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

2018 Shellfish Program Classification Report

GA 1 Triennial Review: Upper Narragansett Bay

Rhode Island Department of Environmental Management
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Shellfish Program

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1. Introduction

A twelve (12) year sanitary survey of Upper Narragansett Bay Growing Area 1 (GA1; Figure 1) was conducted in 2009. A total of seventy-seven (77) actual or potential sources were identified during this shoreline survey, excluding marinas. A total of twenty-eight (28) of the seventy-seven (77) sources were not actively flowing at the time of the shoreline survey with the remaining forty-nine (49) having flows warranting sampling. In 2012 follow-up sampling was done of thirteen (13) sources of actual or potential pollution that were identified in the 2009 shoreline survey report. Each of these sources had results that were equal to or exceeded the recommended follow-up threshold of 240 MPN outlined in the shellfish programs standard operating procedures when sampled in 2009 for the triennial update. Sources that had results greater than 240 cfu/100ml in 2012 were investigated and only two had flows and thus sampled.

In the 2015 Triennial review, no sources previously sampled in 2012 warranted resampling. Four of the five sources sampled in 2012 exhibited elevated bacteria counts, however no source had flow significant enough to warrant resampling.

A triennial re-evaluation shoreline survey of Upper Narragansett Bay was conducted during 2018 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. 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 cfu/100ml and identification of any new sources of pollution if applicable. These previously identified pollution sources were re-evaluated in 2018 to determine their bacteriological impacts on the Upper Narragansett Bay.

2. 2018 Shoreline Survey

A triennial re-evaluation shoreline survey of this growing area was conducted during September 20th and 24th of 2018. There were seventy-seven (77) actual or potential sources identified (excluding marinas) during the 12-year shoreline survey completed in 2009. A total of twenty-eight (28) of the seventy-seven sources were not actively flowing at the time of the 2009 shoreline survey with the remaining forty-nine (49) having flows warranting sampling. All sources in which flow was observed were sampled in 2009.

The Upper Narragansett Bay Growing Area 1 was reclassified in May 2017, due to improvements in water quality after the Narragansett Bay Commission (NBC) completed upgrades at their two upstream Waste Water Treatment Facilities (WWTF). The "Conditionally Approved" "Area B" was reclassified to "Approved" after additional wet weather monitoring showed significant improvements in bacteria levels which met NSSP criteria for Approved Shellfish Growing Areas. The Growing Area 1 conditionally approved subarea "Conimicut Triangle" was merged with Growing Area 1 conditionally approved subarea "A." Wet weather sampling and data analysis showed improvements in water quality to both conditionally approved subareas after the NBC WWTF upgrades, which allowed for the merge of the two

subareas. The rainfall closure threshold was also increased in the conditionally approved "Area A" from 0.8 to 1.2 inches. Refer to the revised Conditional Area Management Plan (CAMP), Addendum # 3 dated July 2017 for the analysis of wet weather sampling and the rationale for re-classification of Area "B" and the revised rain criteria for Area "A".

A sewer line break near the Cedar Swamp pump station in Warwick upstream of GA1 on 8/26/2018 resulted in a discharge of approximately 300,000 gallons of untreated sewage to Buckeye Brook. An emergency shellfishing closure was enacted for the area. Following the sewer line break, fecal coliform levels in Buckeye Brook were monitored by Warwick Sewer Authority and DEM staff to document remediation efforts in the area and to evaluate Buckeye Brook as a fecal coliform source to the shellfishing waters of Upper Narragansett Bay near the mouth of Buckeye Brook and Old Mill Creek. After extensive monitoring over 3 months, during which time the area remained closed to shellfishing during a very wet September to December, almost 2x the average amount of rain during that time period, a new conditional area labeled "Area 1D" was implemented to protect the receiving waters from high bacterial levels. The area is described as follows, all waters of Upper Narragansett Bay west of a line from the Rhode Island Department of Environmental Management range marker located on a pole on Conimicut Point to the extension of Ogden Avenue in Warwick excluding those waters of Old Mill Creek in their entirety will reopen as Conditionally Approved Area "D." Available data suggests that a rainfall closure threshold of 0.80" is protective of public health in the area of the Buckeye Brook emergency closure (Conditional Area 1D). Conditional Area "D" will close for seven days after 0.8" or more of rain or snow melt within any 24-hour period. Initially 18 stations were established and sampled to classify this conditional area, as sampling continued, the list of stations gradually decreased to a total of 4 stations (8C, 8F, 8G, 8L) which will be used to continually monitor this conditional area in 2019, as seen in Figure 2. Additional sampling stations in Buckeye Brook and Old Mill Creek have also been established and will be monitored to further quantify impacts of this freshwater estuarine systems impacts to the Upper Bay.

Figure 1: Current Upper Narragansett Bay Growing Area 1 Classification Map

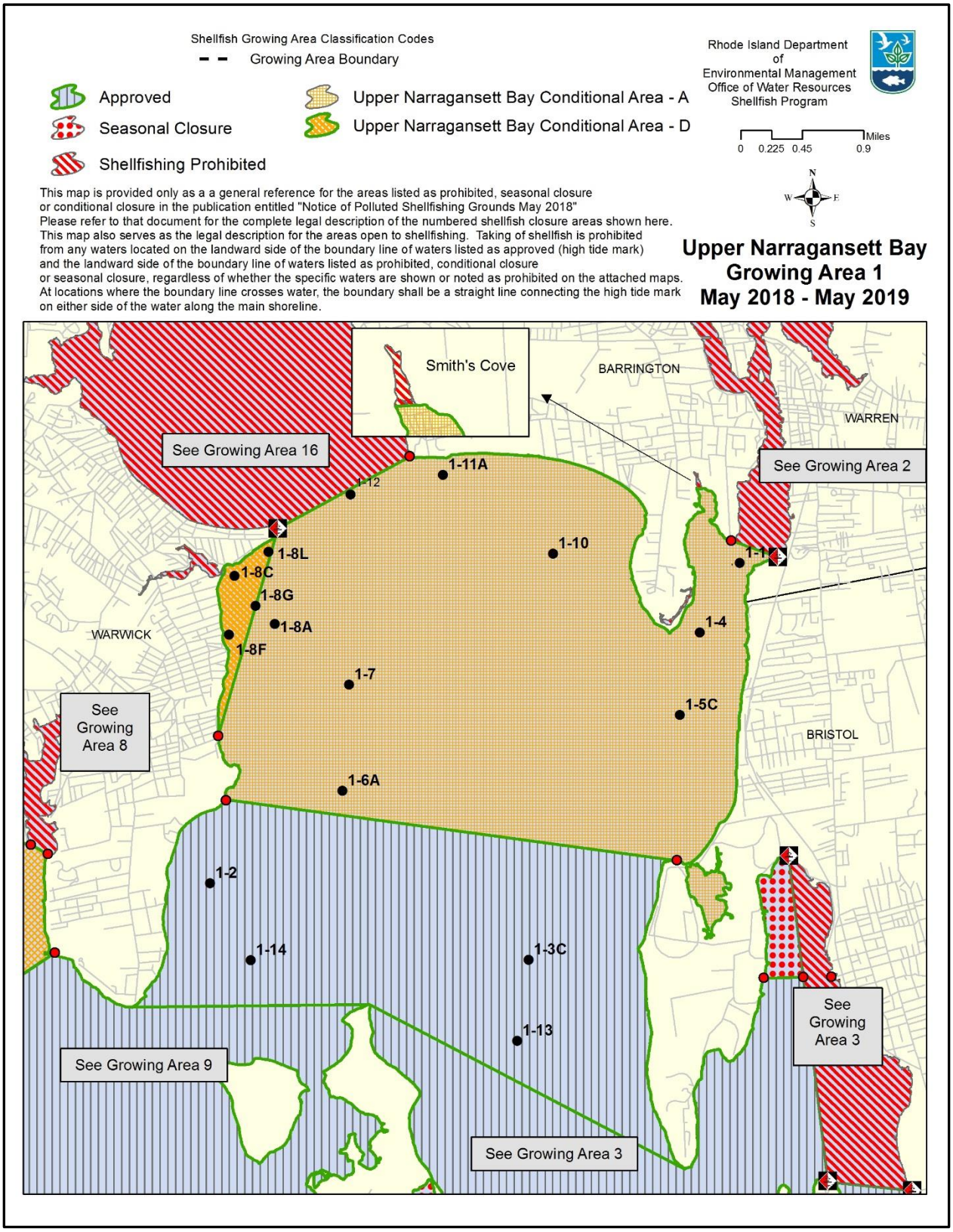
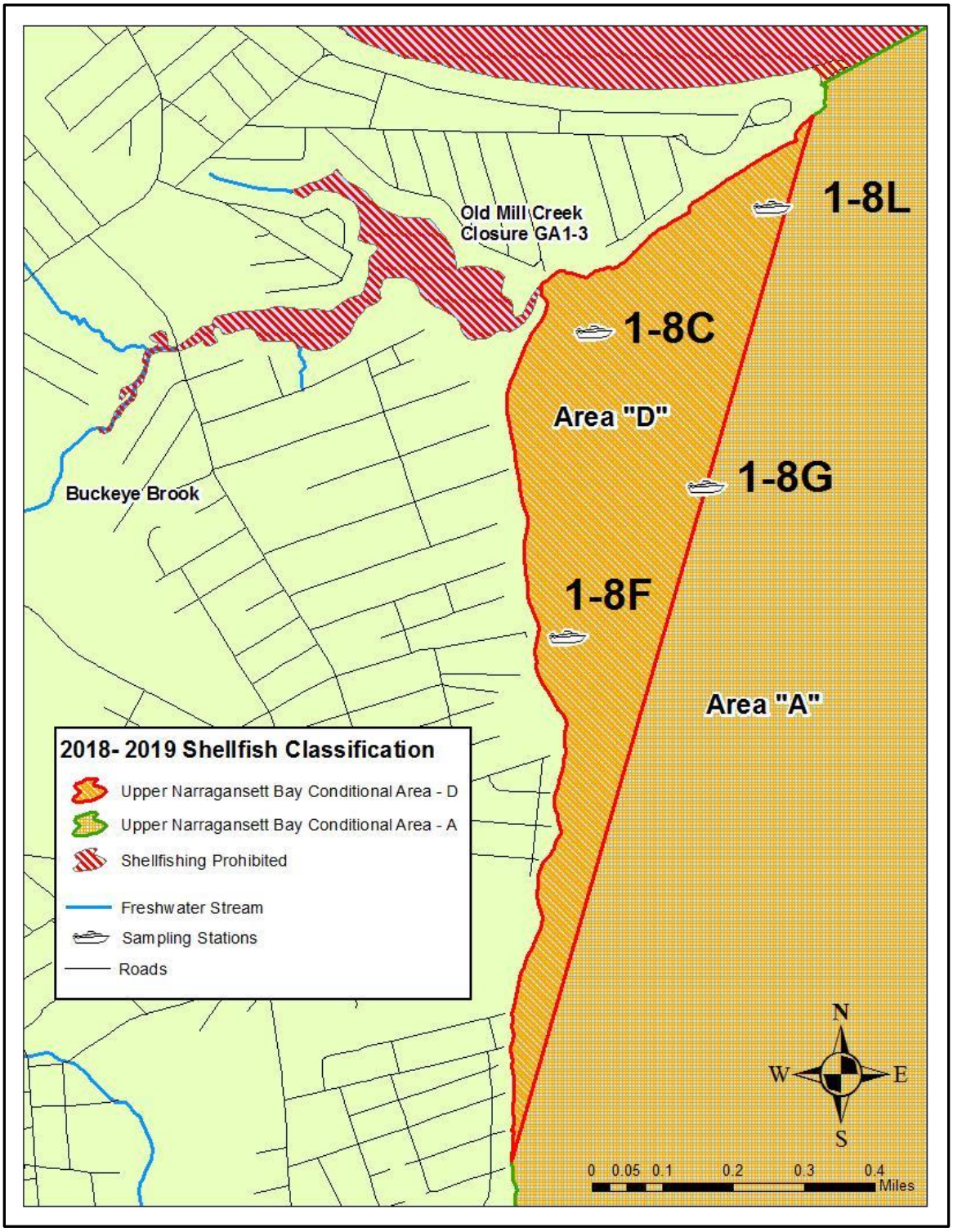


Figure 2: Conditional Area 1D Sampling Stations



3. Description of Growing Area

Growing Area 1 consists of approximately 9,668 acres of conditionally and approved waters (RIDEM GIS), which encompasses all of the shoreline north of a line that extends from Warwick Point light to Providence Point on Prudence Island to the southern extremity of Poppasquash Point in Bristol. It also includes all of the shoreline south of a line from Adams Point in Barrington to Jacobs Point in Warren and south of a line from Conimicut Point in Warwick to Nayatt Point in Barrington.

The area is divided into three areas identified as Areas 1A, 1B and 1D. Area 1A (5,374 acres) which encompasses the area north of a line from the southeast corner of the Rocky Point pier in Warwick to the southwest corner of the Colt State Park pier in Bristol, south of a line from Adams Point in Barrington to Jacobs Point in Warren and south of the Conimicut Triangle line. Just to the south of Area 1A is the area formerly known as Area 1B which is currently classified as Approved. The description of Area 1A is : The area north of a line from Warwick Point to Providence Point on Prudence Island, north of a line from Providence Point to the southern extremity of Poppasquash Point in Bristol, and south of the line from the southeast corner of Rocky Point pier in Warwick to the southwest corner of the Colt State Park pier in Bristol. This area comprises 3,712 acres of waters that were upgraded in classification from Conditionally Approved to Approved in May 2017. Area 1D, newly created in 2018 consists of 138.5 acres of Conditionally Approved waters located in the northwest corner of the Upper Bay. Area 1D is described as: the waters of Upper Narragansett Bay west of a line from the Rhode Island Department of Environmental Management range marker located on a pole on Conimicut Point to the extension of Ogden Avenue in Warwick excluding those waters of Old Mill Creek in their entirety.

In 2010 the RIDEM shellfish program in cooperation with the Narragansett Bay Commission (NBC) conducted an extensive wet weather sampling program. The report entitled "Upper Narragansett Bay Conditionally Approved Growing Area 1 Closure Criteria Review, April 2011" presents the results of this monitoring and was used to defend amendment of the areas' closure criteria. **Table 1** displays the current precipitation events that trigger the closure of these areas.

Table 1: Precipitation Triggers

AREA	**0 – 0.79"**	**0.8.– 1.19"**	**1.20" – 2.99"**	**>3.0"**
Upper Narragansett Bay Area "A"	Open	Open	7 day closure	10 day closure
Upper Narragansett Bay Area "D"	Open	7 day closure	7 day closure	10 day closure

The precipitation that initiates these 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). Closures must be implemented within 12 hours of achieving the trigger precipitation amount for both Area "A" and Area "D". The duration of all shellfish closures must be a minimum of 7 full days from the ending time of the precipitation event.

The following information describes the physical geography of this growing area under its current (2018) classification:

Total area of Upper Narragansett Bay	9,714 acres
Area of Conditional Area A	5,841 acres
Area of Approved Area B	3,711 acres
Area of Conditional Area D	139 acres
Area of Old Mill Creek (Prohibited)	23 acres
Longest reach	4.3 miles
Widest reach	3.8 miles
Deepest point	48 feet
Mean depths	
Conditional Area A	13.5 feet
Approved Area B	25.0 feet
Conditional Area D	5.3 feet

4. Pollution Source Survey

During September 2018 and additionally in January 2019, DEM OWR Shellfish staff reviewed previous sources and conducted sampling as part of the 2018 triennial update of GA1. Twenty-four (24) sources were sampled during this triennial survey. Of the sources that were sampled, ten (10) exceeded the 240 cfu/100ml threshold, follow ups have been completed for these elevated sources and are detailed in the following Table 2 and are located as shown in Figure 3. .

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 August 2017.

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 the Upper Bay (Growing Area 1) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

Figure 3: 2018 Shoreline Survey Pollution Sources

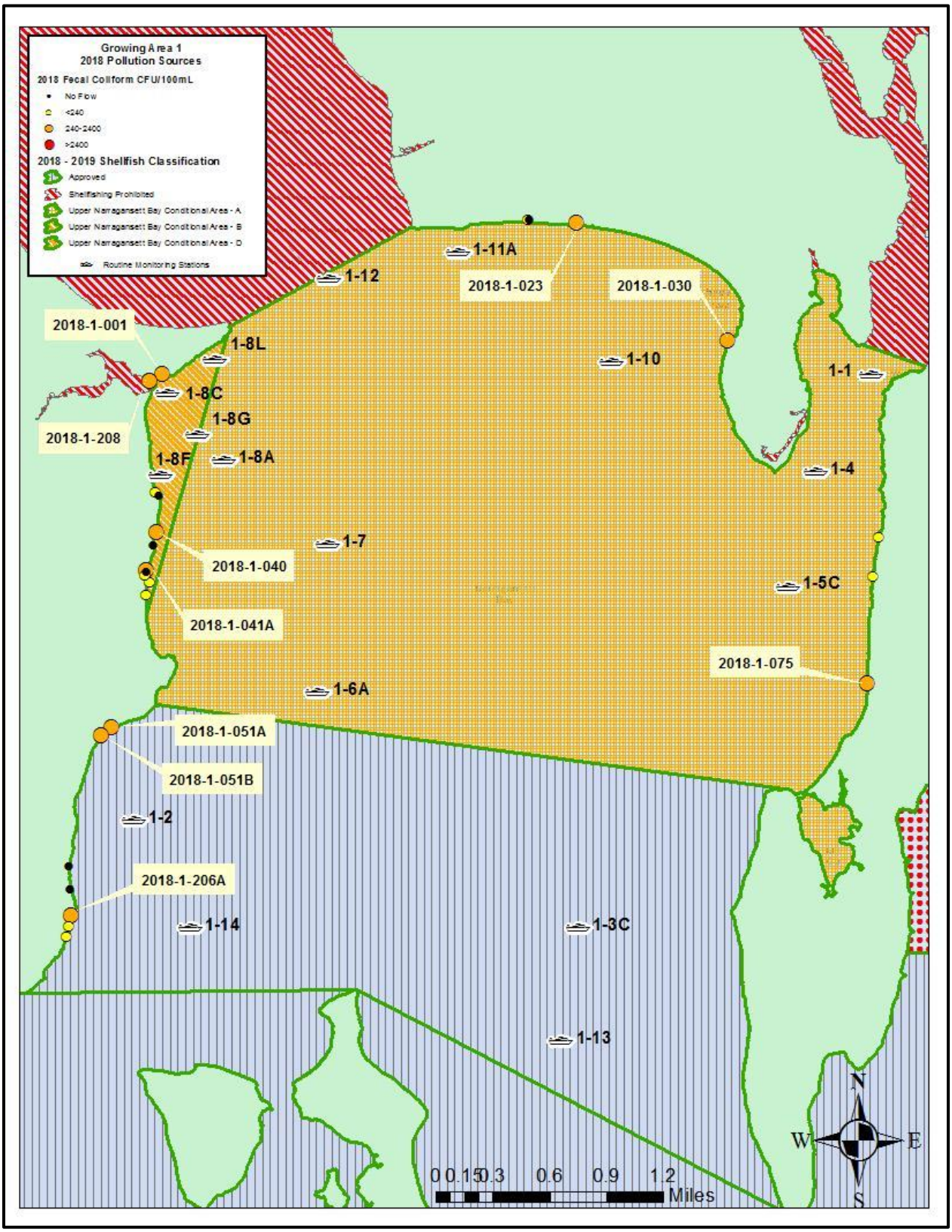


Table 2: Results of 2018 shoreline survey of potential sources in GA1

Source ID	Date Visited	Lat	Long	Description	Receiving Waters Classification	Act/Pot	Dir/Ind	2009 Results MPN FC/100ml	2012 Results mTEC cfu/100ml	2014 Results mTEC cfu/100ml	2017 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	2018 Volumetric Flow (cfs)	2018 Follow up Samples
2018-1-001	9/20/2018	41.71385	-71.3645	Stream draining marsh reaching receiving waters	Conditionally Approved	A	D	430	29	NS	NS	>1600	10.2	9
2018-1-002	9/24/2018	41.72562	-71.32703	Western most tidal outflow drainage marsh Harrington beach	Conditionally Approved			930	102	NS	NS	No flow across beach at time of survey		
2018-1-004	9/20/2018	41.704831	-71.365128	Outlet wetland, flows through phragmites stand across sand and rock beach before reaching receiving waters	Conditionally Approved	A	D	0	0	NS	NS	16	0.1416667	
2018-1-003	9/20/2018	41.704591	-71.364855	Dry	Conditionally Approved	P	D	750	610	NS	NS	NF		
2018-1-022	9/24/2018	41.72561	-71.3271	Outlet Marsh 2ft x 2 inch	Conditionally Approved	A	D	230	0	NS	NS	24	0.05678	
2018-1-023	9/24/2018	41.72536	-71.3222	Out Marsh 1ft x .5 inch	Conditionally Approved	A	D	1100	130	NS	NS	700	0.2125	
2018-1-030	9/24/2018	41.71632	-71.3068	18 inch RCP-orange iron slime in outflow	Conditionally Approved	A	D	430	933	NS	NS	540	Trickle	
2018-1-040	9/20/2018	41.70177	-71.3651	Stream-flows thru phragmites stand	Conditionally Approved	A	D	460	754	NS	NS	820	0.0354167	400
2018-1-041	9/20/2018	41.70079	-71.3654	Stream-dry	Conditionally Approved			930	140	NS	NS	NF	NF	13
2018-1-041IS	9/20/2018	41.69879	-71.3661	dry	Conditionally Approved			23	0	NS	NS	NF	NF	
2018-1-044	9/20/2018	41.69704	-71.3661	Stream-Not reaching receiving waters at time of survey but appears to flood frequently and reach the receiving waters.	Conditionally Approved	P	D	1500	0	NS	NS	80	Trickle	
2018-1-051A	9/20/2018	41.68684	-71.3697	Stream draining marsh reaching receiving waters	Approved	A	D	240	0	NS	NS	>1600	0.0708333	240

Source ID	Date Visited	Lat	Long	Description	Receiving Waters Classification	Act/Pot	Dir/Ind	2009 Results MPN FC/100ml	2012 Results mTEC cfu/100ml	2014 Results mTEC cfu/100ml	2017 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	2018 Volumetric Flow (cfs)	2018 Follow up Samples
2018-1-060	9/24/2018	41.70126	-71.2914	24 cmo 1 gal 2 sec	Conditionally Approved	A	D	230	0	NS	NS	46	0.0354167	
2018-1-070	9/24/2018	41.69827	-71.292	Stream-not reaching high tide line	Conditionally Approved	P	D	460	160	NS	NS	130	Trickle	
2018-1-075	9/24/2018	41.69008	-71.2927	36" CMP-not reaching receiving waters, possibly reaching at high tide	Conditionally Approved	P	D	460	260	NS	NS	>1600	0.0044143	
2018-1-202	9/20/2018	41.67096	-71.3743	24" RCP completely covered in plants. Flow is seeping out of rocks and flowing across beach with steady flow and reaching receiving waters. Green algae within streambed.	Approved	A	D	24001	0	3	21	80	Trickle	
2018-1-206	9/20/2018	41.67457	-71.3739	Pipe not flowing but appears to have been recently	Approved	P	D	2	NS	NS	1150	NS	NF	
2018-1-207	9/20/2018	41.67632	-71.3741	Too little to sample- not reaching receiving waters	Approved	P	I	4300	12	NF	450	NS		
2018-1-208	9/20/2018	41.713297	-71.365772	Buckeye brook	Conditionally Approved	A	D	23	0	NS	NS	1300	133.875	27
2018-1-208IS	9/20/2018	41.713297	-71.365772	Instream	Conditionally Approved			NS	NS	NS	NS	450	133.875	74
2018-1-041A	9/20/2018	41.698879	-71.366189	Stream draining through phragmites and eroded marsh	Conditionally Approved	A	D	930	NS	NS	NS	520	Trickle	
2018-1-041B	9/20/2018	41.698531	-71.366214	12" CPP storm drain within cement wall. Pipe half filled with water	Conditionally Approved	A	D	23	NS	NS	NS	<2	0.2125	
2018-1-043	9/20/2018	41.697993	-71.365801	12" RCP draining onto beach. Lots of green algae in pipe and stream bed	Conditionally Approved	A	D	2	0	NS	NS	13	0.2125	
2018-1-051B	9/20/2018	41.686222	.-71.370731	Spring at edge of beach pooling along sand above high tide line. Some is seeping towards receiving waters. Orange/brown goo growing in water.	Approved	P	D	NS	NS	NS	NS	580	Trickle	11
2018-1-206A	9/20/2018	41.672476	-71.373799	RCP from storm drain, doesn't reach receiving waters	Approved	P	D	2	NS	NS	NS	940	7s/125ml	
2018-1-211	9/20/2018	41.671708	-71.374115	PVC pipe draining. Have sampled before. Draining pipe full force.	Approved	A	D	NS	NS	NS	NS	<2	dd	

Source 2018-1-001 is a stream that flows into Buckeye Brook at Old Mill Creek just before it flows into Upper Narragansett Bay. When this source was initially visited on September 20th, 2018 this source had a result of >1,600 cfu/100ml. When revisited for follow ups on 1/10/2019 this source had a result of 9 cfu/100ml. RI DEM, RI DOT and the City of Warwick are taking remedial actions to trace and repair leaking sewer lines in the Buckeye Brook and Old Mill Creek watersheds during the intervening period between samples. Shellfish program staff will continue to monitor Buckeye Brook, Old Mill Creek and this stream and the nearby receiving waters of newly created Conditional Area 1D during 2019. The area will also be revisited in the next 12-year survey in 2021.

