 52 days due to an illness outbreak related to Campylobacter contamination from birds roosting on aquaculture floats. The operational plan for the implicated aquaculture lease has been modified (removed floating gear) to prevent bird contamination in the future.

Growing Area 10 has conditionally approved areas in upper Pt. Judith Pond that are negatively impacted by precipitation and wet weather discharge of the Saugatucket River. Therefore, the RIDEM Shellfish Program manages Growing Area 10 in accordance with the guidelines set forth in the Pt. Judith Pond Conditional Area Management Plan (CAMP) revised in August 2021. A review indicated that management of the GA10 conditional area was consistent with the CAMP during 2021.

The 2021 annual reevaluation has demonstrated that all approved and conditionally approved waters are in current compliance with NSSP criteria. However, areas of eastern Pt. Judith Pond

(near station 10PJ-16) and northern Potter Pond (near stations 10PP-24 and 10PP-27) have fecal coliform variability statistics that are approaching the NSSP standard of 31 cfu/100 ml. Should the pattern of elevated fecal coliform variation continue, these areas may require a classification downgrade.

No classification changes are recommended for the Pt. Judith and Potter Pond growing area (GA10) at this time.

**Ninigret Pond and Green Hill Pond
Growing Area 11 NG
Triennial Re-Evaluation
Calendar Year 2021**



Photo credit: United States Fish and Wildlife Services

**Rhode Island
Department of Environmental Management
Office of Water Resources
Shellfish Program**

GA11NG Triennial Sanitary Survey: Ninigret Pond and Green Hill Pond 2021

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1. Introduction

A triennial re-evaluation shoreline survey of the Ninigret Pond and Green Hill Pond shellfish growing area (GA11NG; Figure 1) was conducted during 2021 in compliance with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline survey was to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys. Previous shoreline surveys of this area included comprehensive 12-year surveys completed in 2002 and 2012 and triennial surveys completed during 2005, 2008, 2015 and 2018.

The Ninigret Pond and Green Hill Pond Growing Area (GA11NG) presently has two classifications: Prohibited and Approved. The entirety of Green Hill Pond and the easterly section of Ninigret Pond adjoining Green Hill Pond are presently classified as prohibited to shellfishing due to elevated fecal coliform levels. The remainder of the growing area is in Ninigret Pond and is classified as Approved. There are twenty-three monitoring stations that are routinely sampled to characterize the water quality of the growing area.

A 12-year shoreline survey of this growing area was last conducted in 2012. A total of ten actual or potential sources were identified during the 2012 shoreline survey. All sources were sampled in 2012, only two of which had bacteria counts that exceeded the 240 cfu/100 ml benchmark used for follow-up sampling. The two sources having greater than 240 cfu/100 ml results in 2012 were identified as 11GH-01 (Factory Brook) and 11GH-04 (an RCP outfall into Allen Cove). Both of these sources discharge into the prohibited area of Green Hill Pond and have no impact on the approved waters of Ninigret Pond.

2. Description of Growing Area

Ninigret and Green Hill Ponds (Figure 1) are located along the southern shoreline of Rhode Island in the towns of South Kingstown and Charlestown. These two ponds are in the center of the Salt Pond Region, which consists of a series of shallow coastal lagoons separated from the ocean by barrier beaches. A narrow tidal channel passing under Charlestown Beach Road connects Green Hill Pond to the east with Ninigret Pond to the west. A constructed tidal breachway connects Ninigret Pond to the oceanic waters of Block Island Sound. Tidal flow passes through the breachway into Ninigret Pond and then through the narrow channel into Green Hill Pond.

Ninigret Pond encompasses an area of approximately 1,666 acres with an average depth of 4.3 feet (RIDEM TMDL, 2006) and contains approximately twelve oyster aquaculture leases (CRMC, 2020). Green Hill Pond is approximately 430 acres in size with an average depth of 2.5 feet. The multiple tidal restrictions between Block Island Sound and Green Hill Pond drastically reduce tidal amplitude and tidal flushing in Green Hill Pond (Isaji et al., 1985; RIDEM TMDL, 2006).

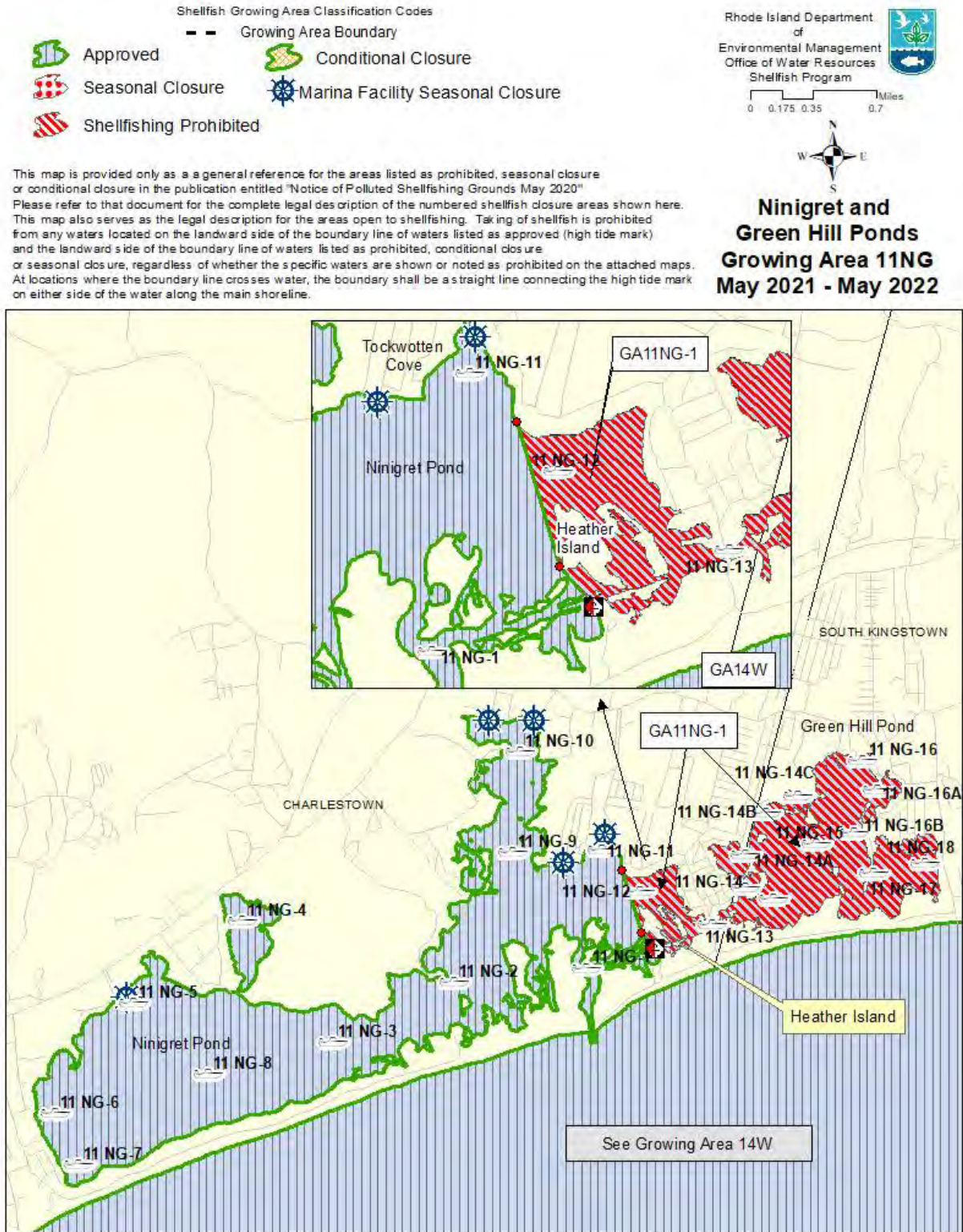
The towns of Charlestown and South Kingston Rhode Island are popular summer destinations for vacationers and seasonal residents. More recently, the favorable living conditions have encouraged transformation of summer cottages to year-round residences and a significant increase in the number of new residences built in the vicinity of coastal salt ponds in these communities. There are no public sewers available, and all residences rely upon On-site Wastewater Treatment Systems (OWTSs) for treatment of wastewater. There has been a heightened awareness of the impacts of densely populated areas that have numerous outdated

and poorly functioning septic systems that lie adjacent or in the watershed of these two ponds. The Town of Charlestown has completed an on-site wastewater management plan addressing new construction and the proper maintenance of septic systems especially in sensitive resource areas such as Ninigret Pond. The Town of South Kingstown has also adopted a wastewater management plan that establishes special requirements for septic systems sited in the vicinity of waterbodies

The Towns of Charlestown and South Kingstown have taken action to reduce potential fecal contamination of Ninigret and Green Hill Ponds through the state-wide cesspool phase-out program. As of 2016, all cesspools within the Charlestown portion of the Ninigret and Green Hill Pond watershed have been reportedly removed and replaced. Additionally, in the Salt Pond (Green Hill and Ninigret Ponds) critical resource area nitrogen reducing technology is required, and additional horizontal and vertical setbacks have been established. Similarly, the Town of South Kingstown has offered low interest loans for the repair of onsite wastewater systems and the replacement of cesspools.

Freshwater inputs to the pond are mainly from groundwater, several small freshwater streams, and direct precipitation and associated stormwater runoff. Teal Brook and Factory Brook both enter the prohibited waters of Green Hill Pond in the upper northeast reach of the growing area. RIDEM Office of Water Resources has produced a TMDL (Total Maximum Daily Load) plan for the area that was approved by EPA in 2006. This report was developed to address the bacteriological impairments to these two freshwater streams and the downstream shellfishing waters of Green Hill Pond. As stated in the TMDL document a small number of pipes, or channelized conveyances were identified as potential or actual pollution sources to both the ponds themselves and to the freshwater streams flowing into the growing area. Although the report also identifies failing septic systems as a source of pollution, the majority of the sources that cause these water quality impairments are from indiscreet, non-point sources that reach the ponds either by groundwater or from stormwater runoff. Concerned citizens have formed the 'Friends of Green Hill Pond' association to advocate for improved water quality in the pond.

Figure 1: Current (2021-2022) Shellfish Classification Map of GA 11NG with Routine Monitoring Stations.



3. Pollution Source Survey

i. 2021 Survey

The 2021 shoreline survey was conducted as a triennial re-evaluation of this growing area. The survey included a review of previous shoreline surveys, bacteriological sampling of actual pollution sources that were found to be equal to or greater than 240 cfu/100 ml in previous surveys and identification of any new pollution sources. The 2021 shoreline survey was completed by Steve Engborg and Steve Rogers of the DEM Water Resources Shellfish Program. The 2021 shoreline survey was conducted on two dates: June 10, 2021 (7 days after 0.09” rain at nearby Westerly, RI NOAA weather station KWST) and October 18, 2021 (2 days after 0.21” rain at KWST).

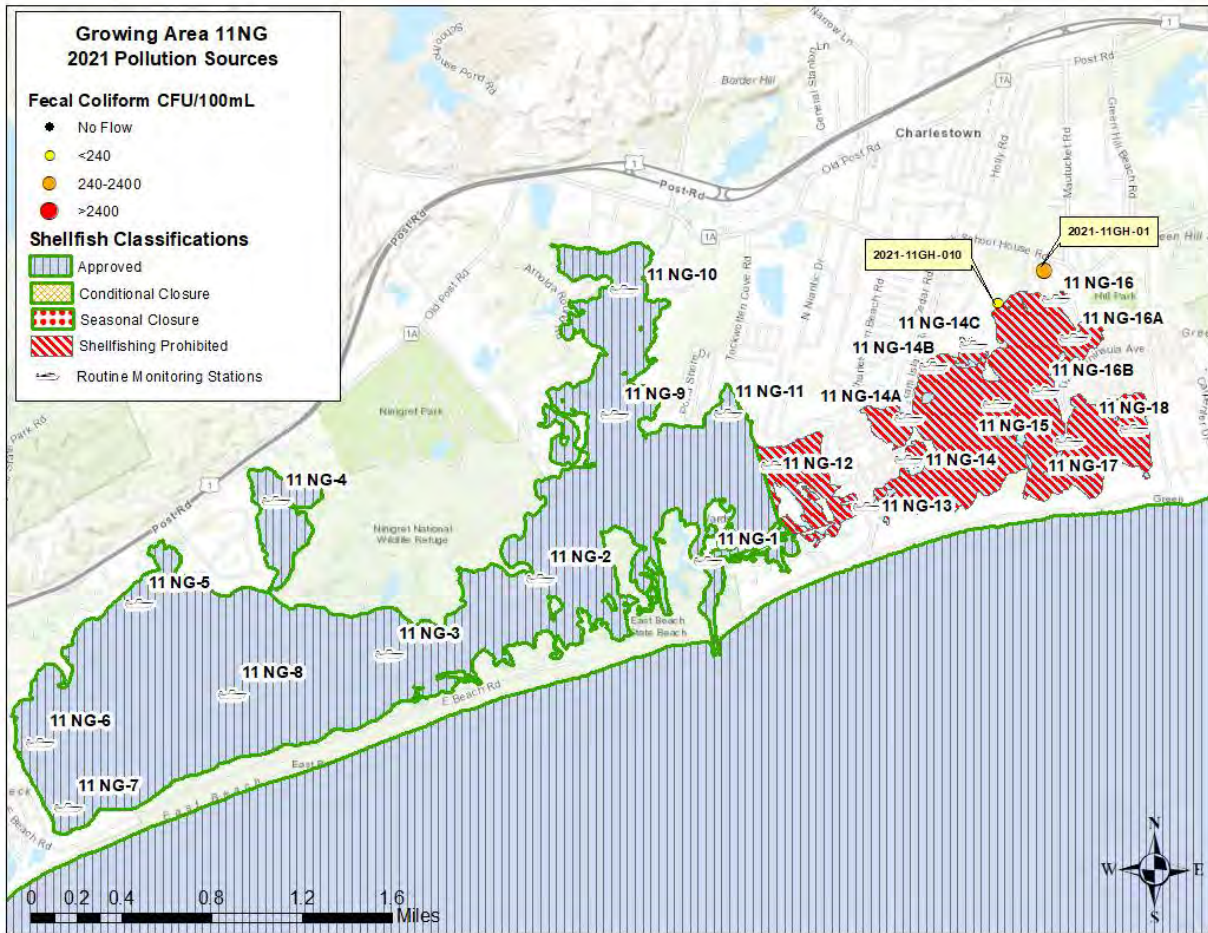
ii. Description of Shoreline Sources

Two (2) sources were sampled during the 2021 survey (Table 1, Figure 2). Source 11GH-01 is Factory Brook flowing into Green Hill Pond. It was sampled on June 10, 2021 (2 days after 0.21” rain) and had a fecal coliform result of 360 cfu/100 ml and a flow of 2.04 cfs. This source flows into prohibited waters in the northeast corner of Green Hill Pond (Figure 2). Source 11GH-10 is a small, culverted stream that also flows into the northeast corner of Green Hill Pond. In 2021 it had a fecal coliform value of 100 cfu/100 ml and a trickle flow. Both of these sources flow into prohibited waters approximately 2 miles east of the approved shellfish waters of Ninigret Pond. The 2021 evaluation indicated that these sources are relatively low in bacteria concentration and flow and are sufficiently distant from the approved waters of GA11NG to have a negative impact on the microbial water quality of approved waters.

Table 1: Fecal coliform results of 2021 shoreline survey GA 11NG

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-11GH-01	10/18/2021	41.37954	-71.6107	Factory Brook	Prohibited	Actual	Indirect	360	2.04
2021-11GH-010	6/10/2021	41.37751	-71.6146	Culverted stream	Prohibited	Actual	Direct	100	Trickle

Figure 2: GA11NG 2021 potential pollution sources.



iii. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM’s Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program’s HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area

11NG (Ninigret and Green Hill Ponds) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

iv. Mooring Fields and Marinas

There are eleven recreational boating facilities, marinas or dockage areas located in Ninigret and Green Hill Ponds. Two are located in the prohibited Green Hill Pond and four others are located within the prohibited areas of Ninigret Pond. The remaining five located in approved waters are listed in the following table.

Table 2: Ninigret Pond Marinas

Marina Facility Name (As Currently Known)	Number of Boats	Town	Latitude	Longitude
Ninigret Landing	70	Charlestown	41° 21.51'	-71° 41.31'
Ocean House Marina	95	Charlestown	41° 22.85'	-71° 38.70'
Fort Neck Association	25 (est.)	Charlestown	41° 22.85'	-71° 38.99'
Tockwotten Cove Assn	25 (est.)	Charlestown	41° 22.30'	-71° 38.24'
Pond Shore	15 (est.)	Charlestown	41° 22.17'	-71° 38.51'

Due to the shallow depth of the salt ponds, most of the boats in the growing area are small (less than 25' long) fishing and recreational day boats. There is a Seasonal Marina Closure area described as that area within 25 feet of any in water structure for docking vessels around each of the five marinas listed (Table 2). Ocean House Marine, the largest marina in the growing area, operates a dock side marine pump out facility that is available to all boats operating in these waters. Details of these marinas can be found in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters of the marina proper and waters adjacent to marinas have either a year-round prohibited area or a seasonal closure to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state. Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found on our website: <http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Wastewater Treatment Facilities (WWTF)

There are no wastewater treatment facilities (WWTF), or any permitted RI Pollution Discharge Elimination (RIPDES) discharges that discharge to Ninigret and/or Green Hill Pond (GA11NG).

5. Water Quality Studies

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption. Growing Area 11NG is an approved area with no point sources of bacterial pollution and is monitored on a systematically random sampling regime. Sampling runs are conducted six times per year typically more often in the spring, summer and fall. Harsher weather and ice conditions would prevent access to many of the sampling stations in the winter months. Water samples are collected at twenty-four (24) monitoring stations throughout the growing area (Figure 1). Ten stations are in Green Hill Pond, one in the channel connecting the two ponds and the remaining thirteen are in Ninigret Pond.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the SM48 and SM01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (updated August 2021; copy in the Program's permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or shoreline survey program – are evaluated by RIDEM OWR staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are further evaluated to determine the need for additional sampling and/or investigation. The 2021 annual statistical evaluation of GA11NG fecal coliform monitoring is below.

i. GA11NG Annual Statistical Evaluation

HIGHLIGHTS

- * Sampled 6X during 2021 (4 wet weather, 2 dry weather).
- * Statistics represent recent 30 samples collected under both wet (n= 16) and dry (n= 14) weather conditions during 10/19/2016 or 12/7/2016 to 11/2/2021.
- * All approved stations in compliance.

* All samples analyzed by the mTEC method.

* Data run 12/20/2021.

COMMENTARY

Ninigret Pond and Green Hill Ponds (Growing Area 11NG) were sampled six times (2X dry weather and 4X wet weather) during 2021, consistent with the minimum systematic random sampling monitoring requirements for approved areas. The recent 30 sample results are representative of both wet (n= 16) and dry (n= 14) weather conditions.

Ninigret Pond

The 2021 statistical review demonstrated that all approved stations in Ninigret Pond met criteria for shellfish harvest for direct human consumption. The recent 30 samples used to calculate compliance were collected during late 2016 through 2021. These samples included 16 ‘wet weather’ samples collected within 7 days of rainfall of 0.5” or more. Twelve of these wet weather samples were collected within five days of rainstorms of approximately 1” or more. The increased frequency of wet weather samples may have contributed to moderately elevated fecal coliform at some stations. Stations 11NG-4 (Foster Cove) and 11NG-10 (near Marshneck Point) had elevated, but still acceptable, fecal coliform variability statistics for both 2020 and 2021. The ‘sentinel station’ 11NG-12 (classified as prohibited) that marks the transition from approved waters in the western end of Ninigret Pond to prohibited waters at the far eastern end of Ninigret Pond and Green Hill Pond exceeded NSSP variability criteria in the 2019 through 2021 evaluations. This is mainly due to wet weather experienced during 2019 as most 2020 and 2021 observations at that station were acceptable. Continued monitoring of this station is required to determine if there is westward expansion of reduced water quality from eastern Ninigret and Green Hill Pond.

Table 3: Fecal coliform summary statistics for Ninigret Pond based on recent 30 samples collected during all weather conditions (10/19/2016 or 12/7/2016 to 11/2/2021; all mTEC, 16 wet and 14 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
11NG-1	A	30	4.4	21.6
11NG-2	A	30	3.0	8.3
11NG-3	A	30	2.8	8.2
11NG-4	A	30	5.7	25.9
11NG-5	A	30	2.4	4.7
11NG-6	A	30	2.4	4.9
11NG-7	A	30	2.7	6.3
11NG-8	A	29	2.5	4.7
11NG-9	A	30	5.0	22.5
11NG-10	A	30	4.7	28.1
11NG-11	A	30	3.1	8.6
11NG-12	P	30	6.2	51.6

Green Hill Pond

Shellfishing has been prohibited in the entirety of Green Hill Pond since May 28, 1994, due to elevated and unpredictable fecal coliform concentration. A TMDL study of Green Hill Pond was completed in 2006. The TMDL study identified freshwater streams in the north-northeast side of Green Hill Pond and groundwater as sources of fecal coliform. 2021 ambient monitoring results are consistent with this, indicating elevated fecal coliform levels exceeding NSSP standards for shellfish harvest at stations along the northern side of Green Hill Pond. Stations on the south side of Green Hill Pond displayed lower but highly variable (90th percentile statistic above NSSP threshold) and unpredictable fecal coliform levels. The 2021 statistical evaluation demonstrated that all twelve (12) monitoring stations located in Green Hill Pond exceeded NSSP variability criteria (90th percentile of 31 cfu/100 ml) for harvest of shellfish. Future monitoring will continue in Green Hill Pond to track and support TMDL and other water quality improvement efforts in the watershed.

Table 4: Fecal coliform summary statistics for Green Hill Pond based on recent 30 samples collected during all weather conditions (6/28/2016 to 11/2/2021; all mTEC, 16 wet and 14 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
11NG-13	P	30	7.4	50.6
11NG-14	P	30	10.3	93.1
11NG-15	P	30	6.5	38.5
11NG-16	P	30	35.8	321.1
11NG-17	P	30	7.5	66.3
11NG-18	P	30	5.9	42.9
11NG-14A	P	30	12.8	76.6
11NG-14B	P	30	9.4	65.3
11NG-14C	P	30	24.7	232.0
11NG-16A	P	30	12.6	96.7
11NG-16B	P	30	8.8	62.1
11NG-19G	P	13	5.9	45.0

** new station added in 2017; number of observations is low (n= 13) and insufficient data to calculate representative statistics for compliance.

All approved stations in the growing area are in program compliance and the GA11NG growing area (Ninigret and Green Hill Pond) is properly classified.

RECOMMENDATIONS

- * 2.5” rain emergency closure required to maintain compliance with NSSP criteria.
- * Carefully review future results for stations 11NG-1 (Foster Cove), 11NG-10 (Marshneck Point) and sentinel station 11NG-12. These stations have an increasing fecal coliform variability trend in recent years.
- * Continue sampling in shellfishing-prohibited Green Hill Pond to support TMDL study and to track changes in fecal coliform concentration.

6. Conclusions and Recommendations

The 2021 triennial update of the Ninigret Pond and Green Hill Pond growing area (GA11NG) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A statistical review of water column fecal coliform samples collected in the growing area demonstrated that all Approved stations met NSSP criteria and that GA11NG is in program compliance and is properly classified. Two stations in approved waters, station 11NG-4 in Foster Cove and station 11NG-10 near Marshneck Point, had elevated fecal coliform variability statistics that are approaching the NSSP standard of 31 cfu/100 ml (Table 3). These stations will be watched for exceedance of NSSP criteria that may require a classification downgrade.

The 2021 triennial evaluation demonstrated that all approved waters met NSSP criteria and are in program compliance. No classification changes are recommended for the Ninigret Pond and Green Hill Pond growing area (GA11NG) at this time.

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**Quonochontaug and Winnapaug Ponds
Growing Area 11 QW
2021 Triennial Update**



**Rhode Island
Department of Environmental Management
Office of Water Resources
Shellfish Program**

GA11QW Triennial Re-evaluation: Quonochontaug and Winnapaug Ponds

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1. Introduction

A triennial re-evaluation of the Quonochontaug Pond and Winnapaug Pond shellfish growing area was conducted during 2021 in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this evaluation was to identify and characterize sources of pollution affecting the area, re-evaluate point and non-point sources identified during prior surveys, to evaluate fecal coliform data for compliance with NSSP standards, and to reevaluate the growing area classification.

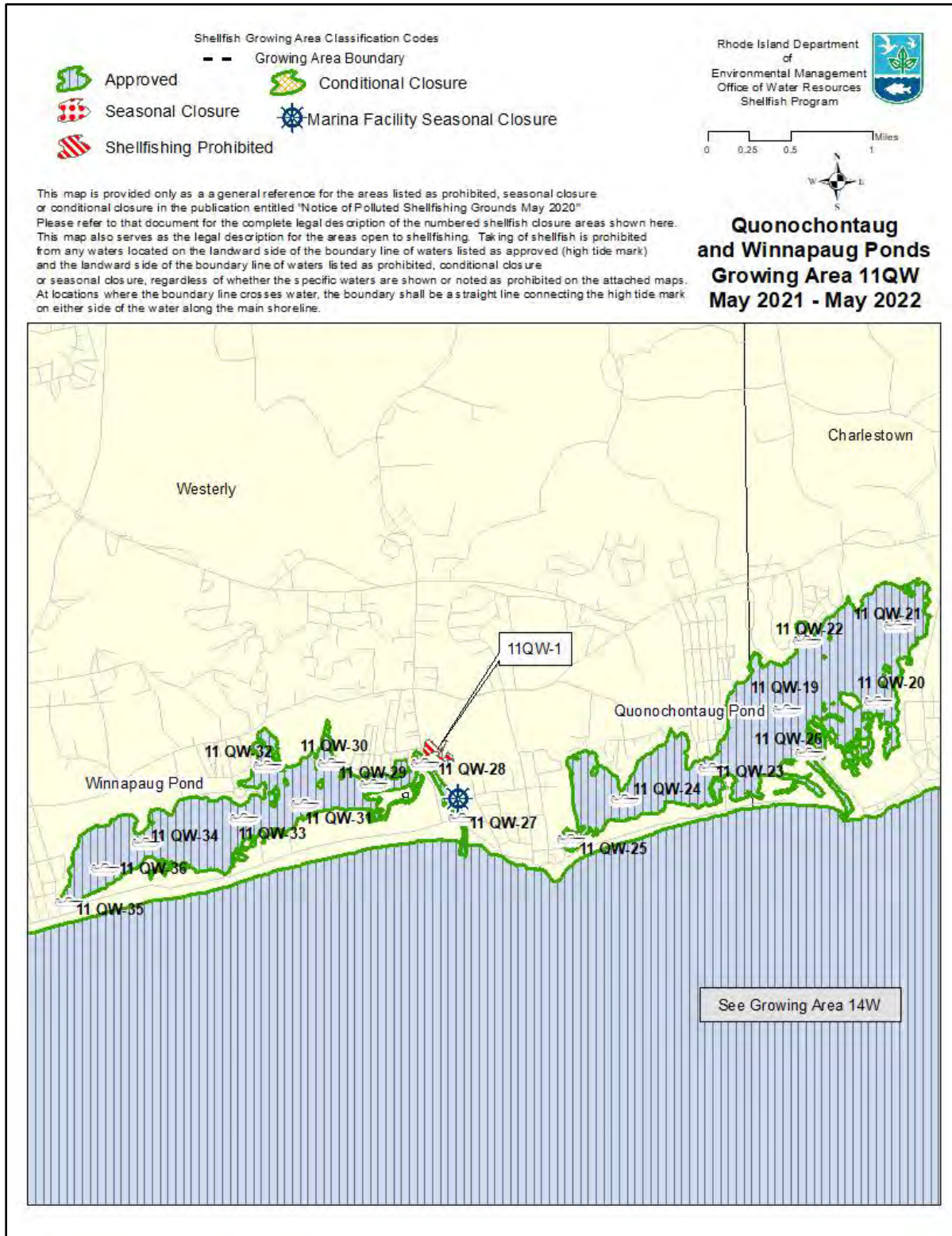
Comprehensive 12-year shoreline surveys of Quonochontaug and Winnapaug Ponds (Growing Area 11QW; Figure 1) were conducted in 2002 and 2012, and triennial updates were completed in 2005, 2008, 2011, 2015 and 2018. The last 12-year shoreline survey, completed in 2012, identified a total of twenty-six (26) actual or potential sources, seventeen (17) in Quonochontaug Pond and nine (9) in Winnapaug Pond. In the 2018 triennial update a total of eight (8) sources were identified, with three (3) having no flows at the time of the survey. Two (2) sources required follow up in the 2021 triennial survey.

The 2021 shoreline survey was conducted as a triennial re-evaluation of this growing area. As such the survey involved review of previous shoreline surveys, bacteriological sampling of actual pollution sources noted in previous surveys that were found to be equal to or greater than 240 fc/100ml and identification of any new sources of pollution if applicable.

2. Description of Growing Area

Growing area 11QW is located on the southern coast of Rhode Island and consists of shallow coastal lagoons that are productive marine embayments separated from the ocean by narrow barrier beaches. Quonochontaug Pond is approximately 745 acres in size with an average depth of 5.9' (RIGIS, RI SeaGrant). Winnapaug Pond encompasses an area of approximately 475 acres with an average depth of 4.9' (RIGIS, RI SeaGrant). Tidal range in the two ponds is approximately 1.5 feet (Shellfish program staff observations). Quonochontaug Pond lies to the east of Winnapaug Pond with no physical connection between the two. Both ponds have constructed narrow connections or 'breachways' that connect the salt ponds to the oceanic waters of Block Island Sound. All of Quonochontaug Pond is classified as Approved for shellfish harvest. All of Winnapaug Pond, with the exception of the shallow marsh area to the northeast of Weekapaug Road, is classified as Approved shellfish waters (Figure 1).

Figure 1: GA 11QW Current Classification Map (2021-2022)



3. Pollution Source Survey

i. 2021 Survey

A shoreline survey of growing area 11QW was completed on October 7, 2021, by DEM Shellfish Program biologist Steve Rogers and Anthony Crudale. This survey took place 3 days after a rainfall of 1.08” was received at nearby Westerly, RI (NOAA weather station KWST). A total of two (2) sources were identified and sampled during the 2021 shoreline survey of GA11QW (Figure 2). Fecal coliform concentration in flowing sources ranged from 100 to 400 cfu/100 ml (Table 1).



Figure 2: Locations of GA11QW potential pollution sources from 2021 shoreline survey.

Table 1: Fecal coliform results for GA11QW shoreline sources 2021.

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-11QW-5	10/7/2021	41.3475	-71.7242	Stream in cove west side	Approved	Potential	Direct	400	.08
2021-11QW-6	10/7/2021	41.34545	-71.7289	Stream at end of ROW at end of Warren Rd	Approved	Potential	Direct	100	0.0035

ii. Description of Shoreline Sources

Source 11QW-5 is an unnamed stream located on the west side of a cove flowing into Quonochontaug Pond. When sampled during this triennial survey, this source had a result of 400 cfu/100mL. Given its low estimated flow of 0.08 cfs, this source is likely to have limited impact on the growing area, as demonstrated by the instream sample results of 14 cfu /100 ml.

Source 11QW-6 is a stream that flows through a culvert under Warren Road and is adjacent to the right of way access to the cove. This area had a lower fecal result in 2021 (100 cfu/100ml) compared to the 2018 triennial (480 cfu/100 ml), and the 12-year survey in 2012 (460 cfu/100 ml). This source drains a wooded upland wetlands that has minimal potential anthropogenic sources. Given the low flow (trickle) and the relatively low fecal coliform concentration, this source is not likely to have a negative impact on the microbial water quality of the approved waters of the growing area.

iii. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 11QW (Quonochontaug and Winnapaug Ponds) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

iv. Marinas and Mooring Fields

Winnapaug Pond has one unnamed marina operated by the Weekapaug Fire District and located along Weekapaug Road in the breachway. There are approximately thirty, twenty-foot long docks along the road with no pump out facilities. By observation the boats tied up here are small 'day boat' fishing vessels under 25' in length which typically do not contain marine sanitation devices (MSDs). In 2010 the shellfish program established a Seasonal Marina Closure area described as that area within 25 feet of any in water structure for docking vessels. This marina falls under this restricted classification as indicated with a boat wheel symbol on Figure 2.

Quonochontaug Pond has one small marina, the Weekapaug Yacht Club located in the southwest corner of the pond (near station 11QW-25). The yacht club is home to a small sailing club with on land storage of small sailboats (Sunfish) and approximately 40 seasonal moorings. These seasonal moorings are used to moor a fleet of Beetle Cat sailboats, 13 foot long wooden catboats having an open cockpit and no cabin. These boats typically do not have marine sanitation devices. In addition, all waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state. Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found at: <http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Wastewater Treatment Facilities (WWTF)

There are no wastewater treatment facilities (WWTF), or any permitted RI Pollution Discharge Elimination (RIPDES) discharges that discharge to either pond in GA11QW. The entire watersheds of Quonochontaug and Winnapaug Ponds are served by On-Site Waste Water Treatment systems (OWTS). In 2007 RIDEM introduced legislation that was subsequently passed in 2011 that all cesspools located within the critical resource area boundary and within 200ft of the inland edge of coastal shoreline feature bordering a tidal water area must be abandoned and the home upgraded with a new onsite wastewater treatment system or connected to available municipal sewer lines by January 2014.

In 2008 a stormwater detention pond was constructed at the westerly end of Winnapaug Pond to handle stormwater from the adjacent neighborhood. This basin has previously been indicated as a potential pollution source to the pond and a concern as to the impacts of stormwater discharged during wet weather. Damage from Hurricane Sandy in 2010 and lack of maintenance have rendered this stormwater system inoperable and is no longer discharging to the pond. We will continue to sample the growing area adjacent to the discharge (station 11QW-36) and will monitor the condition of the stormwater system during future shoreline surveys.

5. Water Quality Studies

The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish industry. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of the shellfish harvesting waters of the state in order to maintain certification of these waters for shellfish harvesting for direct human consumption.

Growing Area 11QW has an approved classification and the growing area water quality is not influenced by point sources of pollution. Therefore, the area is monitored on a systematically random sampling regime with six (6) randomly selected sample dates per year. Sampling is biased towards warmer months because harsher weather and ice conditions would prevent access to many of the sampling stations in the winter. Water samples are collected at seventeen (17) monitoring stations throughout the growing area (Figure 1). Nine stations are in Winnapaug Pond and eight are in Quonochontaug Pond.

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in “Standard Methods for the Examination of Water and Wastewater” (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the SM48 and SM01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (updated August 2021; copy in the Program’s permanent file).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or shoreline survey program – are evaluated by RIDEM OWR staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are further evaluated to determine the need for additional sampling and/or investigation. The 2021 annual statistical evaluation of GA11QW fecal coliform monitoring is below.

i. GA11QW Annual Statistical Evaluation

HIGHLIGHTS

- * Sampled 6X when open (4 wet weather, 2 dry weather) during 2021.
- * Compliance statistics calculated for recent 30 samples when area was in the open status (12/8/2016 to 10/21/2021, 17 wet weather and 13 dry weather samples).
- * All approved stations meet NSSP criteria.
- * All samples analyzed by the mTEC method.
- * Data run 1/10/2022.

COMMENTARY

Winnapaug and Quonochontaug Ponds (Growing Area 11QW) were sampled six times during 2021; four times during wet weather and twice during dry weather (<0.5” in prior 7 days). Extreme rainfall during summer of 2019 led to elevated fecal coliform and the need to institute an excessive rain closure threshold of 2.5: in 24 hours. (measured at Westerly Airport) for this growing area beginning in 2020.

Quonochontaug Pond

2021 compliance statistics indicated that all Approved stations in the growing area met NSSP fecal coliform water quality criteria. Fecal coliform levels observed during 2020 and 2021 were generally lower than those observed during 2019 (a wet year with multiple extreme rain events). Station 11QW-25 (located in the southwest corner of Quonochontaug Pond near Weekapaug Yacht Club) met criteria but had a 90th percentile variability statistic of 29.3 cfu/100 ml that is approaching the NSSP criteria of 31 cfu/100 ml. The Westerly area has had several wetter-than normal summers recently and the recent 30 samples used to calculate compliance statistics included a majority of wet-weather samples (17 wet weather and 13 dry weather samples). Most fecal coliform observations made at station 11QW-25 during 2020 and 2021 were acceptable,

with the elevated variability statistic due to high fecal coliform values recorded during 2018 and 2019.

Table 2: Fecal coliform summary statistics for Quonochontaug Pond based on recent 30 samples collected during all weather conditions (12/8/2016 to 10/21/2021; all mTEC, 17 wet and 13 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
11QW-19	A	30	2.4	5.5
11QW-20	A	30	2.4	5.3
11QW-21	A	30	2.6	5.5
11QW-22	A	30	3.9	17.1
11QW-23	A	30	2.9	9.3
11QW-24	A	30	3.0	7.1
11QW-25	A	30	4.8	29.3
11QW-26	A	30	2.6	6.9

Winnapaug Pond

2021 compliance statistics indicated that all Approved stations in the growing area met NSSP fecal coliform criteria for Approved waters. There was an emergency closure of Winnapaug Pond on 8/23/2021 due to flooding related to Hurricane Henri (dropped nearly 3” rain on the area in 24-hours). Post-storm sampling demonstrated acceptable water quality and the growing area was able to re-open on 8/26/2021 after a 3-day closure. The 2021 review demonstrated that all stations in Winnapaug Pond have fecal coliform water quality compliance statistics well-below NSSP criteria.

Table 3: Fecal coliform summary statistics for Winnapaug Pond based on recent 30 samples collected under all weather conditions (12/8/2016 to 10/21/2021; all mTEC, 17 wet and 13 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean</u> <u>(cfu/ 100 ml)</u>	<u>90th percentile</u> <u>(cfu/100 ml)</u>
11QW-27	A	30	2.6	4.8
11QW-28	A	30	2.7	5.2
11QW-29	A	30	3.6	9.3
11QW-30	A	30	4.8	17.3
11QW-31	A	30	2.7	5.9
11QW-32	A	30	3.9	13.3
11QW-33	A	30	3.1	8.9
11QW-34	A	30	2.9	8.8
11QW-35	A	30	3.8	16.7
11QW-36	A	30	3.2	10.8

The 2021 evaluation demonstrated that the Quonochontaug Pond and Winnapaug Pond growing area (GA11QW) is in program compliance and the area is properly classified.

RECOMMENDATIONS

* 2.5” excessive rain closure required to maintain compliance with NSSP fecal coliform criteria.

6. Conclusions and Recommendations

The 2021 triennial update of the Quonochontaug Pond and Winnapaug Pond growing area (GA11QW) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A statistical review of water column fecal coliform samples collected in the growing area demonstrated that all Approved stations met NSSP criteria and that GA11QW is in program compliance and is properly classified. Station 11QW-25 (located in the southwest corner of Quonochontaug Pond near Weekapaug Yacht Club) met criteria but had a 90th percentile variability statistic of 29.3 cfu/100 ml that is approaching the NSSP criteria of 31 cfu/100 ml. This elevated fecal coliform variability is likely due to the prevalence of wet weather samples in recent samples. Fecal coliform levels will be followed carefully for station 11QW-25 to document continued compliance with NSSP criteria.

The 2021 triennial evaluation demonstrated that all approved waters met NSSP criteria and are in program compliance. No classification changes are recommended for the Quonochontaug Pond and Winnapaug Pond growing area (GA11QW).

**Growing Area 12:
Little Narragansett Bay and Pawcatuck River
2021 Annual Update**

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Introduction

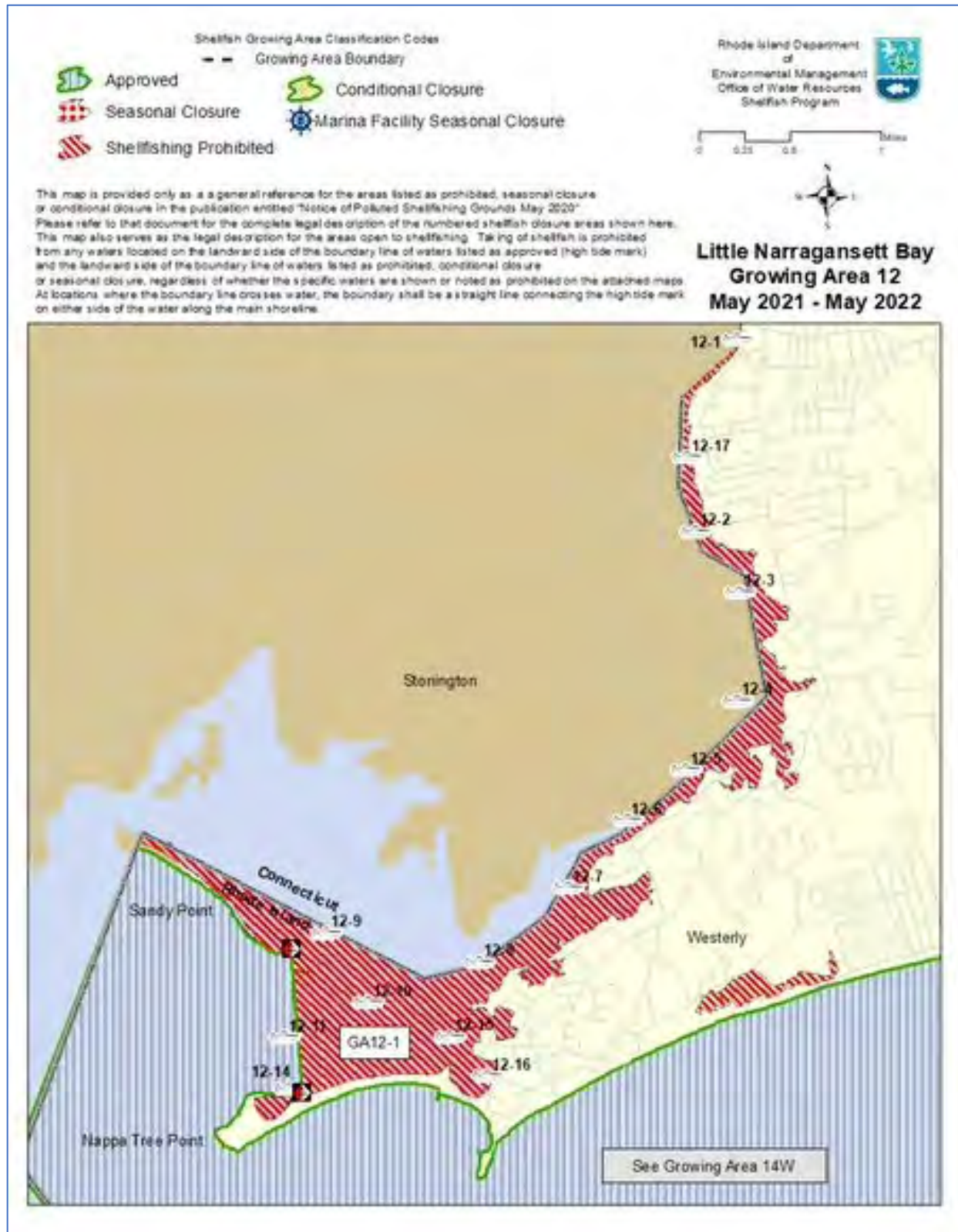
Little Narragansett Bay is an embayment located at the mouth of the Pawcatuck River, behind the barrier beach of Napatree Point. Little Narragansett Bay is located in the southwestern corner of Rhode Island adjacent to the Rhode Island – Connecticut state line. All waters of Little Narragansett Bay (Growing Area 12, Figure 1) are currently prohibited to shellfishing due to elevated fecal coliform concentration. A fecal coliform loading TMDL study of Little Narragansett Bay was approved by EPA in December of 2010. The TMDL-recommended implementation activities that focused on stormwater control, wastewater treatment, and waterfowl management (RI DEM, 2010). As part of that ongoing effort sampling has been conducted in the past several years by RI DEM TMDL and Shellfish staff in partnership with Save the Bay. The collaborative sampling effort with Save the Bay has resulted in more frequent sampling of this growing area (two to six times per year) for the past several years. This recent data is more representative of current conditions in Little Narragansett Bay and the Pawcatuck River compared to more sporadic historic sampling that had been done prior to the collaboration with Save the Bay.

In addition to closures due to unacceptable fecal coliform water quality, there are approximately a dozen commercial marinas and mooring fields within these prohibited waters. All waters of Little Narragansett Bay within and adjacent to these marinas are currently classified as prohibited. By calculation there is sufficient dilution within these prohibited waters to be protective of adjacent shellfish harvesting waters. These calculations and marina details can be found in the document entitled “Marina Dilution Analysis – June 2017” and within the electronic excel file 2017 Marina Calcs CIMS_FDA located in the program’s permanent files.

2021 Survey

The entirety of the Rhode Island portions of Little Narragansett Bay is classified as Prohibited (Figure 1), therefore there has not been a comprehensive shoreline survey of the area by the shellfish program staff. This 2021 update summarizes recent fecal coliform water quality data in the growing area in support of TMDL efforts and to track potential changes in fecal coliform water quality.

Figure 1: Current (2021-2022) Shellfish Classification Map of GA 12 with Routine Monitoring Stations



Water Quality Studies

RIDEM Shellfish Program

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is the result of an agreement between the State of Rhode Island and the Food and Drug Administration (FDA) and managed by the National Shellfish Sanitation Program (NSSP). The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at fifteen (15) monitoring stations throughout the growing area (Figure 1). Fourteen (14) monitoring stations are in Prohibited waters and one (1) station (station 12-11) is a 'sentinel station' in Approved waters just west of the Prohibited region of Little Narragansett Bay.

Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated August 2021 and available in the Program's permanent files). Briefly, samples are collected 0.5 m(1-2 feet) below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2021) annual statistical report and commentary is below.

HIGHLIGHTS

- * Sampled 4X during 2021.
- * The area is classified as prohibited, with the exception of sentinel station 12-11 which is located on the line between approved and prohibited waters.
- * For approved station 12-11, statistics represent recent 30 samples collected under both wet (n= 13) and dry (n= 17) weather conditions during 5/26/2016 to 9/21/2021.
- * Statistics for prohibited stations calculated for information purposes only, not for compliance.
- * Informational statistics calculated for Approved and Conditionally Approved (7-day closure after greater than 0.5" rain) management scenarios.
- * Approved station 12-11 is in compliance.
- * All samples analyzed by the mTEC method.
- * Data run 12/22/2021.

COMMENTARY

Little Narragansett Bay (Growing Area 12) was sampled four times during 2021 through a cooperative partnership between DEM Office of Water Resources and Save the Bay. All four samples collected during 2021 were collected during dry weather (< 0.5" rain prior 7 days). The area is classified as Prohibited, so there is no minimum sampling requirement. For more than ~20 years the area has been closed to shellfish harvest for direct human consumption due to elevated and unpredictable fecal coliform levels during wet weather. A TMDL study of the area was completed in 2010, with a focus on improving stormwater and wastewater management and reducing waterfowl impacts in the Pawcatuck River watershed.

The 2021 statistical review indicated that Little Narragansett Bay would not meet NSSP water quality criteria for shellfish harvest under either Approved or Conditionally Approved (with 0.5", 7-day rain closure) management scenarios. Fecal coliform levels remain unpredictable and elevated, especially during wet weather. The sentinel station (12-11) on the line between approved and prohibited waters was in compliance for 2021, demonstrating that the current closure line is appropriate. Under an Approved scenario, only stations 12-11 and 12-14 located in the western edge of the growing area adjacent to Approved waters, met fecal coliform criteria. Under a Conditionally Approved management scenario, with a 0.5", 7-day rain closure only two stations (12-9, 12-11) would meet NSSP criteria during dry weather.

The elevated and unpredictable fecal coliform response to rainfall indicates that the area is currently properly classified as Prohibited for shellfish harvest.

RECOMMENDATIONS

- * Continue cooperative sampling effort with Save the Bay to monitor water quality and to support TMDL work in the watershed.

Table 1: Fecal coliform summary statistics for GA12 (Little Narragansett Bay and Pawcatuck River) under an Approved classification scenario. Statistics based on recent 30 samples collected under all weather conditions during 5/26/2016 to 9/21/2021, 13 wet and 17 dry weather samples. Statistics shown for informational purposes only, not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
12-1	P	30	179.2	732.2
12-2	P	30	194.5	824.9
12-3	P	30	192.8	793.3
12-4	P	30	86.6	471.5
12-5	P	30	63.4	507.7
12-6	P	30	45.5	374.4
12-7	P	30	24.6	167.0
12-8	P	30	14.1	135.5
12-9	P	30	6.9	52.7
12-10	P	30	8.6	54.0
12-11	A	30	4.8	28.8
12-14	P	30	5.1	29.6
12-15	P	30	10.2	56.5
12-16	P	30	23.3	137.3
12-17	P	30	83.0	302.2

Table 2: Fecal coliform summary statistics for GA12 (Little Narragansett Bay and Pawcatuck River) under a Conditionally Approved classification scenario of a 0.5", 7-day closure. Recent 15 samples collected during 7/21/2016 to 9/21/2021, all mTEC, all dry weather of <0.5" in prior 7 days. Statistics shown for informational purposes only, not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
12-1	P	15	132.8	100.0
12-2	P	15	119.6	93.3
12-3	P	15	120.3	93.3
12-4	P	15	40.4	66.7
12-5	P	15	30.9	46.7
12-6	P	15	21.8	33.3
12-7	P	15	13.3	20.0
12-8	P	15	5.6	13.3
12-9	P	15	3.4	6.7
12-10	P	15	4.9	13.3
12-11	A	15	3.4	0.0
12-14	P	15	3.2	13.3
12-15	P	15	5.6	13.3
12-16	P	15	21.4	33.3
12-17	P	15	68.7	80.0

Summary and Conclusions

The 2021 review of fecal coliform water quality data indicated that fecal coliform water quality in GA12 (Little Narragansett Bay) does not reliably meet NSSP standards under all weather conditions (Approved scenario) or under a Conditionally Approved scenario with a 0.5", 7-day rain closure. Only sentinel stations on the far western edge of the growing area adjacent to the Approved waters of GA14 met NSSP criteria under any scenario. The fecal coliform water quality of GA12 is too variable, primarily due to wet weather elevations, to meet NSSP criteria for safe shellfish harvest.

The 2021 update has demonstrated that the area is properly classified as Prohibited. No changes in classification are recommended.

Literature Cited:

RI DEM, 2010. Total maximum daily load (TMDL) analysis for the Pawcatuck River and Little Narragansett Bay bacteria impairments. 83 pages. Available at:
<http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/lnbwdrft.pdf>

Growing Area 13
Block Island Great Salt Pond
Triennial Update
2021



Rhode Island
Department of Environmental Management
Office of Water Resources
Shellfish Program



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1. Introduction

A triennial reevaluation of Great Salt Pond, Harbor Pond and Trims Pond (Growing Area 13) was conducted during 2021 consistent with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective was to evaluate any previously identified pollution sources and to evaluate fecal coliform data for compliance with NSSP standards for safe shellfish harvest. Comprehensive 12- year sanitary surveys of Growing Area 13 were completed in 2018 and 2006. Triennial surveys were completed in 2021 (this survey), 2015, 2012, 2009, and 2006 and annual updates were completed in each intervening year.

All previously identified sources having fecal coliform values of greater than 240 cfu/100 ml during prior triennial and 12-year surveys were sampled and reevaluated as part of the 2021 triennial survey.

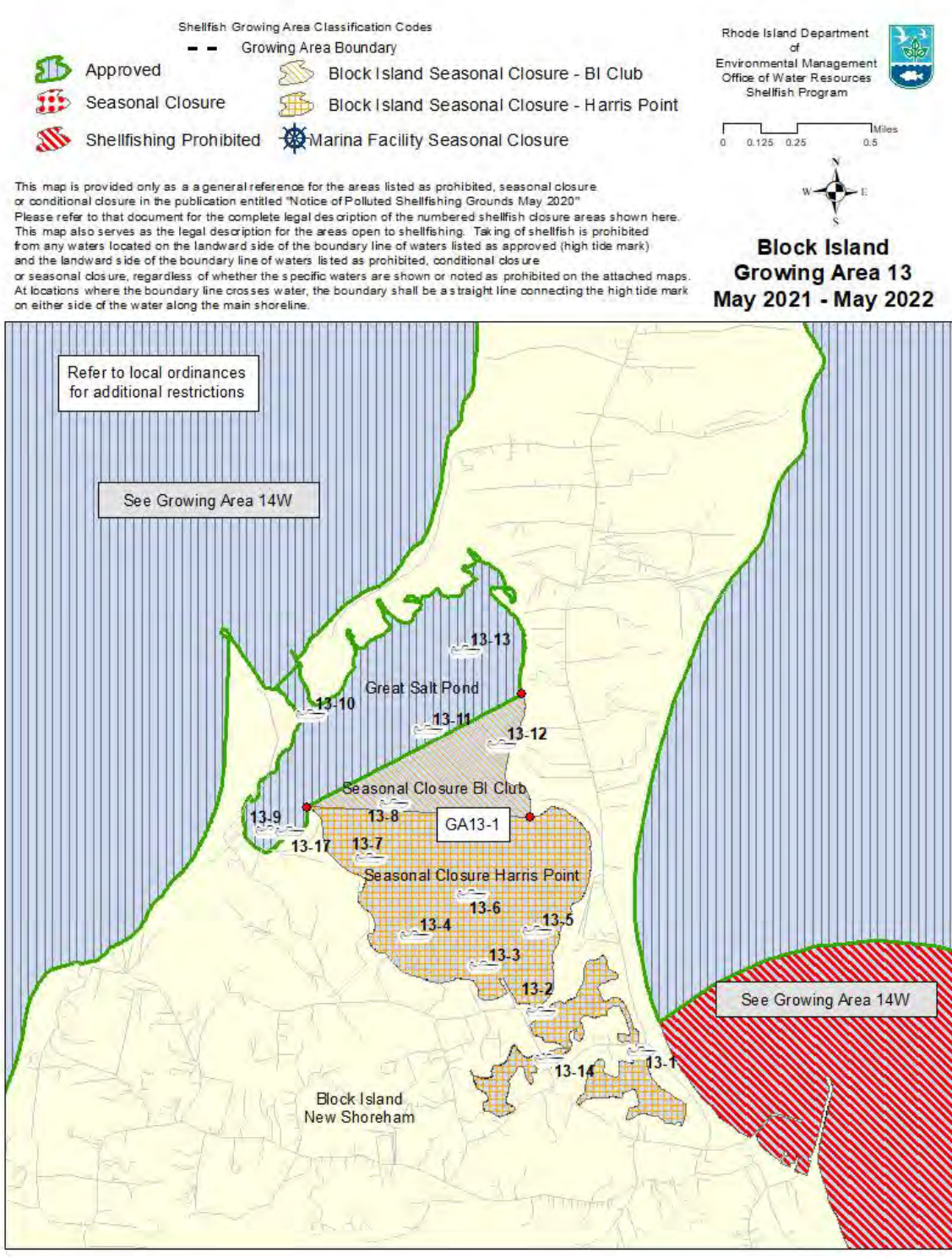
2. Description of Growing Area

Great Salt Pond (GA13) is located in Washington County, in the Town of New Shoreham, on Block Island. Great Salt Pond is the southernmost waterbody in Rhode Island, located 12 miles off the Rhode Island coastline. It is located in the Block Island watershed. The growing area also includes Trims Pond and Harbor Pond. Growing Area 13 is presently comprised of sections classified as approved, seasonally approved and prohibited for shellfishing (Figure 1).

Great Salt Pond stretches about 1.2 miles southeast to a smaller pond, known as Inner Harbor or Trims Pond, which then stretches to Harbor Pond. Together, these ponds nearly bisect Block Island and occupy approximately 640 acres. GA13 is located entirely within the town of New Shoreham. The land surrounding Great Salt Pond, Harbor Pond, and Trims Pond is sparsely developed. The only commercialized area on the island is Old Harbor, which consists of restaurants, shops and hotels and is adjacent to the southeastern end of Harbor Pond. Three large commercial marinas and a seasonally active recreational boat mooring field are located in Great Salt Pond.

The majority of Great Salt Pond is currently classified as seasonally approved for shellfishing. A small portion of the northwest section of the Pond nearest the breachway connecting the Pond to the Atlantic Ocean is classified as approved for shellfishing year-round. The seasonal closure is actually a three-part closure, with the size of the closure zone varying seasonally. Seasonal closure A (Figure 1) affects the innermost region of the pond which is closed to shellfishing from the Saturday prior to Memorial Day through the last Saturday in June. Seasonal closure B expands the closure area (Figure 1) and takes effect from the last Saturday in June through the third Monday in September. Closure C (Figure 1) reduces the closure zone size (Figure 1) and is in effect from the third Monday in September through the Tuesday immediately following Columbus Day. During the winter (after Columbus Day until the Saturday before Memorial Day) the seasonally approved area is in the open status. This series of seasonal closures is designed to coincide with the seasonal increase and decline in recreational boat activity in Block Island's Great Salt Pond. While all waters in Rhode Island are designated as No Discharge Zones, the seasonal closures are precautionary and are protective of public health in the event of a recreational boater accidental waste discharge in Great Salt Pond.

Figure 1: Growing Area 13 current classification map.



3. Pollution Source Survey

The 2021 shoreline survey of Great Salt Pond was conducted as a triennial reevaluation of this growing area. As such, the survey involved review of previous shoreline surveys and sampling of actual pollution sources with bacteriological results greater than 240 cfu / 100 ml as well as identification of any new sources of pollution (Figure 2). The 2021 survey was conducted on 8/18/2021 during dry weather conditions (less than 0.5” rain accumulation within 5 days at nearby Block Island Airport, NOAA weather station KBID). Five (5) sources evaluated in the 2018 survey had elevated (greater than 240 cfu/ 100 ml) bacteria results (Table 1).

During the survey special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the growing area but may contribute to pollution), actual (discharging at the time of the survey), or potential (not actively discharging at the time of the survey but considered a possible source of pollution). Bacteriological samples were collected in sterile, four-ounce (125mL) Nalgene bottles from all sources that were actively flowing at the time of the field study. Samples were stored in a portable cooler and transported to the Rhode Island Department of Health Laboratory at the end of each field day. The mTEC membrane filtration method, as described in Standard Methods for the Examination of Water and Wastewater (APHA, 1999), was used for analysis for both shoreline and routine growing area monitoring samples. Details of sample collection are in the DEM Shellfish Program Standard Operating Procedure document (updated August 2021) in the Program’s permanent files.

A Survey Personnel

Steven Rogers, Steven Engborg, and Anthony Crudale, Biologists in the RIDEM Office of Water Resources, coordinated the shoreline reconnaissance of the Great Salt Pond with the assistance of other staff members at RIDEM. Sampling was completed on August 18, 2021 (9 days since 0.43” rain and 13 days since 3.88” rain at Block Island Airport, KBID).

B Description of shoreline sources

During the time of survey, five (5) sources (2021-13-001, 2021-13-006, 2021-13-010, 2021-13-011 and 2021-13-SH) were visited, four (4) of which were flowing. Source 2021-13-006 was not flowing at the time of survey, so no sample was taken. Pollution sources are mapped in Figure 2 and fecal coliform results are summarized in Table 2.

Source 2021-13-001 is tributary to upper Harbor pond. This source has had elevated fecal coliform in the past. When sampled in 2018, this source had a result of 600 cfu/100mL; in 2016 it had a result of 1,000 cfu/100mL and in 2009 it had a result of 1,100 MPN. When sampled in 2021, this source had a result of 300 cfu/100 mL and a flow of 0.51 cfs. Companion in stream samples collected in 2021 had results of 14 cfu/100 mL indicating rapid dilution of this source in the receiving waters. Note that the receiving waters were in the closed status (seasonal closure) at the time of the 2021 sample collection, This source will continue to be monitored based on the pattern elevated fecal coliform.

Source 2021-13-010 is an outfall that drains a wetland area in Cormorant Cove. During the 2018 12-year survey this source had a result of 300 cfu/100 mL, and when sampled during the 2021 triennial survey it again had a result of 300 cfu/100 mL. Instream samples were taken with results of 160 cfu/100mL for the North sample and 44 cfu/100mL for the South sample, demonstrating rapid dilution. This source had a flow of 1.7 cfs which is the highest flow of the sources sampled. The source flows into receiving waters that are Approved. Nearby monitoring station 13-17 (approximately 100 feet from the source) and 13-9 (approximately 400 feet from the source) had acceptable fecal coliform levels during 2021 (Table 1) demonstrating rapid dilution and limited impact on the microbial water quality of the growing area.

Source 2021-13-011 drains a tidal wetland drainage just west of the Harbor Masters outpost. This source has a history of elevated results, with fecal coliform of 1,600 cfu/100 mL in 2016 and 600 cfu/100 mL in 2018. When visited in 2021, this source had a low flow of 0.05 cfs and a fecal coliform value of 270 cfu/100 mL. Instream samples were taken with results of 5 cfu/100mL for the East sample and 5 cfu/100mL for the West sample. Given the low flow and reduced fecal coliform concentration, this source appears to have limited negative impact on the water quality of GA13. While 2021 results were relatively low, we will continue to monitor this source because of its history of elevated fecal coliform.

The final source sampled during this 2021 triennial survey was a newly identified source labelled 2021-13-SH. This source is drainage from a tidal wetland that passes through a 12" corrugated pipe under the dirt road access to the Sullivan House and other residences. This source flows directly into the seasonally approved waters of GA13. In 2021 this source had a fecal coliform value of 100 cfu/100 mL. Companion instream samples had a result of < 2 cfu/100 mL demonstrating rapid dilution and little negative impact on the receiving waters.