Source 2018-1-023 is an outlet from an upland tidal marsh into the Barrington Beach area at the northern shoreline of Area "A". Previous results in 2012 for this source were 130 CFU/100ml with minimal flow. There are no anthropogenic influences upstream from this tidal marsh and most likely the slightly elevated bacteria counts are due to the nature of tidal marshes as wildlife and waterfowl habitat. This source should be monitored for evaluation of impacts to the GA during dry weather but at this time do not appear to be having an adverse impact on the growing area. Offshore sampling station GA1-11A with the most recent statistical analysis resulting in a geo-mean of 3.9 CFU/100ml and a 90th percentile of 6.7 CFU/100ml well within program compliance.

Source 2018-1-030 is an 18-inch concrete pipe, that had a result of 540 CFU/100mL, but the very minimal flow (trickle flow) of this source dissipates into the sand and vegetation along the shoreline and is of limited concern, and no change in classification is needed.

Source 2018-1-040 is a stream located approximately 15 ft from the end of Grove Avenue and discharges into Area 1D. This stream flows through *Phragmites* and over a small portion of sand to the receiving waters which are classified as conditionally approved. This source had elevated bacteria results (820 cfu/100ml) on 9/20/2018, but flow rate was low (0.03 cfs). This source was sampled following a rain event (two days after 0.53" rain at TF Green Airport). A follow-up sample in dry weather conditions indicated a bacteria concentration of 400 cfu/100ml, with flow reduced to a trickle. The relatively low bacteria counts and low flows would indicate that this source is not negatively impacting the receiving waters.

One of the higher sources during this triennial survey was 2018-1-051A, which initially had results of >1,600 cfu/100ml. This source is a stream draining a small pond and marsh area and has a flow that was estimated at 0.07 cfs on 9/20/2018 2 days after a half inch rain event. This source was followed-up under dry weather conditions and the results decreased to 240 cfu/100ml. Given the flow is very minimal even during wet weather, this source is of limited concern for the growing area water quality.

Source 2018-1-075 is a 36-inch corrugated plastic pipe that had a result of >1,600 cfu/100ml during a period of extended wet weather (5 days after 0.52" and 10 days after 1.46"). This source was then resampled during dry weather with a follow up result of 12 cfu/100ml. This source's minimal flow rate of approximately 125ml per one second (0.004 cfs) even during wet weather along with the fact that the flow does not reach the receiving waters indicate that this source does not appear to be impacting the receiving waters during open conditions.

Buckeye Brook, source 2018-1-208 flows into upper Narragansett bay between Mill Cove Rd and S Shore Avenue in Warwick, RI. This source had a result of 1300 cfu/100ml when sampled for this triennial, as well as an in-stream sample of 450 cfu/100ml taken in the tidal waters of Old Mill Creek. All of Old Mill Creek, including the site of sample collection is classified as 'Prohibited' for shellfish harvest. The freshwater portion of Buckeye Brook has a flow rate of approximately 2 – 4 cubic feet per second (USGS). This source has since been followed up on with a great reduction in bacteria levels both at the source (27 cfu/100ml), and in-stream samples (74 cfu/100ml; in Prohibited waters). DEM, DOT, and the Warwick Sewer Authority are continuing their efforts to address the upstream source(s) of the higher bacteria levels. Refer to further discussion of this source and its impacts to the newly created conditional area "D" within this report.

Source 2018-1-041A is the next source with slightly elevated bacteria levels. At the time of this triennial survey, this source had results of 520 cfu/100ml during wet weather conditions (2 days after 0.52" rain). This source was resampled when follow ups were being conducted during dry weather and resulted in a decreased bacteria level to 13 cfu/100ml. In both sampling events the flows from this source were minimal and therefore not impacting the receiving waters. No reclassification is necessary based on this source.

Source 2018-1-051B is a spring flowing through the sand at the edge of the beach, above the high tide mark. This source had a result of 580 cfu/100ml during wet weather conditions (2 days after 0.52" rain). When resampled during dry weather follow up sampling this source had a result of 11 cfu/100ml. No reclassification is necessary based on this source as it is not reaching the receiving waters of growing area 1B.

The final source that had elevated results during this triennial survey was 2018-1-206A. This source is a concrete pipe that empties a storm drain, it had a result of 940 cfu/100ml. This sources flow is extremely low, estimated at 125ml in 7 seconds (0.0006 cfs), and does not reach the upper bay receiving waters. This source is not impacting the receiving waters.

5. Wastewater Treatment Facilities (WWTF)

There are currently no wastewater treatment facilities that discharge directly to this growing area, however several existing plants discharge into the Providence and Warren rivers upstream of this area and have an indirect impact on the water quality of the upper bay.

On the Providence River, three facilities have permitted discharges, the Narragansett Bay Commission's (NBC) Fields Point and Bucklin Point facilities and the city of East Providence's wastewater treatment facility.

The Fields Point facility is permitted to discharge a maximum of 77 million gallons per day (MGD) of flow to secondary treatment. In 2018 average flow was 50.7 MGD. The Bucklin

Point facility is permitted to discharge 31 MGD and averaged 22 MGD also below permit limits. Neither plant reported any fecal violations in 2018.

The East Providence facility is permitted to discharge 14.2 MGD and the average discharges for 2018 were 7.9 MGD well within permit limits. No fecal coliform or flow violations were reported by this facility.

The Warren wastewater treatment facility discharges to the Warren River which is a tributary to this growing area and has a permit limit of 3.43 MGD. In 2018 the monthly average flow was 2.26 MGD which is within permit limits. Warren's permit has changed, and they no longer have a permitted fecal coliform maximum. Reporting criteria has now changed to Enterococci. There were four reported Enterococci violations from the plant in 2018.

The confluence of the Pawtuxet River and Narragansett Bay is approximately three miles north of this growing area. Three treatment facilities have permitted discharges to the Pawtuxet River, and as a result the Pawtuxet is a potential source of pollution to Narragansett Bay and this growing area. Cranston, Warwick and West Warwick all operate wastewater treatment facilities that discharge effluent. West Warwick's permitted flow of 10.5 MGD was not exceeded with average flows equal to 6.5 MGD. However, West Warwick reported two fecal coliform violations in early 2018. A January 2018 violation of 687 cfu/100ml, and a March 2018 violation of 2420 cfu/100ml were reported in excess of their permit value 400 cfu/100ml. Cranston had no reported violations for 2018 and average flows were 9.8 MGD. The city recently completed a major upgrade to the plant to add tertiary treatment to the system for biological nutrient removal. Warwick's average monthly flow was 5.3 MGD, well below the permitted flow of 7.7 MGD. The Warwick WWTF also reported a single fecal coliform violation in May 2018 (a reading of 4,899 cfu/100ml which exceeded their permit value of 400 cfu/100ml).

The northern waters of GA1, Upper Narragansett Bay are conditionally managed with routine closures instituted following specific precipitation events as outlined in the Conditional Area Management Plan (CAMP). Additional historical routine closures based on upstream wastewater treatment facility bypasses of wet weather effluent are also included in the current CAMP. The two NBC facilities in the Seekonk and Providence Rivers, Bucklin Point and Fields Point respectfully have completed extensive upgrades to treatment methods and have also constructed major combined sewer overflow abatement projects since these historic routine closure triggers were implemented. Beginning in 2018 the shellfish program began a reassessment of the potential impacts these WWTF may have on the downstream waters of the Upper Narragansett Bay with the goal of eliminating or reducing the specific trigger conditions that cause routine wet weather closures. This analytical report is not contained in this document but rather is a standalone document entitled "Classification of Shellfish Growing Waters of the Upper Narragansett Bay Adjacent to Waste Water Treatment Facilities" and is housed in the program's permanent files, available for review upon request. Once this analysis is completed the CAMP will be modified to incorporate these changes to the routine wet weather closure triggers for the conditionally approved portions of the growing area.

6. Water Quality Studies

These conditionally approved waters are potentially impacted by point sources, whether they are stormwater outfalls or waste water treatment plant discharges. Any growing area in the conditionally approved classification shall meet the requirements for an approved area

classification when the conditionally approved classification is in the open status. In "Approved" waters that are affected by point sources the 90th percentile standard is not used, but rather a standard of not more than 10 percent of the samples shall exceed a 49 MPN per 100 ml for a three-tube decimal dilution test and 31 CFU per 100 ml for a MF (mTEC) test. Samples are collected monthly when the areas are open and the most recent 15 samples are evaluated in January upon completion of the annual sampling.

In July of 2012 the RIDOH converted from the MPN multi tube fermentation process to the mTEC membrane filtration method for analyzing shellfish water samples. The protocol for collecting and storing samples is the same as it is for the MPN 3 tube method, however the mTEC method allows for an extended holding period, 30 hours versus 6 hours. The mTEC membrane filtration method as described in Standard Methods for the Examination of Saltwater and Shellfish is now used to analyze these samples. The data is compiled and reviewed according to NSSP requirements stating that at least the most recent 15 data sets be used. All routine monitoring samples used in the statistical analysis were processed using the mTEC method.

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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

7. Annual Statistical Summary GA1 Upper Narragansett Bay

HIGHLIGHTS

Upper Bay - Area A

* Area A sampled 24X (9X while in open status and 15X while in closed status) during 2018.
* Statistics represent most recent data collected 7/10/2017 or 9/18/2017 to 12/19/2018 (n = 15) for Area A.
* All conditionally approved areas in compliance when open.
* Data run 12/28/2018.

Upper Bay – southern section (former Area B)

* Improvements in water quality resulted in a change in classification of the southern portion of the Upper Bay (formerly known as Area B) from conditionally approved to approved on May 27, 2017.
* Area B sampled 14X during 2018 (8 wet and 6 dry weather).
* Statistics for stations 1-2, 1-3C, 1-13 and 1-14 in the southern part of the Upper Bay (former Conditional Area B) calculated with the blended procedure recommended by NSSP guidance for the transition from conditionally approved to approved waters.
* Statistics for stations 1-2, 1-3C, 1-13 and 1-14 represent recent data collected from 11/17/2016 to 5/18/2017 when the area was in the open status (n = 6 or 7) and from 6/28/2017 to 10/31/2018 (n = 23 or 24).
* All approved stations in area in compliance.
* Data run 12/28/2018.

COMMENTARY

Upper Narragansett Bay Area A (Growing Area 1A) was sampled twenty-four times during 2018 under a variety of weather conditions. The autumn of 2018 was extremely wet, with 24.4" of rain, compared to a long-term average of 12.4", falling between September 1 and November 30, 2018. The frequent and large rainstorms during autumn 2018 (six rainstorms of greater than 1"; three storms of ~2" or greater and a 3.17: storm) resulted in frequent closure of Upper Bay GA1A. Area A was closed 11.5 of 20 work days (58%) during September; 18 of 23 working days (78%) during October and 22 of 22 weekdays (100%) during November 2018. Upper Bay Area A was closed 79% of the weekdays (51.5 of 65 days) during October and November 2018. The frequent autumn rainfall closures resulted in only nine of the 24 samples collected in Upper Bay Area A during 2018 being collected while in the open status. The remaining 15 sets of sampled collected while the area was closed were used to characterize the response of water column fecal coliform to wet weather after upgrades in wastewater treatment and storm water control in the Providence area. The 2018 statistical review demonstrated that all conditionally approved station in Upper Bay Area A met fecal coliform water quality criteria while the area was in the open status (less than 1.2" of rain; 7-day closure) and that the area is properly classified

Upgrades of waste water treatment and storm water facilities in the Providence area resulted in improved water quality and a change in the classification of the southern portion of the Upper Bay (formerly known as 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 B) was sampled 14 times (8 wet weather and 6 dry weather) during 2018, exceeding minimum sampling requirements for approved areas. While 2018 was a wetter than normal year (2018 had ~62" of rain at TF Green (PVD) Airport compared to a long-term average of ~47" of rain per year), all stations in the southern portion of the Upper Bay met criteria for approved waters. The 2018 statistical summary demonstrated that the southern portion of the Upper Bay (former Area B) is properly classified as Approved.

Area 1D was created in 2018 as the result of an initial SSO and then subsequent wet weather events that limited recovery of fecal coliform concentration in the growing area. Area 1D was sampled 24 times during August 2018 to January 2019 to characterize the area's wet weather response. This included 4 to 8 sampling events (dependent on station) under open conditions of the newly-created 0.8" rain trigger and 18 sets of samples under closed conditions (greater than 0.8" rain in prior 7 days). DEM Shellfish staff will continue to monitor the area as upstream sources are investigated and remediated.

RECOMMENDATIONS

* All conditionally approved stations in compliance and conformance when open.
* All approved stations in compliance.
* Continue additional wet weather sampling to track fecal coliform concentration response to rain and to monitor effects of upgrades in waste water and storm water treatment on Upper Bay water quality.
* Continue monitoring to evaluate the need for the 0.8" rain closure trigger in Area 1D as upstream sources are remediated.

Table 3: Growing Area 1 2018 statistical update

RIDEM SHELLFISH GROWING AREA MONITORING: GA1

Upper Bay Area A when open (7/10/17 or 9/18/2017 to 12/19/2018; all mTEC)

FECAL-GEO

Station Name	*Status*	*N*	*MEAN*	*%>CRITICAL 31 cfu/100 ml*
GA1-1	CA	15	3.0	0.0
GA1-4	CA	15	2.3	0.0
GA1-5C	CA	15	2.0	0.0
GA1-6A	CA	15	2.7	0.0
GA1-7	CA	15	2.7	0.0
GA1-8A	CA	15	2.2	0.0
GA1-10	CA	15	3.0	6.7
GA1-11A	CA	15	3.9	6.7
GA1-12	CA	15	3.9	6.7

Upper Bay (former Area B; 11/17/2016 to 10/31/2018; all mTEC)

FECAL-GEO

Station Name	*Status*	*N*	*MEAN*	*90th Percentile (<31)*	*Weather*
GA1-2	A	30	3.1	9.5	15 wet, 15 dry
GA1-3C	A	30	3.5	16.0	14 wet, 16 dry
GA1-13	A	30	3.0	13.4	14 wet, 16 dry
GA1-14	A	30	2.9	10.2	15 wet, 15dry

Upper Bay, Area 1D (when open at 0.8" rain trigger, 8/31/2018 to 3/5/2019; all Mtec; number of samples <15, statistics shown for informational purposes only)

FECAL-GEO

Station Name	*Status*	*N*	*MEAN*	*%>CRITICAL 31 cfu/100 ml*
GA1-8C	CA	8	5.9	0.0
GA1-8F	CA	7	2.7	0.0
GA1-8G	CA	8	2.5	0.0
GA1-8L	CA	4	3.8	0.0

8. Conclusions and Recommendations

The triennial update for the Upper Narragansett Bay Growing Area 1 involved the review of sources identified in the 2012 triennial update. As indicated in **Table 2** these sources either exhibit relatively low fecal counts for higher flows or have very low flows for slightly elevated fecal counts and would therefore are not impacting the growing area. As of early 2019 the RI DEM is continuing to monitor fecal coliform levels in Buckeye Brook and the newly-created "Area 1D" in the western side of Upper Bay GA1.

A review of the current GA1 Management Plan was conducted to ensure compliance and accurate representation of current procedures related to the operation and management of GA1. This assessment indicated no significant deviations from the GA1 management plan. The sources identified and sampled as part of the 2018 triennial update of GA 1 indicated that the impact of the sources on the water quality of Upper Narragansett Bay GA1 was minimal and that no changes in the growing area classification are recommended. The Conditional Area Management Plan (CAMP) for the Upper Bay (GA1) will be revised to incorporate the creation of Area 1D and to reflect the conditional management changes (0.8" rain threshold) associated with newly created Conditional Area 1D and the recommendations for revised treatment plant bypass triggers as warranted in the previously referenced analytical report.

GA 2 Annual Update: Barrington, Palmer and Warren Rivers

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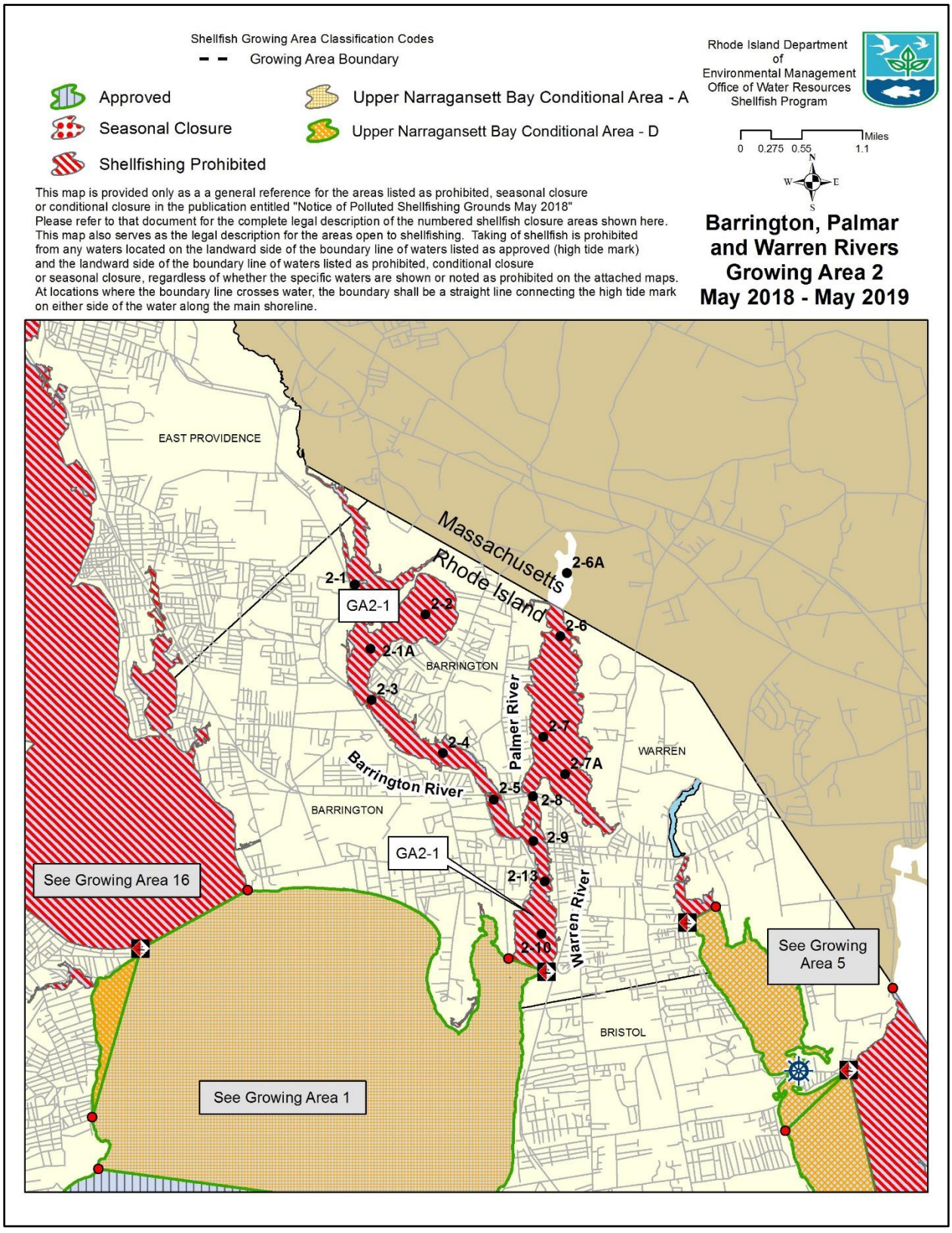
A. Introduction

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 (Figure 1), are currently classified as prohibited to shellfishing. The area was sampled two (2) times during 2017 (both during wet weather) and the area was sampled five (5) times during 2018 (1 dry weather, 4 wet weather). Results from recent sampling and statistical evaluation indicate that based on the most recent 30 samples collected under all weather conditions ('Approved' status scenario), four (4) of fourteen (14) stations (~29%) are in compliance. Under a 'Conditionally Approved' scenario with a 0.5" rainfall closure trigger, eight (8) of fourteen (14) stations (~57%) 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, 2-3, 2-4 in the Barrington River and station 2-7 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: 2017-2018 classification map and 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.