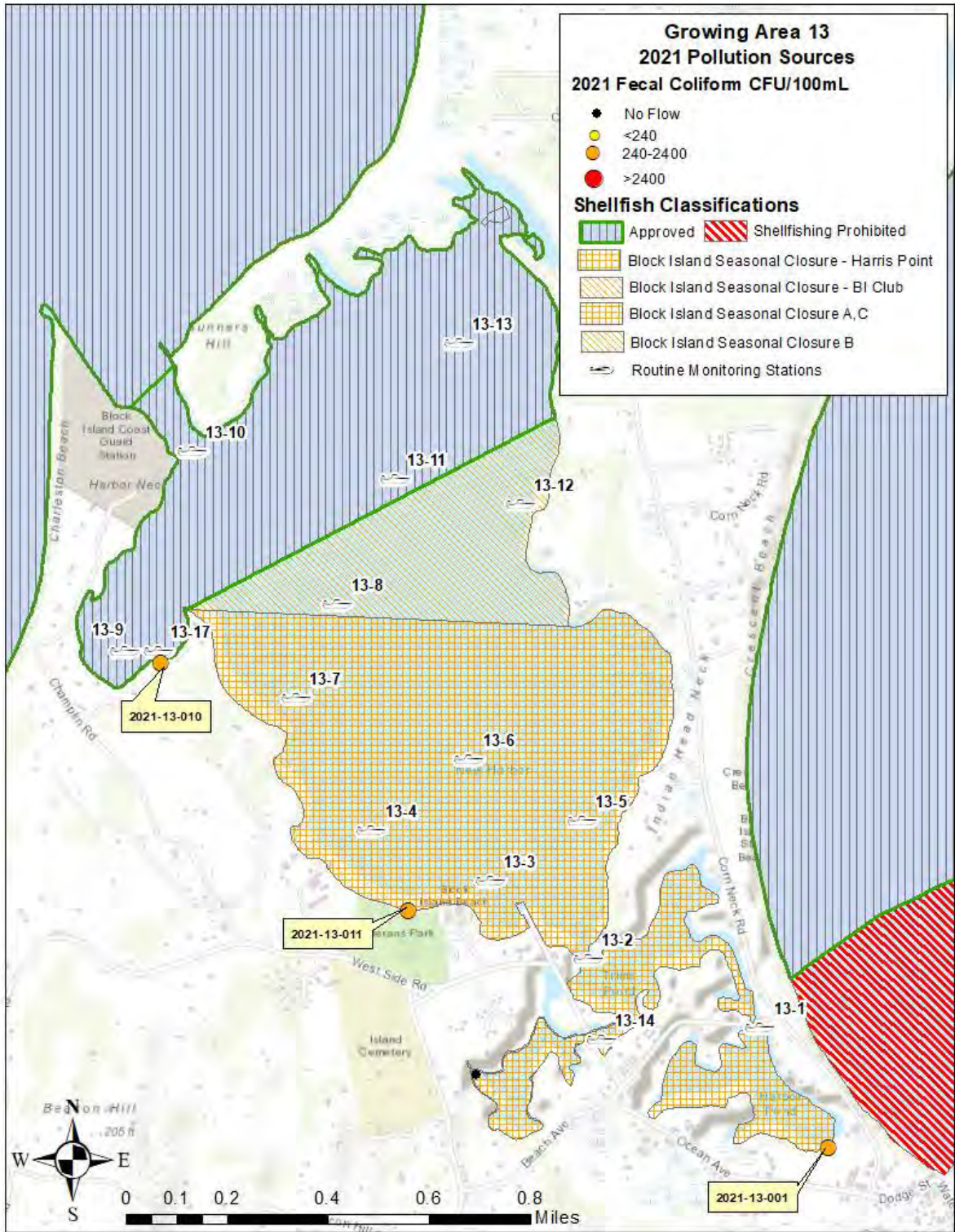


Figure 2: GA13 potential pollution source locations

Table 1: 2021 Summary of Pollution Sources in GA13

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100 ml	2021 Volumetric Flow (cfs)
2021-13-001	8/18/2021	41.17522	-71.5634	Tributary upper Harbor Pond	SA	Actual	Direct	300	0.51
2021-13-006	8/18/2021	41.17733	-71.5768	Upper Tributary	SA			NF	
2021-13-010	8/18/2021	41.18915	-71.5888	Cormorant Cove outfall drains wetland complex	A	Actual	Direct	300	1.7
2021-13-011	8/18/2021	41.18202	-71.5794	west of Harbor Master shack drains wetland	SA	Actual	Direct	270	0.05
2021-13-sh	8/18/2021	41.183814	-71.568799	Sullivan house Driveway	SA	Actual	Direct	100	

C Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 13 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

D Mooring Fields and Marinas

Three (3) commercial marinas having a total of approximately 400 slips are located in Great Salt Pond. The Pond also contains approximately 289 private moorings and 90 municipal moorings. In addition, there is a public anchorage area in the Great Pond that serves a transient fleet of boats during the warmer months. In total, it is customary to see 1,000 to 2,000 (peak holiday weekend) transient boats tied up in Block Island's Great Salt Pond during the summer (New Shoreham Comprehensive Plan, 2016). The Block Island Harbor Master operates pump-out facilities in the Great Pond. While all RI waters, including the Great Salt Pond are designated as a "No Discharge Zone", seasonal closures (see legal description of the growing area) are in place to safeguard public health due to accidental discharge of MSD to the growing area. The dilution calculations used to establish the seasonal closures can be found in the programs permanent file and are tabulated in the document entitled "Marina Dilution Analysis Background, June 2017".

Information regarding the "No Discharge Zone" enforcement and inspection procedures for vessels operating in RI waters can be found at:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Wastewater Treatment Facilities (WWTF)

There are currently no RIPDES permits authorized to allow discharge into the growing area. The Town of New Shoreham's WWTF discharges offshore to Block Island Sound outside of the receiving waters of Great Salt Pond (Growing Area 13).

5. Water Quality Studies

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is an agreement between the State of Rhode Island, the Food and Drug Administration (FDA), and the shellfish industry as described in the National Shellfish Sanitation Program (NSSP) Model Ordinance. The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at fifteen (15) monitoring stations throughout the growing area. Ten (10) stations are located in the seasonally approved waters of Great Salt Pond, Harbor Pond and Trim Pond and five (5) stations are located in the approved waters closest to the breachway of Great Salt Pond (Figure 1). Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated August 2021 and available in the Program's permanent files). Briefly, samples are collected 1-2 feet below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2021) fecal coliform monitoring statistical summary is below.

A Fecal coliform statistical summary and review

HIGHLIGHTS

- * Sampled 11X during 2021.
- * For approved stations, statistics represent recent 30 samples collected under both wet (n= 12) and dry (n= 18) weather conditions during 3/20/2019 or 4/30/2019 to 12/14/2021.
- * For seasonally approved stations, statistics represent recent 15 samples when area was open 12/4/2019 to 12/14/2021 during both wet (n= 4) and dry (n= 11) conditions.
- * All approved stations in compliance.
- * All seasonally approved stations in compliance.
- * All samples analyzed by the mTEC method.
- * Data run 12/22/2021.

COMMENTARY

Growing Area 13, the Great Salt Pond at Block Island, was sampled eleven (11) times during 2021 (5 wet weather, 6 dry weather), exceeding NSSP systematic random sampling requirements for the area. Monitoring of Block Island shellfish growing waters was done through a cooperative agreement between the Town of New Shoreham Harbor Master's Office and DEM Office of Water Resources. Following NSSP guidelines, statistics calculated for approved areas are based on the recent 30 samples and are representative of both wet and dry weather, with 12 wet weather and 18 dry weather samples.

Similarly, statistics for seasonally approved areas are representative of both wet (n= 4) and dry (n= 11) weather conditions collected when the area was in open status.

The 2021 statistical review demonstrated that all approved and conditionally approved stations in GA13 (Block Island Great Salt Pond) are in compliance. Comparison of results at the seasonally approved stations also demonstrated that seasonal closures are effective in protecting public health. Many stations in the seasonally approved areas of GA13 had elevated fecal coliform during July and August 2021, reinforcing the continued need for a seasonal closures (summer closures A,B,C) for the area of Great Salt Pond furthest from the breachway. Fecal coliform observations of up to 1,300 cfu/100 ml were observed in the closed (seasonal closure) waters of GA13 during July 2021. Elevated fecal coliform values of this magnitude have not been observed in Great Salt Pond since 2014. The 2021 evaluation showed that seasonally approved stations 13-1, 13-2, 13-3 and 13-14 would exceed NSSP criteria if managed as Approved waters that were open year-round.

The 2021 statistical evaluation (Tables 2-5, below) demonstrated that all Approved and Seasonally Approved stations in Block Island’s Great Salt Pond met NSSP fecal coliform criteria. The area is properly classified.

RECOMMENDATIONS

- * Continue cooperative agreement with Block Island Harbor Master to monitor Block Island shellfish growing areas.
- * No other actions recommended.

Table 2: Fecal coliform summary statistics for GA13 approved stations based on recent 30 samples collected during all weather conditions (3/20/2019 or 4/30/2019 to 12/14/2021; all mTEC, 12 wet and 18 dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
13-7	A	30	4.0	12.5
13-9	A	30	3.1	7.2
13-10	A	30	2.5	5.2
13-11	A	30	2.2	3.4
13-13	A	30	2.7	8.0

Table 3: Fecal coliform summary statistics for GA13 seasonally approved and prohibited stations based on recent 30 samples collected during 3/20/2019 or 4/30/2019 to 12/14/2021; all mTEC, 12 wet and 18 dry weather. Statistics for reference only and not for compliance.

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>90th percentile (cfu/100 ml)</u>
13-1	SA	30	8.3	37.1
13-2	SA	30	8.0	60.9
13-3	SA	30	5.5	48.6
13-4	SA	30	4.1	26.9
13-5	SA	30	3.1	9.9
13-6	SA	30	2.5	5.6
13-7	SA	30	2.7	7.5
13-8	SA	30	3.1	16.0
13-12	SA	30	2.7	6.3
13-14	SA	30	8.8	58.6

Table 4: Fecal coliform summary statistics for seasonally approved (closure A & C) stations in GA13. Statistics based on recent 15 samples collected at seasonally approved stations while in the open status (closure A & C when station was open. Recent 15 samples (12/4/2019 to 12/14/2021, 4 wet and 11 dry weather, all mTEC).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
13-1	SA	15	4.6	0.0
13-2	SA	15	3.4	6.7
13-3	SA	15	1.9	0.0
13-4	SA	15	2.1	0.0
13-5	SA	15	1.9	0.0
13-6	SA	15	2.0	0.0
13-7	SA	15	1.9	0.0
13-14	SA	15	2.9	0.0

Table 5: Fecal coliform summary statistics for seasonally approved (closure B) stations in GA13. Statistics based on recent 15 samples collected at seasonally approved stations while in the open status (5/14/2020 to 12/14/2021, 4 wet and 11 dry weather, all mTEC).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
13-8	SA	15	1.9	0.0
13-12	SA	15	2.4	0.0

6. Conclusions and Recommendations

The 2021 Triennial Re-evaluation of the Great Salt Pond (GA13) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area's Approved waters or the Seasonally Approved waters when they are in the Open status. A statistical review of water column fecal coliform data collected while the area was in the open status indicated that all Approved and Conditionally Approved stations met NSSP criteria and that the Great Salt Pond Growing Area (GA13) is in program compliance and is properly classified.

No classification changes are recommended for the growing area at this time.

**Offshore Growing Area 14 East and West
Including Offshore Block Island
Triennial Re-Evaluation
2021**



**Rhode Island
Department of Environmental Management
Office of Water Resources
Shellfish Program**



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1. Introduction

A triennial reevaluation of the oceanic coastal waters of Rhode Island (shellfish Growing Area 14, GA14) was completed during 2021 consistent with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. GA14 is a large area stretching along the coast from Westerly to Little Compton, RI, and the coast of Block Island out to the 3-mile limit of state waters. This large area is subdivided into Offshore East (GA14E), Offshore West (GA14W) and Offshore Block Island (GA14BI). The primary objective of evaluation is to update the shoreline survey of potential pollution sources, to re-evaluate point sources such as WWTF that may discharge to a growing area, and to complete a statistical summary and evaluation of fecal coliform data for the growing area. Comprehensive 12- year sanitary surveys of Growing Area 14 were completed in 2004 and 2018, triennial evaluations were completed in 2009, 2015 and 2021 (this survey) and annual updates were completed in each intervening year.

Thirty-two (32) sources were identified in the 2018 12-year survey that required follow up sampling in this triennial. Of these sources identified to require follow up sampling, nine (9) were revisited in 2021. These sources included tributaries, pipes, and seeps. Due to circumstances such as foul weather, routine monitoring, and COVID-19 restrictions the remaining twenty-three (23) sources were not visited during 2021. Priority was given to those sources located in Offshore Block Island (GA14BI).

2. Description of Growing Area

The Offshore Growing Area is within Block Island and Rhode Island Sounds. The sounds are a strait in the open Atlantic Ocean, approximately ten miles wide, separating Block Island from the mainland coast of Rhode Island. Geographically, it is the eastward extension of Long Island Sound and the westward extension of Buzzards Bay. The shoreline of the growing area ranges from miles of open beach in Westerly to the causeway at Point Judith to rocky, steep cliffs that predominate on Block Island and the ocean shoreline of Jamestown, Newport, Middletown, and Little Compton. From west to east, the towns of Westerly, Charlestown, South Kingstown, Narragansett, Jamestown, Newport, Middletown, and Little Compton form the mainland boundary of this growing area. In addition, the growing area includes the waters surrounding the ocean coast of Block Island (Town of New Shoreham).

Growing Area 14E and 14W including Offshore Block Island is presently comprised of sections classified as either approved or prohibited for shellfishing (Figure 1 and Figure 2). *Five distinct portions of this growing area are prohibited to shellfishing, as described below.*

GA14W-1: The waters in the vicinity of Scarborough which are within 5,600 feet of the WWTF marine outfall sewer located south of Scarborough beach and east of Fort Nathaniel Greene 41 .3806 ° N, 71 .4711 ° W. Approximately 1,599 acres.

GA14W-2: The waters in the vicinity of Tucker's Dock which are within 4,000 feet of the South Kingstown WWTF marine outfall sewer located 41 .4212 ° N, 71 .4526 ° W. Approximately 679 acres.

GA14W-3: The waters in the vicinity of Pebbly Beach which are within 5,900 feet of the marine outfall sewer located 41 .1678 ° N, 71 .5512 ° W, including Old Harbor in its entirety. Approximately 1,407 acres.

GA14E-1: Castle Hill Cove in its entirety.

GA14E-2: Easton’s Bay north of a line from the southeast extension of Tuckermans Terrace in Middletown to the south-east extension of Narragansett Avenue in Newport meant to include “Forty Steps”. Approximately 339 acres.

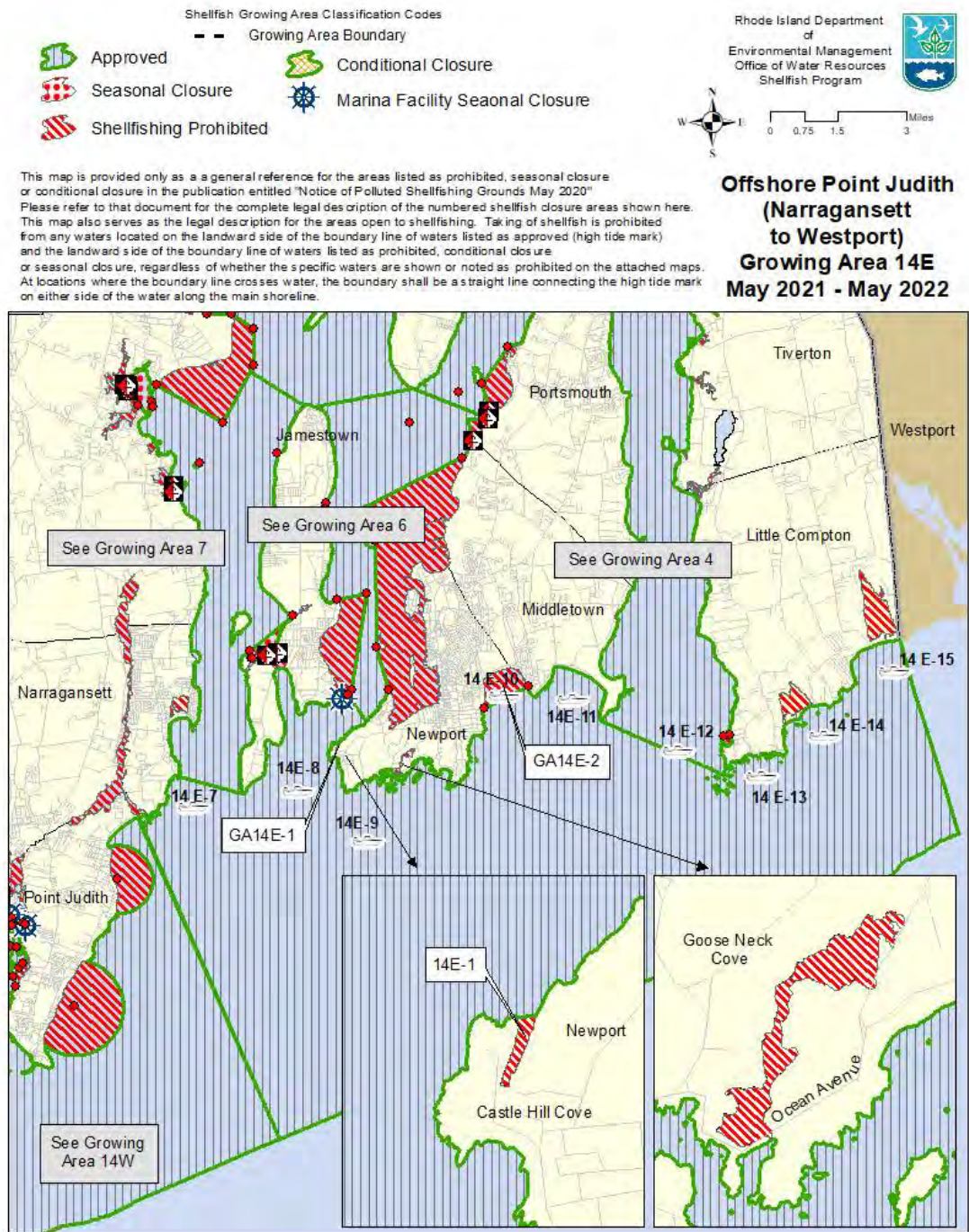


Figure 1: Growing Area 14E Current Classification Map

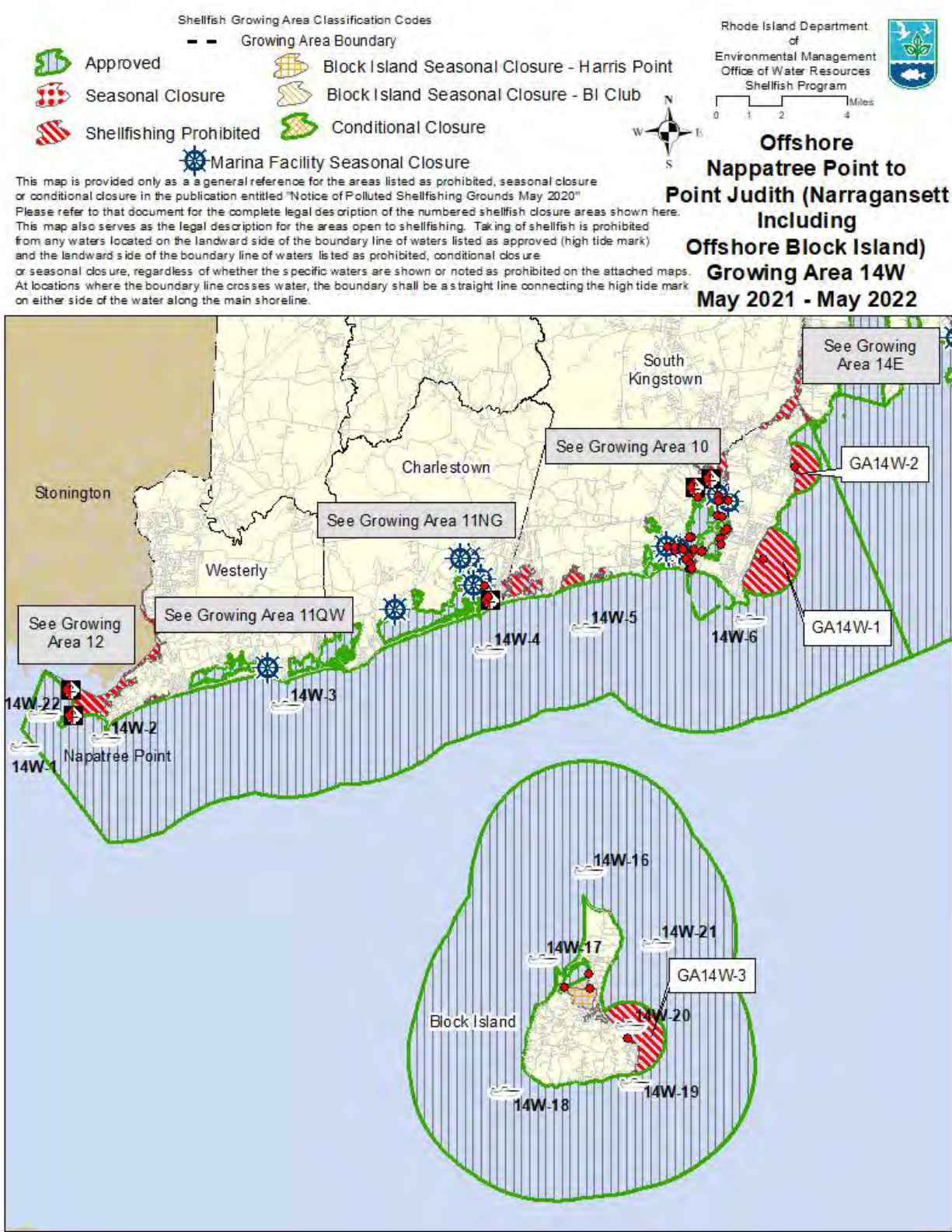


Figure 2: Growing Area 14W Current Classification Map

3. Pollution Source Survey

A Survey Personnel

Steve Rogers, Steven Engborg and Anthony Crudale, Marine Biologists for RIDEM Office of Water Resources Shellfish Program, coordinated and conducted a shoreline reconnaissance of Offshore Growing Area and Offshore Block Island. Teams of surveyors were organized and assigned to each section of the bay to inspect the entire shoreline. The 2021 shoreline survey was conducted on Block Island on 8/18/2021 (8 days after 0.43" rain and 12 days after 3.88" rain at Block Island Airport, KBID).

B Description of shoreline source

During the 2021 survey nine (9) sources were visited within the Block Island portion of the growing area. Seven (7) of the sources were either not flowing or inaccessible due to the steep bluffs and tide at the time of visit. Access to them is extremely limited due to the terrain and limited public shoreline access on the island. Two (2) flowing sources were samples as described below.

Source 2021-14W-1319 is a ground water stream that flows down the bluffs to the foot of the cliff but does not reach the receiving waters. When sampled in 2018 during the 12-year survey, this source had a trickle flow and a result of 300 cfu/100 mL. When revisited in 2021, this source also had a trickle flow but a result of <100 cfu/100 mL. Given the relatively low fecal coliform level and that the source does not reach the receiving waters, this source is not expected to have a negative impact on the receiving waters.

The second source sampled in 2021 was source 2021-14W-1327, which is a ground water seep that dissipates into the ground before reaching the receiving waters. When sampled in 2018 during the 12-year survey, this source had a result of 80,000 cfu/100 mL and a trickle flow. When visited in 2021, the flow was still only a trickle, but the fecal coliform concentration was 270 cfu/100 mL. This drastic decrease in fecal coliform concentration and content, combined with this source not reaching the receiving waters indicates that this source has little potential to negatively impact the water quality of the receiving waters.

There were no large concentrations of waterfowl or wildlife observed during the 2021 field reconnaissance.

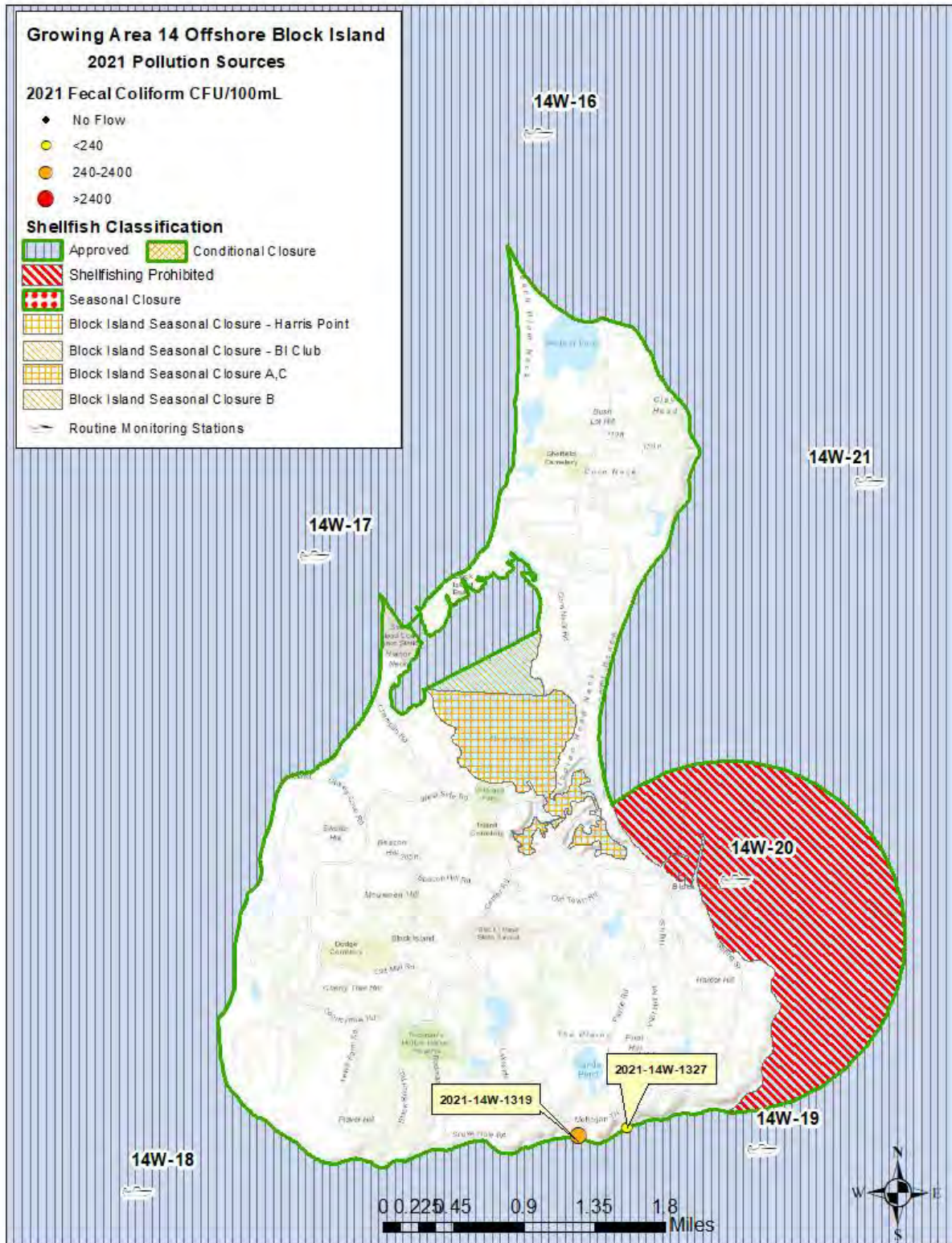


Figure 3: GA14 BI potential pollution source locations

Table 1: 2021 Summary of Pollution Sources sampled in GA14

Source ID	Date Visited		Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2021 Results mTEC cfu/100ml	2021 Volumetric Flow (cfs)
2021-14W-1319	8/18/2021		41.1503	-71.56301	GW stream flowing down bluffs, does not reach receiving waters	A	P	I	<100	Trickle
2021-14W-1327	8/18/2021		41.14947	-71.56894	GW stream, does not reach receiving waters, stops in sand	A	P	I	270	Trickle

C Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas were visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 14 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

D Mooring Fields and Marina

There is one (1) marina located in the Offshore Growing Area GA14; the marina located at Old Harbor in New Shoreham (Block Island). This marina is located in the approximately 1,400 acre prohibited zone near the New Shoreham WWTF outfall (GA14W-3). There is sufficient dilution in the prohibited zone to prevent pollution of the growing area due to accidental discharge of marine sewage. The dilution calculations used to establish the marina closures can be found in the programs permanent file and are tabulated in the document entitled "Marina Dilution Analysis Background, June 2017".

Additionally, Rhode Island coastal waters are Federally designated as "No Discharge" mandating that the discharge of treated and untreated boat sewage is prohibited (not including greywater or sink water) in these designated areas. These designated areas encompass the entire offshore growing area. There is one pump out facility located in Old Harbor on Block Island. This pump-out boat is currently being upgraded for the 2021 boating season. Information regarding the "No Discharge Zone" enforcement and inspection procedures for vessels operating in RI waters can be found at:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Wastewater Treatment Facilities (WWTF)

The Rhode Island Pollution Discharge Elimination System Program (RIPDES) is responsible for permitting all industrial and municipal waste discharges to waterbodies of the state. The RIPDES Program has documented and permitted three (3) wastewater treatment facilities that discharge into GA14 (Figure 4). A description of each of these WWTF and a summary of the WWTF's compliance with effluent criteria during 2021 is below.

The Scarborough wastewater treatment facility is located in Narragansett at the southernmost end of Scarborough State Beach. This WWTF discharge is located 2,000 feet offshore and is relatively close to Scarborough State Beach, so it is imperative that the WWTF remain in compliance to protect public health. The Narragansett – Scarborough WWTF serves ~7,500 people and was built in 1965 as a primary treatment plant. The WWTF was upgraded to secondary treatment in 1983 and had major upgrades in the 1990s. This facility did not report any violations during 2021. For 2021, the WWTF had an average flow of 0.79 million gallons per day (MGD) with a permitted flow of 1.4 MGD and have not exceeded any of their permits for biochemical oxygen demand, total suspended solids, and total residual chlorine. Fecal coliform in the effluent averaged 1.6 mpn/100 ml during 2021 (EPA ECHO data), indicating an efficiently operating WWTF.

The South Kingstown Wastewater Treatment facility discharges treated effluent to the waters of GA14 offshore of State Pier #5 in Narragansett RI. The South Kingstown WWTF serves approximately 29,400 people, including the University of Rhode Island Campus. The facility was built in 1978 as a secondary treatment plant and received major upgrades in 1990. In 2021 the WWTF averaged a daily flow of 2.6 million gallons which is well below the permitted flow of 5.0 MGD. Treated effluent discharged from the South Kingstown WWTF had an average fecal coliform concentration of 1.9 mpn/100 ml during 2021 (EPA ECHO data) demonstrating efficient reduction of potentially pathogenic bacteria.

The Town of New Shoreham Wastewater Treatment Facility is located on the South Eastern portion of the island close to Old Harbor. This WWTF is the only facility on the island and serves a population that ranges from 300-700 people during winter to a peak of 4,000 people during summer. The average daily flow for this WWTF was 0.14 MGD during 2021 compared to a permitted flow of 0.45 MGD. No violations of permit limits were reported during 2021. An average fecal coliform level of 1.7 mpn/100 ml was observed during 2021 (EPA ECHO data), indicating efficient reduction of pathogens in the effluent.

The 2021 review has shown that the three WWTF discharging to GA14 are not violating permitted discharges and are well-run facilities. Fecal coliform levels in the treated effluent are low, indicating efficient reduction on potentially pathogenic microbial pathogens. Consistent with NSSP guidance, all WWTF in RI waters have a Prohibited classification safety zone around the effluent outfall. PLUMES model analysis was used to establish the size of the closed safety zone around each WWTF outfall. These analyses are available for review in the program's permanent files.

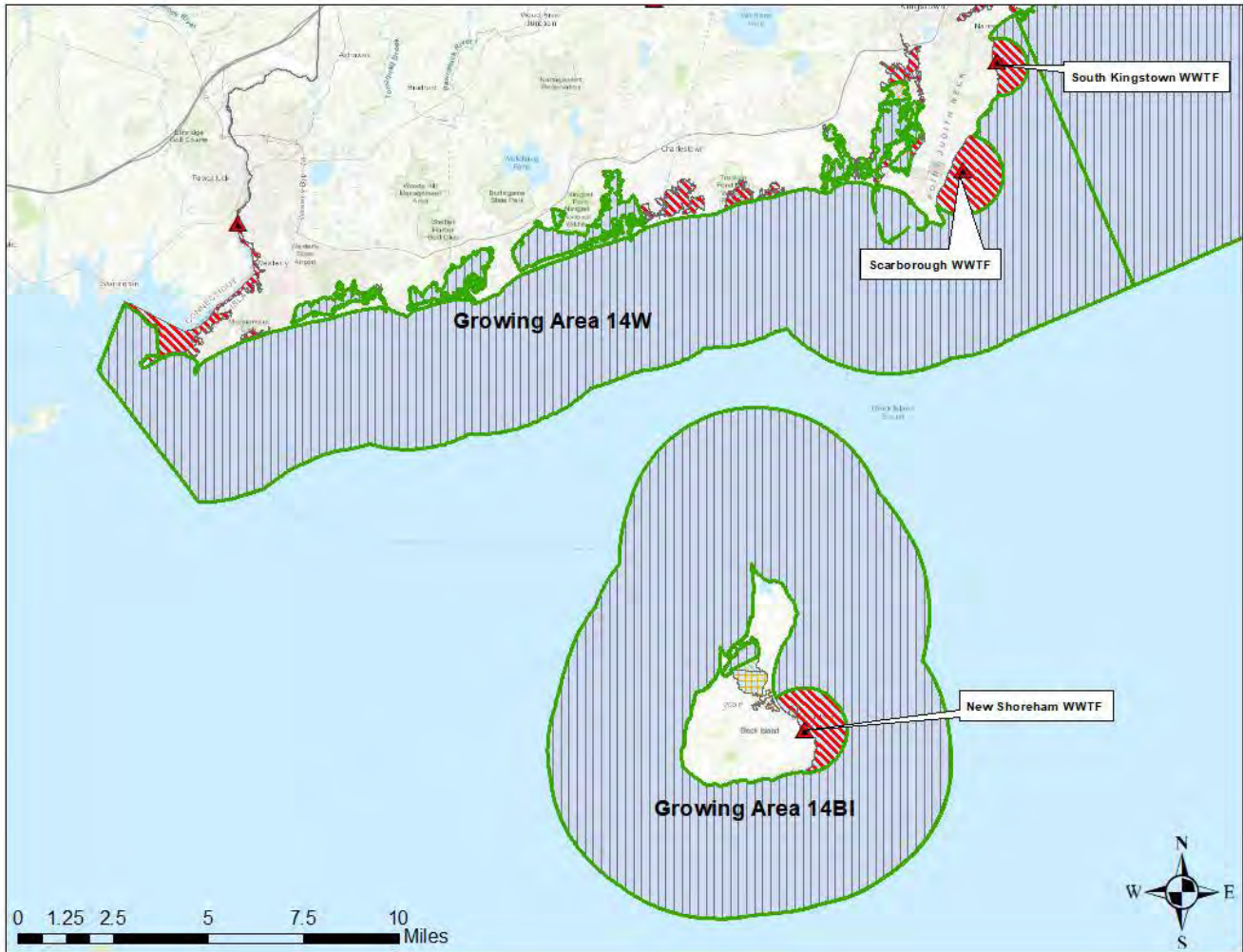


Figure 4: Locations of WWTF in Growing Area 14

5. Water Quality Studies

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is an agreement between the State of Rhode Island, the Food and Drug Administration (FDA), and the shellfish industry as described in the National Shellfish Sanitation Program (NSSP) Model Ordinance. The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption.

The offshore growing area is currently classified as a “remote” area. Remote status requires that the area be sampled twice a year. Water samples are collected at fifteen (15) monitoring stations along the southern shore of the mainland of Rhode Island dispersed throughout the growing area (Figure 1 and Figure 2). Only one of these stations is located in a prohibited area. There are six (6)

stations (Figure 1 and Figure 2) within the Offshore Block Island growing area, one of which is located in the prohibited area of the safety zone surrounding the New Shoreham WWTF discharge.

RI DEM Office of Water Resources personnel cooperate with DEM Division of Law Enforcement officers to sample the offshore waters south of the mainland. Personnel from the Town of New Shoreham's (Block Island) Harbormasters Office collect the offshore Block Island samples and coordinated with DEM-Water Resources staff to transport the samples to the certified RI DOH Lab for analysis. Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated August 2021 and available in the Program's permanent files). Briefly, samples are collected 1-2 feet below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored 14 on ice. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2021) fecal coliform monitoring statistical summary is below.

A Fecal coliform summary statistics and review

HIGHLIGHTS

- * Each station sampled at least 2X and area sampled on 6 dates during 2021.
- * Area is remote in status.
- * Statistics represent all data collected 6/9/2014 to 9/29/2021 (GA14-E); 6/6/2014 to 9/23/2021 (GA14-W) and 10/29/2014 to 11/4/2021 (GA14-BI).
- * All samples analyzed by the mTEC method.
- * All stations in program compliance.
- * Data run 12/24/2021

COMMENTARY

The coastal offshore areas of Rhode Island (Growing Area 14) along the south coast of the mainland and the waters around Block Island have historically been considered remote in status due to their distance from land-based point- and non-point sources of fecal coliform contamination. A twice per year sampling program of these areas was begun in 1994, consistent with NSSP guidelines for the monitoring of remote areas. Stations 14-1 to 14-15 and 14-22 along the RI coast from the Connecticut to Massachusetts borders were sampled twice during 2021 in a collaborative effort between DEM Water Resources and DEM Division of Law Enforcement. Waters around Block Island (stations 14-16 to 14-21) were monitored twice during 2021 in collaboration with the Town of New Shoreham Harbor Master's Office.

The statistical evaluation included the most recent 15 samples dating back to 2013. All recent samples in the analysis set (n=15) were analyzed by the mTEC method. Fecal coliform concentration in the offshore waters is consistently low (2 cfu/100 ml or less), with only four (4) of the 330 observations (1.2%) in the recent data set exceeding the 2 cfu/100 ml detection limit.

The 2021 statistical evaluation demonstrated that all stations in the offshore area (GA14) meet criteria and are in program compliance. The area is properly classified.

The FDA was recently indicated that GA14 may not meet the criteria for remote status due to increased development along the coast and the presence of WWTF discharge into the growing area. Efforts are underway to increase the frequency of sampling in GA14 to five-time per year, consistent with NSSP sampling guidance for approved waters monitored under the adverse pollution conditions (APC) strategy.

RECOMMENDATIONS

- * Continue collaborative efforts to monitor GA14 offshore remote waters.
- * Increase frequency of monitoring to 5X per year due to potential change from remote status
- * No other actions recommended based on ambient monitoring results.

Table 2: Fecal coliform statistical summary for GA14E based on recent 15 samples collected during all weather conditions (6/9/2014 to 9/29/2021; 3 wet weather, 12 dry weather; all mTEC)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
14E-7	A	15	2.0	0.0
14E-8	A	15	2.1	0.0
14E-9	A	15	1.9	0.0
14E-10	A	15	2.0	0.0
14E-11	A	15	2.0	0.0
14E-12	A	15	1.9	0.0
14E-13	A	15	1.9	0.0
14E-14	A	15	2.0	0.0
14E-15	A	15	1.9	0.0

Table 3: Fecal coliform statistical summary for GA14W based on recent 15 samples collected during all weather conditions (6/9/2014 to 9/23/2021; 3 wet weather, 12 dry weather; all mTEC)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
14W-1	A	15	1.9	0.0
14W-2	A	15	2.0	0.0
14W-3	A	15	2.0	0.0
14W-4	A	15	2.0	0.0
14W-5	A	15	2.2	0.0
14W-6	A	15	2.0	0.0
14W-22	A	15	2.0	0.0

Table 4: Fecal coliform statistical summary for GA14BI based on recent 15 samples collected during all weather conditions (9/29/2014 to 11/4/2021; 3 wet weather, 12 dry weather; all mTEC)

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
14BI-16	A	15	1.9	0.0
14BI-17	A	15	2.0	0.0
14BI-18	A	15	1.9	0.0
14BI-19	A	15	1.9	0.0
14BI-20	A	15	2.0	0.0
14BI-21	A	15	2.0	0.0

6. Conclusions and Recommendations

The 2021 Triennial Re-evaluation of the Offshore growing area (GA14) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area's Approved waters. In addition, the three (3) WWTF that discharge treated effluent to the growing area were shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform data collected while the area was in the open status indicated that all Approved stations met NSSP criteria and that the Offshore Growing Area (GA14) is in program compliance and is properly classified.

GA14 has historically been considered remote in status. Shellfish areas having remote status have a reduced sampling requirement of two samples per year. The FDA was recently indicated that GA14 may not meet the criteria for remote status due to increased development along the coast and the presence of several WWTF that discharge into the growing area. Efforts are underway to increase the frequency of sampling in GA14 to five-time per year, consistent with NSSP sampling guidance for approved waters monitored under the adverse pollution conditions (APC) strategy.

No classification changes are recommended for the growing area at this time.

Growing Area 15

Seekonk River

2021 Annual Update

All waters of the Seekonk River, Growing Area 15, are currently classified as prohibited to shellfishing. The area has historically been closed to shellfish harvesting because of consistently elevated fecal coliform levels, and the multiple industrial, transportation and wastewater discharge uses in the area. The area was not sampled in 2021, but a review of available fecal coliform data indicated elevated bacteria levels in the growing area. The area is properly classified as prohibited.

HIGHLIGHTS

- * Area was not sampled during 2021.
- * Harvest of shellfish is prohibited in Growing Area 15.
- * Last sampled in 2008.
- * Summary statistics not updated for 2020.

COMMENTARY

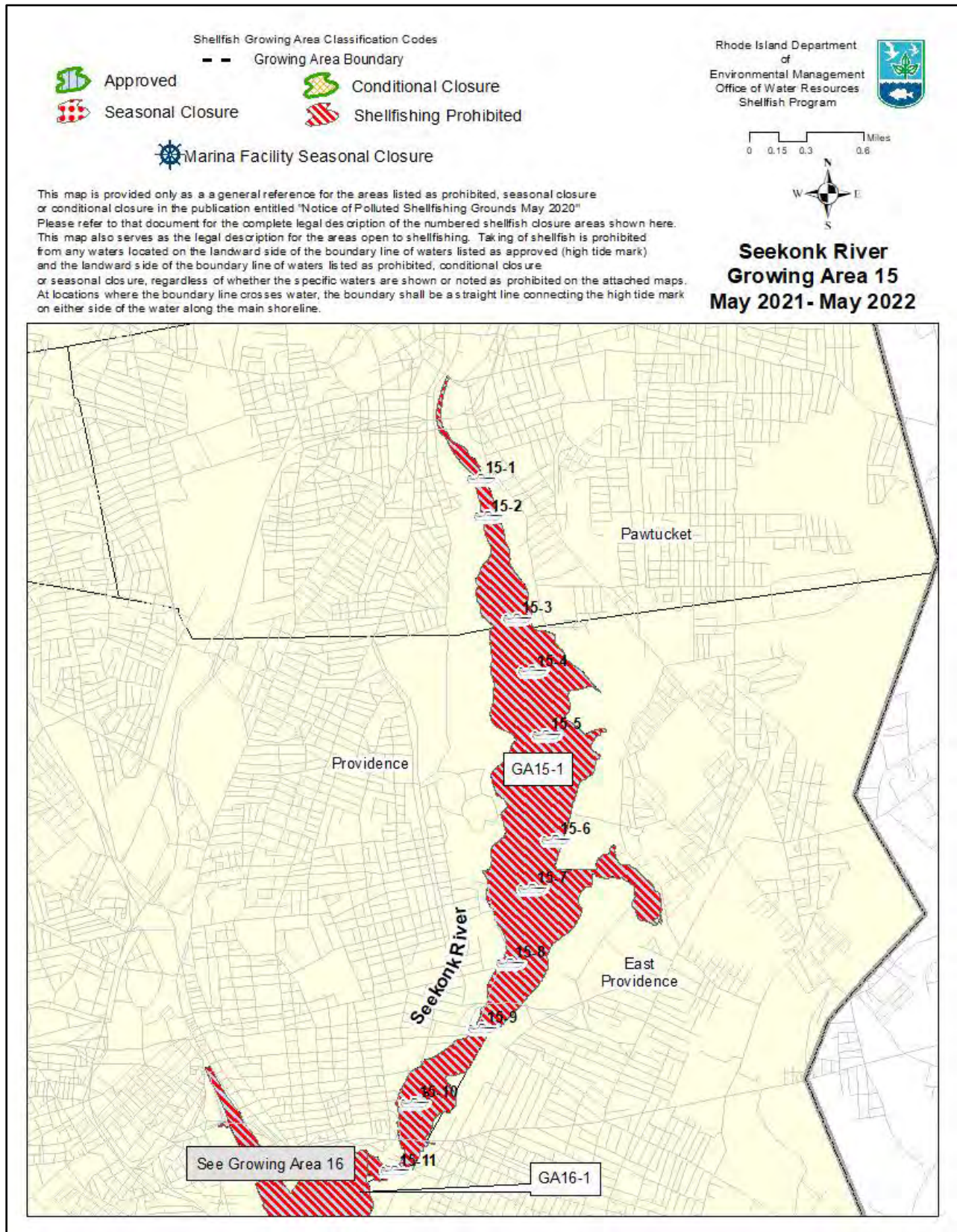
The Seekonk River (Growing Area 15) was not sampled during 2021. The area is classified as prohibited for the harvest of shellfish, so there is no minimum sampling requirement. The area is largely urban and has historically been prohibited for the harvest of shellfish because of consistently elevated fecal coliform levels.

A review of Narragansett Bay Commission monitoring data (<https://snapshot.narrabay.com/>) indicated that fecal coliform levels were consistently far above shellfish harvest standards in the Seekonk River during 2021. Sampling Growing Area 15 is a low priority for the shellfish water quality program because available data indicate fecal coliform levels are too elevated to support safe harvest of shellfish.

RECOMMENDATIONS

- * Dependent on staff resources, sample the Seekonk River (Growing Area 15) at least once per year to monitor recent fecal coliform conditions.
- * Continue to assess water quality data collected in the Providence River, such as Narragansett Bay Commission water quality data (<https://snapshot.narrabay.com/>), to evaluate water quality trends in the growing area.
- * No action recommended based on ambient monitoring results.

Figure 1. Current (2021-2022) Shellfish Classification Map GA15 with routine monitoring stations.



**Providence River Conditional Area 'E'
(South of Gaspee and Bullock Points)
Growing Area 16
12 Year Sanitary Shoreline Survey
Calendar Year 2021**



**Rhode Island Department of
Environmental Management
Office of Water Resources
Shellfish program**

This 12-year sanitary shoreline survey was compiled with guidance of the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish 2019 Revision.

A handwritten signature in black ink that reads "David Borkman".

David Borkman, Sanitary Survey Officer, RI Department of Environmental Management

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Acronyms and Terms

<u>BMP:</u>	Best Management Practice
<u>CSO:</u>	Combined Sewer overflow
<u>FDA:</u>	Food and Drug Administration
<u>ISSC:</u>	Interstate Shellfish Sanitation Conference
<u>MPN:</u>	Most Probable Number
<u>NOAA:</u>	National Oceanographic and Atmospheric Administration
<u>NSSP:</u>	National Shellfish Sanitation Program
<u>OWTS:</u>	On-site Wastewater Treatment Systems (Formerly ISDS, Individual Sewage Disposal Systems)
<u>RIDEM:</u>	Rhode Island Department of Environmental Management
<u>RIPDES:</u>	Rhode Island Pollutant Discharge Elimination System
<u>SGAM:</u>	Shellfish Growing Area Monitoring
<u>SSCA:</u>	State Shellfish Control Authority
<u>SWMPP:</u>	Storm Water Management Program Plan
<u>TMDL:</u>	Total maximum Daily Load
<u>WWTF:</u>	Waste Water Treatment Facility

"Controlled relay" means the transfer of shellstock from a growing area classified as restricted or conditionally restricted to a growing area classified as approved or conditionally approved for the purpose of reducing pathogens as measured by the coliform indicator group or poisonous and deleterious substances that may be present in the shellstock by using the ambient environment as the treatment process.

1. Executive Summary

A comprehensive 12-year shoreline survey of the Lower Providence River shellfish Conditional Area E Growing portion of Growing Area 16 (GA16) was conducted during the summer and fall of 2021 by staff from RIDEM's Office of Water Resources Shellfish Program. The portion of GA16 south of Gaspee and Bullock Points to Conimicut Point, corresponding to Conditional Area E was surveyed. The survey involved a shoreline reconnaissance of the conditionally approved portion of GA16 to locate and catalog pollution sources and collect bacteriological samples from all sources actively flowing into the survey area. This survey was conducted following the guidance of the 2019 NSSP Model Ordinance.

The primary objective of the shoreline survey was to identify and characterize any sources of pollution potentially impacting the microbial water quality of the growing area, to reevaluate point and non-point sources identified during previous surveys, and to resample previously identified sources. This report updates previous surveys and includes recent shoreline survey results and a statistical summary of recent shellfish growing area fecal coliform results for comparison with NSSP compliance criteria for safe harvest of molluscan shellfish.

The 2021 shoreline survey investigated thirty-one (31) shoreline sources that could potentially deliver fecal coliform pollution to the growing area. In addition, wastewater treatment facilities that could potentially impact the growing area were reviewed and found to be operating in an efficient manner and in compliance with discharge permits. Analysis of water samples demonstrated that none of these sources compromise the microbial water quality of the shellfish growing area. A review of fecal coliform data indicated that the conditionally approved portions of the growing area meet NSSP criteria for safe shellfish harvest when the area was in the open status. A review indicated that the conditional area management plan, sampling schedule, and sampling station locations support the current classification of the growing area.

The findings of the shoreline survey support the current classification and legal description of the growing area and no classification changes are recommended.

2. Description of the Growing Area

A. Location

The Providence River is a tidal river formed by the confluence of the Woonasquatucket and Moshassuck Rivers flowing from the west and the Seekonk/Blackstone River flowing from the northeast. These rivers converge southeast of downtown Providence near Fox Point to form the Providence River Estuary, in colonial days known as the Great Salt River, which extends southward approximately 7 miles (11.5 km) to Conimicut Point where the Providence River joins upper Narragansett Bay. The cities of Providence, [Cranston](#), and [Warwick](#) lie to the west of the river, while the City of [East Providence](#) and the Town of [Barrington](#) lie to the east.

The portion of RI DEM shellfish growing area 16 (GA16) that is classified as Conditionally Approved is an approximately 1,900 acre (7.69 hectare) portion of the Providence River located in the southern region of the Providence River Estuary approximately bounded by Gaspee Point to the north and a line from Conimicut Point to Nyatt Point to the south. This east to west line between Conimicut and Nyatt Points is also the dividing line between GA16 and Upper Narragansett Bay Growing Area 1 Conditionally Approved Area “A” (GA1).

B. Physical Description

The Providence River (Figure 1) is a tidal river which flows approximately seven miles from its origin to its confluence with the upper portion of Narragansett Bay. Along its way the river is joined by the Seekonk River approximately one-half mile south of its perceived origin. The tidal portion of the Seekonk River starts at the base of the natural falls in Pawtucket, and at this point the river is locally called the Pawtucket River. The upland source of fresh water is the Blackstone River, the largest freshwater river in the state. In addition to the two major tributaries forming the river; the Woonasquatucket and Moshassuck Rivers, the Providence River is supplied with freshwater inputs from the Pawtucket River located south of Fields Point and numerous other smaller named and unnamed tributaries. The West River another major freshwater tributary joins the Moshassuck River approximately 1 ½ miles north of its merger with the Woonasquatucket River in Providence.

i. Depth and bottom topography

The Conditionally Approved region of GA16 is in the southern portion of the Providence River Estuary. The depth of this portion of the growing area transitions from shallow, 1 to 5 meter (3 to 16 feet) depth shoals along the eastern and western shores to deeper 5 to 10 meter (16 to 33 feet) deep in the central part of the growing area (NOAA chart 13224). Greene Island, a small sandbar island that is nearly submerged at high tide, is located near the western shore of the growing area. The Port of Providence is New England’s second largest deep-water port, handling over nine million tons of cargo per year, and a 27 km (16.8 mile) long, 40 foot (12 m) depth dredged ship channel transects GA16 and continues northward to the Port of Providence terminal at Fields Point and the hurricane barrier near downtown Providence. In addition to this major channel a smaller channel was constructed in 1959 that connects from the deep-water Providence River channel to Bullocks Cove. The Bullock’s Cove channel is approximately 75’ in width and varies in depth from 6 – 8 feet. The bottom sediments in the Conditionally Approved portion of GA16 are generally silty sand and mud with a gravel bottom in the deeper central region of the growing area and a shift to sandy sediments in the southern portion of the growing area near Conimicut Point (USGS, 2003).

ii. Freshwater input and tides

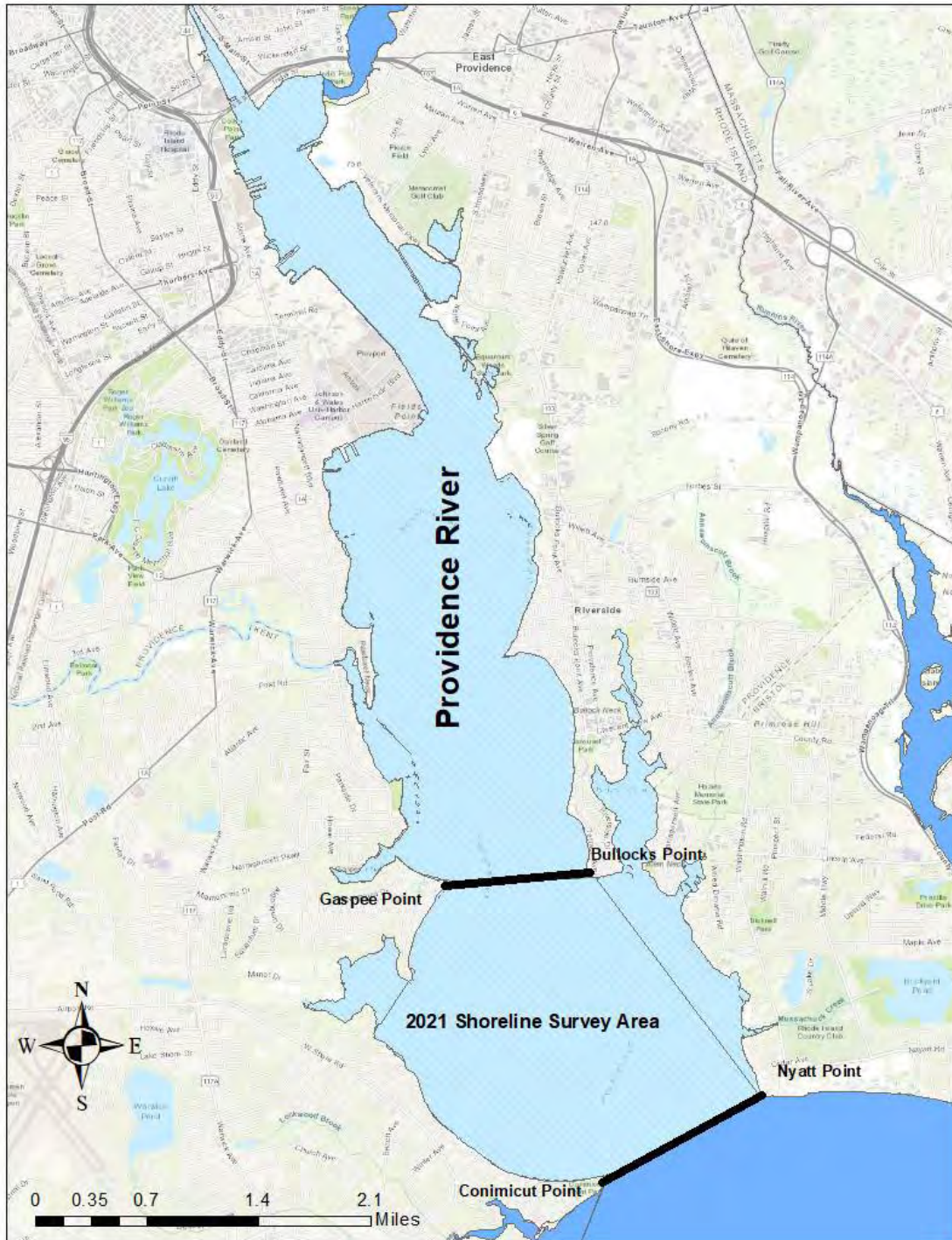
The Providence River is tidally influenced from its confluence with Narragansett Bay at Conimicut Point northward to Pawtucket Falls, near Slater’s Mill on the Blackstone/Seekonk River, upstream to near Rising Sun Mills in Olneyville for the Woonasquatucket River, and upstream to near crossing under Canal Street in Providence

for the Moshassuck River. The largest sources of freshwater input to Narragansett Bay are in the GA16 area. Approximately 68% (Spaulding and Swanson, 2008) to 85% (Pilson, 1985) of total freshwater flow to Narragansett Bay is from the Blackstone, Moshassuck, Woonasquatucket and Pawtuxet Rivers. These major freshwater rivers provide drainage to approximately 1,754 km² of the Blackstone, Woonasquatucket, Moshassuck and Pawtuxet watersheds and this drainage flows into the Providence River. Although influenced by freshwater input, the Providence River also has strong semi-diurnal tides, with a tidal range of 1.16 meters (at Conimicut Point) to 1.40 meters at Pawtucket (Spaulding and Swanson, 2008). Similarly, NOAA operates a real-time tide gauge on the Providence River in the northern section above Fields Point. They report that the mean tidal range for the Providence River of 1.35 meters (4.42 feet) and a tidal range of 1.48 meters (4.84 feet) at Fields Point (NOAA 2020). Because of the strong tidal input, salinity in the Providence River quickly increases from near freshwater (0-5 psu salinity) in the upper Seekonk River to approximately 15 psu salinity at Fox Point, 25 psu at Field's Point, approximately 28 psu at Gaspee Point and 30-32 psu at Conimicut Point (Spaulding and Swanson, 2008). The combination of freshwater input and strong tidal flow result in a rapid flushing time of approximately 0.9 to 1.0 day for the GA16 area of the lower Providence River (Spaulding and Swanson, 2008) and 0.8 to 4.4 days dependent on freshwater flow in the upper Providence River (Asselin and Spaulding, 1993). The Conditionally Approved region of GA16 in the Providence River has salinity (28-32 psu) and flushing times (approximately 1 day) that are similar to that of Upper Narragansett Bay shellfish growing area 1A.

C. Latest Survey

The Providence River has been classified as prohibited to shellfishing since 1946. Due to the prohibited classification, routine shoreline surveys and monitoring of this growing area were not performed for many years. A 12-year survey of the lower portion of the Providence River (GA16) was completed in 2009, and a triennial survey of this area was completed in 2017. In May of 2021 the southernmost section of the Providence River, south of Gaspee Point to Conimicut Point, was reclassified as conditionally approved. This conditional area (Conditional Area E in GA16) has a 0.5" rain closure (see the GA16 Conditional Area Management Plan, available in the Program's permanent files) and a limited harvest schedule. In 2021 personnel of the Office of Water Resources Shellfish Program conducted a comprehensive 12-year survey of the Lower Providence River conditional shellfish area south of Gaspee and Bullocks Points (this report).