Major accomplishments through the above-mentioned efforts have resulted in completion of several agricultural BMPs having been implemented in the upstream watershed. These mitigation efforts should reduce bacteria loadings to the watershed and result in improved water quality. Efforts will be made to sample the growing area more frequently during 2019 to document these results with the goal of re-classifying some of this growing area.

B. Waste water Treatment Plants

Growing Area 2 is within the receiving waters of the Warren Waste Water Treatment Facility; 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. 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. Estimated construction completion is set for 2019. 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 has 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".

C. Annual Statistical Analysis 2018

HIGHLIGHTS

* Sampled 5X during 2018.
* Area is currently classified as prohibited, statistics calculated for informational purposes only, not for compliance.
* Statistics represent recent 30 combined wet and dry weather data 9/22/2008 to 10/18/2018, 17 wet weather and 13 dry weather samples; 11 MPN and 19 mTEC samples.
* Statistics also calculated for recent 15 samples collected during dry weather only (<0.5" rain in prior 7 days) during (9/22/2008 to 5/19/2018); 9 mTEC and 6 MPN.
* Data run 11/7/2018.

COMMENTARY

The Barrington, Palmer and Warren Rivers (Growing Area 2) were sampled five times during 2018 (1 dry weather, 4 wet weather). The stations in the Barrington River (stations 1-5) and the Palmer River (stations 6-8) were downgraded from conditionally approved to prohibited 15 years ago 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. Although this area is prohibited for the harvest of shellfish, compliance statistics were run under two scenarios: approved (recent 30 observations) and conditionally approved (recent 15 observations during dry weather). Only four stations (stations 2-5, 2-9, 2-10, 2-13) located in the southern-most Barrington River and in the Warren River met compliance criteria under the approved scenario. These stations are located in marina areas and adjacent to a WWTP outfall which keeps the area classified as prohibited to shellfishing. Under dry weather conditions (less than 0.5" rain in prior 7 days), 8 of 14 stations meet criteria, but these stations are located in the lower Barrington and Warren Rivers (marina and WWTP area) or are surrounded by areas that do not meet water quality criteria (examples: stations 2-3 and 2-4 in the Barrington River and station 2-2 in 100-Acre Cove). Up-river stations (1 and 1A in the Barrington River and stations 6 and 6A in the Palmer River) are also out of compliance during dry weather. TMDL work in RI and MA portions of the watershed continue 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' to shellfish harvest.

RECOMMENDATIONS

* Maintain closure of the Barrington River and Hundred Acre Cove.
* Maintain closure of the Palmer River.
* Complete six (6) systematic random sampling trips per year to support TMDL efforts and to track water quality changes.

Table 1: 2018 Statistical Summary for GA2

RIDEM SHELLFISH GROWING AREA MONITORING: GA2

Approved scenario: recent 30 all weather
(9/22/2008 to 10/18/18; 17 wet and 13 dry weather; 11 MPN / 19 mTEC)

			FECAL-GEO	
Station Name	Status	N	MEAN	90th Percentile (<31cfu/100 ml)
GA2-1	P	30	42.9	438.7
GA2-1A	P	30	14.5	188.6
GA2-2	P	30	7.2	71.9
GA2-3	P	30	9.8	84.2
GA2-4	P	30	6.7	47.7
GA2-5	P	30	6.0	37.5
GA2-6	P	30	60.9	837.0
GA2-6A	P	30	163.6	1,735.0
GA2-7	P	30	10.9	99.0
GA2-7A	P	30	13.4	154.6
GA2-8	P	30	7.3	47.3
GA2-9	P	30	6.1	30.7
GA2-10	P	30	4.7	23.4
GA2-13	P	30	4.5	18.5

Conditionally Approved scenario: recent 15 dry weather (<0.5" rain prior 7 days) only
(8/25/2008 to 9/13/2016; 9 mTEC, 6 mpn)

			FECAL-GEO	
Station Name	Status	N	MEAN	%>CRITICAL 31 cfu/100 ml
GA2-1	P	15	23.0	46.7
GA2-1A	P	15	7.2	26.7
GA2-2	P	15	4.3	6.7
GA2-3	P	15	5.1	6.7
GA2-4	P	15	4.4	0.0
GA2-5	P	15	5.0	13.3
GA2-6	P	15	25.7	33.3
GA2-6A	P	15	116.2	86.7
GA2-7	P	15	6.0	6.7
GA2-7A	P	15	9.1	20.0
GA2-8	P	15	7.2	0.0
GA2-9	P	15	5.1	6.7
GA2-10	P	15	3.5	6.7
GA2-13	P	15	5.0	6.7

GA 3 Annual Update: East Middle Bay

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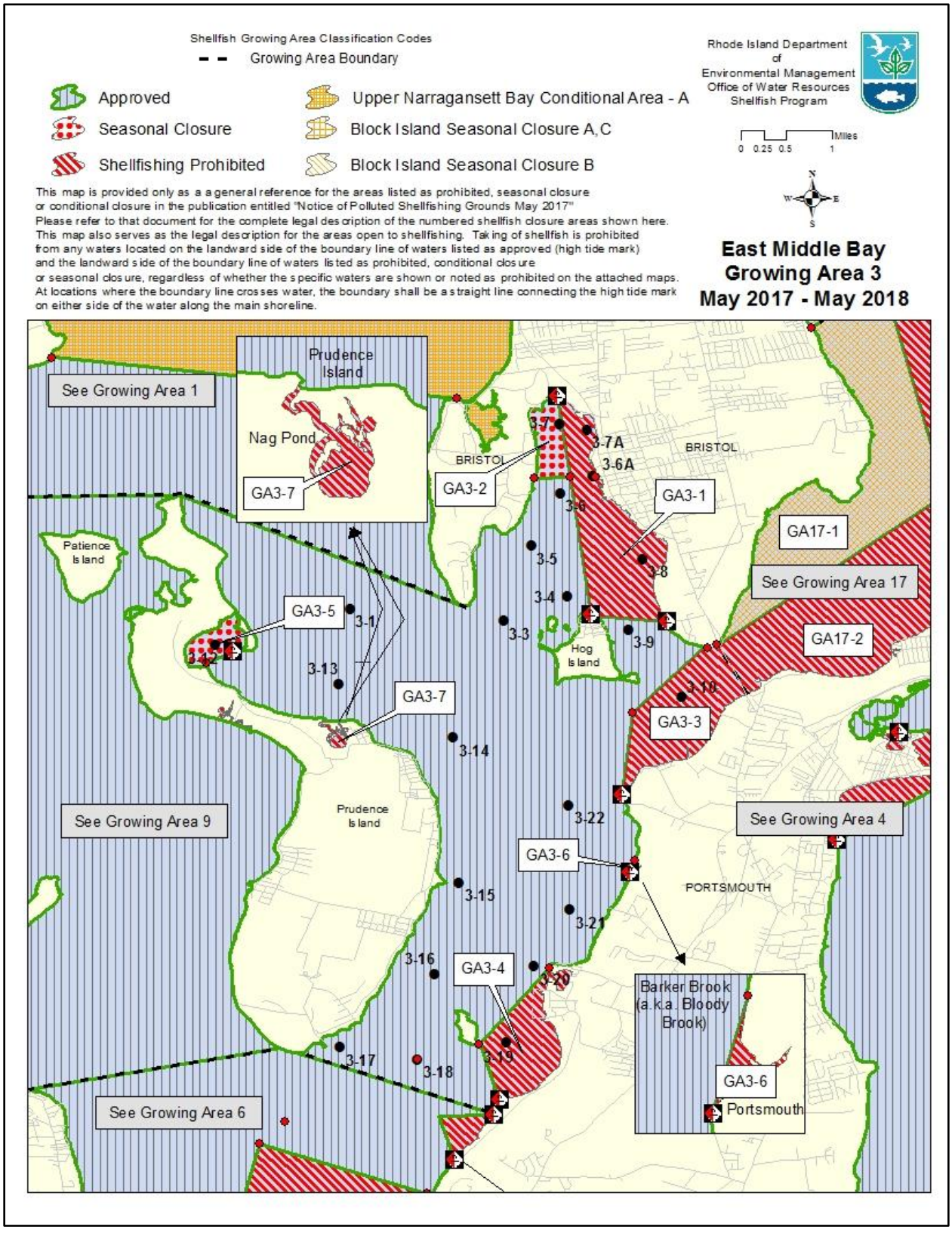
A. Introduction

A 12-year sanitary shoreline survey of the East Middle Bay Growing Area 3 (Figure 1) was conducted in 2010 and a Triennial Update was performed in 2016. A total of sixty-one (61) actual or potential sources were identified during the 2010 shoreline survey, excluding marinas. 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, eight (8) sources exceeded the 240 MPN/100ml threshold and six (6) of those eight (8) sources were located in approved waters, which required a follow-up sampling in 2016. Only one of the sources was actively flowing when resampled (2016-3-039) and remained with levels above 240 MPN/100ml but had a significantly decreased Fecal coliform (FC) result from the 2010 sampling.

During the 2017 annual shoreline survey a total of eight (8) sources were visited and of those one (1) source did not have any flow and one (1) was not found. The remaining six (6) sources had bacteria levels < 2,400 cfu/100 ml, which did not require any follow-up sampling. Two (2) of the sources (3-201 and 3-209) had bacteria levels above 240 cfu/100 ml, which will require follow-up sampling during the 2019 shoreline survey. Source 3-201 if it were discharging to the bay it would be into prohibited waters, however both sources with elevated bacteria levels were

not discharging into the bay, the sources ending and dissipating into the beach above the high tide line, and thus not impacting the growing area.

Figure 1: GA3 Classification map with water quality monitoring stations.



B. 2018 Shoreline Survey

During the 2018 shoreline survey two (2) sources which had bacteria levels above 240 cfu/100 ml in the 2017 survey were re-sampled. Source 3-201, a 2' by 3" deep stream flowing under a railroad trestle bridge) was sampled on 10/15/2018. On that date, source 3-201 had a fecal coliform reading of 440 cfu/100 ml and the stream was flowing at approximately 1 cubic foot per second. However, the stream flow was dissipating into a sandy beach before reaching the receiving waters of Growing Area 3. Source 3-209, a 3' wide by 1' deep stream that drains uplands in the Melville Pond area was also sampled on 10/15/2018. When sampled, the stream was flowing at approximately 3 cubic feet per second and fecal coliform was found to be 76 cfu/100 ml. Source 3-209 also dissipated into the sand/gravel beach above the high tide line before reaching the receiving waters of Growing Area 3 also not impacting GA3 waters..

Figure 2: Sources 3-201 (left) and source 3-209 (right) on 10/16/2019.

A comprehensive shoreline survey of Hog Island was also completed during 2018 (survey dates were 6/21/2018 and 8/1/2018). Hog Island is a small island (190 acres) located near the mouth of Bristol Harbor. Hog Island has no year-round residents and has no distributed electrical power system. Hog Island has approximately 50 small residences that are occupied primarily in the summer months. Seven (7) sources were identified in the shoreline survey of Hog Island. Of these, one (1) source, 2018-3-303, had a fecal coliform value of greater than 240 cfu/100 ml. Source 2018-3-303 is a small tidal creek (1' wide by ½ inch deep stream with a flow of approximately 0.01 cfs on 6/21/2018) that drains a saltmarsh and enters a shallow (3-5' depth) cove in Growing Area 3. On 6/21/18, fecal coliform in this small stream were observed at 1,600 cfu/100 ml and instream sampling at the shoreline of the shallow cove revealed an instream fecal coliform result of 100 cfu/100 ml. An oyster aquaculture lease (lease # 2016-06-047) is located in the shallow cove on the western side of Hog Island, approximately 500 feet from source 2018-3-303. Follow-up sampling of source 2018-3-303 on 8/1/2018 showed that fecal coliform at the stream mouth had declined to <2 cfu/100 ml and two (2) samples collected by boat at the nearby aquaculture lease were also <2 cfu/100 ml. Although fecal coliform results were slightly elevated, in stream results indicated that this source is not impacting the waters of GA3.

Table 1: Results of Hog Island shoreline survey conducted 6/21/18 and 8/1/18.

GA3 East Middle Bay Hog Island Survey													
Source ID	Latitude 41.xxxxx° (Decimal Degrees)	Longitude 71.xxxx° (Decimal Degrees)	Description and Location	Receiving Waters Classification	Act/ Pot	Dir/ Indir	Results	Flow (___ per sec.)	Source Dimensions (Width or Dia. X Stage)	Time	Picture	Date Visited/ Sampled	Sampler
2018-3-060	41.6383	-71.2809	Stream draining saltwater marsh on south side of Hog Island	Open	A	D	36	1 ft in 4sec	2'x2" deep	934	3,4	6/21/2018	AGW
201-3-060IS			Instream-5 feet from shore		A	D	100			932	1,2	6/21/2018	AGW
2018-3-302	41.6424	-71.2854	Stream draining upland marsh. Drains into cove near aquaculture site. Hog Island		A	D	<2	1 ft in 5 sec	2'x1" deep	1017	5,6,7	6/21/2018	AGW
2018-3-302IS			Instream- 300 ft from aquaculture		A	D	100, <2			1019		6/21/2018	AGW
2018-3-303	41.6434	-71.2839	Stream draining upland marsh. Receiving waters near aquaculture farm. Hog Island		A	D	1600	1 ft in 3 sec	1'x0.5" deep	1027	8,9	6/21/2018	AGW
2018-3-303IS			Instream		A	D	100, <2			1030		6/21/2018	AGW
2018-3-304	41.6481	-71.2813	Groundwater seep coming from marsh-Hog Island		A	D	13	Trickle		1057	10,11,12	6/21/2018	AGW
2018-3-306	41.6384	-71.2752	Stream draining upland marsh-Hog Island		A	D	12	1 ft in 3 sec	3'x1" deep	1144	22,23,24	6/21/2018	AGW
2018-3-306ISN	41.6386	-71.2752	Instream North				180			1140		6/21/2018	AGW
2018-3-306ISS	41.6385	-71.2749	Instream South				100			1142		6/21/2018	AGW
2018-3-307 (2018-3-4A by boat)	41.645	-71.2832	Mouth of Foul Cove-Hog Island				<2					8/1/2018	AGW

Figure 3: Source 3-303 on Hog Island (6/21/2018)

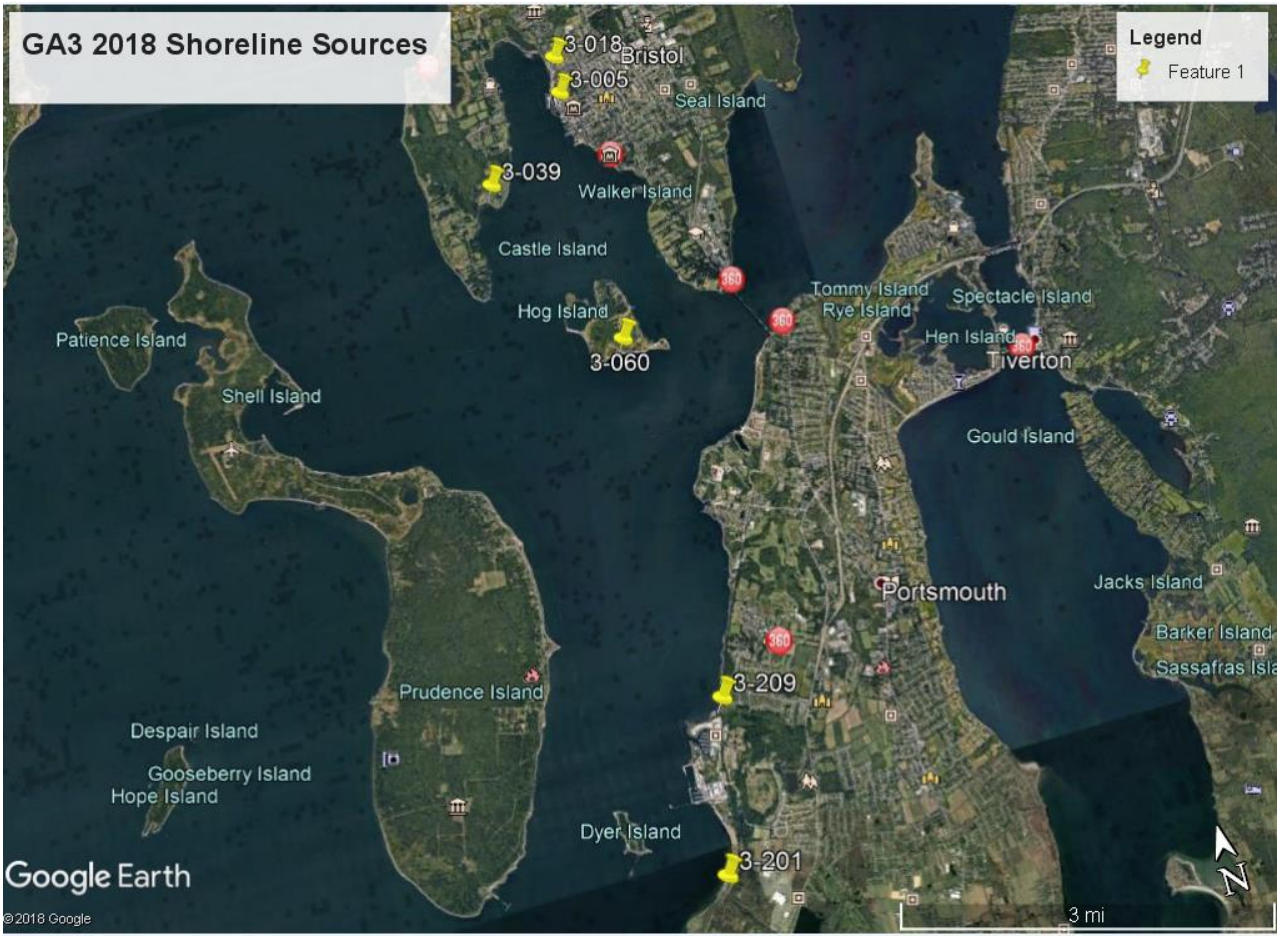


Figure 4: Map of GA 3 shoreline survey sources.

Table 2: Summary of 2018 Shoreline Results for Growing Area 3 East Middle Bay

Source ID	Date visited	Lat	Long	Description	Receiving Waters Classification	Act/ Pot	Dir/ Ind	2010 Results MPN FC/100ml	2016 Results mTEC cfu/100ml	2017 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	2018 Volumetric Flow (cfs)
2018-3-018	10/15/2018	41.67652	-71.279	18" RCP outfall in rip rap wall from storm drain. Rubber sleeve attached over pipe.	Prohibited	P	D	23000	ibited - not san	NF	NF	NF
2018-3-005	9/5/2017	41.67161	-71.2798	36" diameter RCP storm drain from under condo building	Prohibited	A	D	15000	ibited - not san	CNL	---	---
2018-3-201	10/2/2017	41.57333	-71.2881	Stream at R/R trestle Burma (Defense Drive) Road. In 2017, stream was not flowing into receiving waters. Ended ~50' from shore in a "pond" on beach. Possibly seeping underneath sand.	Prohibited	A	D	4600	0	1000	440	2
2018-3-060	12/18/2017	41.63827	-71.2809	Stream draining saltwater marsh on south side of Hog Island	Approved	A	D	2400	0	100	36	1
2018-3-301	12/18/2017	41.58155	-71.3211	24" diameter RCP 50 yards north of #301	Approved	A	D	2400	0	<100		
2017-3-301IS	12/18/2017	41.58155	-71.3211	In-Stream	Approved	A	D			100		
2017-3-039	9/5/2017	41.66195	-71.2952	Stream draining wetland	Approved	A	D		500	100	220	0.25
2018-3-209	43010	41.59298	-71.2813	Stream from upland pond. In	Approved	A	D		0	800	76	3
2018-3-209IS	10/2/2017			In-stream taken at shore closest to stream	Approved	A	D			99	<100	---
2017-3-300	12/18/2017	41.58139	-71.322	Stream just north of pier 48" RCP	Approved	A	D		0	30		
2017-3-300IS	12/18/2017	41.58139	-71.322	In-Stream	Approved	A	D		0	<100		

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. There are currently four (4) pump-out facilities located within the area of Bristol Harbor: Bristol Marina Boat, Stone Harbor Marina, Rockwell Town Pier, and the Bristol Town pump-out boat. For additional information refer to the 2017 RIDEM Pump-out Facilitates Report which evaluates the area's compliance with Rhode Island's "No Discharge" policies.

To account for illicit discharges, dilution calculations were 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 are located within the prohibited waters of Bristol Harbor, in which the closure area is more than adequate to meet the fecal coliform level in the event of an accidental discharge from an occupied vessel. 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 within prohibited waters again with ample area for dilution. In addition to the slip counts for the identified marinas the numerous moorings located within Bristol harbor were included in the dilution calculations.

The shoreline survey for 2018 indicates that Growing Area 3 is properly classified and that all pollution sources have accurate dilution zones established and no additional closure areas are warranted. A seasonal closure in the northwest portion of Bristol Harbor is due to the numerous slips and moorings associated with the Bristol Marina and Yacht Club that occupy this area of Bristol Harbor only during the summer boating season.

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 August 2017.

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.

D. Wastewater Treatment Facilities

The most significant point source discharge into this growing area is from the Bristol wastewater treatment facility located in Bristol Harbor discharging to Walker Cove. The facility is permitted to discharge a maximum flow of 3.79 MGD (million gallons/day). The average daily flow for 2017 was 2.8 MGD which is well below the permit limits. 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). 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 C 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.