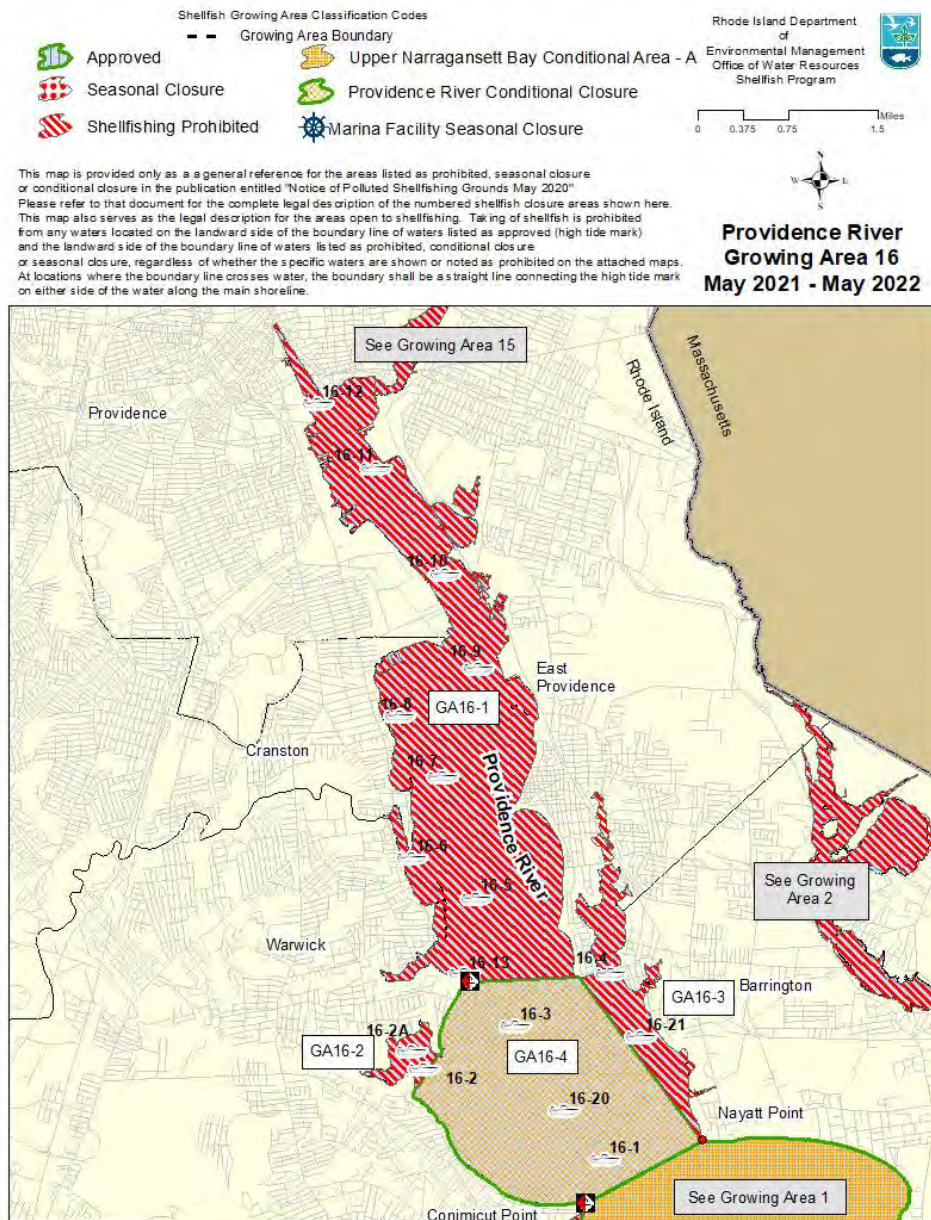
Figure 1: Location map of the Providence River estuary. The conditionally approved waters of GA16 are in the lower Providence River south of Gaspee Point and north of Conimicut Point.



D. Current Classification Map

As previously discussed, the Providence River, Growing Area 16 has been closed to shellfishing since 1946. However, in 2021 a portion of the Lower Providence River (GA16-4) was reclassified to Conditionally Approved. The following figure shows the current classification of the Providence River.

Figure 2: Current classification map



E. Legal Description

The current legal description of the waters of the Providence River includes all tidal waters and their landward estuarine tributaries waters north and west of a line from the Rhode Island Department of Environmental Management range marker on a pole located on Conimicut Point to the center of the Old Tower at Nayatt Point including any tributaries north of this line.

As of sunrise May 26, 2021, the legal descriptions of the Providence River growing area were changed to reflect the change in classification of the southern portion (GA16-4) of the growing area from Prohibited to Conditionally Approved. The legal descriptions of GA16 are below and the corresponding GA16 classification map is shown in Figure 2.

Prohibited

GA 16 - 1 All waters of the Providence River and its tributaries north of a line from the RIDEM range marker at Gaspee Point to the northern most tip of the rock seawall on the opposite shore of Bullock Neck in East Providence.

GA16 - 2 All waters of Occupessatuxet Cove north and west of a line from the landward end of the CRMC permitted dock # 073 on the Warwick shoreline opposite #6 Meadow Road to Pole # 67 at 11 Namquid Drive on south Gaspee Point in Warwick

GA16 – 3 All waters north and east of a line from the northern most tip of the rock seawall on the west shore of Bullock Neck to the center of the tower at Nayatt Point.

Conditionally Approved

Providence River Conditional Area E:

GA16 – 4 All waters of the Providence River bounded by a line from the Department of Environmental Management range marker on a pole located on Conimicut Point to the center of the Old Tower at Nayatt Point to the northern most tip of the rock seawall on the shoreline of Bullock Neck in East Providence to the RIDEM range marker on Gaspee Point, excluding all waters of Occupessatuxet Cove (GA16 - 2).

F. Previous Classification Maps

The Providence River has been classified as prohibited to shellfishing since 1946 (Figure 3). In 1946 the waters of the river were classified as Class “C”, “D” and “E” traveling from south to north from the confluence with the Upper Bay. The 1946 classifications were ‘use classifications’, not the current NSSP shellfish classifications, with Class “C” (yellow, southern Providence River) being waters suitable for recreational boating, fishing, culture of seed oysters, or industrial supply after treatment (Figure 3). Class “D” (red, mid-Providence River) primarily for commercial navigation or transportation of wastes without nuisance and Class “E” (dark violet, northern Providence River) are grossly polluted and cause a nuisance (Figure 3). Rhode Island adopted a shellfish classification system that was consistent with NSSP classification guidance in 1947 (Figure 4). The 1947 shellfish classification map indicated that the entire Providence

River and its upstream tributary, the Seekonk River were classified as Prohibited Areas in which no shellfishing was allowed (Figure 4).

Figure 3: Sanitary Classification of Tidal Waters, December 1946

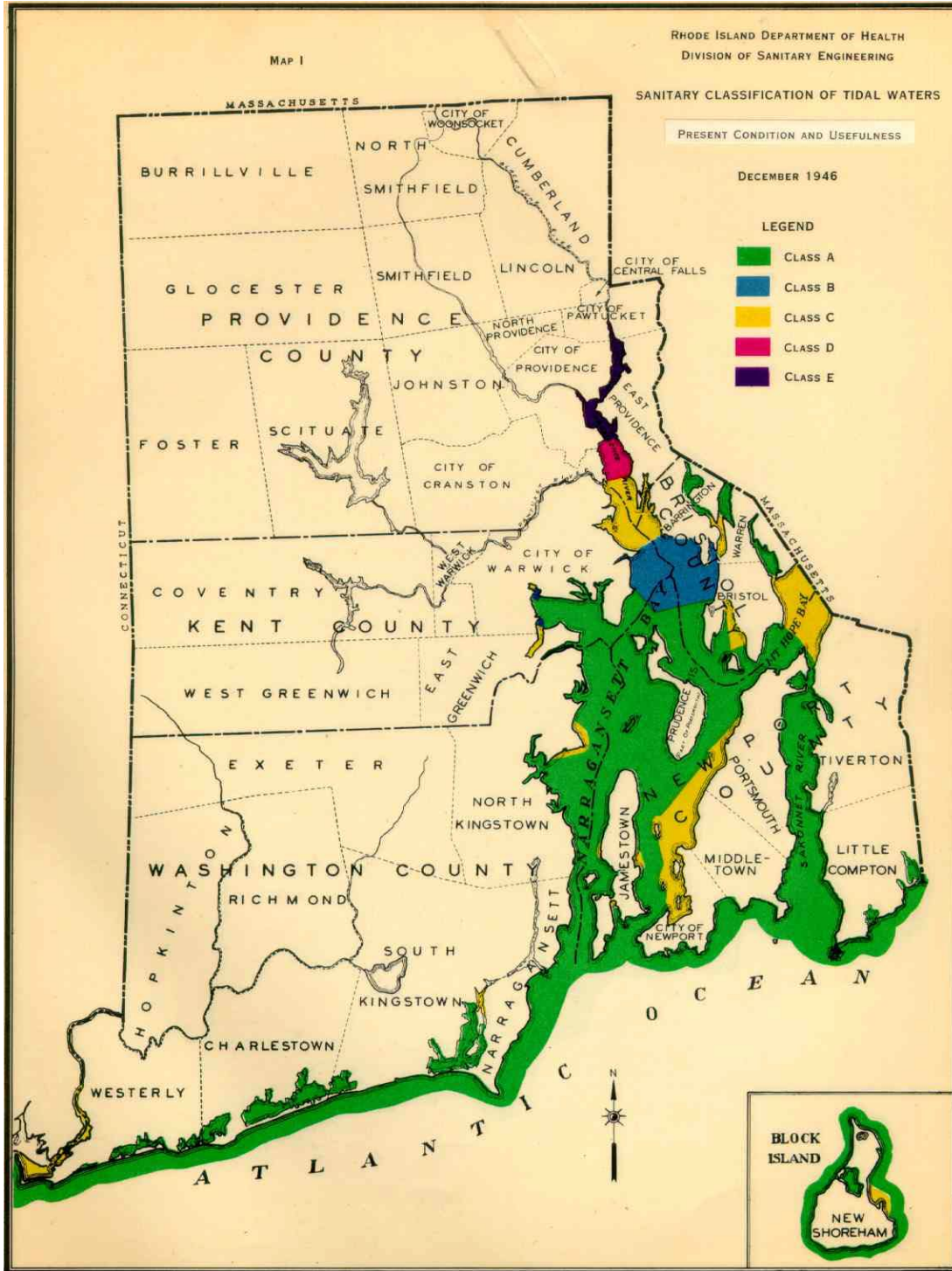
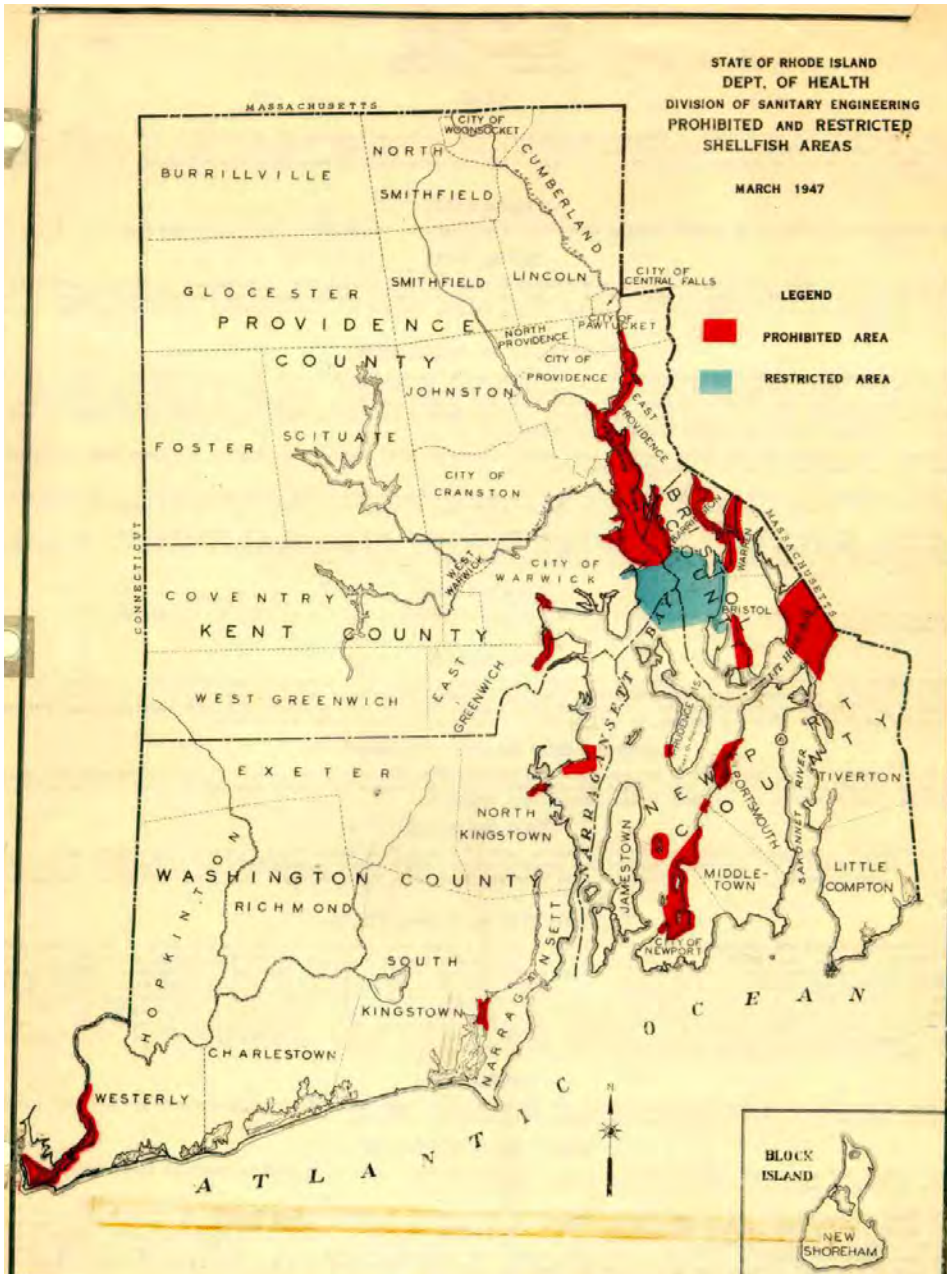


Figure 4: Prohibited and Restricted Shellfish Area Map, March 1947.



The Providence River (GA16) remained classified as Prohibited to shellfish harvest until 2021 such that at the time of the 2009 12-year survey the entirety of GA16 remained classified as prohibited to shellfish harvest (Figure 5). In May of 2021 approximately 1,900 acres of the lower Providence River (GA16-4) was reclassified as conditionally approved (see current classification map, Figure 2).

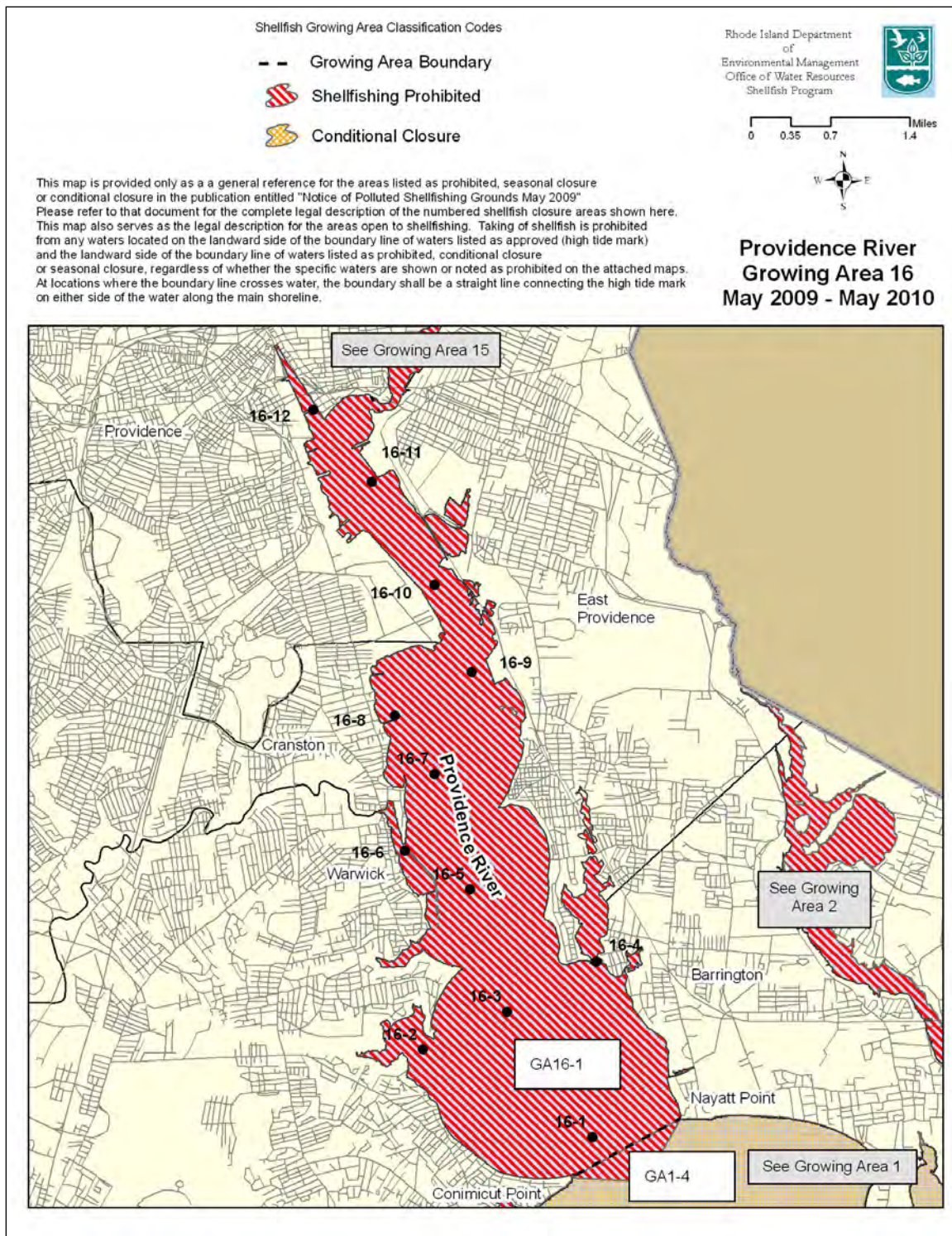


Figure 5: 2009 shellfish classification map for the Providence River (GA16).

G. Comparison of current and previous classification maps

There has been one classification change in the Providence River growing area (GA16) since the last 12-year survey in 2009. In May of 2021 approximately 1,900 acres of the lower Providence River, known as Lower Providence River Conditional Area E, was reclassified as conditionally approved (GA16-4, see current classification map, Figure 2). Details on the management of this conditional area may be found in the GA16 Conditional Area Management Plan, available in the Program's permanent files. A comparison of the 2009 and 2021 legal descriptions of GA16 is below.

2009 Legal Description:

Shellfishing Prohibited:

GA16-1: All waters of the Providence River north and west of a line from the Rhode Island Department of Environmental Management pole located on Conimicut Point (Latitude: 41° 43' 2.93" North, Longitude: 71° 21' 27.68" West) to the center of Conimicut Light, and a line from the center of Conimicut Light to the center of the Old Tower at Nayatt Point including any tributaries north of this line.

2021 Legal Description:

Shellfishing Prohibited:

GA16-1: All waters of the Providence River and its tributaries north of a line from the RIDEM range marker at Gaspee Point to the northern most tip of the rock seawall on the opposite shore of Bullock Neck in East Providence.

GA16-2: All waters of Occupessatuxet Cove north and west of a line from the landward end of the CRMC permitted dock # 073 on the Warwick shoreline opposite #6 Meadow Road to Pole # 67 at 11 Namquid Drive on south Gaspee Point in Warwick.

GA16-3: All waters north and east of a line from the northern most tip of the rock seawall on the west shore of Bullock Neck to the center of the Old Tower at Nayatt Point.

Conditionally Approved:

GA16-4: Lower Providence River Conditional Area E: All waters of the Lower Providence River bounded by a line from the Department of Environmental Management range marker on a pole located on Conimicut Point to the center of the Old Tower at Nayatt Point to the northern most tip of the rock seawall on the shoreline of Bullock Neck in East Providence to the RIDEM range marker on Gaspee Point, excluding all waters of Occupessatuxet Cove (GA16 - 2).

3. Pollution Source Survey

A. Personnel

Steve Rogers, Steve Engborg and Anthony Crudale, Biologists, of the RI DEM Office of Water Resources coordinated and conducted a shoreline reconnaissance of the Providence River with the assistance of other shellfish program staff. As noted previously, only the conditionally approved, southern portion of the river was surveyed for this twelve-year review. Sampling for this survey was completed on the 24th of June 2021 (2 days after 1.05” rain at TF Green Airport (KPVD weather station)), the 30th of November 2021 (4 days since 0.14” rain at KPVD), and the 2nd of December 2021 (6 days after 0.14” rain at KPVD). See Tables 4,5,6 for daily rainfall data during the months of the 2021 shoreline survey.

B. Survey procedures

Special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the growing area but may contribute to pollution), actual (discharging at the time of the survey), or potential (not actively discharging at the time of the survey but considered a possible source of pollution). Water samples were collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated August 2021 and available in the Program’s permanent files). Briefly, samples were collected using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice at 4 °C. Samples were transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1995).

C. Summary of Sources and Locations

Thirty-one (31) actual or potential sources were identified during this shoreline survey. Seven (7) of the sources were flowing, while twenty-four (24) of the thirty-one sources were not actively flowing at the time of the shoreline survey. All sources in which flow was observed were sampled. Locations of all potential or actual sources of pollution identified in the southern portion of the Providence River are mapped in Figure 6. Fecal coliform results from recent sampling of flowing sources are summarized in Table 1.

Figure 6: Locations of potential pollution sources to the conditionally approved waters of GA16 identified during the 2021 survey.

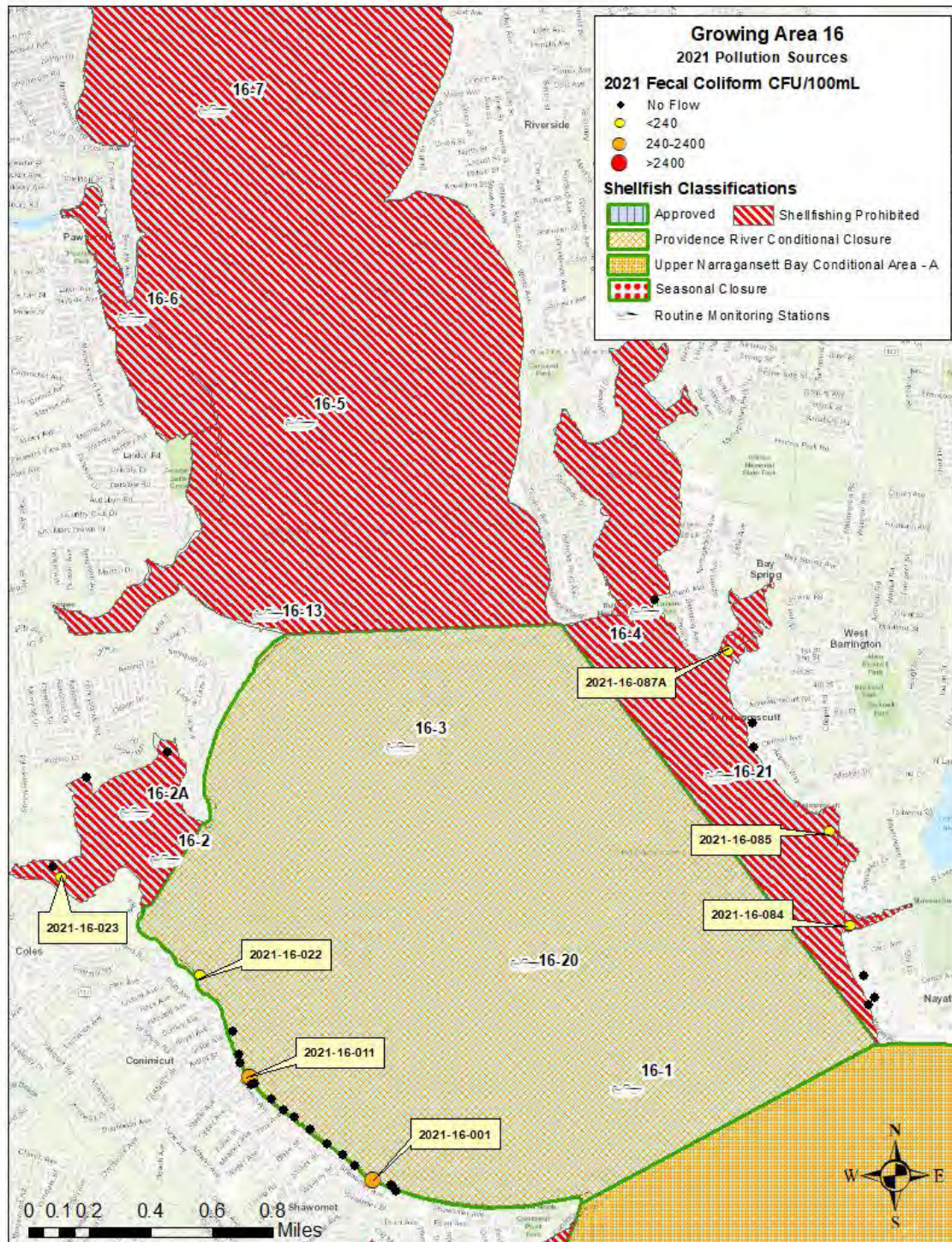


Table 1: Fecal coliform results for GA16 potential pollution sources.

Source #	Latitude	Longitude	Description and Location	Receiving Waters Classification	Actual / Potential	Direct / Indirect	2009 Results (MPN)	2021 Results (cfu/100mL)	Flow (cf / s)
2021-16-001	41.71857	-71.3708	24" RCP	CA	A	D	15	2400	<.001
2021-16-002	41.71928	-71.372	gw seep	CA	P	D	NF	NS	NF
2021-16-003	41.7198	-71.3727	12" RCP	CA	P	D	240	NS	NF
2021-16-004	41.72034	-71.3737	12" RCP	CA	CNL		NF	NS	NF
2021-16-005	41.72099	-71.3748	12"RCP	CA	CNL		NF	NS	NF
2021-16-006	41.72159	-71.3758	12" RCP	CA	CNL		NF	NS	NF
2021-16-007	41.72193	-71.3765	(2) 12" CMP	CA	P	D	NF	NS	NF
2021-16-008	41.72244	-71.3772	12" RCP	CA	P	D	NF	NS	NF
2021-16-009	41.72321	-71.3783	(2) 4" PVC	CA	CNL		NF	NS	NF

2021-16-011	41.72347	-71.3786	24" RCP next to 21" CMP, storm drain at the end of Woodbury St ext.	CA	A	I	460	270	<.001
2021-16-012	41.72314	-71.3785	24" CMP	CA	CNL		NF	NS	NF
2021-16-013	41.72415	-71.3792	12" RCP	CA	P	I	NF	NS	NF
2021-16-014	41.71809	-71.3694	Broken Storm Drain	CA	P	D	240	NS	NF
2021-16-015	41.7183	-71.3696	4" PVC	CA	P	D	NF	NS	NF
2021-16-016	41.71835	-71.3697	4" PVC	CA	P	D	NF	NS	NF
2021-16-020	41.72457	-71.3793	12" RCP	CA	P	D	NF	NS	NF
2021-16-021	41.72564	-71.3797	12" RCP	CA	P	D	NF	NS	NF
2021-16-022	41.72835	-71.3817	Stream that drains into marshy beach, upstream., at end of Rock ave.	CA	A	D	43	<100	0.22

2021-16-023	41.73299	-71.3905	Stream (lots of birds)	P	A	D	750	200	<.001
2021-16-081	41.72687	-71.3395	12" RCP	P	P	D	2	NS	NF
2021-16-082	41.7272	-71.3391	4" PVC	P	P	D	NF	NS	NF
2021-16-083	41.72824	-71.3398	12" Clay	P	P	D	NF	NS	NF
2021-16-084	41.73061	-71.3406	Stream	P	A	D	15	<100	34
2021-16-085	41.73508	-71.3419	Outlet Marsh	P	A	D	39	<100	3.37
2021-16-086	41.73904	-71.3467	12" Concrete pipe at end of ROW	P	P	D	NF	NS	NF
2021-16-087	41.74018	-71.3468	4" Steel	P	P	D	NF	NS	NF
2021-16-087A	41.74365	-71.3483	Outlet Marsh	P	A	D	21	<100	61.2
2021-16-088	41.74607	-71.353	12" PVC submerged at high tide, no flow at low	P	P	D	NF	NS	NF

D. Detailed Description of Major Sources

Of the thirty-one (31) sources visited during this survey, only seven (7) were found to be flowing at the time of the 2021 survey. Twenty-four (24) sources either could not be located or had no flow at the time of visit and therefore could not be sampled. Of the seven sources sampled, sources 2021-16-001 and 2021-16-011 were the only two that exceeded 240 cfu/100mL.

Figure 7: Sources 2021-16-001



Source 2021-16-001 is a 24” concrete pipe that flows from the extension of Symonds Avenue in Warwick, RI to the conditionally approved waters of GA16 (Figure 7). When sampled in 2009 this source had a fecal coliform of 15 cfu/100 ml and a moderate flow rate. This source was sampled again in 2017 during a triennial survey with a result of 160 cfu/100mL and a flow of 0.21 cfs. When sampled during wet weather (2 days after 1.05” rain at TF Green Airport (KPVD weather station)) in June 2021, the source had elevated fecal coliform of 2,400 cfu/100 ml. However, the pipe was partially filled with sand (Figure 7) and source 16-001 had only a trickle flow and the elevated fecal coliform results are believed to be due to stagnant or very low flow water trapped in the pipe. In-stream samples collected to the north (4 cfu/100 mL) and to the south (13 cfu/100 ml) of where this source enters the waters of the growing area demonstrated rapid dilution and little impact on the microbial water quality of the growing area.

Figure 8: Source 2021-16-011.



The only other source that was above the 240 cfu/100 mL threshold was source 2021-16-011. This source is a 24" diameter concrete pipe located at the end of the Woodbury Street extension in Warwick, RI (Figure 8). This source had a trickle flow that indirectly enters the receiving waters. The flow must travel roughly 40 feet over sand before entering receiving waters and most of the flow dissipates into the sand before reaching the receiving waters. When sampled in 2009, this source had a fecal coliform result of 460 cfu/100 mL. When visited in 2017, this source had a result of 1,600 cfu/100 mL. When initially visited in June 2021 during wet weather (2 days after 1.05" rain at TF Green Airport (KPVD weather station)), source 16-011 had a fecal coliform result of 4,400 cfu/100 mL. Companion in-stream samples demonstrated rapid dilution with a result of 16 cfu/100 mL to the north and 100 cfu/100 mL to the south of where this source enters the receiving waters. Note that the conditionally approved waters of GA16 close for 7-days after 0.5" rain at TF Green, so the area was in the closed status during the June sample period. Source 16-011 was resampled on November 30, 2021 (dry weather, 4 days after 0.14" rain at KPVD) and this source had a fecal coliform result of 270 cfu / mL, indicating much reduced fecal coliform during dry weather. Given that the conditionally approved waters to which this source flows close at 0.5" rain, and the rapid dilution of this source in the receiving water, this source poses little threat to the microbial water

quality of the growing area while the area is in the open status. However, the history of elevated results, source 16-011 will be monitored to evaluate the impact of this source on the conditionally approved waters of GA16 while in the open status.

E. Identification and Evaluation of Pollution Sources

i. Domestic Wastes

The Providence River watershed covers approximately 8,575 hectares (21,192 acres, 33.11 square miles) encompassing major urban areas of Rhode Island and extending into the adjacent state of Massachusetts. The watershed is populated by approximately 820,000 residents (2000 Census, RIGIS). The majority of the Providence River – Seekonk River watershed is urban, with approximately 86% of land in the watershed listed as urban (NBEP, 2017). Population density in the Providence-Seekonk River watershed has remained fairly stable at 10 people per acre during 1990 to 2010 (NBEP, 2017). Based on 2012 data available from the RIDEM GIS database, approximately one third (1/3) of the watershed is serviced by municipal sewers while the remaining population utilizes on-site wastewater treatment facilities (OWTS) to treat wastewater. A review of OWTS—related complaints indicated that the RI DEM Office of Compliance and Inspection (OCI) received eleven complaints for the City of Warwick, two for the city of Providence, and five for the city of East Providence and no reports or complaints in the Town of Barrington. All complaints were found to be minor and no notices of OWTS violations were issued.

Although the majority of the watershed is dependent upon OWTS the areas and neighborhoods immediately adjacent to the Conditionally Approved portion of the lower Providence River are largely served by municipal sewers. This indicates that fecal coliform input to the growing area from sub-standard or failing OWTS should be limited. Potential wastewater impacts to the Conditionally Approved portion of the growing area are discussed later in this document.

ii. Wastewater Treatment Facilities

No municipal WWTF discharge directly to the conditionally approved waters of the lower Providence River. However, the growing area is downstream of three (3) municipal WWTF that discharge treated effluent to the prohibited waters of the Seekonk River (Growing Area 15) and the prohibited waters of the Providence River (Growing Area 16). The Providence and Seekonk Rivers receive treated effluent from the Narragansett Bay Commission (NBC) Bucklin Point WWTF, NBC Fields Point WWTF and the City of East Providence WWTF (Table 2; Figure 9). The NSSP MO requires assignment of the Prohibited classification to waters adjacent to a WWTF within an effluent dilution zone of less than 1,000:1 under normal, efficient operating conditions (Normal Operating Conditions, NOC; NSSP MO, Sect IV Guidance Documents – Chap. II, I, Guidance for Dilution Ratios). Waters beyond this zone can be classified as conditionally approved. RI has chosen a more conservative approach and has established prohibited WWTF dilution zones that are of sufficient size to allow proper dilution under WWTF minor upset conditions such as a limited loss of disinfection. Decades of WWTF upgrades (RI DEM, 2016) and CSO abatement in the Providence area have resulted in increased WWTF efficiency and improved microbial water quality in the Providence River as described in the GA1 and GA16 Conditional Area Management Plans. An analyses of WWTF performance and dilution zones completed in 2021 (see analysis in the RI DEM document “Establishing the Closure Zones and Shellfish Water Classifications Adjacent to Waste Water Treatment Facilities (WWTF) in the Providence River (GA16)”, RIDEM February 2021) documented that there is sufficient dilution within the prohibited waters of GA15 and GA16 such

that effluent discharged to the upper Providence River and the upper Warren River while the treatment plants are operating under normal treatment and permitted flow conditions will not degrade the microbial water quality of the conditionally approved waters of GA16 (Conditional Area E, GA16-4). The WWTF that discharge to the waters upstream of GA16 are modern, efficient, and well-run facilities that rarely exceed permitted effluent criteria . A review of recent EPA ECHO performance data for the WWTF discharging to the Providence and Seekonk Rivers is below.

Table 2: GA16 WWTF specifications and recent upgrades (data from RI DEM, 2016).

	NBC Field's Point	NBC Bucklin Point	East Providence
Year built	1901	1954	1952
Population served	226,000	120,000	46,100
Year secondary treatment	1934	1972	1976
Design flow (MGD)	65.0 109 (wet weather)	31.0	14.2
Latest major upgrades	2008: (Phase 1 CSO tunnel) 2013: (N reduction) January 2015: (Phase 2 CSO tunnel)	2005: (UV disinfection) 2014: (N reduction)	2012: (N reduction)

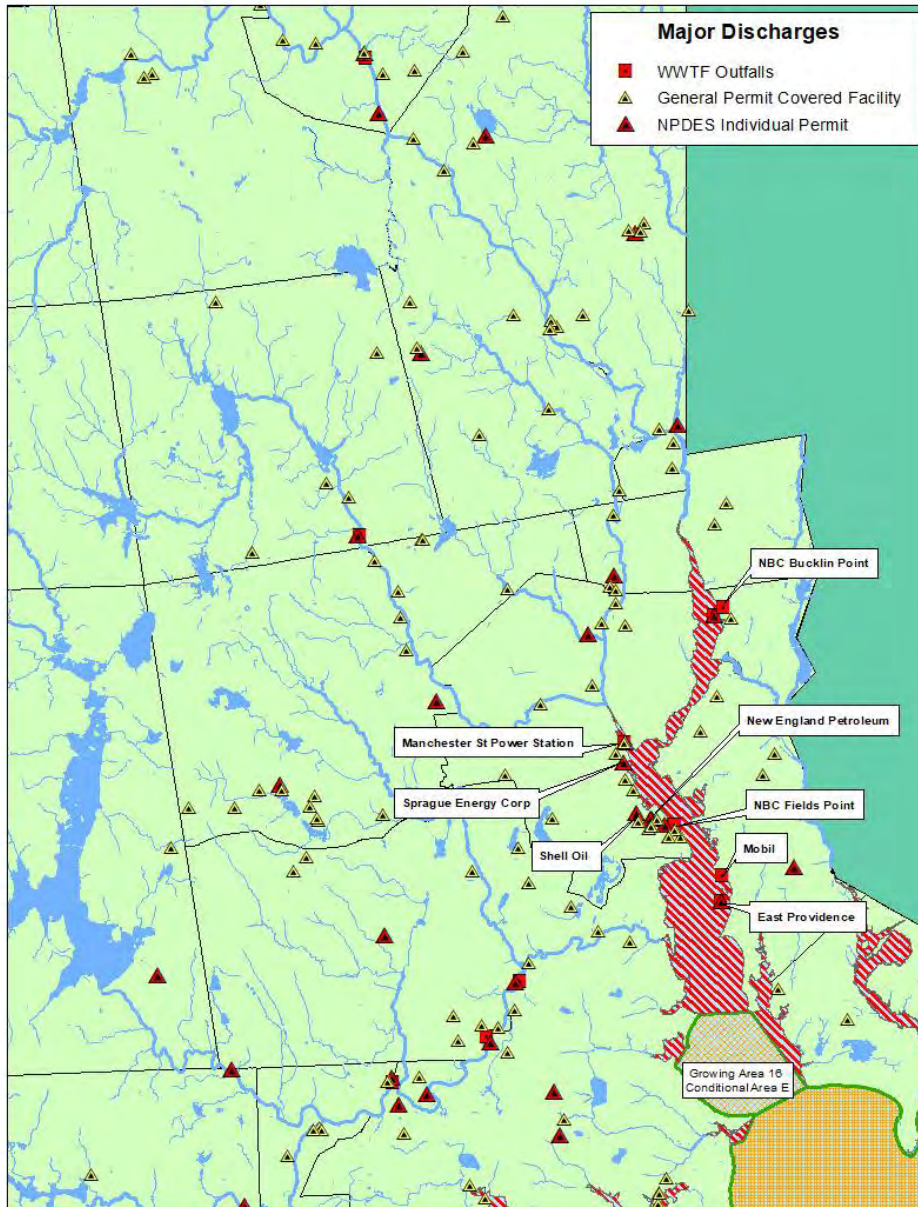
A review of EPA ECHO data indicated that the NBC Bucklin Point had two (2) minor permit violations during 2021. Both minor violations were for removal of suspended solids being under the permitted value of 50%. Flow through the Bucklin Point WWTF averaged 7.6 MGD during 2021, well below the permitted flow of 31 MGD. Treated effluent had a fecal coliform geometric mean of 5.8 mpn / 100 mpn during 2021, indicating efficient reduction of pathogens.

The NBC Fields Point WWTF had six (6) permit violations during 2021: three (3) violations of total suspended solids exceeding permit value, two (2) BOD carbonaceous violations, and one (1) total chlorine violation. The average effluent discharge during 2021 was 43.6 MGD, less than the permitted flow of 65 MGD. The treated effluent had a geometric mean fecal coliform concentration of 2.5 mpn/100 ml during 2021 indication efficient removal of potential pathogens,

The East Providence WWTF reported eight (8) violations during 2021; 3 total suspended solids violations, 1 suspended solids percent removal not meeting permit requirements, 2 BOD carbonaceous violations, 1 total Nitrogen violation exceeding monthly avg, and 1 *Enterococci* violation on 9/30/2021 where the daily max limit of 276 mpn/100 ml was exceeded with a value of 2,420 mpn/100 ml. This violation appears to be related to an upset in the treatment process. The upset was reported to DEM and GA16 and nearby GA1 (Upper Bay) were closed to shellfishing as a precaution until the WWTF returned to normal operation.

There is one other major permit that allows discharge into the prohibited waters of the Providence River. EXXON Mobile's East Providence Terminal is permitted to release treated groundwater, and industrial wastewater from their tank farm operations. The permit for this facility does not include a flow limit however they reported a 1.36 MGD average monthly flow during 2021.

Figure 9: Location of major sanitary dischargers to the prohibited waters of GA16 and GA15.



iii. Stormwater

Rivers entering the Providence River and growing area 16 (GA16) deliver a large percentage of the freshwater entering Narragansett Bay, with approximately 68% (Spaulding and Swanson, 2008) to 85% (Pilson, 1985) of total freshwater flow to Narragansett Bay coming from the Blackstone, Moshassuck, Woonasquatucket and Pawtuxet Rivers. This freshwater flow may be a mechanism for delivery of fecal coliform bacteria to GA16 and studies have documented increased fecal coliform concentration extending to the southern Providence River (GA16) and upper Narragansett Bay during wet weather. During the late 1980s (surveys during 1988-89), analysis of wet-weather fecal coliform sources to the Providence River indicated that 81% of the fecal coliform loading was from point sources – primarily CSOs – that discharged to the Providence River and its tributaries during wet weather (Wright et al., 1991). The same study also indicated that elevated fecal coliform loading occurred after rainfall of 0.5” or greater during a 24-hour period and that fecal coliform levels returned to background levels 5-days after the end of rainfall (Wright et al., 1991). Guidance derived from this, and other studies was used to successfully manage the Upper Narragansett Bay Conditional Area (Growing Area 1A) including the ‘Conimicut Triangle’ adjacent to the southern portion of GA16 with a 0.5” rain closure of 7-days duration (5 days to return to acceptable fecal coliform levels plus 2 days shellfish cleansing) during the 1990s through 2017.

There has been considerable investment in eliminating, consolidating, and capturing CSOs for treatment, and improving stormwater control and treatment in the Providence area since the 1990s (RI DEM, 2016). The three major WWTFs discharging to the Providence River (East Providence WWTF, NBC Bucklin Point WWTF and the NBC Fields Point WWTF) have implemented several treatment upgrades to improve wastewater treatment (e.g., improving disinfection and reducing levels of nitrogen discharge; Table 2). Most importantly, tunnels were installed in bedrock beneath Providence to capture CSO runoff and store it prior to treatment and discharge at the Fields Point treatment facility. The WWTF upgrades and the 26-foot diameter, 3-mile long CSO storage tunnel have resulted in an 80% reduction in discharge of untreated CSO and WWTF bypass flows and a 41% reduction in fecal coliform bacteria concentration in the Providence River (Narragansett Bay Commission, 2014). Following construction of the CSO tunnels, waters in upper Narragansett Bay experienced reduced fecal coliform concentration such that the rain fall trigger in the upper Bay Area 1A was increased from 0.5” to 0.8” of rain in 2011 and the rain closure threshold for Area A was further increased to 1.2” in 2017. In addition, the rainfall closure trigger for Conditional Area B was increased to 1.5” and after several years of documented improved fecal coliform water quality, Area B was reclassified as Approved waters in 2017. The investment in CSO abatement and the CSO storage tunnel have been reflected in substantial reductions in Upper Bay fecal coliform concentration and an increase in the conditional area rain closure threshold with a concomitant increase in the number of days that Upper Bay Area A has been open to shellfish harvest. Prior to the completion of CSO tunnel phase 2 (December 2014) Area A was open to shellfish harvest approximately 165 days per year. Following the completion of CSO phase 2 (December 2014), improved water quality allowed an increase in the Area A closure rain trigger to 1.2”. Since completion of the phase 2 CSO tunnel and concomitant increase in closure rainfall to 1.2”, Upper Bay Area A has been in the open status an average of 265 days per year – an increase of approximately 100 days open per year. Similar fecal coliform concentration reductions have also occurred in the Providence River (GA16), as described below.

Although previously classified as Prohibited, the waters of GA16 have been routinely monitored for fecal coliform by the RI DEM Shellfish Program for many years. A total of 451 fecal coliform samples have been collected in the southern portion of GA16 (stations shown in Figure 14) since the completion of the CSO tunnel (Phase 2 in 2015). Of these, 254 were collected during dry weather (<0.5", 7 days) and 195 samples were collected during wet weather. While water quality is still impacted by wet weather, evaluation of these fecal coliform data has demonstrated that *all stations in the area meet NSSP criteria during dry weather* (<0.5" rain in 7 days prior to sample collection; Figure 10). Remarkably, four of six stations in the southern-most area of GA16 also meet NSSP criteria for Approved waters *during wet weather* (samples collected 0 to 7 days after rain of 0.5" or greater; Figure 6). ***Under a Conditionally Approved scenario with a 0.5" rain in prior 7 days closure criteria, the stations in GA16 have met NSSP criteria for Conditionally Approved waters every year since 2016 (2016, 2017, 2018, 2019, 2020, 2021).*** This demonstrates that improvements in CSO wastewater treatment with subsequent improvements in fecal coliform water quality in the lower Providence River (GA16-4; Conditional Area E) are a regular feature that has persisted during both dry years (2016, 40.0" inches annual rainfall compared to 49.0" mean annual rainfall at NOAA KPVD) and wet years (2018, 63.5" inches annual rainfall compared to 49.0" mean annual rainfall at NOAA KPVD). Given this improved water quality, the classification of the lower Providence River was changed from prohibited to conditionally approved (with a 0.5" rain closure) in May of 2021. Details of the management of the conditionally approved portion of the lower Providence River may be found in the Lower Providence River Conditional Area Management Plan, updated December 2021 and available in the Program's permanent files.

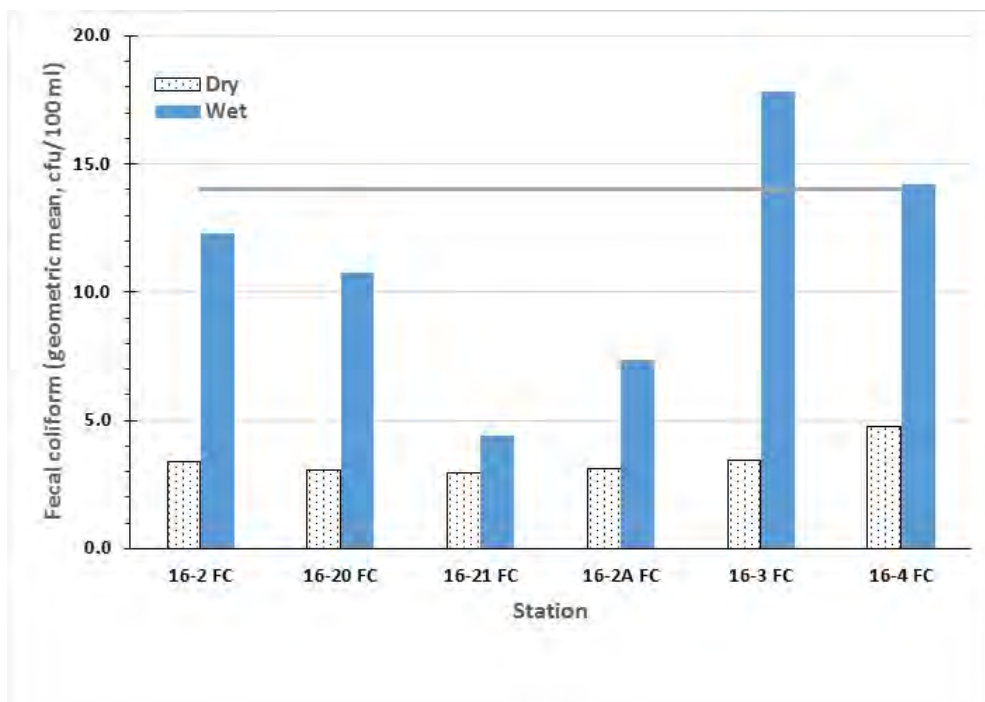


Figure 10: Geometric mean fecal coliform concentrations at stations in GA16 during dry (<0.5: rain in prior 7 days) and wet (> 0.5" rain in prior 7 days) weather. NSSP geometric mean standard of 14 cfu / 100 mL shown for reference (horizontal line). See Figure 7 for station locations.

iv. Marinas

As mentioned earlier the Providence River is the gateway from Narragansett Bay to the Port of Providence. Thousands of vessels a year travel these waters transporting goods to and from Rhode Island, along with hundreds of sailing and boating vessels of all sizes that travel these waters for recreational enjoyment. In addition to the major commercial docks in the Port of Providence and surrounding commercial piers, there are 19 marinas located throughout the river. These smaller marinas service approximately 1,250 boats with a variety of slips, moorings, and floating docks. There are six pump out facilities located among the marinas to service the needs of the general boating public. Rhode Island coastal waters are federally designated as “No Discharge” mandating that the discharge of *treated* and *untreated* boat sewage is prohibited (not including greywater or sink water) in these designated areas. These designated areas encompass the entire Providence River growing area.

While there are numerous marinas in GA16 and upstream GA15, as described above, there are no marinas in the conditionally approved waters of the lower Providence River (GA16-4).

v. Agricultural Waste

Within the Providence River growing area watershed approximately five (4.7) percent of the land is currently used for agricultural purposes, the majority of which is in the upper reaches of the watershed in Massachusetts. These sources are generally non-point in nature and only occupy a very small portion of the 860 square mile watershed. It is reasonable to assume that agricultural fecal coliform sources have little impact on the water quality of the conditionally approved waters of GA16.

vi. Wildlife

A variety of terrestrial wildlife such as birds, raccoons, fox, deer, muskrat, and rodents that inhabit the open space lands, as well as urban and suburban lands, adjacent to the Providence River, may contribute pathogens through stormwater runoff or direct deposition. Pet waste has been identified as a potentially significant source of pathogens to a waterbody especially in urban park sites that may be along the banks of the river and its numerous tributaries. Part of the public education / awareness program of the RIPDES Stormwater Phase II program is to educate the public on this controllable pollutant. No accurate information as to the magnitude and geographic dispersion of the waste source is available.

Marine birds and mammals are also present in the Providence River. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of waterfowl it is difficult to assess their impact on water quality. The presence of large flocks of birds or other wildlife is noted on field data sheets during both shoreline surveys and routine monitoring of the growing area,

vii. Industrial Wastes

The Rhode Island Pollution Discharge Elimination System Program (RIPDES) is responsible for permitting industrial and municipal waste discharges to waterbodies of the state. According to the most recent records available there are three-hundred and thirty-two permits issued by RI and eighty of those being in municipalities located within the Providence River watershed. Of those, six (6) individual permitted facilities discharge within 1 mile proximity of the Providence River. There are twenty (20) general permit covered facilities within that mile proximity which include facilities such as municipal facilities, large retail shops, and auto repair facilities. Figure 9 shows all RIPDES permits within the Providence River growing area. *Note that no RIPDES permitted facilities are in the immediate vicinity of the conditionally approved water of the lower Providence River (GA16-4).*

viii. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan (RI DEM November 2021).

At the time of the shoreline survey, identified sources and immediately adjacent upland areas were visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation was conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation was conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved or conditionally approved waters of the growing area due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

4. Hydrographic and Meteorological Characteristics

A. Tides

Tides in Rhode Island are semi-diurnal with a period or cycle of approximately one-half of a tidal day (12.84 hrs.) characterized by two similar high waters and two similar low waters each tidal day. Upper Narragansett Bay has strong semi-diurnal tides, with an average tidal range of 1.16 meters at Conimicut Point (Spaulding and Swanson, 2008). Similarly, NOAA operates a real-time tide gauge at Conimicut Light in the northern section of GA1 near the mouth of the Providence River where the mean tidal range is 1.27 meters (4.17 feet; NOAA 2020). Tidal range during spring tides at Conimicut Point averages 1.43 meters (4.69 feet; Spaulding and Swanson. 2008).

The shoreline survey was scheduled to coincide with ebb and/or low tide, which is the most opportune time for observing stormwater outfalls that may otherwise be hidden by tidal water. Additionally, pollution effects such as runoff are generally more pronounced during low tide. Sampling of streams and pipes during low tides should represent actual stream flows rather than the retreating tidal waters that they may receive.

Sampling for this survey was completed on the 24th of June, the 30th of November, and the 2nd of December 2021. Tide charts indicating tide heights during these periods are shown in the following Figures 11 and 12.

Figure 11: Tide Chart for June 24th, 2021

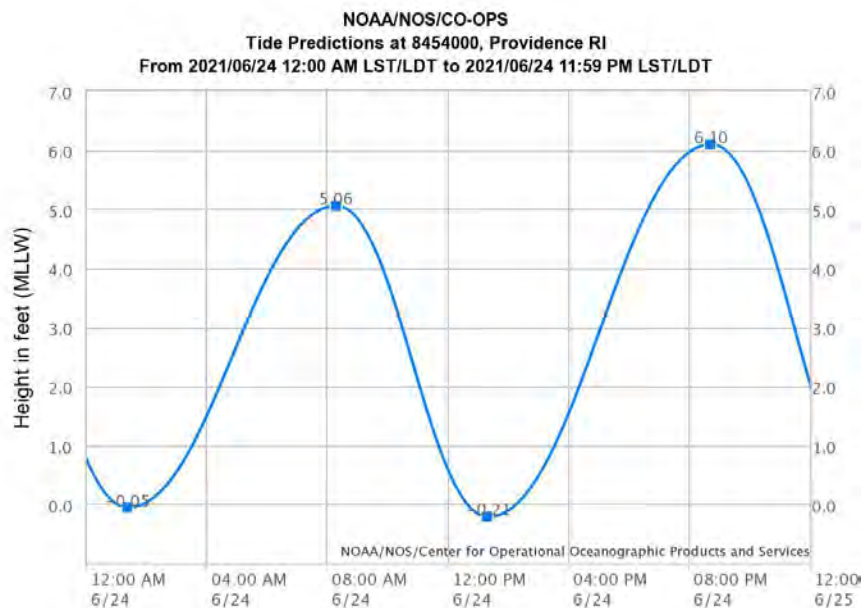
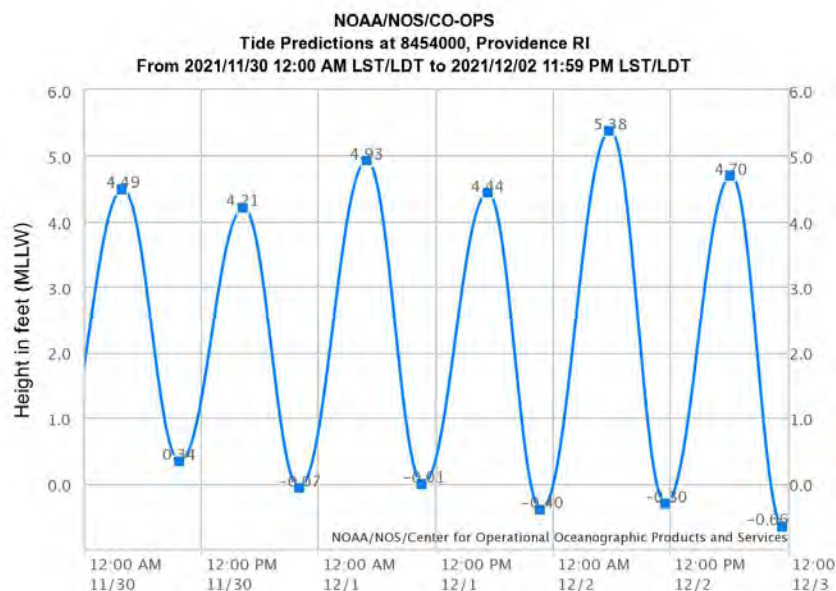


Figure 12: Tide Chart for November 30, 2021 – December 2, 2021



B. Rainfall

The lower Providence River (GA16) is approximately eight miles south of Providence, RI and approximately 4 miles east of the NOAA/ National Weather Service meteorology station at TF Green Airport. The rainfall patterns at this NOAA weather station (KPVF) are summarized below. There is no strong seasonal pattern in rainfall in the GA16 region (Table 3). Rainfall is fairly evenly distributed

in each month of the year, although spring months of March – April and the autumn months of November – December tend to have increased rainfall (Table 3).

Table 3: Average monthly rain and wind in the GA16 area (1904-2018 averages from NOAA KPVD weather station at TF Green Airport). The KPVD weather station is located approximately 4 miles west of GA16.

Month	Avg Rainfall (inches)	Minimum Rainfall (inches & year)	Maximum Rainfall (inches & year)	Avg. Windspeed (mph)	Prevailing Wind Direction
January	3.79	0.51 (1970)	11.66 (1979)	11.2	NW
February	3.32	0.39 (1987)	7.2 (1984)	11.5	NNW
March	4.06	0.07 (1915)	16.34 (2010)	12.1	WNW
April	3.86	0.72 (1942)	12.74 (1983)	12.2	SW
May	3.33	0.57 (1939)	10.58 (1948)	10.8	SW
June	3.25	0.05 (1949)	11.08 (1982)	9.9	SW
July	3.11	0.32 (1952)	10.52 (2009)	9.5	SW
August	3.67	0.71 (1984)	12.24 (1946)	9.3	SSW
September	3.58	0.48 (1914)	10.99 (2008)	9.4	SW
October	3.41	0.15 (1924)	15.38 (2005)	9.7	NW
November	3.92	0.31 (1917)	11.01 (1983)	10.6	SW
December	3.97	0.58 (1955)	10.75 (1969)	10.9	WNW
Annual total (rain)					
Annual avg (wind)	43.25	25.44 (1965)	67.52 (1983)	10.6	SW

Storms that occur between October and May are primarily extra-tropical cyclones. The most famous are the "nor-easters:" low-pressure systems that typically develop off the North and South Carolina coasts and move northeast along the Atlantic seaboard, occasionally colliding with colder and drier air (from Canada) in the New England region. This results in the development of heavy rain and/or snow. These storms are more widespread in their range. The second type of storm, occurring between June and October, are primarily tropical cyclones. The biggest storms are hurricanes, which have hit Rhode Island 71 times during the last 350 years. In the summer, most precipitation results from thunderstorms and smaller convective systems. These typically produce short-duration high-intensity precipitation events and are more localized than regional nor-easters.

Rainfall data for nearby TF Green Airport (NOAA/NWS station KPVD) during the months of the 2021 shoreline survey are below (Tables 4, 5,6). Dates of the shoreline survey are designated with yellow highlight. The NOAA weather station at TF Green State Airport in Warwick, RI is the closest station to the growing area and is designated in the GA16 CAMP as the rain gauge used to initiate conditional closures of the growing area.

Table 4: Rainfall June 2021

Date	Max temp (°F)	Min Temp (°F)	Avg Temp (°F)	Precipitation
6/1/2021	78	53	65.5	0
6/2/2021	76	55	65.5	T
6/3/2021	71	58	64.5	0.02
6/4/2021	77	60	68.5	0.77
6/5/2021	87	58	72.5	0
6/6/2021	93	65	79	0
6/7/2021	91	68	79.5	0
6/8/2021	89	69	79	T
6/9/2021	92	69	80.5	T
6/10/2021	77	58	67.5	0
6/11/2021	72	53	62.5	T
6/12/2021	71	57	64	0.11
6/13/2021	82	57	69.5	0
6/14/2021	68	57	62.5	0.53
6/15/2021	79	64	71.5	T
6/16/2021	77	59	68	0
6/17/2021	78	53	65.5	0
6/18/2021	83	55	69	T
6/19/2021	90	66	78	0.2
6/20/2021	85	66	75.5	T
6/21/2021	81	67	74	0
6/22/2021	84	62	73	1.05
6/23/2021	76	57	66.5	0
6/24/2021	74	53	63.5	0.01
6/25/2021	77	61	69	0.16
6/26/2021	82	66	74	0
6/27/2021	85	73	79	0
6/28/2021	93	72	82.5	0

Table 5: Rainfall November 2021

Date	Max Temp (°F)	Min Temp (°F)	Avg Temp (°F)	Precipitation
11/1/2021	62	40	51	0
11/2/2021	57	38	47.5	T
11/3/2021	54	35	44.5	0
11/4/2021	53	30	41.5	0
11/5/2021	53	31	42	0
11/6/2021	53	29	41	0
11/7/2021	58	28	43	0
11/8/2021	64	37	50.5	0
11/9/2021	71	36	53.5	0
11/10/2021	65	42	53.5	0
11/11/2021	58	33	45.5	0
11/12/2021	64	49	56.5	1.46
11/13/2021	62	38	50	0.36
11/14/2021	53	36	44.5	0.02
11/15/2021	52	38	45	0.03
11/16/2021	50	35	42.5	0
11/17/2021	56	29	42.5	0
11/18/2021	69	52	60.5	T
11/19/2021	52	36	44	0.16
11/20/2021	46	29	37.5	0
11/21/2021	56	33	44.5	T
11/22/2021	59	37	48	0.13
11/23/2021	42	29	35.5	0
11/24/2021	44	27	35.5	0
11/25/2021	58	32	45	0
11/26/2021	48	35	41.5	0.14
11/27/2021	42	29	35.5	0
11/28/2021	37	29	33	T
11/29/2021	44	27	35.5	0
11/30/2021	41	23	32	0
Sum	1623	1022	-	2.3
Average	54.1	34.1	44.1	-
Normal	53.2	35.8	44.5	4.27

Table 6: Rainfall December 2021

Date	Max Temp (°F)	Min Temp (°F)	Avg Temp (°F)	Precipitation
12/1/2021	50	33	41.5	0.00
12/2/2021	62	34	48.0	T
12/3/2021	46	27	36.5	T
12/4/2021	43	27	35.0	0.00
12/5/2021	48	30	39.0	0.00
12/6/2021	62	42	52.0	0.37
12/7/2021	45	33	39.0	0.00
12/8/2021	38	31	34.5	0.01
12/9/2021	39	27	33.0	T
12/10/2021	48	30	39.0	0.00
12/11/2021	63	35	49.0	0.17
12/12/2021	61	34	47.5	0.07
12/13/2021	53	37	45.0	0.00
12/14/2021	54	37	45.5	0.00
12/15/2021	51	27	39.0	0.02
12/16/2021	65	51	58.0	0.02
12/17/2021	63	42	52.5	0.00
12/18/2021	44	37	40.5	0.14
12/19/2021	41	24	32.5	0.08
12/20/2021	34	19	26.5	0.00
12/21/2021	45	27	36.0	0.00
12/22/2021	47	32	39.5	0.12
12/23/2021	34	26	30.0	0.00
12/24/2021	29	23	26.0	0.13
12/25/2021	35	28	31.5	0.23
12/26/2021	44	34	39.0	0.16
12/27/2021	37	30	33.5	T
12/28/2021	50	33	41.5	0.08

C. Winds/Climate

The Providence area has a strong seasonal temperature cycle, with mean air temperatures varying from below freezing during January and February to greater than 70 °F during July and August (Table 7). This range is based on observations made at TF Green Airport (located approximately 3.5 miles west of Growing Area 16). Within the general temperature pattern there is considerable variability in that any season can have much colder or warmer mean temperatures than usual in a given year. For example, in the past twenty years mean air temperature during February varied from a low of 18.4 °F during 2015 to a maximum of 39.6 °F during 2006 – a 21.2 °F difference. Similarly, summer air temperatures can vary by 9 °F between a cool summer (July 2001, 69.8 °F) and a warm summer (July 2013, 78.4 °F). Overall, the mean air temperature in the region has an annual average of 51.7 °F.