E. 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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 8X during 2018. (6X all stations sampled plus 2X 3-4 stations sampled as part of post-rain sampling)
* Statistics represent recent 30 combined wet (n=24) and dry (n=6) weather data 7/11/2014 to 10/11/2018 for approved stations.
* Statistics represent recent 15 combined wet (n=13) and dry (n=2) weather data when the area was open 5/14/2014 to 5/16/2018 for seasonally approved stations.
* All approved and conditionally/seasonally approved stations in compliance and conformance.
* All samples analyzed by mTEC method (90^{th} percentile criteria= 31 cfu / 100 ml).
* Data run 11/5/2018.

COMMENTARY

All stations in Growing Area 3 (East Middle Bay) were sampled 6 times during 2018, in compliance with systematic random sampling monitoring requirements for approved areas. The 2018 statistical evaluation includes the most recent 30 samples collected during both wet and dry

weather (24 wet, 6 dry weather) since 7/11/2014. Two stations in GA3 (3-7 and 3-12) are classified as seasonally approved. The statistical analysis for these stations includes the most recent 15 samples collected during wet and dry weather (13 wet and 2 dry weather) when the area was in the open status since 5/14/2014.

All approved stations met criteria during the 2018 evaluation. However, stations 3-5 and 3-6 located in the southwestern side of Bristol Harbor had recent increases in the 90th percentile variability criteria due to elevated fecal coliform observations made during the extremely rainy autumn of 2018. These stations in the approved area of Bristol Harbor will be watched for continued compliance with water quality criteria. Results of the 2018 statistical evaluation indicate that all approved and seasonally approved stations in Growing Area 3 are in compliance and that the area is properly classified.

RECOMMENDATIONS

* No action recommended based on 2018 monitoring results.

Table 3: Annual statistical summary of GA3

RIDEM SHELLFISH GROWING AREA MONITORING: GA3

Recent 30 all weather (7/11/2014 to 10/11/2018; all mTEC, 24 wet and 6 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA3-1	A	30	3.3	14.4
GA3-3	A	30	2.9	7.6
GA3-4	A	30	2.6	5.7
GA3-5	A	30	3.0	12.4
GA3-6	A	30	3.7	17.2
GA3-6A	P	30	3.9	19.7
GA3-7	SA	30	3.5	16.5
GA3-7A	P	30	4.5	32.4
GA3-8	P	30	4.8	38.5
GA3-9	A	30	2.7	8.5
GA3-10	P	30	2.6	6.7
GA3-12	SA	30	2.5	4.9
GA3-13	A	30	2.4	5.6
GA3-14	A	30	2.7	7.3
GA3-15	A	30	2.5	5.4
GA3-16	A	30	2.5	4.4
GA3-17	A	30	2.7	6.8
GA3-18	A	30	2.5	5.9
GA3-19	P	30	2.4	5.0
GA3-20	A	30	2.3	4.5
GA3-21	A	30	2.4	4.0
GA3-22	A	30	2.6	6.6

Seasonally Approved stations, recent 15 when open

(5/14/2014 to 5/16/2018, all mTEC, 13 wet and 2 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA3-7	SA	15	3.0	0
GA3-12	SA	15	2.9	0

GA 4 Annual Update: Sakonnet River

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A. Introduction

A twelve (12) year sanitary shoreline survey of Growing Area 4 the Sakonnet River (Figure 1 & 2) was conducted in 2013 and a triennial update was performed in 2016. There was a total of one hundred and sixty-seven (167) actual or potential sources 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/100ml 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/100ml, which would warrant follow-up sampling. One source (4-702) resulted in an elevated bacteria concentration (> 2400 cfu/100ml) requiring a follow-up sampling in 2014. However, at the time of the follow-up visit there was no flow coming from the pipe.

The 2016 triennial shoreline survey re-evaluated twenty-seven sources within the growing area and identified any new pollution sources. Six (6) of the twenty-seven (27) sources were located within the

"Prohibited" sections of the growing area and were not resampled in the 2016 triennial update. Twenty-one (21) sources were revisited and sampled plus an additional three new sources were identified.

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

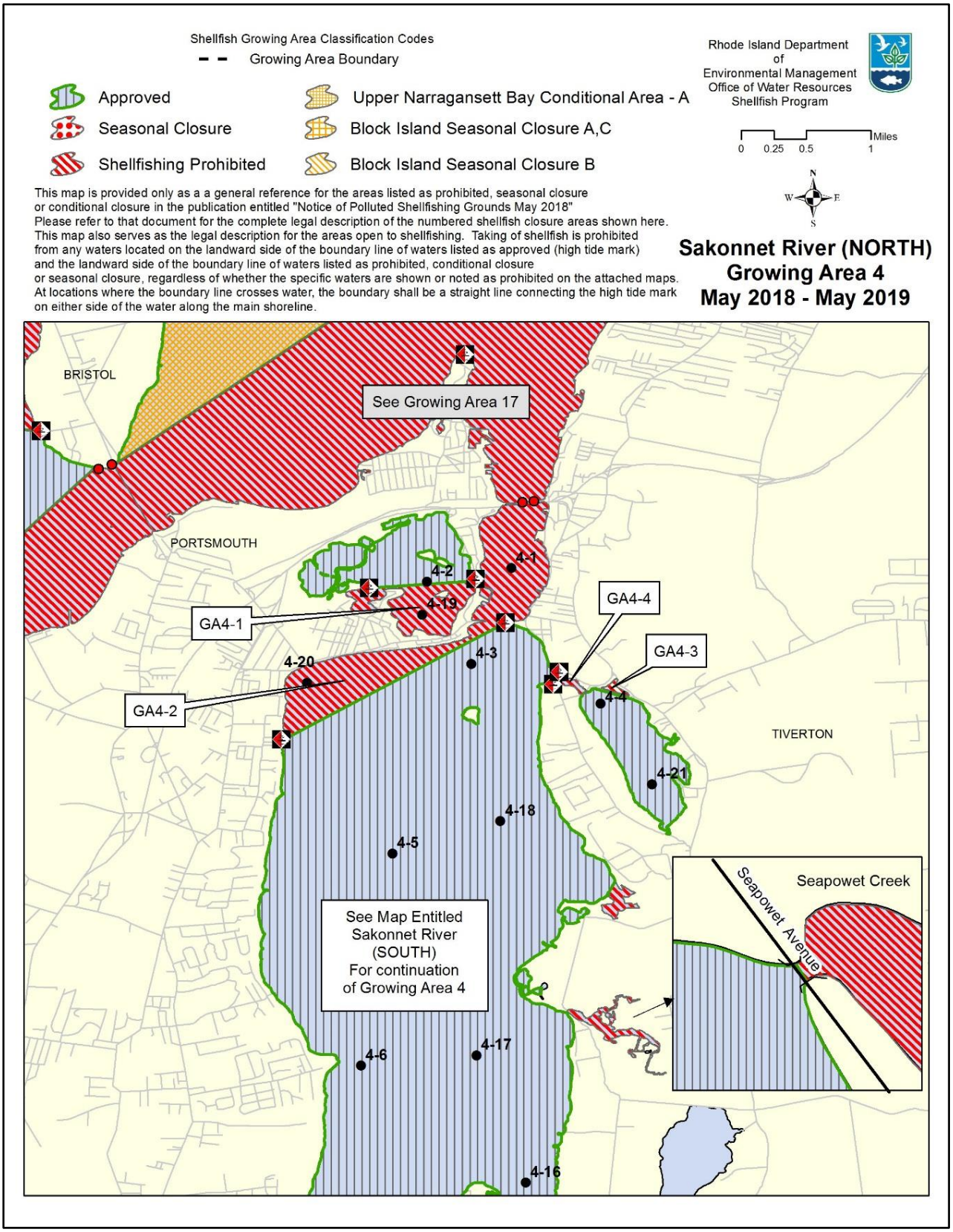
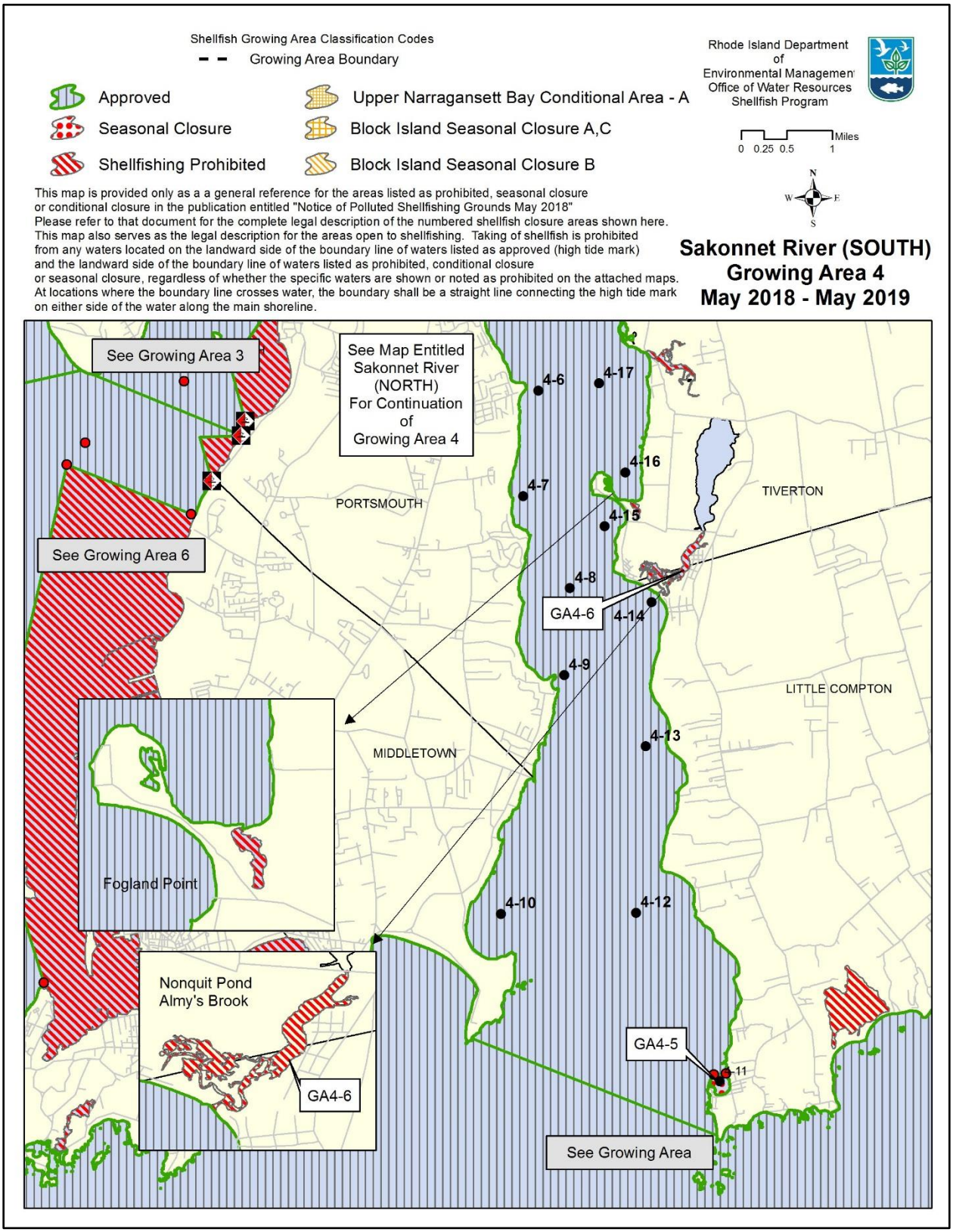


Figure 2: Growing Area 4 (South) Current Classification Map



B. 2018 Shoreline Survey

During the 2018 annual update a total of seven (7) sources were revisited. Figure 3 shows the location of all sources and Table 1 shows the fecal coliform results for sources investigated during 2018. One source (2018-4-619) was dry and was not sampled. One source had fecal coliform bacteria concentration of < 240 cfu/100 ml. (source 4-1007) and the remaining five sources had bacteria levels of 1,600 cfu/100 ml. One (1) of the sources (2018-4-540) was stagnant water that had pooled onto the beach and was not reaching or impacting the growing area. Source 2018-4-540 is an intermittent stream in the area of Second Beach in Middletown. Installation of new culverts in the connector road was completed during the spring of 2018 with the intention of improving drainage within the saltmarsh and Maidford River. Dredging and expansion of the channel was included in the proposed action plan for Sachuest Point restoration. All of these improvements will most likely affect the consistency of flow at sources 4-540 and nearby source 4-550, potentially impacting bacteria counts. In a second follow-up visit in 2018 upon the completion of the Sachuest Point restoration, the outflow at 4-540 was again pooled on the beach and not reaching the receiving waters. This source is an intermittent stream which should be followed-up during the annual shoreline surveys. Source 2018-4-710 had a bacteria count of 1,600 cfu/100ml but had only a trickling flow that would have little to no impact on 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 August 2017.

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.

Figure 3: 2018 Sakonnet River Growing Area 4 Pollution Sources

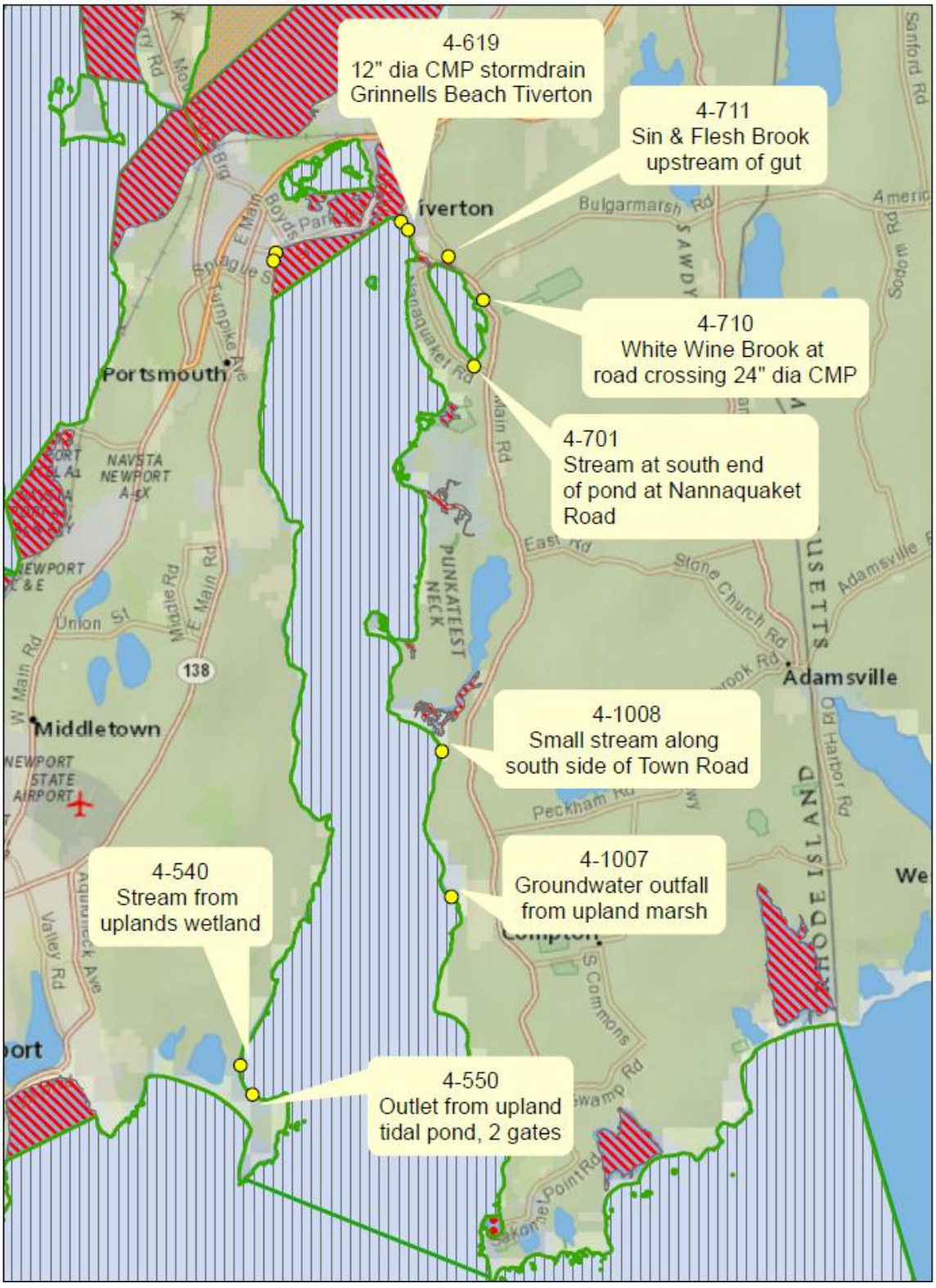


Table 1: Summary of 2018 Shoreline Results for Growing Area 4 Sakonnet River

*Highlighted sources >240 CFU/100ml. IS = In stream sample NS = Not sampled NF = No flow CNL = Could not locate

Source ID	Date Visited	Lat.	Long.	Description	Receiving waters classification	2013 Results mTEC cfu/100ml	2014 Results mTEC cfu/100ml	2015 Results mTEC cfu/100ml	2016 Results mTEC cfu/100ml	2017 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	2018 Volumetric Flow (cfs)
2018-4-540	10/2/2017 Follow-up: 5/8/2018	41.4908	-71.2475	Stream from uplands wetland. Not flowing through culvert. Culvert filled with sand. Stream diverges away through bird sanctuary and empties into wetland/pond near 3rd Beach boat ramp.	Approved	0	NF	NF	NF	5500 Follow-up: 91	1600	NF
2018-4-550W	9/19/2018	41.4852	-71.2438	Marsh side of the culvert.	Prohibited					100	1600 Follow-up: 16	
2018-4-619	9/19/2018	41.6248	-71.2134	12" diameter CMP storm drain, Grinnells Beach Tiverton	Approved	NF	NF	NF	NF	0	-----	NF
2018-4-1007	9/19/2018	41.5176	-71.2027	Groundwater outfall from upland marsh. Seeps under rocks onto sand from Phragmites-overgrown marsh.	Approved	107			NF	99	120	Trickle
2018-4-1007IS	9/19/2018			In-stream	Approved					99	100	
2018-4-710	9/19/2018	41.6124	-71.1959	White Wine Brook at road crossing 24" diameter CMP	Approved	1500	6600	NF	320	1100 Follow-up: 100	1600	Trickle
2018-4-711	9/19/2018	41.61926	-71.2033	Sin and Flesh Brook on north side of bridge at Highland St.	Prohibited	73				91	1600	Low flow
2017-4-711IS	5/8/2018	41.6178	-71.2044	Instream of Sin and Flesh Brook at bridge south of The Gut.	Prohibited					360	900	
2018-4-701	9/19/2018	41.6019	-71.1978	New culvert with stream draining into rip-rap.	Prohibited						1600	Trickle
2018-4-701IS	9/19/2018	41.6019	-71.1978	In stream in front of culvert	Approved						1600	

Figure 4: Source 4-540 view looking inland from culvert (left photo) and view looking seaward towards GA4 (right photo). Photos taken 9/19/2018.

Source 4-710 is White Wine Brook, which drains through a 24-inch CMP into Nanaquaket Pond in Tiverton. The source had an elevated bacteria count of 1600 cfu/100ml in 2018 but the volumetric flow was a trickle at the CMP, which is located within a dense *Phragmites* stand and must travel over 100 feet before reaching the receiving waters. A follow-up sample was taken on 5/8/2018 with a result of 100 cfu/100ml and an instream of 31 cfu/100ml. These instream results indicate that the travel distance from the CMP to the receiving waters is sufficient to filter and dilute bacteria levels before reaching open shellfishing waters.

Figure 5: Source 4-710 White Wine Brook. The Brook was a trickle running through the dense Phragmites stand (photo on 9/19/2018).

Source 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. Recent sampling has indicated elevated fecal coliform bacteria in Sin and Flesh Brook where it enters Mill Gut, especially during wet weather, with observations of 91 cfu/100 ml (2017) and 1,600 cfu/100 ml in 2018. In addition, a collaborative effort by URI Watershed Watch and the Tiverton Harbor Commission has monitored fecal coliform 5-6 times per year at a location near where Sin and Flesh Brook enters the Gut (site URI WW258) for the past several years. Analyses of the URI Watershed Watch fecal coliform data showed that readings during 2014 to 2018 had a range of 2 to 717 mpn/100 ml with a geometric mean of 111 mpn/100 ml. 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 6: Source 4-711 Sin and Flesh Brook. Upstream view (towards freshwater, left photo) and downstream view looking towards prohibited waters of 'the Gut" (right photo). Photos taken 9/19/2018.

C. 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 by following this link:

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

D. Waste Water Treatment Facilities

Public sewers service only a very 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 two RIPDES permits that discharge into the general area. One permitted discharge is non-sanitary in nature, and the other minor sanitary discharge is from an elementary school in Little Compton that discharges to Dundery Brook which does not discharge to the Sakonnet River but rather to Briggs Marsh and subsequently the Atlantic Ocean

E. ANNUAL STATISTICAL SUMMARY: GA4 SAKONNET RIVER

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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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

HIGHLIGHTS

* Sampled 6X during 2018 (5 wet weather, 1 dry weather).
* Statistics represent recent 30 samples collected 4/28/2014 to 11/1/2018 during wet (n = 19) and dry (n = 11) weather for approved stations; all samples analyzed by mTEC method.
* Statistics represent recent 15 samples (10 wet weather, 5 dry weather) collected 4/28/2014 to 11/1/2018 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 11/12/2018.

COMMENTARY

The Sakonnet River (Growing Area 4) was sampled six times during 2018 which meets minimum systematic random sampling requirements for approved areas. The statistical evaluation of approved areas includes the recent 30 samples collected since 4/28/2014 during both wet (n=19) and dry (n=11) weather conditions. All approved stations are in program compliance and properly classified.

While all approved stations in GA4 are in compliance, two stations bear careful watch due to recent increases in fecal coliform values. The northern end of Nannaquaket Pond (station 4-4; south of Nannaquaket Bridge) had a second consecutive year of increased frequency of elevated fecal coliform observations. The 90th percentile variability criteria calculated for station 4-4 was 26.6 cfu/100 ml during 2018 which is edging towards the variability criteria threshold of 31 cfu/100 ml for approved waters. Four of the recent 30 observations at this station were elevated, with all four of these elevated observations occurring when greater than 1" of rain fell in the 7 days prior to sampling. This station (4-4), is subject to freshwater input from nearby Sin and Flesh Brook which may be a source of elevated fecal coliform following rain. Station 4-14, located off the mouth of Almy Brook also displayed an increase in fecal coliform variability during 2018 due to four of the recent 30 observations being greater than 31 cfu/100 ml.