Table 7: Mean, maximum and minimum monthly air temperature at TF Green Airport (NOAA station KPVD) during 2000 to 2019. The KPVD weather station is located approximately 3.5 miles west of GA16.

Month	Air Temperature (F)				
	Mean	Max	Year	Min	Year
Jan	30.0	37.2	2006	21.4	2004
Feb	31.9	39.6	2018	18.4	2015
Mar	39.1	46.3	2012	32.7	2015
Apr	49.3	53.8	2010	45.4	2003
May	59.0	63.0	2018	53.4	2005
Jun	68.0	71.3	2008	64.4	2009
Jul	74.4	78.4	2013	69.8	2001
Aug	73.3	77.0	2018	70.2	2000
Sep	66.2	69.1	2015	63.0	2009
Oct	54.8	61.2	2017	51.7	2003
Nov	44.6	49.2	2006	40.5	2019
Dec	35.4	46.0	2015	28.9	2000
Annual mean	51.7	53.8		43.6	

Water temperature in the lower Providence River (GA16) also has a strong seasonal pattern and considerable annual variability (Figure 13). The NOAA PORTS system maintains a real-time water temperature sensor at the Conimicut Point lighthouse, just south of Growing Area 16. Data from this sensor were compiled to illustrate the range of water temperature in the growing area during recent years. As with air temperature, there is a strong seasonal variation in water temperature, with an approximately 50 °F range in winter versus summer water temperature (Figure 13). Winter water temperature can vary annually from years having prolonged periods of <32 °F water with formation of sea ice in the growing area, as was seen during 2015, to warm winters such as 2019 in which the water temperature never dropped below 35 °F. Similarly, maximum summer water temperature at Conimicut Point can vary from approximately 76 °F during a cool summer to up to 80.7 °F during a warm summer (Figure 13). Annual average water temperature at Conimicut Point during recent years (2015-2019) was 54.8 °F.

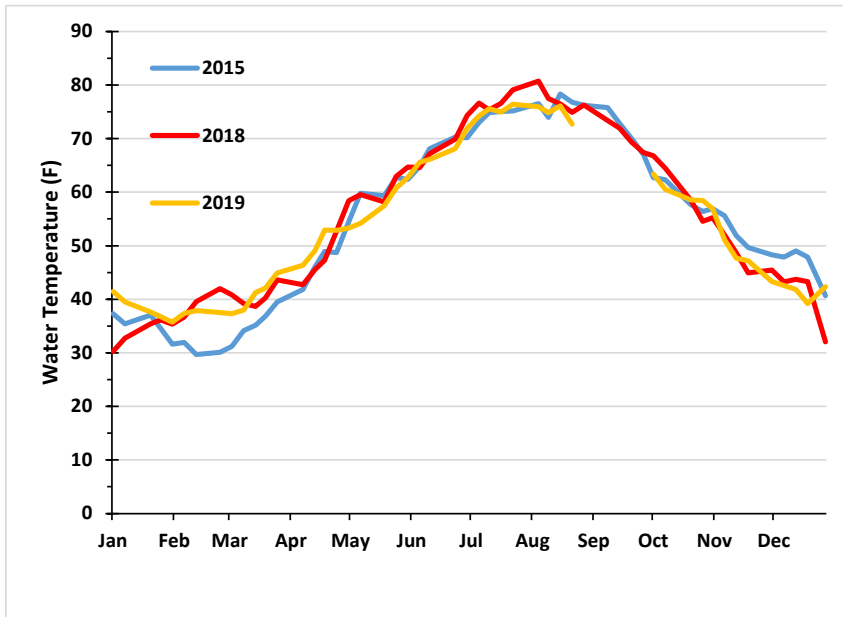


Figure 13: Surface water temperature (F) at Conimicut Point Lighthouse during 2015 (a cold winter), 2018 (warm winter) and during 2019. Temperatures taken every 6 minutes at NOAA PORTS station 8452944 Conimicut Light, RI.

Winds: Winds in the region follow a seasonal shift from winds predominantly from the northwest during winter and southwest winds dominant during spring and summer (April through September; Table 3 in section 5B). Summer winds tend to be calmer, but occasional tropical storms or hurricanes can bring elevated wind speeds during summer and early autumn.

D. River Discharges

The largest sources of freshwater input to Narragansett Bay flow through GA16 via the Providence River. Approximately 68% (Spaulding and Swanson, 2008) to 85% (Pilson, 1985) of total freshwater flow to Narragansett Bay is from the Blackstone, Moshassuck, Woonasquatucket and Pawtuxet Rivers. These major freshwater rivers provide drainage to approximately 1,754 km² of the Blackstone, Woonasquatucket, Moshassuck and Pawtuxet watersheds and this drainage flows into the Providence River which flows into lower Providence River GA16. The area has strong semi-diurnal tides, with an average tidal range of 1.16 meters at Conimicut Point (Spaulding and Swanson, 2008). Similarly, NOAA operates a real-time tide gauge at Conimicut Light in the northern section of GA1 near the mouth of the Providence River where the mean tidal range is 1.27 meters (4.17 feet; NOAA 2020). Tidal range during spring tides at Conimicut Point averages 1.43 meters (4.69 feet; Spaulding and Swanson, 2008).

Because of the riverine freshwater input to the north and strong tidal input from the south, salinity in GA16 is similar to that of the Upper Bay near Conimicut Point (approximately 25 to 28 ppt at the

surface near Conimicut Light; FDA, 1970; Codiga, 2012). However, surface salinity can intermittently decline in response to freshwater input with values as low as 16.5 ppt observed at Conimicut Point during wet weather periods having elevated river flow (Smayda and Borkman, 2008). The water column of the area is often stratified due to the input of buoyant freshwater (Hicks, 1959, FDA, 1970) and microbial pathogen indicators such as fecal coliform are consistently more abundant in the surface waters than the bottom waters (FDA, 1970, Watkins and Rippey, 1990).

The combination of freshwater input and strong tidal flow result in a rapid flushing time of approximately 0.9 to 1.0 day for lower Providence River (Spaulding and Swanson, 2008).

5. Water Quality Studies

A. Overview

The water quality of the lower Providence River is monitored through several state and local agencies and academic institutions. The primary source of fecal coliform data used for classification of GA16 shellfish waters is the RI DEM OWR Shellfish Program monitoring data described in section B, below. However, ancillary bacteria and related water quality data from other monitoring programs is also taken into consideration. Two Narragansett Bay monitoring programs used as sources of additional data are described briefly below.

RI DEM and URI Graduate School of Oceanography Fixed Site Monitoring Program. This program maintains a network of monitoring buoys at 15 locations in Narragansett Bay, including several monitoring buoys located in the Providence River (GA16 and GA15). Instruments collect near-real time data on water temperature, salinity, chlorophyll fluorescence and dissolved oxygen at near-surface and near-bottom depths. For details and to access data please see <http://www.dem.ri.gov/programs/emergencyresponse/bart/stations.php>.

Narragansett Bay Commission, Bay Monitoring Bacteria Sampling (part of 'Snapshot of Upper Narragansett Bay' program). The Narragansett Bay Commission conducts approximately 16 fecal coliform and *Enterococci* sampling cruises per year in the Seekonk and Providence Rivers. These sampling trips measure near surface fecal coliform and *Enterococci* levels approximately once per month in winter and approximately every two weeks during summer. Samples are collected at eight (8) stations spanning from Division Street in Pawtucket southward to Conimicut Point in Warwick. Details of the program and monitoring data can be found at <http://snapshot.narrabay.com/WaterQualityInitiatives/PathogenMonitoring>.

B. RI DEM Fecal Coliform Monitoring 2021 Review and Statistical Summary

The RIDEM Shellfish Program maintains a Shellfish Growing Area Monitoring (SGAM) program, as part of an agreement between the State of Rhode Island and the Food and Drug Administration (FDA) as described in the National Shellfish Sanitation Program (NSSP). The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states' management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island conducts regular bacteriological monitoring of shellfish harvesting waters. Below is a summary of 2021 fecal coliform monitoring compliance statistics for the conditionally approved waters of the lower Providence River (GA16-4).

HIGHLIGHTS

- * Stations in the lower Providence River were sampled thirteen (13) times during 2021 under both wet conditions when the area was in the closed status (n= 5) and dry conditions when the area was in the open status (n= 8).
- * In May 2021 the southern portion of the area (south of Gaspee Point to Conimicut Point) was classified as Conditionally Approved with a 0.5", 7-day rain closure.
- * Marine Fisheries regulations limited harvest to 45 hours (3 hours of harvest per day on 15 dates) during 2021.
- * The portion of the growing area north of Gaspee Point remains classified as Prohibited for shellfish harvest.
- * Statistics represent recent 15 samples collected while the conditional area was in the open status.
- * Recent 15 dry weather samples collected 2/3/2020 to 12/13/2021.
- * All samples analyzed by mTEC method.
- * Data run 1/10/2022.

COMMENTARY

The lower Providence River has experienced improvements in fecal coliform water quality due to WWTF and storm water control (Narragansett Bay CSO tunnel) upgrades. Sampling over the past several years has documented that these improvements have resulted in fecal coliform water quality meeting NSSP criteria for conditionally approved waters under a management plan having a 0.5", 7-day rain closure. Accordingly, RI DEM reclassified the lower Providence River (south of Gaspee Point) as conditionally approved in May 2021 and this area was open to shellfish harvest for 45 hours (3 hours per day on 15 days) under 2021 Marine Fisheries regulations.

The conditionally approved waters of the southern portion of the Providence River (stations 16-2, 16-3, 16-4, 16-20, 16-21 and 16-2A in Growing Area 16) were sampled 13 times during 2021 under a variety of wet (n= 5; area in closed status) and dry (n= 8; area in open status) weather conditions. The Providence area had a wetter than usual summer, especially during July, with TF Green Airport (NWS station KPVD) receiving 7.12" of rain (3.73" above normal) during July 2021. This frequent rain kept GA16 in the closed status for 27 of 31 days during July 2021 (closed 87% of time).

The 2021 statistical update demonstrated that the growing area supports a Conditionally Approved management scenario with a 0.5", 7-day rain closure. All conditionally approved stations met NSSP criteria during 2021. 2021 marks the sixth consecutive year (2016 to 2021) that the stations in the now conditionally approved central portion of the lower Providence River (GA16) met NSSP criteria for Conditionally Approved areas using a 0.5", 7-day rain closure criteria.

The area is properly classified as Conditionally Approved with a 0.5", 7-day rain closure.

RECOMMENDATIONS

- * Continue to monitor lower Providence River under all weather conditions to evaluate impacts of WWTF and CSO upgrades on fecal coliform water quality.
- * No other actions recommended based on ambient monitoring results.

Table 8: Fecal coliform summary statistics for lower Providence River conditionally approved waters (GA16-4) based on recent 15 samples collected while in the open status (<0.5”, 7-day closure) during 2/3/2020 to 12/13/2021, all mTEC method.

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
16-2	P	15	5.0	6.7
16-2A	P	15	6.3	6.7
16-3	CA	15	4.9	0.0
16-4	P	15	8.4	13.3
16-20	CA	15	4.1	0.0
16-21	P	15	4.4	0.0

C. Sampling Plan and Justification

i. Frequency of Monitoring

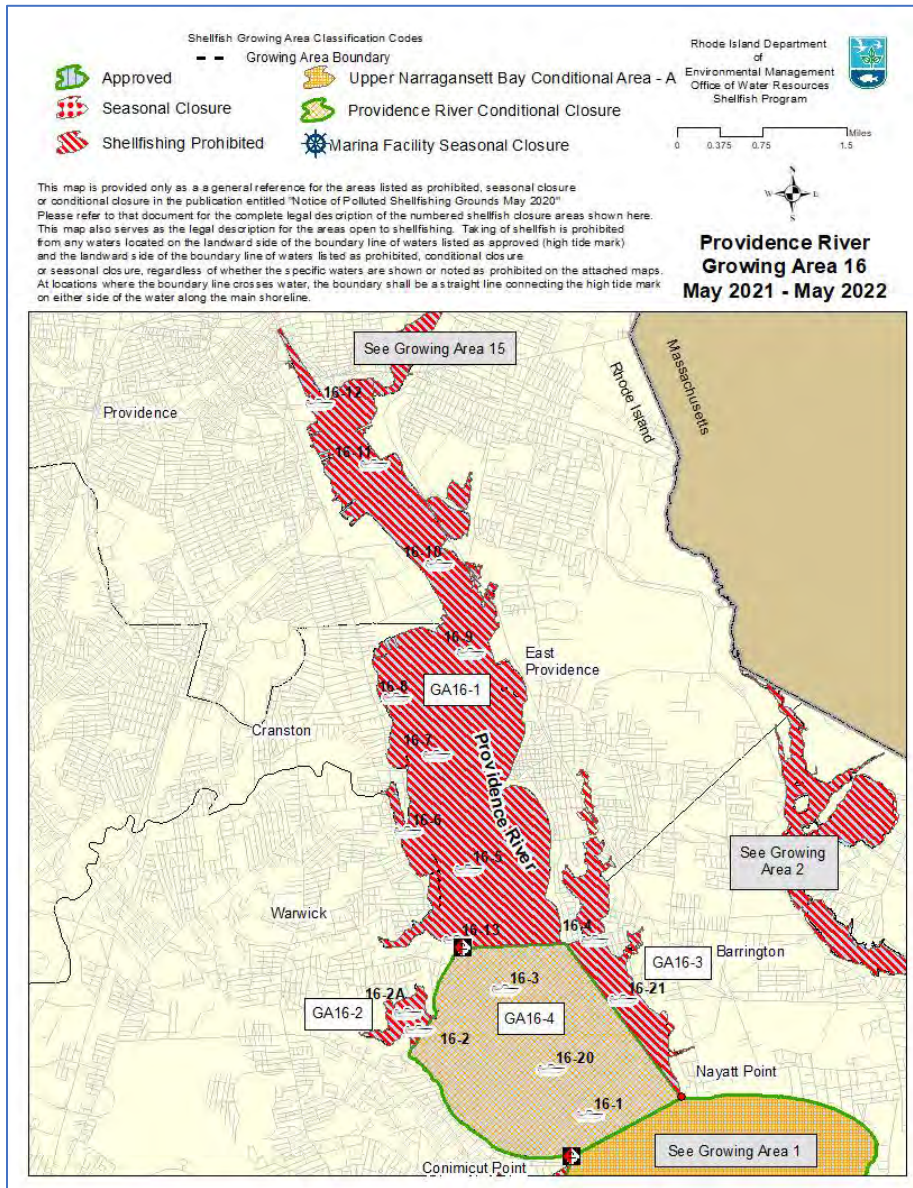
The growing area has both conditionally approved (GA16-4) and prohibited waters (Figure 2). The bacteriological water quality of Conditionally Approved GA16-4 is potentially impacted by point and non-point sources of pollution such as rainfall events, stormwater runoff, and WWTF performance. Program guidance requires that in WWTF performance impacted areas, water samples are collected on a monthly basis when the growing area is in the open status per Section II. Chapter IV @.03(3)(b)(ii) of the FDA guidance document. Therefore, the conditionally approved waters of GA16 are sampled once per month. If due to environmental constraints the monthly sample cannot be collected, an additional sample may be collected in the following month (two samples in that month). The prohibited waters of GA16 are not routinely sampled but are sampled as Program resources allow.

ii. Monitoring Stations

There are sixteen (16) monitoring stations in the Providence River growing area (GA16). Six (6) stations (GA16-2, 2A, 3, 4, 20, 21) in the conditionally approved portion of the area south of Gaspee Point are monitored routinely (Figure 14). Stations 16-3 and 16-20 are in the central conditionally approved portion of the growing area and the remainder of the stations are in prohibited waters (Figure 14). Water quality monitoring station locations and number of stations were selected to be representative of all conditions in the growing area.

Water samples for fecal coliform monitoring are collected following the standard operating procedures described in the “RI DEM Shellfish Program Growing Area Monitoring Standard Operating Procedures, updated August 2021” on file in the Programs permanent files. Briefly, water samples are collected 0.5 m (1.5 feet) below the water surface (using 125 ml sterile Nalgene bottles or other acceptable sample bottles provided by RI DOH). The water temperature at time of collection of the first sample is recorded. Samples are immediately placed on ice in insulated coolers and are transported to the Rhode Island Department of Health (RIDOH) Laboratory for analysis. Since August of 2012 water samples have been analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria using the standard fecal coliform membrane filtration method (sm48 mTEC; American Public Health Association in “Standard Methods for the Examination of Water and Wastewater” APHA, 1995). Prior to August 2012 the multiple tube fermentation test (sm01 MPN) method was used for estimation of fecal coliform abundance.

Figure 14: Routine Monitoring Stations in the Lower Providence River GA16-4.



D. RIDEM TMDL Studies

The Providence River shellfish growing area (GA16) contains two WBID waterbody segments. WBID RI000702OE-01A approximately corresponds to shellfish Conditional Area E (GA16-4) in the area south of Gaspee Point to Conimicut Point. WBID RI000702OE-01B corresponds to the prohibited waters of GA16 north of approximately Gaspee Point. Both of the WBID in GA16 are listed as impaired due to dissolved oxygen impairments, excess total nitrogen, and excess fecal coliform. A TMDL for the Providence River for fecal coliform is on schedule for development in 2022, but compliance with the consent agreement for CSO abatement may negate the need for a fecal coliform TMDL.

6. Interpretation of Data Relevant to Classification

A. Effects of Meteorological and Hydrographic Conditions

Decades of upgrades to WWTF and improved CSO-capture and treatment have resulted in decreased fecal coliform loading and improvements in the microbial water quality of the Providence River and Upper Narragansett Bay. As described above and as documented in the Lower Providence River Conditional Area Management Plan (GA16 CAMP), the microbial water quality of the area is impacted by runoff and stormwater after rainfall of greater than 0.5” in 24-hours. Given this improved water quality, the Lower Providence River Conditional Area (GA16-4, also known as Conditional Area E) was opened to shellfish harvest in May of 2021. The area is also a shellfish management area and has harvest restrictions in addition to the conditional area rain closure.

Annual reviews have demonstrated that the GA16-4 conditional management plan of a 0.5” rain, 7-day closure is protective of public health. Under this management strategy the area has met NSSP fecal coliform criteria for conditionally approved waters for six consecutive years (2016 to 2021 inclusive). The 2021 review demonstrated that this management strategy is effective in managing the area for safe shellfish harvest.

7. Conclusions

A. Classification Map

No changes are recommended for the current Lower Providence River (GA16) classification map (Figure 15).

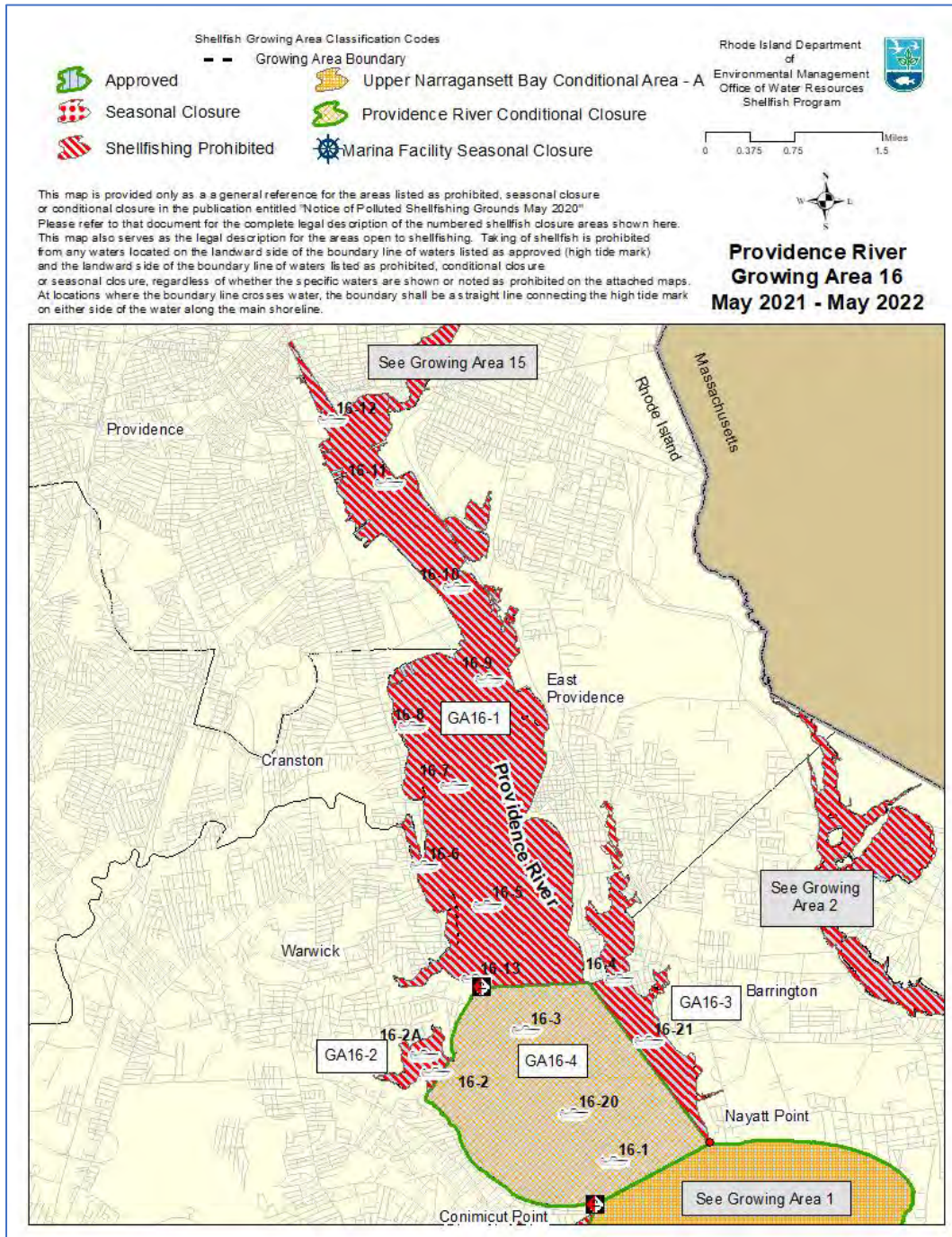


Figure 15: Current (May 2021) GA16 shellfish classification map.

B. Legal Description

Based on regular RIDEM Shellfish Program monitoring data and the data acquired during this 12-year shoreline survey, *it is recommended that the current legal description of the growing area be maintained.* The current (May 2021) legal description of GA16 includes prohibited areas (GA16-1, GA16-2, GA16-3) and conditionally approved areas (GA16-4) as described below: and as shown in Figure 15.

Prohibited

GA 16 - 1 All waters of the Providence River and its tributaries north of a line from the RIDEM range marker at Gaspee Point to the northern most tip of the rock seawall on the opposite shore of Bullock Neck in East Providence.

GA16 - 2 All waters of Occupessatuxet Cove north and west of a line from the landward end of the CRMC permitted dock # 073 on the Warwick shoreline opposite #6 Meadow Road to Pole # 67 at 11 Namquid Drive on south Gaspee Point in Warwick

GA16 – 3 All waters north and east of a line from the northern most tip of the rock seawall on the west shore of Bullock Neck to the center of the tower at Nayatt Point.

Conditionally Approved

Providence River Conditional Area E:

GA16 – 4 All waters of the Providence River bounded by a line from the Department of Environmental Management range marker on a pole located on Conimicut Point to the center of the Old Tower at Nayatt Point to the northern most tip of the rock seawall on the shoreline of Bullock Neck in East Providence to the RIDEM range marker on Gaspee Point, excluding all waters of Occupessatuxet Cove (GA16 - 2).

C. GA16 Management Plan

A review of the current conditional area management plan for Growing Area 16 indicated that it accounts for the effects of weather, hydrography, domestic wastes, and stormwater on the microbial water quality of the growing area. This management plan incorporates a rain closure amount (currently a 0.5” rain, 7-day closure) that improvements in WWTF efficiency and stormwater (CSO) capture have allowed for the Lower Providence River. *Monitoring and annual statistical evaluations of fecal coliform data have demonstrated that the area conforms to NSSP requirements for Conditionally Approved growing areas when the area is in the open status. There are no recommendations for changes in classification.*

i. Monitoring Schedule

The current monitoring schedule is adequate for maintaining the current classification. The current monthly sampling schedule is consistent with NSSP guidance for monitoring conditionally approved waters that have the potential to be affected by pollution from WWTF (2019 NSSP Chapter IV@ .03 C(3)(b)). In addition to routine monthly sampling, the program will complete optional wet weather sampling to better characterize the responses of GA16 water quality to continued upgrades in WWTF efficiency and CSO capture and treatment.

ii. Monitoring Stations

Monitoring station locations were originally established with assistance from the FDA and are believed to be adequate in distribution and location to represent the overall water quality of the

growing area. As needed, “emergency” or additional stations are added on a temporary basis should situations arise due to unexpected or newly identified pollution sources.

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Mt. Hope Bay Shellfish Conditional Area
Growing Area 17 (GA17)
Annual Update 2021

**Rhode Island Department of
Environmental Management
Office of Water Resources
Shellfish Program**

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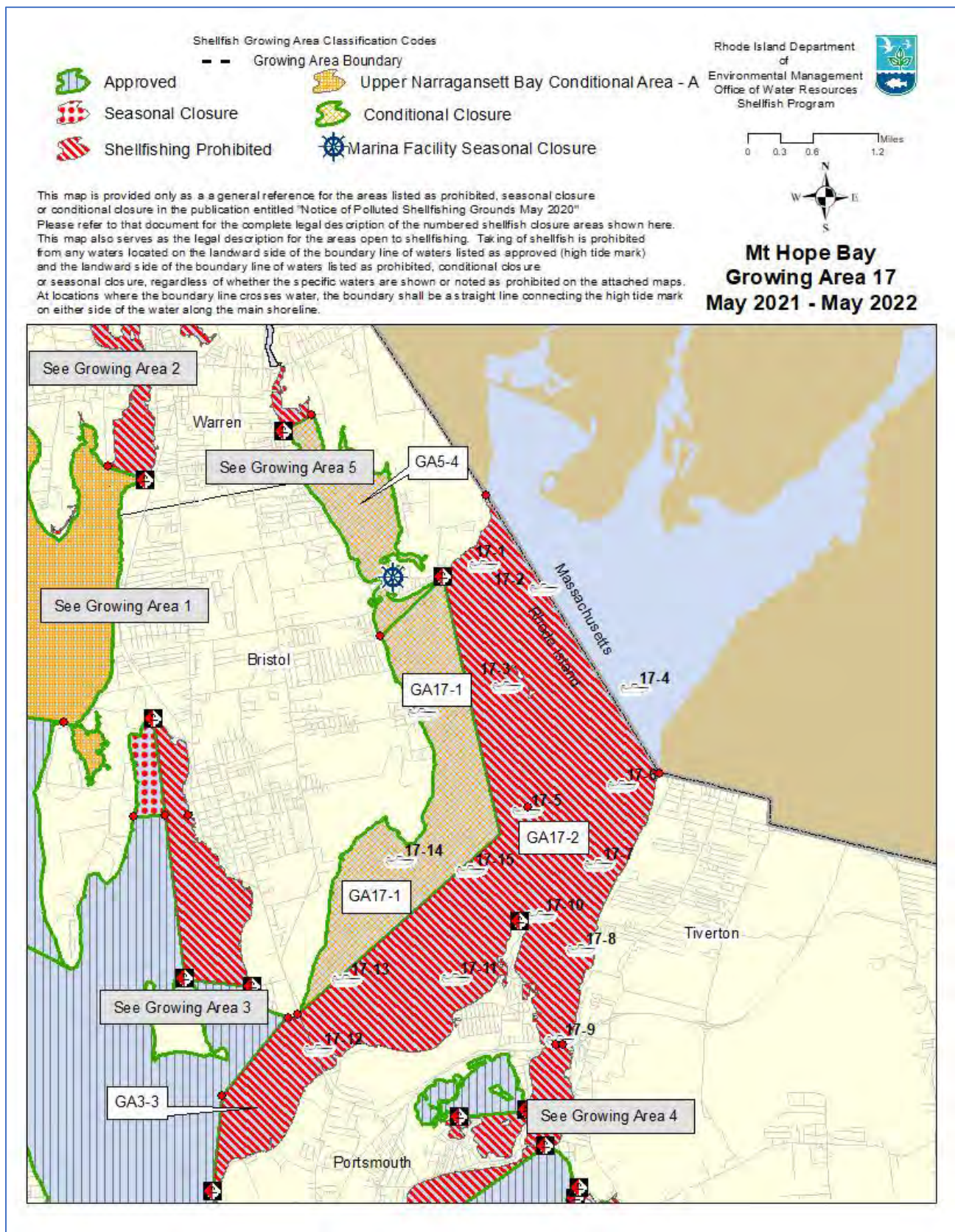
1. Introduction

Mount Hope Bay is a 35.2 km² (~8,700 acres) embayment that forms the northeast corner of Narragansett Bay. Mt Hope Bay is approximately 10.4 km (6.5 miles) long in the SW to NE direction by 4.5 km (2.8 miles) wide in the northwest to southeast direction. The RI – MA state line crosses the northwest portion of the Bay with approximately 5,775 acres of Mt. Hope Bay in RI waters and 2,925 acres of the Bay in MA waters. The Bay is relatively shallow, with a mean depth of 5.7 meters (18.7 feet) although the southern end of the Bay is deeper, with a maximum depth of 22.6 meters (74 feet) in the area near the Mt. Hope Bridge (Chinman and Nixon, 1985; Krahforst and Carullo, 2008). It is bounded by Rhode Island to the west, south and south east and by Massachusetts to the north and north east. The City of Fall River, MA (population approximately 90,000; US Census Bureau 2010) is located on the northeastern shore of Mt. Hope Bay.

The RI portion of Mt. Hope Bay is managed as a conditionally approved shellfish growing area (Growing Area 17 or GA17) that has both Conditionally Approved and Prohibited waters (Figure 1). The conditionally approved portion of the growing area is managed as a rainfall triggered closure with 0.5" of rain or greater requiring a minimum 7-day closure. The precipitation that initiates the shellfishing closures can be in the form of rain and/or snowmelt. All precipitation totals are based on the total accumulation during any consecutive 24-hour period (24 hr. total) as recorded at the NOAA Taunton weather station (KTAN). In addition, the conditional area has a WWTF performance conditional closure to safeguard public health in the event of partially treated wet-weather discharges from the Fall River WWTF.