Classification of station 4-11 in Sakonnet Harbor was upgraded from prohibited to seasonally approved in 2016 due to improvements in water quality. The 2018 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 Nannaquaket Pond (near station 4-4) and at station 4-14 (off Almy Brook) during wet weather.

Table 2: GA4 2018 Statistical Summary

RIDEM SHELLFISH GROWING AREA MONITORING: GA4

Recent 30, all weather
(3/18/2013 to 11/1/2017; all mTEC, 17 wet and 13 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA4-1	P	30	2.2	3.2
GA4-2	A	30	2.4	4.1
GA4-3	A	30	2.4	3.9
GA4-4	A	30	4.5	26.6
GA4-5	A	30	2.2	2.9
GA4-6	A	30	2.3	3.9
GA4-7	A	30	2.1	2.7
GA4-8	A	30	2.1	3.0
GA4-9	A	30	2.3	4.2
GA4-10	A	30	2.4	5.4
GA4-11	SA	30	2.7	6.8
GA4-12	A	30	2.2	4.2
GA4-13	A	30	2.3	4.2
GA4-14	A	30	3.7	16.1
GA4-15	A	30	2.2	3.4
GA4-16	A	30	2.1	3.5
GA4-17	A	30	2.2	3.3
GA4-18	A	30	2.2	3.0
GA4-19	P	30	2.3	4.1
GA4-20	P	30	2.7	7.3
GA4-21	A	30	3.3	10.6

Recent 15, when OPEN
(4/28/2014 to 11/1/2018; all mTEC, 10 wet and 5 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA4-11	SA	15	2.7	0.0

GA 5 Annual Update: Kickemuit River

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A. Introduction

A 12-year shoreline survey of the Kickemuit River (conditionally approved Growing Area 5) was conducted during the summer of 2008 by staff from RIDEM's Office of Water Resources Shellfish Program. A triennial re-evaluation of this growing area was completed in 2017. The 2017 triennial survey included a review of previous shoreline surveys with follow-up bacteriological sampling of pollution sources that were found to be equal to or greater than 240 FC/100ml and identification of any new sources of pollution if applicable. All identified pollution sources were re-evaluated to determine their bacteriological impacts on the Kickemuit River. Pipes, groundwater seeps, tributaries, inland inter-tidal, and freshwater discharges that were potential or actual sources of pollution were re-sampled. Marinas and mooring fields were investigated for potential impacts to the growing area. Sources that may contain poisonous or deleterious substances were also considered as part of the 2017 triennial update. Follow-up sampling of all known GA5 pollution sources having previous observations of > 240 cfu/100 ml was completed as part of the 2018 annual update.

B. 2018 Shoreline Survey

Three (3) potential sources were examined as part of the 2018 annual update. Source 5-013 is a broken PVC pipe within the extension of the ROW of Chace Lane in Touisset. Originally identified as a groundwater seep, erosion has exposed this as an actual broken pipe since first discovered. Original sample results in 2015 had results of 8,000 cfu/100ml with a trickle flow, re-sampling had results greatly reduced at 80 cfu/100ml with a corresponding instream sample of <3 cfu/100ml. Sampling source 5-013 on 10/16/2018 revealed a fecal coliform concentration of 720 cfu/100 ml. As observed in the past, the flow was only a trickle and nearby instream waters, which were closed at the time of sampling, demonstrated a rapid dilution. This intermittently elevated source should be monitored in future surveys.

Figure 1: Source 5-013, a seep at the end of a right-of-way at extension of Chace Avenue. Left photo is looking inland, right photo is view towards Kickemuit River. Source was a trickle on day photos taken (10/16/2018).

Source 5-014 is seepage under a stone seawall. Initial sampling in 2008 and subsequent follow-up sampling indicates a large fluctuation in bacteria results. In 2015 and 2016 there was no flow observed from either of these sources. This source could not be found during follow-up sampling in 2017 and 2018.

The final source examined during the 2018 annual update was source 5-030 which is an 18" corrugated metal pipe at the end of Smith Street in Warren, RI. This source was initially sampled on 10/17/2017 and had a high FC result of 2,900 CFU/100ml. The flow was only a slight trickle and the area the pipe discharges to was filled with debris. Because of the high bacteriological results, this source was resampled on 11/2/2017 with a result of <100 cfu/100 ml. 2018 follow-up sampling at source 5-030 on 10/16/2018 showed a fecal coliform level of > 1,600 cfu.100 ml. However, despite wet weather during October 2018 (GA5 shoreline source sampling was completed on 10/16/2018 while the conditionally approved GA5 was in the closed status. Sampling was done four days after 1.66" rain at the Taunton rain gauge. Source 5-030 was only a trickle and the source was not reaching the receiving waters of the Kickemuit River (GA5). The limited impact of source 5-030 on the receiving waters of GA5 is evidenced by the fact that nearby GA5 shellfish monitoring station 5-4 which is ~500 feet east of source 5-030 was in compliance during 2018 with a geometric mean fecal coliform of 3.3 cfu/100 ml with 0% of samples exceeding 31 cfu/100 ml when the area was open to shellfish harvest.

Figure 2: Source 5-030, an 18" corrugated metal pipe at the end of Smith Street, Warren, RI. View inland (left photo) and view toward the Kickemuit River (right photo). No detectable flow was present when examined on 10/16/2018.

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 August 2017.

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.

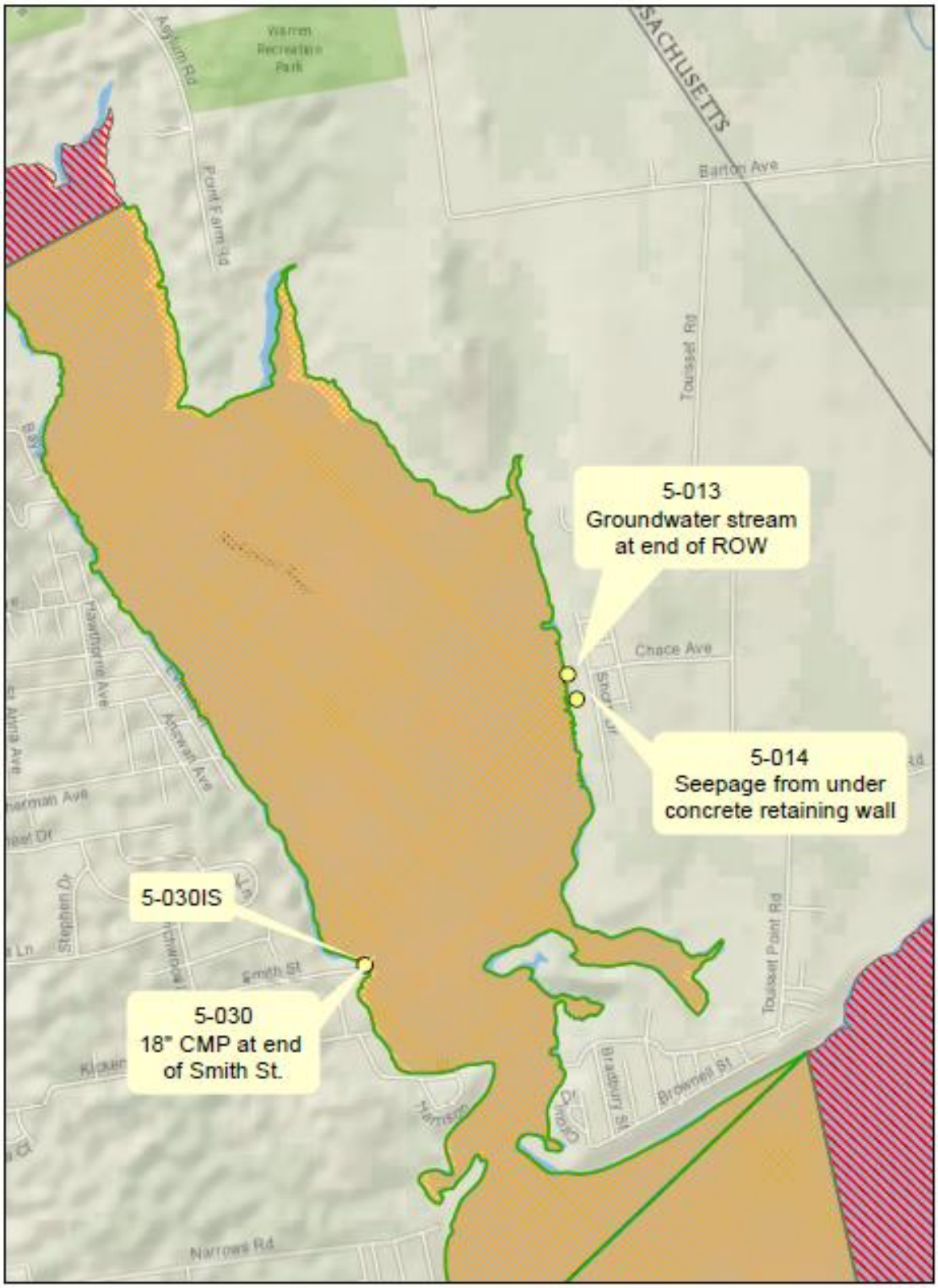
The shoreline survey for 2018 indicates that Growing Area 5 is properly classified and that all pollution sources have accurate dilution zones established and no additional closure areas are warranted. A seasonal (January) closure of the Kickemuit River should continue due to elevated fecal coliform concentration during January.

Table 1: GA5 2018 shoreline survey results.

Source ID	Classification of Receiving waters	2008 Results MPN	2011 Results MPN	2012 Results cfu/100ml	2013 Results cfu/100ml	2014 Results cfu/100ml	2015 Results cfu/100ml	2016 Results cfu/100ml	2017 Results cfu/100ml	2018 Results cfu/100ml	2018 Flow cfs
5-013	Conditionally Approved	93	NS	1670	60	210	8,000 (Trickle flow)	NF	**NF**	**720**	**Trickle**
5-013IS	Conditionally Approved						< 3			100	
5-014	Conditionally Approved	110,000	23	56	NF	8000	NF	NF	DNL	DNL	
5-014IS	Conditionally Approved					3					
5-030	Conditionally Approved		NF	NF	NF	NF	NS	NS	<100	>1,600	**Trickle**
5-030IS	Conditionally Approved								546		

Table of 2018 follow-up Kickemuit River fecal coliform follow-up results. NS = not sampled, NF = no flow, DNL = did not locate.

Figure 3: 2018 GA5 (Kickemuit River) shoreline sources



C. Conditional Closures

The Kickemuit River growing area (GA5) contains conditionally approved and prohibited waters (Figure 4). As described in the GA5 Kickemuit River Conditional Area Management Plan (CAMP, under update in Spring 2019), GA5 closes for 7-days when the condition of 0.5" or greater precipitation (rainfall or melted snowfall) is received in a 24-hour period at the NWS Taunton weather station (KTAN). This precipitation trigger is based on an analysis of fecal coliform response in GA5 during wet weather as described in the GA5 CAMP. The conditionally approved waters of GA5 are managed in tandem with the adjacent Mt. Hope Bay growing area (GA17).

D. Marinas and Mooring Fields

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 on our website by following this link: http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php

E. Wastewater Treatment Facilities (WWTF)

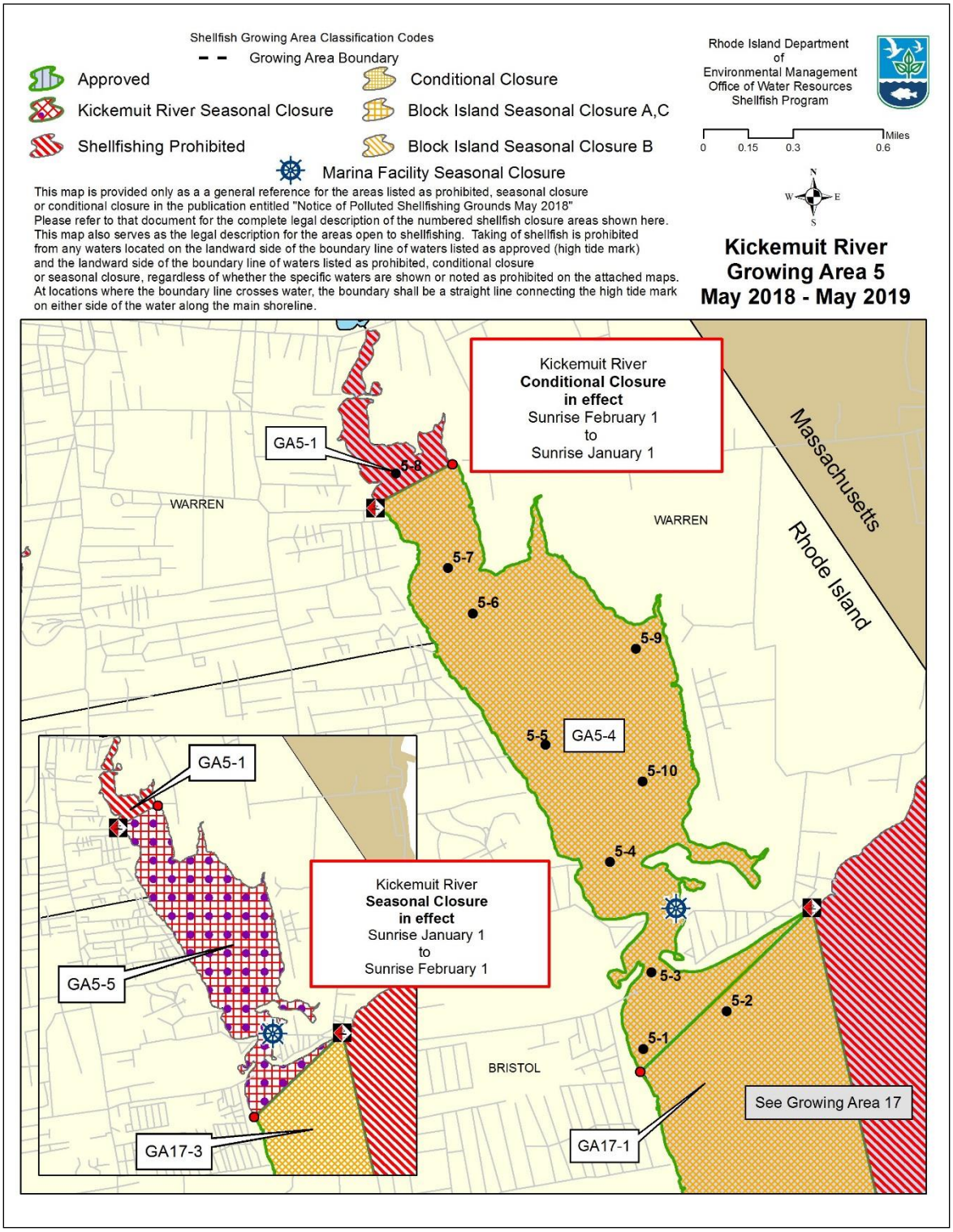
There are currently no wastewater treatment facilities that discharge directly to the Kickemuit River (GA5). This conditionally approved growing area is managed as a precipitation based growing area as outlined in the area's Conditional Area Management Plan (CAMP). As is the case of all areas that may have sewer systems or infrastructure within their watersheds a notification of any sewage overflow that may impact these waters could require an emergency closure. Such was the case when the town of Bristol's sewage pump station had an overflow that discharged into these waters. The River was closed immediately to the harvest of shellfish and remained closed until such time as the waters returned to approved status and sufficient time had elapsed for shellfish to self-cleanse in accordance with the model ordinance guidance or a minimum of 21 days. Records of this closure and subsequent actions are maintained in the program's central files.

A review of Onsite Wastewater Treatment System (OWTS) complaints and failures was conducted as part of the 2017 shoreline survey. There are currently no open complaints within 200ft 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 a 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. The impacts from this SSO on Mt Hope Bay are discussed in that GA report in more detail.

Figure 4: GA5 Kickemuit River classification map with monitoring station locations



F. GA5 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

HIGHLIGHTS

* Sampled 9X during 2018.
* Statistics represent recent 15 dry-weather samples collected 5/24/17 to 12/2/2018 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 1/7/2019.

COMMENTARY

The conditionally approved Kickemuit River (Growing Area 5) was sampled nine times during 2018. A combination of wet weather and limited staff resources prevented collecting 12 samples in GA5 during 2018. Wet weather during February 2018 (GA5 was open only 6.5 of 28 days) and November 2018 (GA5 was open only 2 of 30 days) prevented sampling while the Kickemuit River was in the open status. DEM Shellfish staff resources were devoted to an emergency closure in GA1D during the early autumn of 2018 which prevented sampling GA5 during the autumn. Despite these complications, GA5 was sampled seven times while the area was open for shellfish harvest and twice when the area was in the closed status (January seasonal closure)

during 2018. The Kickemuit has historically (since the 1980s) shown an increase in fecal coliform during winter months. A January seasonal closure was instituted for the Kickemuit River in 2016 due to elevated January fecal coliform readings which would result in exceedance of the NSSP fecal coliform variability criteria. Accordingly, January data are not included in the statistical analysis of the most recent 15 samples. All conditionally approved / seasonally approved (January closure) stations in the growing area are in program compliance. Analysis of 2018 summary statistics were also calculated including January (seasonal closure) data for informational purposes. Inclusion of January closure data in the statistical summary resulted in five of ten stations in GA5 (Kickemuit) exceeding the variability criteria for conditionally approved areas. These results demonstrate that the January seasonal closure is required and that GA5 (Kickemuit River) is properly classified.

RECOMMENDATIONS

* Maintain January seasonal closure of the Kickemuit River growing area.
* When practical, continue to sample Kickemuit during January seasonal closure to track changes in winter water quality.
* Review of current Conditional Area Management Plan (CAMP)

Table 2: GA5 Annual statistical summary.

RIDEM SHELLFISH GROWING AREA MONITORING: GA5

Recent 15 observations while the area is in the open status; all dry weather. Note that there are no January (seasonal closure) data in the recent 15 observations. (5/24/2017 to 12/12/2018; all mTEC)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA5-1	CA/SA	15	3.6	0.0
GA5-2	CA/SA	15	2.9	0.0
GA5-3	CA/SA	15	3.8	0.0
GA5-4	CA/SA	15	3.3	0.0
GA5-5	CA/SA	15	3.1	0.0
GA5-6	CA/SA	15	3.5	0.0
GA5-7	CA/SA	15	3.9	0.0
GA5-8	P	15	5.6	13.3
GA5-9	CA/SA	15	3.2	0.0
GA5-10	CA/SA	15	3.3	6.7

Recent 15 dry weather; including January (seasonal closure) data. Statistics calculated for informational purposes only, not for compliance. (7/5/2017 or 8/9/2017 to 12/12/2018; all mTEC)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA5-1	CA/SA	15	5.3	13.3
GA5-2	CA/SA	15	4.6	13.3
GA5-3	CA/SA	15	5.7	13.3
GA5-4	CA/SA	15	5.0	13.3
GA5-5	CA/SA	15	4.1	0.0
GA5-6	CA/SA	15	3.7	0.0
GA5-7	CA/SA	15	3.9	0.0
GA5-8	P	15	4.6	6.7
GA5-9	CA/SA	15	4.7	13.3
GA5-10	CA/SA	15	4.9	6.7

East Passage

Growing Area 6
Triennial Re-Evaluation
2018

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

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A. Introduction

A twelve (12) year sanitary shoreline survey of the East Passage Growing Area 6 (Figure 1 and Figure 2) was conducted in 2015 which 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. In 2015 six (6) sources had bacteria counts greater than 2,400 cfu/100ml warranting follow-up sampling, however three (3) of those sources discharge to waters classified as prohibited and were not re-sampled as part of the 2016 annual update. In 2017 follow-up visits were made to ten (10) of the eighteen (18) sources that were measured during the 2015 twelve (12) year sanitary shoreline survey. The 2017 annual follow-ups were determined by bacteria sample results > 2400 cfu/100ml from the 2015 survey requiring a site visit during 2017 (see table 1-1 for full list of results). Of the ten (10) sources visited during the 2017 shoreline survey, eight (8) of them had no flow. The two (2) sources (2017-6-001 and 2017-6-500) with flow had bacterial levels < 2,400 cfu/100ml in the 2018 survey, which did not require additional follow-up sampling.

B. Description of Growing Area

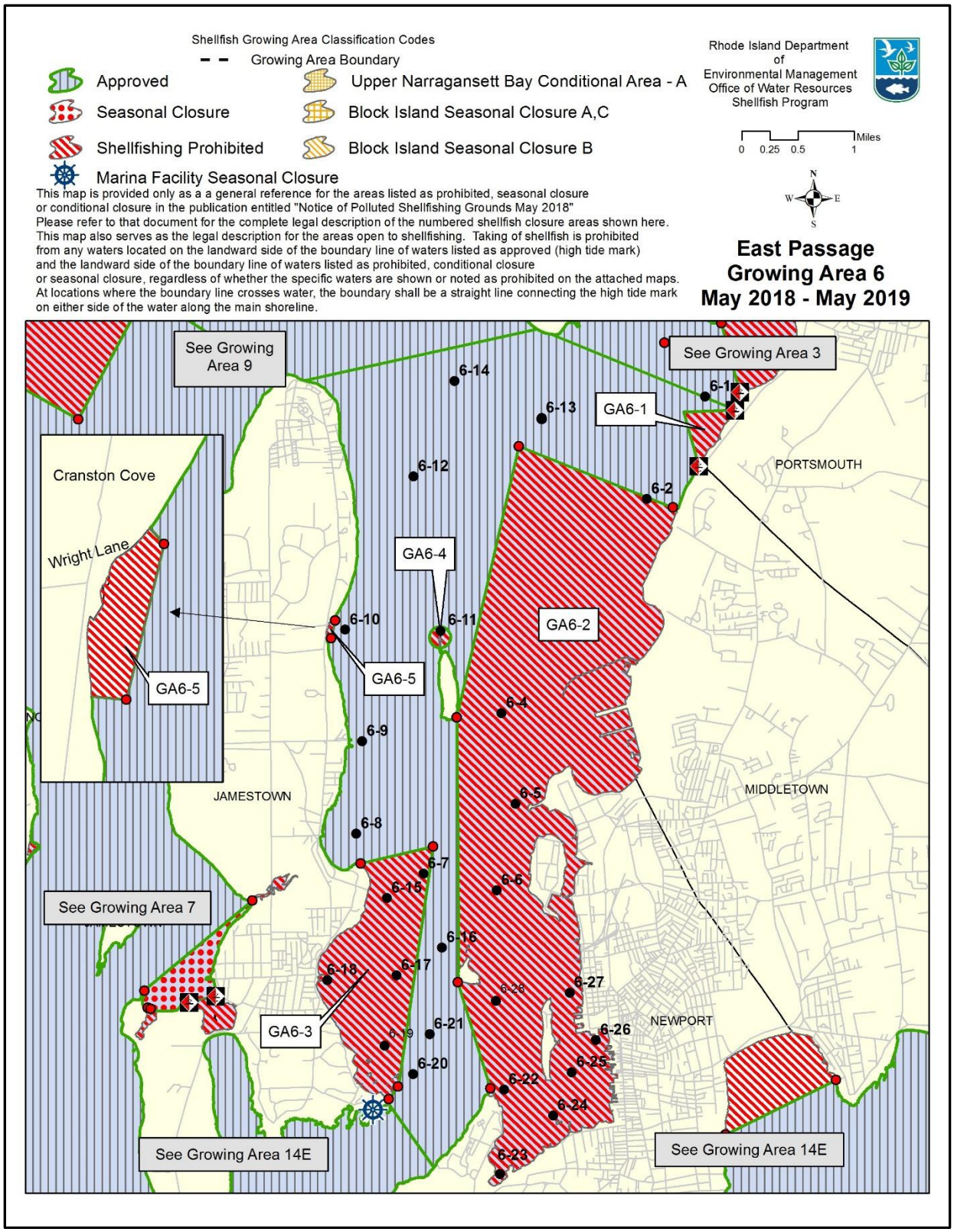
Demarcating the East Passage growing area (GA6; Figure 1) are three large islands: Aquidneck the largest, supports the towns of Newport and Middletown, a place of unusual charm and great historical significance and lies to the east of the passage; Conanicut Island otherwise known as the Town of Jamestown lies to the west, and Prudence Island which marks the northern boundary of the growing area. The southern extent of the growing area is from Fort Wetherill in Jamestown to a point approximately half way along the western shoreline of Newport south of Fort Adams State Park.

The East Passage is a deep gorge that was formed by glacial action, creating depths as deep as 188 feet and relatively shallower depths of 100 feet all the way north to a point about halfway along the Prudence Island shore.

From Fort Adams State Park, you'll see a panoramic view of Newport Harbor and the hundreds of boats moored there, downtown Newport, and the sweeping Newport Pell Bridge crossing the East Passage from Newport to Jamestown. Several small islands, Gould Island off the Jamestown shore, Goat Island and Coaster's Harbor Island off of Newport Harbor and Rose Island are located within the East Passage growing area.

Gould Island and Coaster's Island are Navy facilities with limited or totally restricted access. Goat Island is within the prohibited area of Newport Harbor and Rose Island the majority of which is also within the prohibited classification is home to the Rose Island lighthouse.

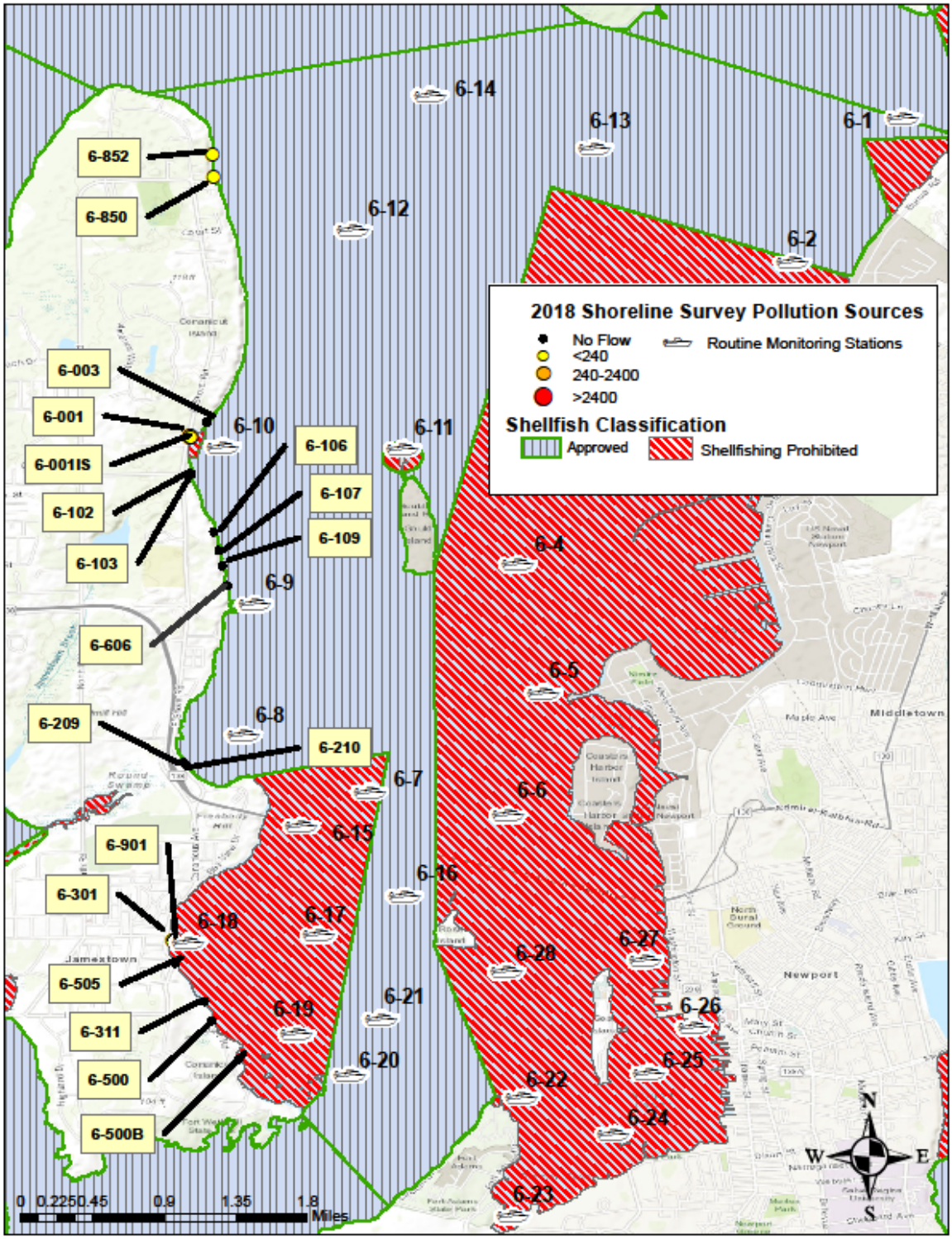
Figure 1: Growing Area 6 Current Classification Map



C. 2018 Shoreline Survey

In 2018 on July 11th, a follow-up visit was made to all eighteen (18) sources that were measured during the 2015 twelve (12) year sanitary shoreline survey. The 2018 annual follow-ups were determined by bacteria sample results > 240 cfu/100ml from the 2015 survey requiring a site visit during 2018 (see table 1-1 for full list of results). Of the eighteen (18) sources visited during the 2018 shoreline survey, fourteen (14) of them had no flow. Of the four (4) sampled, Source 6-001 which flows into the prohibited waters of Cranston Cove was the only source that was above the 240 cfu/100ml threshold, with a result of 320 cfu/100ml. Two (2) new sources were found and sampled, Sources 6-900 and 6-901 both with results of <2 cfu/100ml.

Figure 2: 2018 Shoreline Survey Pollution Sources



D. Pollution Source Survey

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 August 2017.

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.

Of the twenty (20) sources sampled, including the two (2) new sources, the only source that was above the 240 cfu/100ml threshold, was Source 6-001. Source 6-001 is a stream in Jamestown that flows through a thick *Phragmites* stand before draining across a cobble beach into the East Passage (GA6). This source had a result of 320 cfu/100ml when sampled in July 2018 which is much lower than results from 2015 (800 cfu/100 ml) and 2017 (454 cfu/100 ml).. A closure (GA6-5 as described in the RIDEM, Annual Notice of Polluted Shellfishing Grounds, May 2017)) was placed around this source as a result of the findings during the 2015 and has remained in place since then. The small closure around source 6-001 was calculated from a dilution calculation (dilution calculation on file in GA6 folder) designed to dilute the source to <14 cfu/100 ml within the closure zone even under maximum observed bacteria concentration and flow conditions. Given the trend of declining fecal concentration, DEM Shellfish staff will sample this source and receiving waters under various weather conditions and re-evaluate the closure during 2019.

Table 1: Growing Area 6 Sources

Source ID	Latitude	Longitude	Description and Location	Act/ Pot	Dir/ Indir	2015 Results	2017 Results	2018 Results	Volumetric Flow cfs	Date Visited/ Sampled
6-001	41.54162	-71.365	Stream north of Wright Lane	A	D	800	454	320	0.042	7/11/2018
6-001IS			In stream	A	D			200		7/11/2018
6-003	41.54297	-71.3635	Stream thru woods	A	D	2700	NS	Could not find	NF	7/11/2018
6-102	41.53825	-71.3649	Small stream over rocks from uplands	A	D	1100	NS	NS	NF	
6-103	41.53822	-71.3649	Small stream maybe split of source #102 south of #102	A	D	800	NS	NS	NF	
6-106	41.53295	-71.3628	Very small stream from upland woods heavy iron bacteria	A	D	1430	NS	Could not find	NF	7/11/2018
6-107	41.53127	-71.3624	Small stream thru woods	A	D	662	0	Could not find	NF	
6-109	41.52988	-71.3621	Groundwater seepage fades out above tide line	A	I	685	NS	Could not find	NF	
6-209	41.51197	-71.3656	Outfall from retention pond at base of Newport Bridge can't	P	D	2600	0	NS	NF	7/11/2018
6-210	41.51173	-71.3653	Stone headwall w/ standing water most likely from retention	A	D	8000	0	NS	NF	7/11/2018
6-301	41.49587	-71.3667	24" dia CMP storm drain at corner of concrete seawall	P	D	7700	0	NS	NF	7/11/2018
6-311	41.49025	-71.3637	8" dia clay/iron pipe put in water took sample from drip	A	D	2120	NS	NS	NF	7/11/2018
6-500	41.48854	-71.363	24" Dia RCP before broken seawall	A	D	2400	99	DNE	NF	7/11/2018
6-500B	41.48506	-71.3606	24" RCP at private beach	A	D			DNE	NF	7/11/2018
6-505	41.49372	-71.3664	"Unknown source" for original description. Upon surveying, only visible potantial source was an old broken iron pipe, half buried in sand. No evidence of recent flows.	A	D	4600	0	Could not find	NF	7/11/2018
6-606	41.52806	-71.3617	Multiple GW seeps	A	D	1720	NS	Could not find	NF	
6-850	41.56528	-71.3629	GW Seep @ brick abutment north of Broad St	P	D	300	NS	100	Stagnant	7/11/2018
6-852	41.56724	-71.363	Large stream north of Broad St	P	D	560	NS	60	0.021	7/11/2018
6-900			4" dia PVC pipe in cement seawall			10	NS	<2	Trickle	7/11/2018
6-901	41.49587	-71.3667	GW stream coming from base of rock wall below 6-301	A	D		NS	<2	0.042	7/11/2018

NS = no sample, DNE = does not exist / could not find

E. 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, the City of Newport and the Town of Jamestown.

The City of Newport's WWTF 2018 performance data report indicates that there were three very minor total suspended solids and one fecal violation. In 2018 they reported an average flow of 9.292 mgd well below their permit limit of 16 mgd. They will be increasing their permitted flows by approximately 10% and will be completing major upgrades to their equipment. These upgrades include, new grit removal equipment, a new primary clarifier, reconfiguration of the aeration basins, larger chlorine contact tanks and other processing upgrades along with other system improvements to remove/reduce CSOs. The plant is under a judicial consent agreement to complete these improvements by 2019 with the CSO system work to be completed by 2032.

The Town of Jamestown WWTF reported three permitted flow violations of 0.968, .9259 and 1.09 mgd in February, March and November of 2018 as their only reported violations. The plant has a permitted flow of 0.73 mgd with an average flow of 0.504 mgd.

F. Water Quality Monitoring, GA6 Annual Statistical Summary

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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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

HIGHLIGHTS

* Sampled 6X during 2018 (3 wet weather, 3 dry weather).
* Statistics represent recent 30 samples collected during wet (n = 12) and dry (n = 18) conditions during 4/9/2014 to 11/19/2018.
* All samples analyzed by the mTEC method.
* All approved stations are in compliance.
* Data run 12/3/2018.

COMMENTARY

The East Passage (Growing Area 6) was sampled six times during 2018, complying with minimum systematic random sampling criteria. 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. Results of the 2018 statistical evaluation indicate that all approved stations are in program compliance and that the area is properly classified.

RECOMMENDATIONS

* No actions required based on 2018 ambient monitoring results.
* Maintain closure at Cranston Cove in Jamestown.

Table 2: GA6 Annual Statistical Summary 2018

RIDEM SHELLFISH GROWING AREA MONITORING: GA6

Recent 30 all weather.
(4/9/2014 to 11/19/2018; all mTEC, 12 wet and 18 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31)***
GA6-1	A	30	2.1	3.2
GA6-2	P	30	2.2	4.3
GA6-4	P	30	2.4	5.9
GA6-5	P	30	2.2	3.7
GA6-6	P	30	2.2	3.6
GA6-7	P	30	2.2	3.7
GA6-8	A	30	2.0	2.4
GA6-9	A	30	2.2	3.5
GA6-10	A	30	2.2	3.1
GA6-11	P	30	2.2	3.7
GA6-12	A	30	2.3	4.5
GA6-13	A	30	2.2	3.6
GA6-14	A	30	2.0	2.0
GA6-15	P	30	2.3	4.9
GA6-16	A	30	2.3	5.1
GA6-17	P	30	2.0	2.4
GA6-18	P	30	2.1	3.7
GA6-19	P	30	2.3	4.4
GA6-20	A	30	2.2	4.0
GA6-21	A	30	2.1	2.8
GA6-22	P	30	2.5	5.7
GA6-23	P	30	2.3	3.3
GA6-24	P	30	3.0	10.4
GA6-25	P	30	4.3	19.3
GA6-26	P	30	5.6	24.9
GA6-27	P	30	2.5	6.8
GA6-28	P	30	2.1	3.0

G. Conclusions and Recommendations

The current monitoring schedule is adequate for maintaining correct classification. Water quality statistical evaluations indicate that the area conforms to the NSSP requirements as an approved growing area during all types of weather periods. There are no recommendations for changes in classification at this time.

GA 7 Annual Update: West Passage

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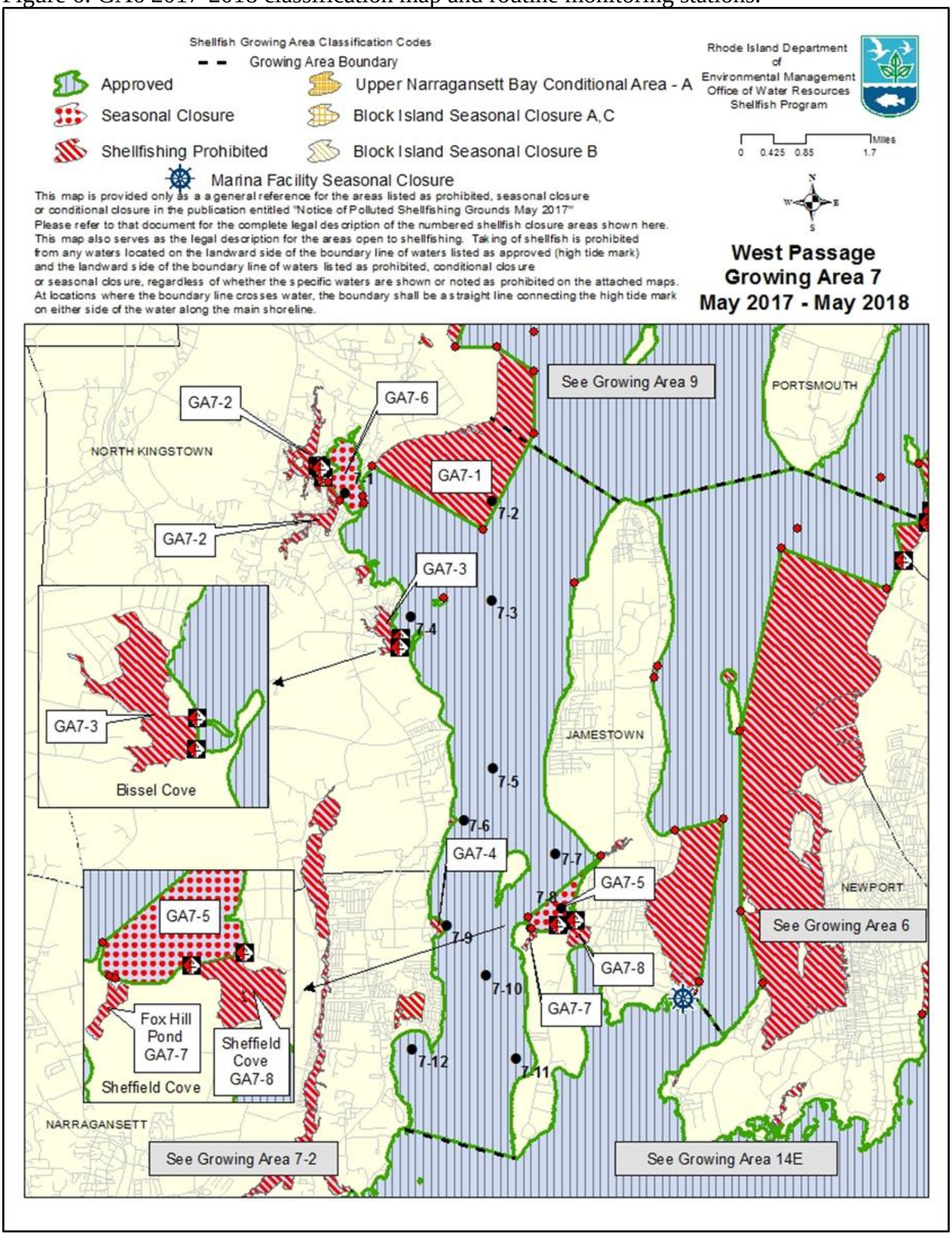
Figure 6: GA6 2017-2018 classification map and routine monitoring stations.



Tables

A. Introduction

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. A twelve (12) year sanitary shoreline survey of the West Passage Growing Area 7 was conducted in 2016. A total of 110 sources were identified during the 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.

B. 2018 Shoreline Survey

During the 2018 annual update a total of nineteen (19) sources were investigated; a location map of all sources is in Figure 2. All sources in which flow was observed were sampled. Of these, three (3) either no longer existed or could not be located and one (1) source had no flow. The remaining sources had fecal coliform results of < 2,400 cfu/100 ml. Five (5) sources (7-6, 7-7, 7-14B, 7-023, 7-102) had bacteria counts above 240 cfu/100ml and should be re-sampled during the 2019 triennial survey.

Sources 7-6 and 7-7 are both small streams that flow into the receiving waters of Mill Cove (classified as Prohibited) in inner Wickford Harbor, North Kingstown, RI. Source 7-6 is a stream near #15 Walnut Street that flows into the prohibited waters of Mill Cove in the northwest corner of inner Wickford Harbor. This source had a fecal coliform concentration of >1,600 cfu/100 ml on 10/3/2018 and flow was ~0.75 cfs. This freshwater stream enters prohibited waters approximately 1.2 miles inland of the seasonally approved waters of outer Wickford Harbor. The distance (1.2 to 1.5 miles) through a prohibited zone from these small streams to seasonally approved waters of outer Wickford Harbor provides sufficient dilution between the source and waters supporting shellfish harvest. This is supported by results at DEM Shellfish monitoring station 7-1, located in seasonally approved waters of outer Wickford Harbor which had 2018 fecal coliform results of a geometric mean = 2.5 cfu/100 ml with 0% of observations exceeding 31 cfu/100 ml when the area was open for shellfish harvest.

Figure 1 2018 Shoreline Survey Sources

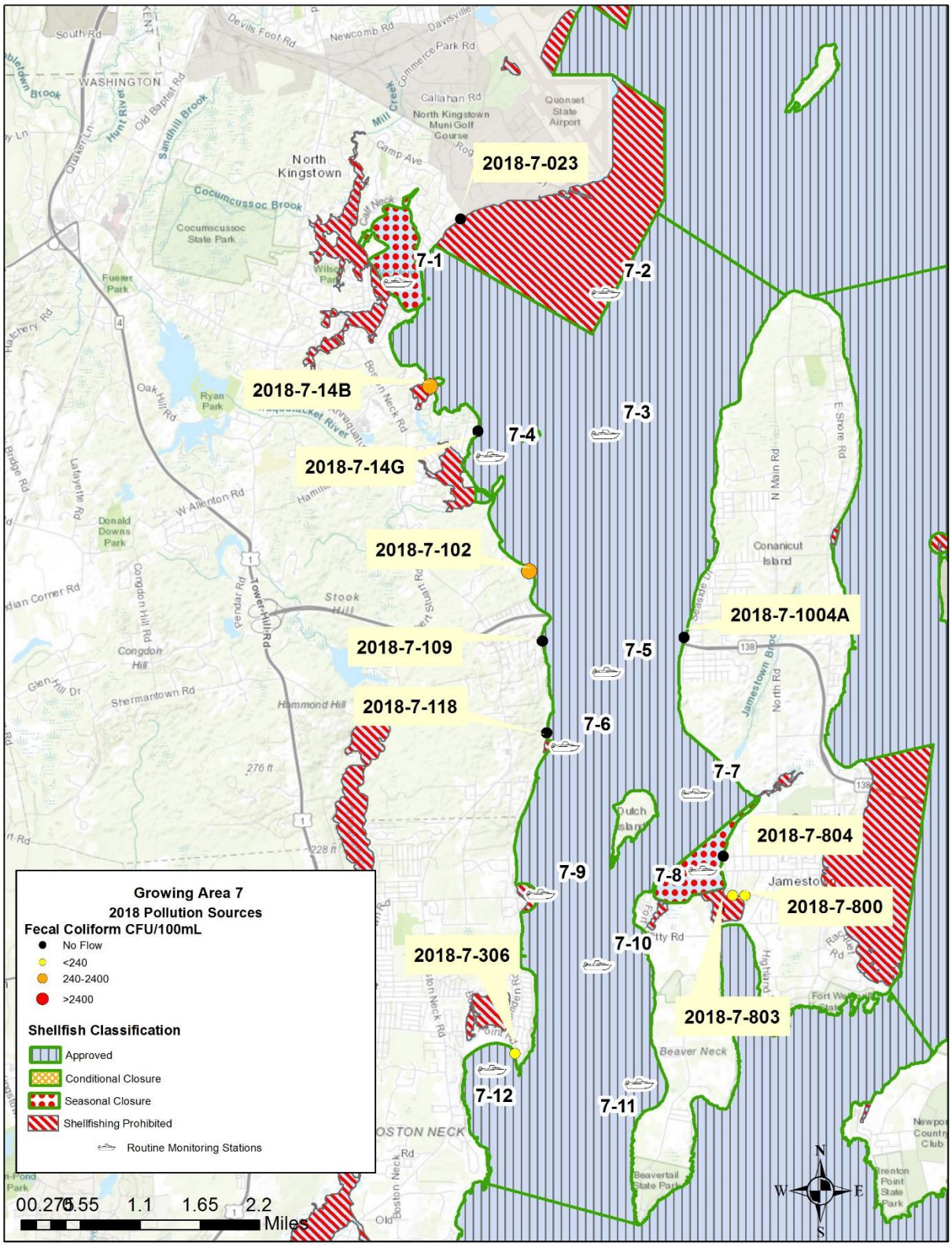


Figure 2: Sources 7-6 (left) and 7-7 (right); both small streams enter prohibited waters of Mill Cove, inner Wickford Harbor. Photos taken 10/3/2018.