An annual update sanitary survey of the Mt. Hope Bay shellfish growing area (Growing Area 17, GA17) was completed during 2021 by staff from RIDEM's Office of Water Resources Shellfish Program. The 2021 annual update survey included a review of previous shoreline surveys including bacteriological sampling of actual pollution sources noted in previous surveys that had greater than 240 cfu/100 ml fecal coliform concentration. These previously identified pollution sources were re-evaluated to determine their bacteriological impacts on the shellfish growing waters of GA17. In addition, the growing area was reviewed for any new potential pollution sources. A comprehensive 12-year survey was completed in 2014 and triennial surveys were completed in 2005, 2008, 2011, 2017, and 2020. Annual surveys were completed in each intervening year. The 2021 survey is an annual update (this report).

Figure 1: Mount Hope Bay (GA17) current classification



2. 2021 Shoreline Survey

A. Description of Sources

No pollution sources having fecal coliform greater than greater than 2,400 cfu/100 ml were identified during the 2014 12-year survey. During the 2020 triennial update of the Mt Hope Bay Growing Area (GA17), three (3) sources which had previously exceeded 240 cfu/100 ml but were less than 2,400 cfu/100 ml were investigated but were found to be not flowing. Given that these sources were found to have no flow during the 2020 triennial, no follow up source sampling was required for the 2021 annual update. Pollution source results from recent surveys are available in the GA17 2020 triennial update.

B. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM November 2021.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 17 (Mt. Hope Bay) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

3. Mooring Fields and Marinas

There are two marinas located along the northeastern shore of Portsmouth within the prohibited portion of the Mount Hope Bay growing area. There are approximately 400 slips for a variety of vessels at these two marinas. There is a pump out facility located at the larger of the two marinas (Safe Harbor Sakonnet Marina) that services the marine sanitation devices on these boats. All RI waters are designated as a "No Discharge Zone". In addition, marinas have closed safety zones around them to protect public health in the event of accidental or illicit discharge of marine sanitation devices. The dilution calculations used to establish marina closures can be found in the programs permanent file and are tabulated in the document entitled "Marina Dilution Analysis Background, June 2017".

Information regarding the "No Discharge Zone" enforcement and inspection procedures for vessels operating in RI waters can be found at:

<http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php>

4. Wastewater Treatment Facilities (WWTF)

During the 1980s studies by RI DEM and the FDA Northeast Technical Services Unit documented the distribution of fecal coliform in Mt. Hope Bay during wet and dry weather conditions. The FDA study identified the Quequechan River and Fall River CSOs as the primary sources of fecal coliform to the Bay and suggested that if these sources were managed or eliminated that a portion of the southwestern side of Mt. Hope Bay in RI waters may be suitable for reclassification as Conditionally Approved with a 7-day closure after a 0.5” rain threshold was reached (Rippey and Watkins, 1987). In the 1980s the City of Fall River eliminated overflows of untreated sewage during dry weather through upgrades to the wastewater treatment system (completion of secondary treatment, expansion of pump station capacity, and repairs to the sewer lines). As a result, since 1989 dry weather discharges to the Bay have effectively been eliminated. In addition, a Federal Court Order was issued which required the City to implement a Combined Sewer Overflow (CSO) Abatement Plan. The CSO Abatement Program included expansion of the Regional Wastewater Treatment Plant’s primary treatment wet weather capacity from 50 million gallons per day (MGD) to 106 MGD, and the construction of a 38 million-gallon rock tunnel with partial sewer separation of selected CSO areas along the waterfront. This work began in the late 1990s, with an expected completion of the Mt. Hope Bay CSO upgrades in 2018 and completion of all CSO abatement projects by 2025. RI DEM monitoring of the growing area has tracked water quality improvements in response to these upgrades. Since 2008 the southwestern area of Mt. Hope Bay has been managed as Conditionally Approved, with the stations in that area meeting NSSP criteria for Conditionally Approved areas continuously during 2008 through 2021. The current Conditionally Approved area of Mt. Hope Bay conforms closely with the area suggested by FDA studies completed in the 1980s (Rippey and Watkins, 1987) and in the 2010s (FDA, 2018).

The major pollution events or sources that adversely affect water quality in Mt. Hope Bay (GA17) are wastewater treatment plant by-passes during wet weather events (rainfall and snowmelt wet equivalency). Several studies have documented the impacts of WWTF bypasses and wet weather on the microbiological quality of the waters of Mt. Hope Bay. The Mt. Hope Bay watershed has portions that are sewered, areas that have combined storm and sewer overflows and areas that are un-sewered and rely upon on-site waste water treatment systems (OWTS) to handle sanitary and domestic waste. There are no Rhode Island WWTFs that discharge to Mt. Hope Bay. RI towns abutting the Bay either have sewers that discharge to other waterbodies or rely solely on OWTSs. Fall River, MA is entirely reliant upon public sewers and the Fall River WWTF also services portions of northern Tiverton, RI. The Fall River WWTF discharges treated effluent directly into Mt. Hope Bay. The Fall River WWTF is located at 1979 Bay St, Fall River, MA 02724. A 66” diameter outfall discharges treated effluent approximately 183 meters (600 feet) offshore from the Bay Street location. A secondary emergency overflow outfall is located at the shoreline near the plant. During extreme peak flows this second outfall discharges primary treated and disinfected effluent to prevent the WWTF from flooding. The Fall River WWTP permitted plant design flow is 30.9 MGD, a secondary capacity of 50 MGD and a wet weather peak flow capacity of 106 MGD per the NPDES permit (# MA0100382). The system is designed to treat rainfall of up to 1.76” in a 12-hour period (Force, 2013). During wet weather, the first 50 MGD receive full secondary treatment and the remaining 56 MGD receive primary treatment and disinfection (Force, 2013). All bypasses receive chlorination prior to discharge (Force, 2013; FDA, 2017).

A review of EPA ECHO DMR data for the Fall River WWTF indicated that average flow was 24.58 MGD during 2021 compared to a permitted value of 30.9 MGD. The Fall River WWTF had no flow or fecal coliform violations during 2021. Treated effluent fecal coliform concentration was typically less than 10 cfu/100 ml, well below the permitted limit of 200 cfu/100 ml. The 2021 review demonstrated that the Fall River WWTF was discharging treated effluent within permitted limits and that the treated

effluent is not negatively impacting the fecal coliform water quality of GA17 outside of the closed (Prohibited to shellfish harvest) WWTF safety zone.

There are rare, acute situations in which the discharge from the Fall River WWTF may reach the conditionally approved waters of GA17 while it is in the open status without receiving a minimum of 1,000:1 dilution (FDA, 2018). This is due to the Fall River WWTF exceeding its treatment capacity during extreme wet weather events which results in a bypass or discharge of partially treated (primary treated and chlorinated) effluent into Mt. Hope Bay. Dye studies and dilution analyses indicated that a bypass of greater than 6 million gallons at the Fall River WWTF may result in a less than 1,000:1 dilution in the surface waters of Conditionally Approved portion of Rhode Island GA17 (FDA, 2018). Bypasses of greater than six million-gallon magnitude generally occur during wet weather when GA17 is already closed due to the existent 0.5” rain and snow melt threshold. An analysis of 2013 and 2014 data indicated that GA17 was in the open status for only one (1) of 29 (or 3.4%) of the greater than 6-million-gallon bypass events that occurred during 2013 and 2014 (FDA, 2018). However, under unusual circumstances (i.e., after locally intense summer thunder storms or spring snow melt) the Fall River WWTF may bypass greater than 6 million gallons while GA17 is in the open status. In light of this recent (2018) finding and in compliance with the NSSP Growing Area Classification Guidelines (2019 NSSP MO Chapter IV@.03(C.) (2.) (a.) (i-viii)) an additional condition of a greater than 6 million gallon bypass volume in a 24-hour period at the Fall River WWTF was added to the Conditional Area Management Plan for Mt. Hope Bay in 2019. Fall River WWTF personnel are in regular contact with RI DEM Office of Water Resources personnel in the WWTF Operations and Maintenance (O&M) section. In the event of a greater than 6 million gallon bypass in a less than 24-hour period at the Fall River WWTF, Fall River WWTF personnel will contact RI DEM O&M staff of the bypass. RI DEM O&M staff will relay the information to DEM Shellfish Program staff who will implement the closure of GA17. DEM shellfish staff are on call and available 7 days per week, 24 hours per day to implement closures in response to Fall River WWTF bypasses as described in the Program’s standard operation procedure (SOP) maintained in the Program’s files.

5. Water Quality Studies

The RIDEM Shellfish Program participates in the Shellfish Growing Area Monitoring (SGAM) program, which is an agreement between the State of Rhode Island, the Food and Drug Administration (FDA), and the shellfish industry as described in the National Shellfish Sanitation Program (NSSP) Model Ordinance. The purpose of these programs is to maintain national health standards by regulating the interstate shellfishing industry. The NSSP is designed to oversee the shellfish producing states’ management programs and to enforce and maintain an industry standard. As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at sixteen (16) monitoring stations throughout the growing area. Two (2) of the stations are in Conditionally Approved waters and the remaining 14 stations are in Prohibited waters. See Figure 1 for a map of these station locations.

Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated August 2021 and available in the Program’s permanent files). Briefly, samples are collected 1-2 feet below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice at 4 °C. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time

they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2021) fecal coliform monitoring statistical summary is below.

A. GA17 Fecal Coliform Statistical Summary

HIGHLIGHTS

- * Mt. Hope Bay (Growing Area 17) was sampled ten times during the 2021 season (9X in 2021, 1X in February 2022).
- * Statistics represent recent 15 samples when area was open during 5/21/2020 or 6/23/2020 to 2/2/2022.
- * Prohibited station summary statistics calculated for informational purposes only.
- * All conditionally approved stations are in program compliance.
- * All samples analyzed by mTEC method.
- * Data run 2/4/2022.

COMMENTARY

The conditionally approved Mt. Hope Bay Growing Area (GA17) was sampled ten times during the 2021 season, a deviation from the usual 12 samples per year. Wet weather kept the growing area in the closed status for 157.5 days (closed 43% of the year) during 2021. The growing area was closed for most of April and August due to wet weather, with only five weekdays open during April 2021 and only seven open weekdays during August 2021 which made sampling the area while in the open status difficult. Because of this and similarly reduced sampling in 2020, the recent 15 samples used to calculate compliance statistics extended over a 21-month range from June 2020 to February 2022.

The Mt. Hope Bay growing area (GA17) was sampled 15 times while open during 5/21/2020 or 6/23/2020 through 2/2/2022. All samples were collected during dry weather (<0.5" rain in prior 7 days) when the area was in the open status. Most of the RI portion of Mt. Hope Bay is classified as prohibited due to time of travel of a potential bypass or upset at the Fall River wastewater treatment facility. Sixteen (16) stations are sampled in Mt. Hope Bay, with two stations classified as conditionally approved and the remaining 14 stations classified as prohibited. The 2021 review demonstrated that both conditionally approved stations (17-14 and 17-16) in Mt. Hope Bay (Growing Area 17) meet criteria and are in program compliance. The 2021 statistical review also demonstrated that 13 of 14 stations in the growing area that are classified as prohibited also met criteria. Station 17-3 (classified as Prohibited) located near Spar Island violated NSSP variability criteria during dry weather (<0.5" rain prior 7 days).

The 2021 review demonstrated that the conditionally approved stations (17-14 and 17-16) in the Mt. Hope Bay (Growing Area 17) meet NSSP criteria and are in program compliance. The area is properly classified.

RECOMMENDATIONS

- * No other actions recommended based on ambient monitoring results.

Table 1: Fecal coliform statistical summary based on recent 15 samples collected when the area was open during 5/21/2020 or 6/23/2020 to 2/2/2022 (all mTEC, all dry weather).

<u>Station</u>	<u>Classification</u>	<u>n</u>	<u>Geometric mean (cfu/ 100 ml)</u>	<u>% greater than 31 cfu/100 ml</u>
17-1	P	15	3.7	0.0
17-2	P	15	3.1	0.0
17-3	P	15	6.7	13.3
17-4	P	15	2.9	0.0
17-5	P	15	3.2	6.7
17-6	P	15	2.4	0.0
17-7	P	15	2.5	0.0
17-8	P	15	2.2	0.0
17-9	P	15	2.4	0.0
17-10	P	15	2.7	6.7
17-11	P	15	2.5	6.7
17-12	P	15	2.5	0.0
17-13	P	15	3.1	0.0
17-14	CA	15	2.9	0.0
17-15	P	15	2.8	0.0
17-16	CA	15	3.7	6.7

6. Summary and Conclusions

The 2021 review documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the conditionally approved waters of the shellfish growing area. The 2021 review of the one WWTF (the Fall River, MA WWTF) discharging to the growing area demonstrated that the WWTF is well-run and is discharging effluent within permitted fecal coliform concentration and flow rates. The review of fecal coliform water quality data indicated that all conditionally approved monitoring stations (stations 17-14 and 17-16) in the growing area met NSSP criteria while in the open status during 2021.

The current GA17 Conditional Area Management Plan was reviewed, and an evaluation indicated that the current operating procedures for GA17 were consistent with the management plan. The Mt. Hope Bay conditional management plan is protective of public health as demonstrated by the two (2) monitoring stations in conditionally approved waters of the growing area meeting NSSP fecal coliform criteria for safe shellfish harvest during each year from 2008 (year of conditionally approved reclassification) through 2021.

The 2021 update has demonstrated that the area is properly classified and that the conditional management plan for the growing area is protective of public health. No changes in classification are recommended.

7. Literature Cited

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Summary of RI DEM & RI DOH HAB Phytoplankton and Biotoxin Monitoring: 2021

A. Introduction

The RI DEM Shellfish Program in conjunction with the RI Department of Health routinely monitors three genera of HAB phytoplankton (*Alexandrium spp.*, *Dinophysis spp.*, *Pseudo-nitzschia spp.*) in RI shellfish growing waters. This is consistent with NSSP guidance to ensure early warning of the presence of potentially toxigenic phytoplankton in shellfish growing waters. For 2021, HAB phytoplankton monitoring began on January 6, 2021 (1st sample collected) and continued through December 30, 2021 (last sample). During this period a total of 233 HAB phytoplankton samples were collected and analyzed for HAB species abundance.

In addition to RI DEM and RI DOH HAB phytoplankton counts summarized below, the program also assesses HAB phytoplankton data collected by partner agencies. These include URI-GSO Plankton Time Series monitoring in the West Passage of Narragansett Bay (weekly samples), Narragansett Bay Commission 'Bay Window' phytoplankton monitoring in the lower Providence River (approximately monthly samples), and URI-GSO's in situ video monitoring of phytoplankton at the GSO dock (IFCB phytoplankton imaging in near real-time).

B. 2021 HAB Biotoxin closures:

No HAB-biotoxin closures were required in Rhode Island waters during 2021.

C. 2021 HAB Phytoplankton Observations

i. *Alexandrium spp.*:

Alexandrium spp. were uncommon, being present in only four (4) of 233 samples (~2%) analyzed during 2021 (Figure 1). Maximum *Alexandrium spp.* abundance was 440 cells/L during 2021 which is below the 1,000 cell/L action level so no follow-up *Alexandrium* biotoxin testing was required during 2021. Consistent with prior observations, relative increases in *Alexandrium* occurred during the late spring and summer months (May to early August; Figure 1).

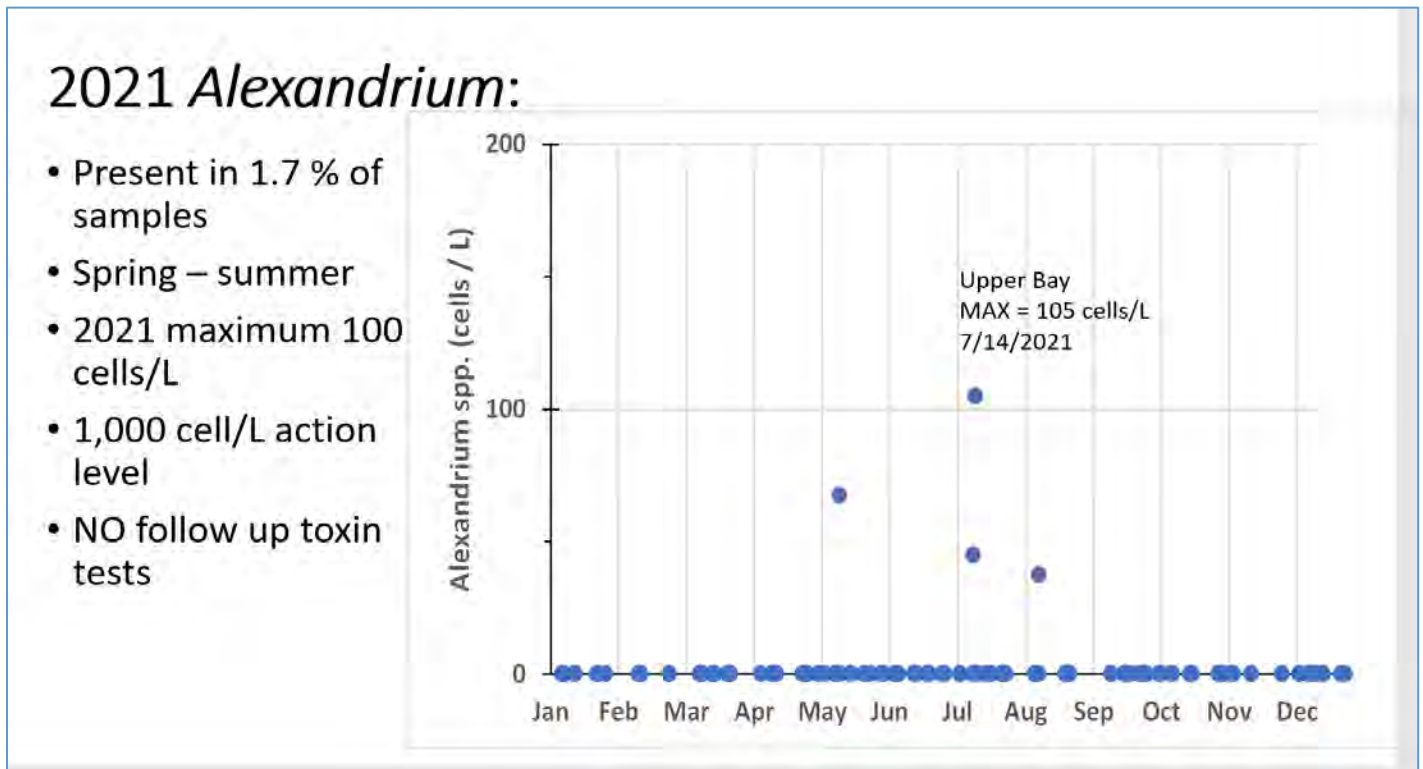


Figure 1: *Alexandrium spp.* abundance (dots) at RI DEM and DOH HAB monitoring stations during 2021.

ii. *Dinophysis* spp.:

Dinophysis spp. were present in 14% of the HAB phytoplankton samples analyzed during 2021 and abundance varied from 0 to a maximum of 5,800 cells per liter. *Dinophysis* abundance tended to be greatest during summer (May - July) of 2021 (Figure 2). Maximum 2021 *Dinophysis* spp. abundance of 5,800 cells/L (station 1B-2) and 3,080 cells/L (station 1B-3) was recorded on 7/14/2021 in Upper Narragansett Bay. Rhode Island received much more rain than usual during July 2021, with 7.4" recorded at TF Green Airport compared to a long-term mean July rain of 3.4". An intense, *Skeletonema*-dominated phytoplankton bloom developed in the Upper Bay coincident with the elevated July 2021 rainfall and the two elevated *Dinophysis* observations appear to have been part of this overall phytoplankton bloom. However, elevated *Dinophysis* was not persistent as follow-up sampling showed that *Dinophysis* abundance declined to 0 cells/L (stations 1A-2 and 1B-2) to 200 cells/L (station 1B-3) in the Upper Bay on 7/15/2021. No follow-up *Dinophysis* toxin testing was required during 2021.

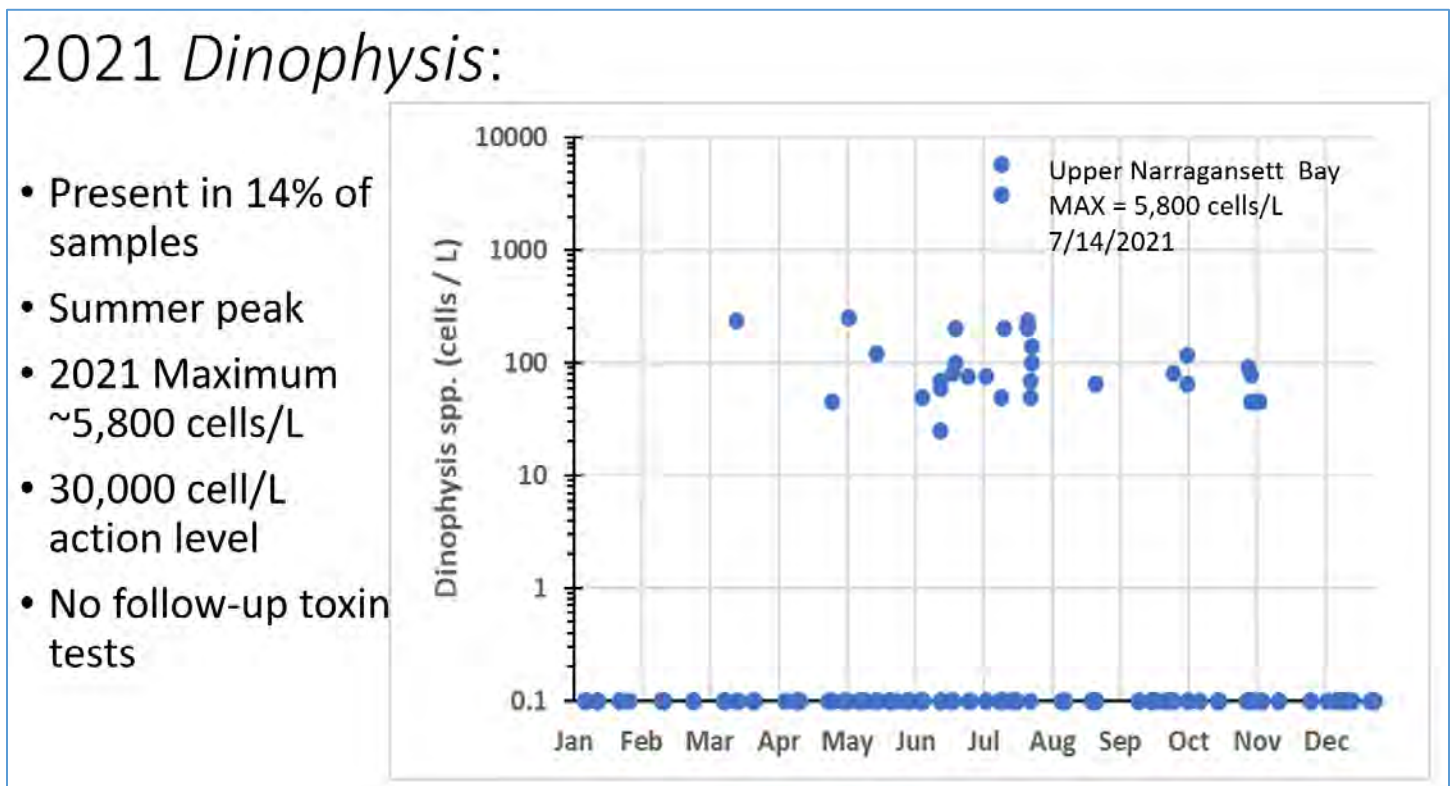


Figure 2: *Dinophysis* spp. abundance (dots) at RI DEM and DOH HAB monitoring stations during 2021.

iii. *Pseudo-nitzschia* spp.:

Pseudo-nitzschia spp. were present in 43% of the HAB phytoplankton samples analyzed, and a maximum abundance of 25,000 *Pseudo-nitzschia* cells L⁻¹ was recorded during 2021. *Pseudo-nitzschia* abundance remained below the action level threshold from January through July of 2021 (Figure 3). In July several samples collected in Upper Narragansett and the West Passage approached or exceeded the 20,000 cell/L action level. Follow-up sampling documented a decline in cell abundance and this ephemeral July 2021 *Pseudo-nitzschia* elevation appeared to be related to elevated rainfall followed by an intense *Skeletonema*-dominated phytoplankton bloom in the Upper Bay. *Pseudo-nitzschia* abundance increased to 18,000 to 19,000 cells/L in the West Passage during July and early August 2021, triggering follow-up testing of sentinel mussels. Sentinel mussels collected at the GSO dock on 8/5/2021 were analyzed for domoic acid by LC-MS-MS and were found to be free of domoic acid. Another elevation in *Pseudo-nitzschia* abundance was observed in the West Passage during October 2021, with cells counts of up to ~150,000 cells/L reported at the URI-GSO monitoring site.

Follow-up analysis of sentinel mussels collected at the URI-GSO dock on 10/6/21 indicated absence of domoic acid (LC-MS-MS analysis). *Pseudo-nitzschia* abundance remained low during November and December of 2021 (Figure 3).

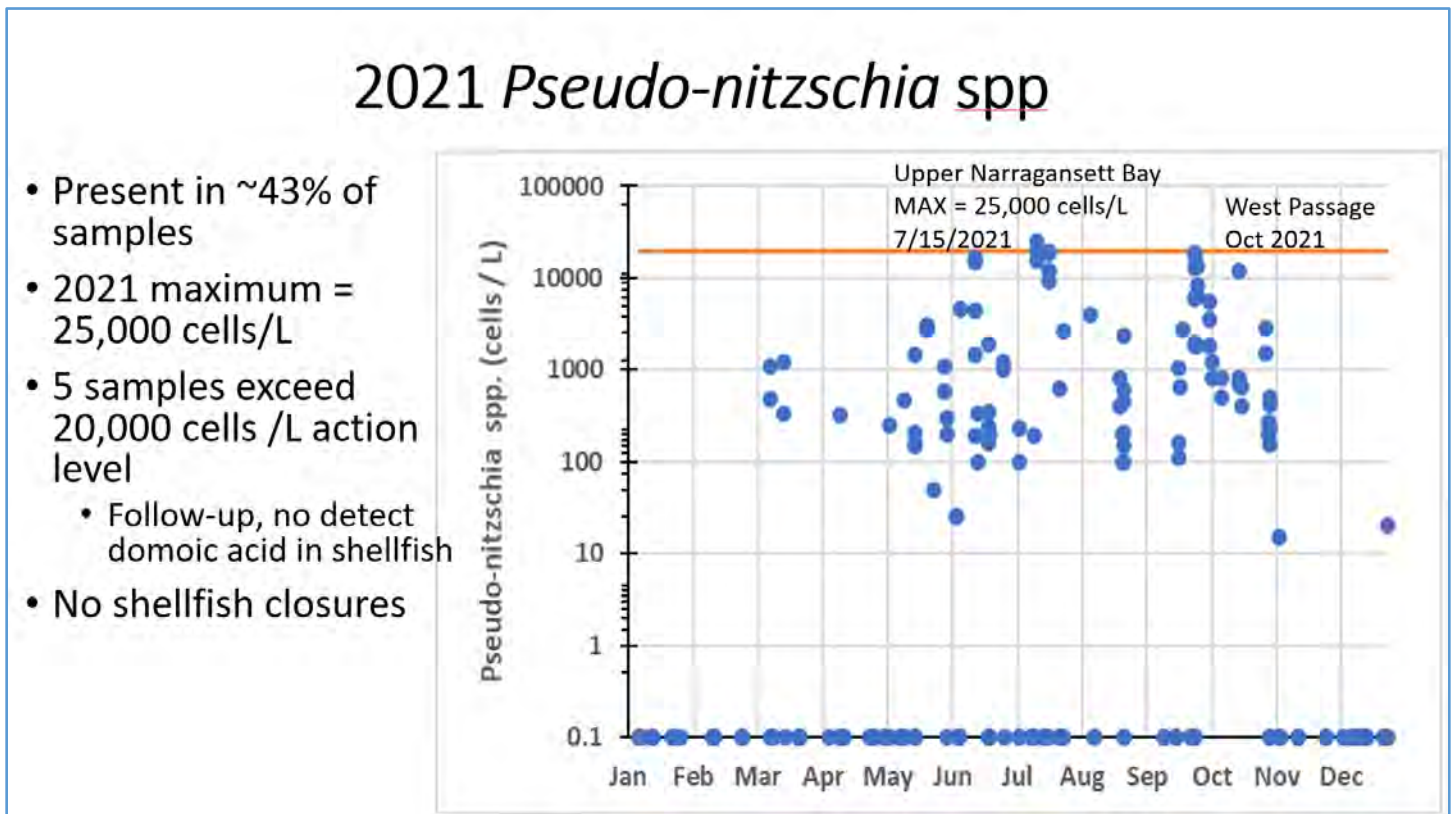


Figure 3: *Pseudo-nitzschia* spp. abundance (dots) at RI DEM and DOH HAB monitoring stations during 2021. 20,000 cell per liter *Pseudo-nitzschia* spp. action level (red line) shown for reference. Follow-up sampling was conducted in response to action level exceedances during August and October 2021, with sentinel shellfish samples showing absence (< 0.4 ppm) of domoic acid and no biotoxin shellfish closures were required.

CollectionTime	LabSampleID	StationName	SampleName	Result	ReportingLimit	Units	Analyte	Analysis	Comment	Sample Location
8/5/2021 8:30:00 AM	2103642-01	7B-S01	BLUE MUSSELS	ND	0.400	ug/g	DOMOIC A	FC08 LC MS/MS Domoic Acid		3W-S01, GSO header tank, new stn ID
10/6/2021 8:15:00 AM	2104622-01	7B-S01	BLUE MUSSELS	ND	0.400	ug/g	DOMOIC A	FC08 LC MS/MS Domoic Acid		3W-S01, GSO header tank, new stn ID

Table 1: Results of shellfish (blue mussel) meat analysis for the presence of domoic acid after *Pseudo-nitzschia* counts exceeded the action threshold during 2021. Domoic acid content was absent (< 0.4 ppm) in all samples analyzed.

iv. Other 2021 Phytoplankton Observations:

There were few water-discoloring phytoplankton blooms detected or reported to DEM Office of Water Resources during 2021. While monitoring of ‘rust tide’ is not a primary focus, available HAB monitoring observations indicated that 2021 was a low abundance year for *Cochlodinium* (now *Margalefidinium*) *polykrikoides* in Rhode Island. Relatively few calls were received reporting ‘rust tide’ during 2021 and limited 2021 *Cochlodinium* cell counts (n = 10) showed absence of *Cochlodinium*.

Colleagues at Massachusetts DMF reported an *Alexandrium* bloom of 470 cells per liter in the Coles River (contiguous with RI GA17, Mt. Hope Bay) in Swansea, MA on 5/13/2021. Analysis by MA DMF indicated low or no saxitoxin associated with this *Alexandrium* increase. Follow-up sampling in RI's portion of Mt. Hope Bay (Growing Areas 17 and 5) on 5/18/2021 indicated *Alexandrium* was absent in the waters of Mt. Hope Bay (GA17) and the Kickemuit River (GA5).