Source 7-14B is the channel draining the prohibited waters of Duck Cove. Duck Cove has been prohibited to shellfish harvest for years because of elevated and variable fecal coliform concentration. The 2018 follow-up had a fecal coliform observation of 760 cfu/100 ml on 10/3/2018 which was 1 day after 1.46" rain and 9 days after 3.75" rain at TF Green Airport. Past observations indicate that Duck Cove fecal coliform levels are variable, with no clear pattern in regard to wet versus dry weather. Given this variability, Duck Cove is properly classified as prohibited to the harvest of shellfish.

Figure 3: Source 7-14B, Prohibited waters of Duck Cove, North Kingstown views looking inland (left photo) and looking seaward towards GA7 (right photo).

Source 7-023 is a small stream that flows from an upland marsh across a beach in the Shore Acres area of North Kingstown. This source had a fecal coliform result of >1,600 cfu/100 ml and a flow rate of 0.83 cfs on 10/3/2018. The small stream enters a prohibited safety zone around Quonset Point which provides a sufficient dilution buffer between the source and the approved waters of GA7.

Figure 4: Source 7-023 a small stream flowing from an upland marsh (left photo) and across a beach in the Shore Acres section of North Kingstown into GA7 (right photo). Photo taken 10/3/2018.

Source 7-102 is an upland tidal pond adjacent to Greene Point in North Kingstown, RI. The fresh water end of this tidal pond had a fecal coliform observation of 1,500 cfu/100 ml and a flow of 0.5cfs on 10/3/2018 which was 1 day after 1.46" rain and 9 days after 3.75" rain at TF Green Airport. The waters of this tidal pond are classified as prohibited with regard to shellfishing. The connection of this tidal pond with the waters of Narragansett Bay varies in size dependent on freshwater flow, storms and tidal stage; the connection between the pond and Narragansett Bay is occasionally filled in by accumulated sand and gravel. When the narrow tidal inlet is open, the tidal flow out of this small pond enters the approved waters of GA7 (West Passage of Narragansett Bay). Follow-up sampling will further quantify fecal coliform concentration in the tidal pond, but tidal mixing in the unclassified tidal pond is believed to provide sufficient dilution before reaching the approved waters of GA7.

Source 7-803 is a 10" CPP draining an upland wetland into the prohibited waters of Sheffield Cove. In 2017, the bacteria count was elevated at 1,000 cfu/100ml, however the volumetric flow was low (0.018 cfs). Because this source is discharging into waters that are currently classified as prohibited, there is sufficient dilution in the area to be protective of the adjacent approved waters of the West Passage receiving waters. The Town of Jamestown has undertaken a stormwater abatement project in the upland watershed of Sheffield Cove to install BMPs (infiltration basin and grass swales) that are designed to capture and treat stormwater flows prior to their entering these receiving waters. These BMP projects were completed in the summer of 2018. Sampling during 2018 documented a decline in fecal coliform to 134 cfu/100 ml on 7/11/2018. While 2018 sampling results are encouraging, until post-BMP upgrade sampling of stormwater reflects consistent reductions in bacteria loadings, Sheffield Cove will remain classified as prohibited and closed to the harvest of shellfish.

Figure 5: Source 7-803, a corrugated metal pipe discharging into the prohibited waters of Sheffield Cove in Jamestown, RI.

Table 1: Summary of 2018 Results for Growing area 7 West Passage

*Highlighted sources >240 CFU/100ml.

Source ID	Date Visited	Lat	Long	Description	Discharging waters classification	Act/Pot	Dir/Ind	2016 Results mTEC cfu/100ml	2017 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	Volumetric Flow (cfs)
2018-7-109	6/19/2018	41.5268	-71.4166	Flow thru upland vegetation. No stream flowing, no signs of recent flow. One area seemed to be carved out possibly by water, but completely dry.	Approved	P	D	0	0	NF	NF
2018-7-118	6/19/2018	41.51452	-71.4159	2" PVC pipe	Approved	A	D	0	< 100	NF	0.0002
2018-7-800	7/11/2018	41.49273	-71.3828	Outlet from tidal marsh. In 2017, no flow into receiving waters. Ground too soft to access tidal pond	Prohibited	A	D	96	0	90	1.3
7-803	7/11/2018	41.49274	-71.3806	10" CPP from upland wetland	Prohibited	A	D	280	1,000	134	0.0118
2018-7-804	7/11/2018	41.49798	-71.3844	Stream from upland thru rock over wall. In 2017, could not find a wall at location. No flow or evidence of recent flows.	Prohibited	A	D	0	0	CNL	
2018-7-306	6/19/2018	41.47162	-71.4216	Groundwater seepage. Slow trickle and multiple seeps ~50ft along rocks.	Approved	A	D	8,000	<100	8	0.05
2018-7-803	7/11/2018	41.49274	-71.3806	10" CPP from upland wetland	Prohibited	A	D	280	1,000	134	0.0118
2018-7-1004A		41.5273	-71.3914	Rusty drainpipe at shoreline access under bridge. In 2017, could not find. Maybe buried.	Approved	P	D	0	0		DNE
2018-7-102	10/3/2018	41.53618	-71.419	Outlet from upland tidal pond - fades into sand above high tide	Approved	A	D	1.9	<100	1,500	0.5
2018-7-14B	10/3/2018	41.56094	-71.4366	Outlet of Duck Cove	Approved	P	D		100	760	tidal
2018-7-14G	10/3/2018	41.5549	-71.4281	2 x 4" PVC under dock. In 2017, could not find. Likely no longer exists.	Approved	P	D		0	CNL	
2018-7-023	10/3/2018	41.58324	-71.4311	Small stream from upland marsh, north end of Shore Acres beach	Prohibited	A	D			>1,600	0.83

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

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 August 2017.

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.

C. 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

D. 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 seven RIPDES permits that discharge into the growing area. Four are part of the University of Rhode Island and EPA facility located at the Coastal Institute on Ferry Road in Narragansett. Currently a radial prohibited safety zone is in place around these discharges. 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 both the geometric mean standard of <14 CFU/100 ml and the 90th percentile of 31 CFU/100 ml. Refer to Table 2 for the 2018 statistical summary.

Two permitted discharges are in the Quonset Point/Davisville area. One is a non-sanitary water release pipe from the V & G Sea products facility and the other is a major sanitary discharge pipe from the RI Economic Development's Waste Water Treatment Plant. A review of Quonset Point WWTF performance data (echo.epa.gov) indicates that there were no fecal coliform violations during 2016, 2017 and 2018. There were occasional *Enterococci* violations during 2016 and 2018, but most were less than 10% above the permitted concentration level for *Enterococci.* There was a single fecal coliform daily maximum violation during 2018 (1,046 cfu/100 ml was observed in the effluent on 8/31/2018); all other daily maximum fecal coliform results for the effluent were in the 2-4 cfu/100 ml range (EPA Echo data reviewed 3/29/2019). Per NSSP Model Ordinance requirements a prohibited safety zone must be established around this outfall. The PLUMES model analysis used to establish the size of the closed safety zone is available for review in the program's permanent files.

The final RIPDES permitted discharge is a non-sanitary water release pipe from the Jamestown Water Treatment Facility that discharges into Jamestown Brook which then ultimately discharges into the east shore of Jamestown at the northern end of Dutch Island Harbor. This discharge (identified as source 7-1000) has historically had low fecal coliform values (2018 result was 1.9 cfu/100 ml) and the source has little impact on the receiving waters.

E. Routine Water Quality Monitoring

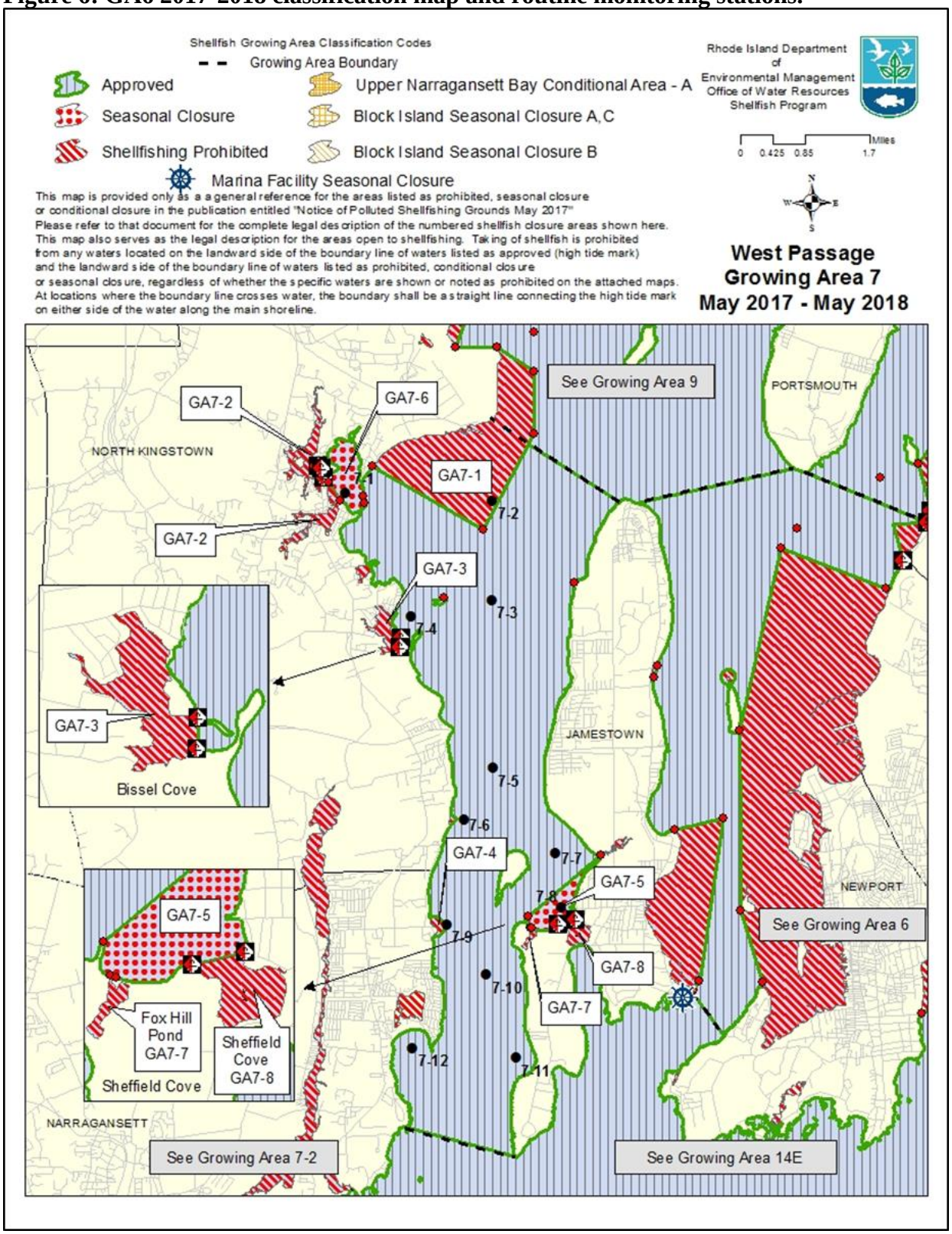
The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish 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, 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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 9 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 6).

Figure 6: GA6 2017-2018 classification map and routine monitoring stations.



F. Annual Statistical Summary: GROWING AREA 7 – WEST PASSAGE

HIGHLIGHTS

* Sampled 6X during 2018.
* For approved stations, statistics represent recent 30 samples collected during wet (n = 17) and dry (n = 13) conditions during 5/7/2014 to 10/10/2018.
* For seasonally approved stations 7-1 and 7-8, statistics represent recent 15 samples collected 3/19/2014 to 10/10/2018 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 11/5/2018.

COMMENTARY

The West Passage (Growing Area 7) was sampled six times during 2018, twice during wet weather and four times under dry weather conditions. The recent 30 samples used in the 2018 statistical evaluation of approved stations were collected since 5/7/2014 and included samples collected during wet (n=18) and dry (n=12) weather conditions. Statistics for seasonally approved stations 7-1 and 7-8 were calculated based on the recent 15 samples (8 wet, 7 dry) collected when the station was in the open status.

Results of the 2018 statistical evaluation demonstrated that all approved stations and are in program compliance. 2018 compliance statistics for seasonally approved stations 7-1 (Wickford Harbor) and 7-8 (Sheffield Cove) also demonstrated that these stations are in compliance and that the seasonal closures in these areas are effective. A new station (station 7-1A) was added to the prohibited area in Mill Cove (inner Wickford Harbor) to assess water quality changes in response to the recent tie-in of homes in the Wickford area to the Quonset WWTF.

RECOMMENDATIONS

* No actions required based on 2018 ambient monitoring results.
* Continue monitoring station 7-1A to track water quality changes in inner Wickford Harbor.

Table 2: 2018 Statistical Summary for GA 7

RIDEM SHELLFISH GROWING AREA MONITORING: GA7

Recent 30 all weather.

(5/7/2014 to 10/10/2018; all mTEC, 17 wet and 13 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA7-1	SA	30	4.3	18.6
GA7-1A**	P	5	26.1	241.7
GA7-2	P	30	2.0	2.4
GA7-3	A	30	2.3	5.3
GA7-4	A	30	3.0	8.0
GA7-5	A	30	2.2	3.6
GA7-6	A	30	2.0	2.4
GA7-7	A	30	2.0	2.4
GA7-8	SA	30	2.2	3.4
GA7-9	P	30	2.0	2.0
GA7-10	A	30	2.1	2.7
GA7-11	A	30	2.0	2.4
GA7-12	A	30	2.1	2.8

****** new station 7-1A added in 2018; number of observations is low (n= 5) and insufficient data to calculate representative statistics for compliance.

Recent 15, when OPEN

(3/19/2014 to 10/10/2018 all mTEC, 8 wet and 7 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA7-1	SA	15	2.5	0.0
GA7-8	SA	15	2.0	0.0

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

Contents

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A. Introduction

All waters of the Narrow River, Growing Area 7-2 have been classified as prohibited to shellfishing since August 28, 1979 due to elevated fecal coliform concentration. 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 Block Island Sound (GA14). In addition, DEM Shellfish staff regularly sample four stations in the Narrow River to track changes in fecal coliform concentration.

B. 2018 Shoreline Survey of Lower River

A shoreline survey of the southernmost portion of the Narrow River (GA 7-2) was completed on July 9th and 10th, 2018 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. Results of the 2018 sanitary survey are in Table 1.

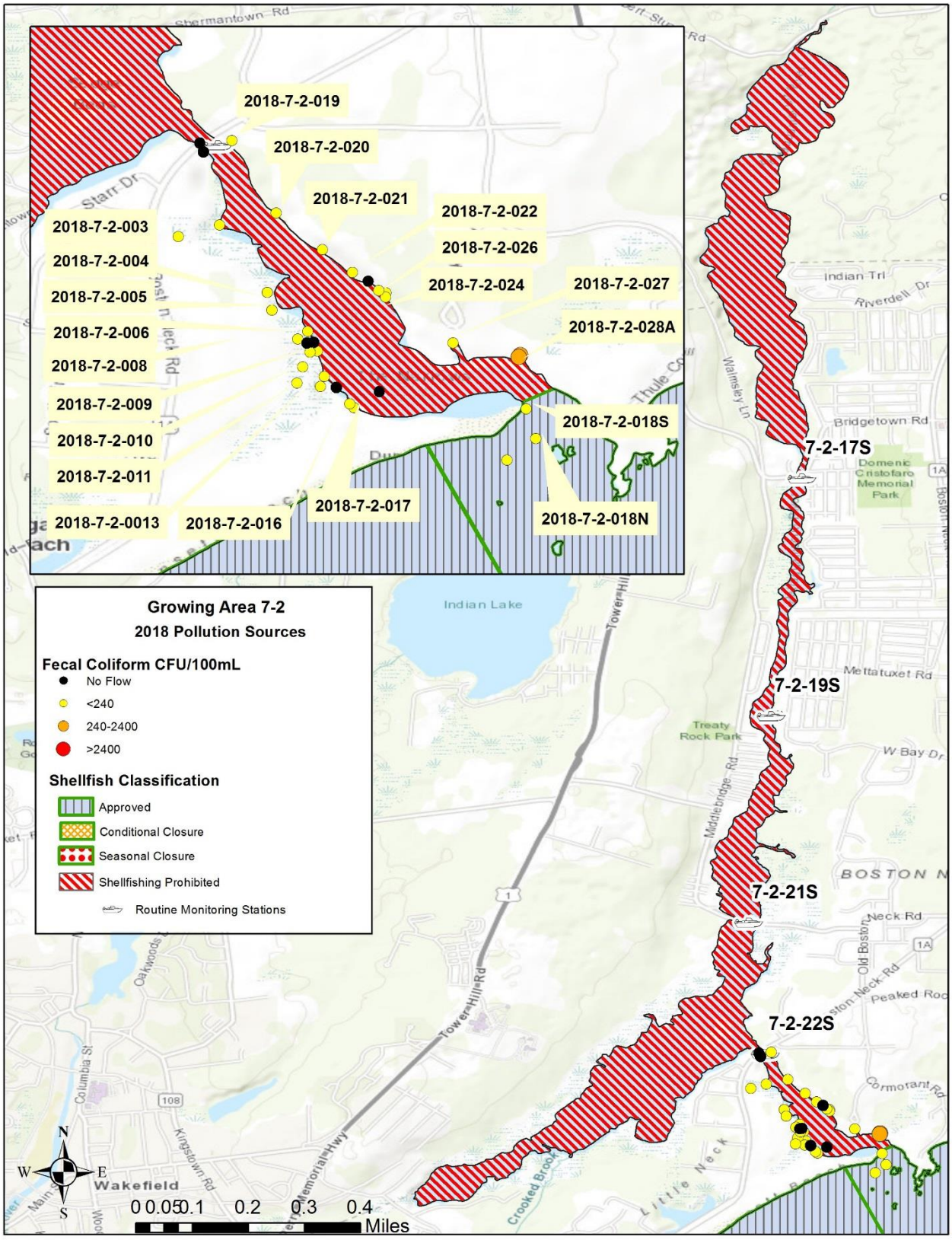


Figure 1: Sites examined during shoreline survey of the lower Narrow River (GA7-2) during July 2018

Twenty-seven (27) separate potential sources were identified with seven (7) sources found to be dry during the July 2018 survey. The survey, on July 9-10 2018 took place during a dry period; the previous rainfall of note was 0.2" 17 days prior to the survey dates. 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.

A single source (7-2-028) was found to have fecal coliform exceeding 240 cfu/100 ml. Source 7-2-028 is a small seep (approximately 1 foot wide by 0.25" deep) flowing from an upland *Phragmites* spp. stand and across a small beach. The seep dissipates into the sand at low tide but would enter the receiving waters of GA7-2 at high tide. On 7/10/2018, this seep had a trickle of flow and a fecal coliform concentration of 1,600 cfu/100 ml was observed at the location where the seep exits the *Phragmites* stand. A companion sample (7-2-28A) collected from this source on the narrow beach near the low tide line had a fecal coliform concentration of 280 cfu/100 ml. Because of the low flow, source 7-2-028 presents little potential for negatively impacting the bacteriological quality of Growing Area 7-2 or adjacent Growing Area 14. Source 7-2-028 will be monitored with follow-up sampling.

Figure 2: Source 7-2-028 a small seep flowing out of uplands, through a Phragmites stand (left photo) and across a small beach (right photo) before dissipating into the sand. Photo taken 7/10/2018.

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

Source ID	Latitude 41.xxxxx° (Decimal Degrees)	Longitude 71.xxxx° (Decimal Degrees)	Description and Location	Receiving Waters Classification	Act/ Pot	Dir/ Indir	Results	Flow (___ per sec.)	Source Dimensions (Width or Dia. X Stage)	Date Visited/ Sampled
2018-7-2-028	41.44351	-71.4416	GW stream, through phrag stand, flows across sand beach into receiving waters.	Prohibited	P	D	1600	Trickle	1' wide x 0.5 cm deep	7/10/2018

C. 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, 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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

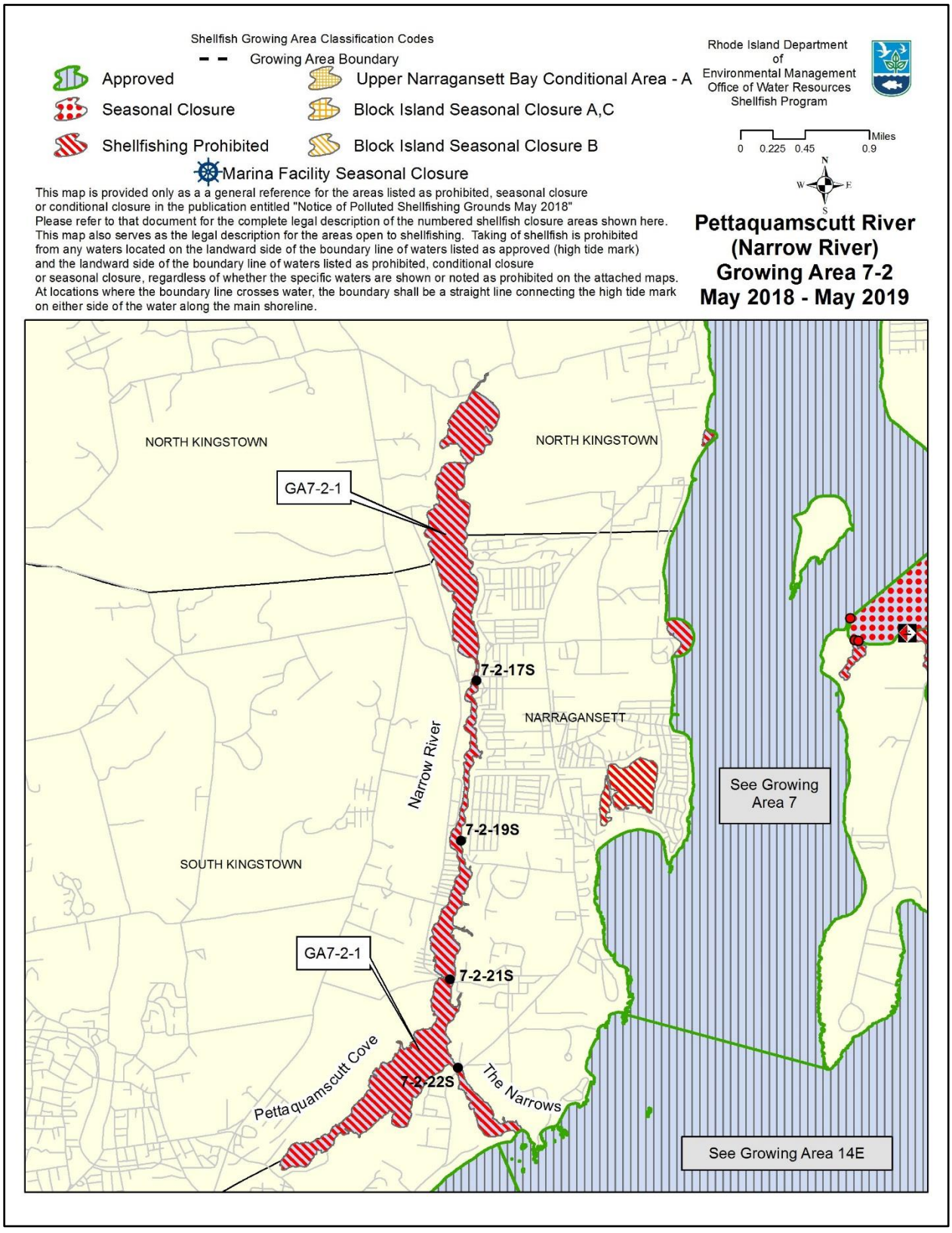
The waters of the Narrow River were sampled eight (8) times during 2018. Four (4) shore stations (stations 7-2-17S, 7-2-19S, 7-2-21S and 7-2-22s; Figure 1) were sampled under a variety of conditions in support of potential re-classification. The attached GA7-2 map shows the sampling station locations and the current classification of this growing area. Results from the statistical evaluation demonstrated that all four stations exceed shellfish standards under an approved scenario (recent 30 samples under all weather conditions, 10 wet weather and 20 dry weather). In addition, all of the stations north of Mettatuxet (stations 7-2-17S, 7-2-19S and 7-2-21S) did not meet shellfish standards under a conditionally approved scenario (recent 15 samples collected during dry weather of < 0.5" rain in 7 days prior to sample). However, under the conditionally approved scenario with a 0.5" or greater rainfall closure, station 7-2-22S located just south of Sprague Bridge did meet statistical criteria for the harvest of shellfish, indicating initial support of a conditionally approved area with a closure criteria during wet weather of less than 0.5" of rain. Continued monitoring of wet weather conditions must be conducted to determine whether station 7-2-22S would reliably stay within compliance under 0.5" of rain, the establishment of recovery times associated with this management criteria and an evaluation of the program's logistical ability to support monitoring of this area if an upgrade to conditionally approved classification is warranted

D. Marinas and Mooring Fields

Records indicate that there are two marinas located within the waters of this growing area. Both marinas have limited capacity in that the waters of the river are fairly shallow, which limits the size of boat capable of navigating to these marinas. However, 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 Block 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: 2017-2018 classification map and routine monitoring stations.



E. Annual Statistical Summary

GROWING AREA 7-2 – PETTAQUAMSCUTT RIVER (NARROW RIVER)

HIGHLIGHTS

* Sampled 8X during 2018.
* 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= 10) and dry (n= 20) weather 6/3/2016 to 12/19/2018.
* Statistics also calculated under dry weather (less than 0.5" rain in prior 7 days) only conditions for recent 15 samples collected 11/2/2016 to 7/12/2018.
* All samples analyzed by the mTEC method.
* Data run 12/24/2018.

COMMENTARY

The Pettaquamscutt River (Growing Area 7-2) was sampled 8 times from shore-access stations during 2018. The area is classified as prohibited to shellfishing so there is no minimum sampling requirement. The 2018 statistical evaluation for the Pettaquamscutt River includes a conditionally approved scenario (recent 15 samples collected during dry weather) and an approved scenario (recent 30 samples collected under all weather conditions). The area has been closed to shellfish harvest for direct human consumption since 1985 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 water quality.

There are no NSSP guidelines for statistical evaluation of prohibited areas. Summary statistics for this growing area were calculated to track changes in water quality, not for compliance. Based on the recent 30 samples, all stations in the Narrow River exceeded criteria for approved waters. Evaluating the recent 15 samples under a conditionally approved management scenario of a 7-day closure following >0.5" rain, all stations north of Mettatuxet (stations 7-2-17S, 7-2-19S and 7-2-21S) exceed fecal coliform criteria. Under this conditionally approved scenario, station 22S, south of Sprague Bridge near the connection of the Narrow River with Block Island Sound, would meet water quality criteria for conditionally approved areas. Future monitoring is required to ascertain whether these recent improvements in lower Narrow River water quality are predictable and persistent enough to support a change in classification.

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 annual statistical summary

RIDEM SHELLFISH GROWING AREA MONITORING: GA7-2

Recent 30 all weather
(6/3/2016 to 12/19/2018; all mTEC, 10 wet and 20 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA7-2-17S	P	30	11.2	84.7
GA7-2-19S	P	30	21.5	210.6
GA7-2-21S	P	30	13.9	101.3
GA7-2-22S	P	30	10.1	48.9

Recent 15 dry weather (<0.5" rain in previous 7 days) only.
(11/2/2016 to 7/12/2018; all mTEC, 15 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA7-2-17S	P	15	7.1	13.3
GA7-2-19S	P	15	10.4	26.7
GA7-2-21S	P	15	7.2	26.7
GA7-2-22S	P	15	6.11	6.7

GA8 Annual Update: Greenwich Bay

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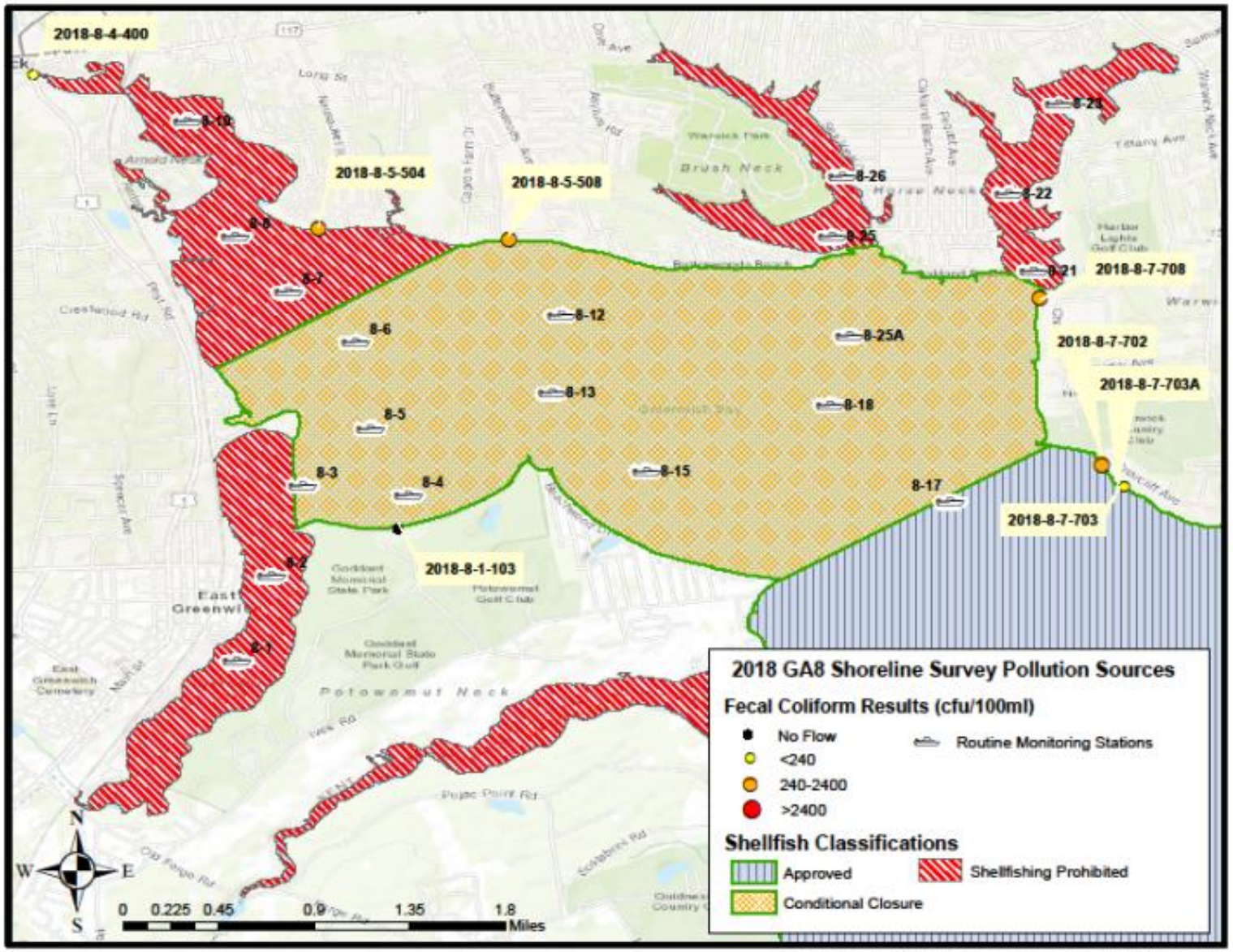
A. Introduction

A 12-year shoreline survey of the Greenwich Bay Growing Area 8 (Figure 1) was conducted in 2017. 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 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. Although no source was identified that exceeded the 2400 MPN/100 ml criteria for follow-up sampling, several sources that had previously elevated counts were re-sampled to ensure they were not impacting the receiving waters.

Figure 1: 2018 Shoreline Survey Pollution Sources



B. 2018 Shoreline Survey

Eight (8) sources had elevated fecal coliform levels above 900 cfu/100ml and were sampled in 2018 to ensure they were not impacting the growing area. Their results can be seen in **Table 1**, seven (7) of the eight had enough flow to be sampled and one source (8-1-103) had no flow at the time of the 2018 survey. Source 2018-8-4-400 had a fecal coliform of 1200 cfu/100ml during the 2017 12-year survey. When this source was followed up in 2018, it had a fecal coliform level of 140 cfu/100 ml, well within the 240 cfu/100 threshold. Source 2018-8-7-702 and source 2018-8-7-703A also had elevated bacteria levels during the 2017 12-year survey and both have drastically decreased to less than 100 cfu/100ml when resampled in 2018 and early 2019.

Source 2018-8-5-508 had a fecal coliform level of 1,000 cfu/100ml during the 2017 12-year survey. When initially resampled in 2018 its fecal coliform levels were similar (1,100 cfu/100ml). However, when followed up in January of 2019, the bacteria levels had dropped to 48 cfu/100ml.

Source 2018-8-5-504 is a 4' wide concrete canal that drains an upstream wetland. This source had elevated bacteria results in 2017 as well as 2018 when resampled, both over 1,100 cfu/100ml. When resampled in January of 2019 the bacteria levels had dropped to 320 cu//100ml. This source has an estimated flow rate of approximately 0.25 ft^3/sec and flows through a residential area directly into Greenwich Bay. The receiving waters of Greenwich Bay near this source are classified as prohibited and there is sufficient dilution in the prohibited waters before reaching conditionally approved waters. This source will be resampled during the next follow up sampling.

The last source (source 2018-8-7-708) that had elevated fecal results is drainage from an upland wetland. This source is 2 feet wide by approximately an inch deep. Given those dimensions, the estimated flow observed during sampling was 0.167 cfs. In 2017, this source had results of 1,180 cfu/100ml, and in 2018 had results greater than 1,600 cfu/100ml. Initial sampling of this source was conducted under what is considered wet weather, greater than 0.5 inches of rain within 24 hours. There was an inch of rain on the day of sampling in 2018 with 0.15 inches of rain the day before as well. In 2017 this source was also sampled during wet weather. This source should be resampled under 'dry weather' conditions (less than 0.5" rain in prior seven days) in the next annual shoreline survey update to assess the impact of this source on GA8 when it is in the open status. Given the low flow rate and given that that Greenwich Bay is a conditionally approved shellfish area which closes after 0.5 inches of rain, this source is not likely impacting GA8 when it is open for shellfish harvest.

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 August 2017.

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.

Table 1: 2018 Shoreline Survey Pollution Sources

Source ID	Latitude	Longitude	Description and Location	2017 Results	2018 Results	Flow (cfs)	Follow up Results
2018-8-4-400	41.697467	-71.459383	Hardig Brook at Rt 1 sum of 408, 409 & 410. Sampled as 8-4-412 in 2017 due to incorrect GPS coordinates	1200	140		
2018-8-1-103	41.66645	-71.43445	Twin 24" concrete pipe in seawall with grate (Wet weather source only)s	1040		NF	
2018-8-5-504	41.686967	-71.43985	4' wide concrete canal draining upstream wetlands	1120	1200	0.25	320
2018-8-5-508	41.68625	-71.426867	15" CMP conveying creek draining upstream wetland	1000	1100	0.08	48
2018-8-7-702	41.67085	-71.386367	24" CMP 5 feet east of #701	1180	280	Trickle	13
2018-8-7-708	41.6822	-71.390633	wetland drainage	1180	>1600	0.17	>1600
2018-8-7-703	41.669333	-71.384867	10" concrete pipe behind vegetation	920	96	0.03	
2018-8-7-703A	41.669333	-71.384867	18" concrete pipe right next to 703-steady flow. Green and brown algae in stream		72		

C. 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 Brewer's Greenwich Bay that has restaurants, pools, full service repair and storage and pump out facilities. All of these marinas are located in shellfish waters that are classified as prohibited and dilution calculations have been performed to ensure that ample adjacent waters are classified as such to be protective. These calculations can be found in the programs permanent file and are tabulated in the document entitled "Marina Dilution Analysis Background, June 2017". All of 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 16 fixed pump-out locations and two mobile pump-out boats 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 files.

D. Waste Water Treatment Facilities

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. 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 2018 was 0.98 MGD, well within the permit limits. Two *Enterococci* violations were reported in 2018. A daily maximum *Enterococci* of 4,00MPN was reported, over the permitted daily max of 276 MPN. The other *Enterococci* violation was 1,940 cfu/100ml which was greater than the permitted 276 cfu/100ml. The facility did not install any new treatment processes. The only 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.

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.

E. GA8 Annual Statistical Summary

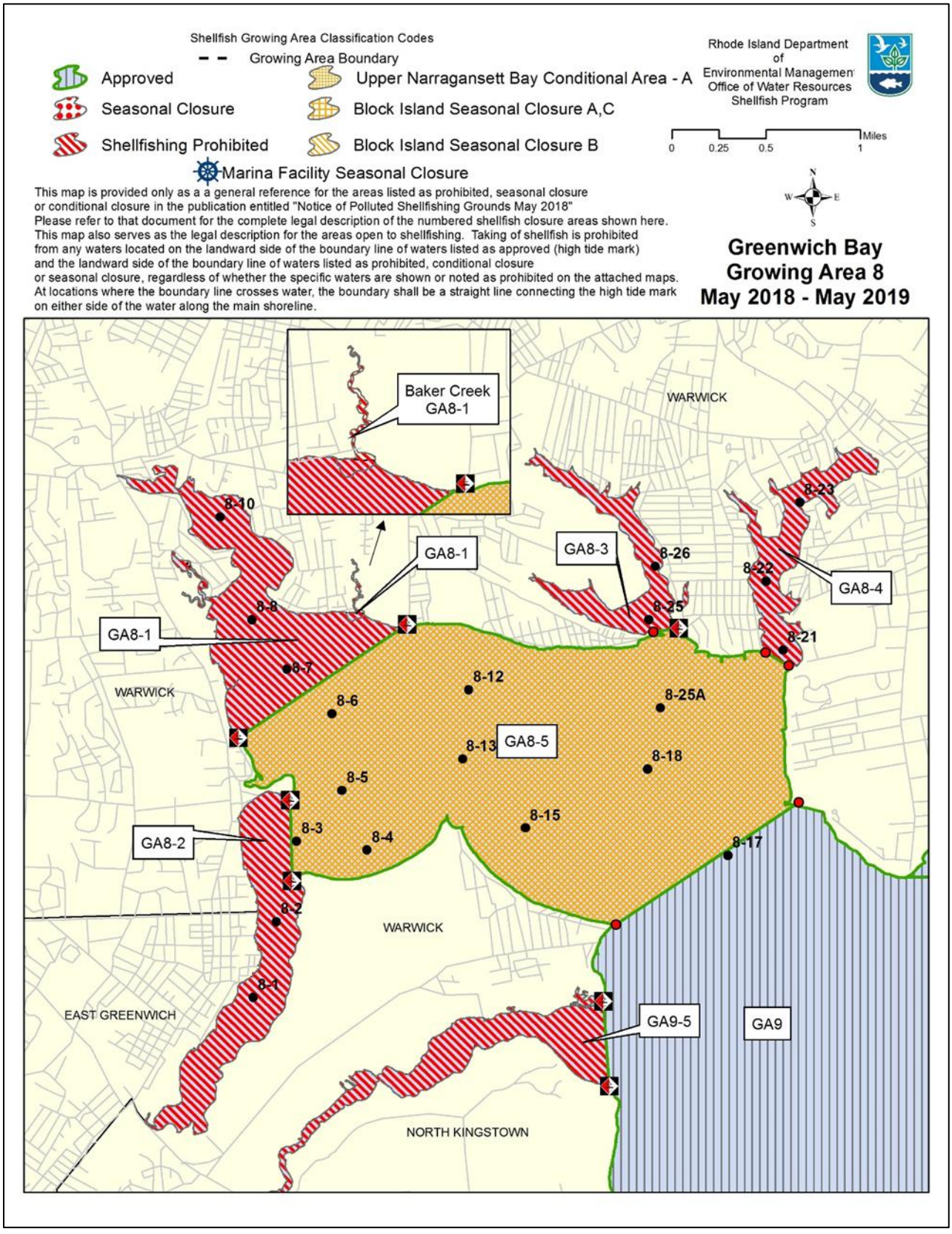
The Shellfish Growing Area Monitoring program is part of the state of Rhode Island's agreement with the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP). The purpose of this program is to maintain national health standards by regulating the interstate shellfish 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

Figure 2 GA8 Growing Area Map with Routine Monitoring Stations



HIGHLIGHTS

* Sampled 13X during 2018.
* Statistics represent recent 15 samples collected between 12/20/2016 (stations 8-25 & 8-26) or 8/16/2017 (all other stations) to 12/10/2018 when the growing area was open.
* All conditionally approved stations are in compliance.
* All samples analyzed by the MTEC method.
* Data run 1/8/2019.

COMMENTARY

Greenwich Bay (GA8) was sampled thirteen times during 2018, with nine sets of samples collected during dry weather when the area was in the open status and four sets of samples collected during wet weather (>0.5" rain in prior 7 days) when the area was in the closed status. Following NSSP guidance, evaluation of this conditionally approved growing area was based on the most recent 15 samples collected when the area was in the open status for shellfish harvest. A seasonal (December) shellfishing closure of this growing area was required prior to 2017 because of elevated fecal coliform observations during the month of December. Recently improved water quality during December allowed this seasonal closure to be lifted in 2017. Accordingly, the 2018 statistical evaluation is based on the recent 15 samples which includes three sets of samples collected during December when the area was in the open status.

The 2018 statistical evaluation showed that all conditionally approved stations in Greenwich Bay (GA8) were in compliance. 'Sentinel stations' in prohibited areas of Greenwich Cove (station 8-3), Apponaug Cove (station 8-7) and Warwick Cove (station 8-21) that are located adjacent to open areas also met criteria for conditionally approved waters. The 2018 statistical review demonstrated that the conditionally approved area of Greenwich Bay (GA8) is in program compliance and is properly classified.

RECOMMENDATIONS

* Maintain Greenwich Bay conditionally approved year-round. Recent December data indicate that the December closure is not required.
* 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.

Table 2: 2018 Statistical Summary of GA8

RIDEM SHELLFISH GROWING AREA MONITORING: GA8

Recent 15 when area was open (all dry weather).
(8/16/2017 to 12/10/2018; all mTEC)

			FECAL-GEO	
Station Name	Status	N	MEAN	%>CRITICAL 31
GA8-1	P	15	5.4	6.7
GA8-2	P	15	8.0	20.0
GA8-3	P	15	5.1	6.7
GA8-4	CA	15	2.7	0.0
GA8-5	CA	15	2.7	0.0
GA8-6	CA	15	4.0	6.7
GA8-7	P	15	4.5	6.7
GA8-8	P	15	5.5	0.0
GA8-10	P	15	29.3	53.3
GA8-12	CA	15	3.3	0.0
GA8-13	CA	15	2.6	0.0
GA8-15	CA	15	2.2	0.0
GA8-17	CA	15	2.3	0.0
GA8-18	CA	15	2.3	0.0
GA8-21	P	15	5.6	6.7
GA8-22	P	15	9.6	6.7
GA8-23	P	15	10.6	26.7
GA8-25A	CA	15	3.5	0.0

Recent 15 when area was open (all dry weather).
(12/20/2016 to 12/10/2018; all mTEC; note that these stations are impossible to sample at low tide so a large date range is required for recent 15 samples)

			FECAL-GEO	
Station Name	Status	N	MEAN	%>CRITICAL 31
GA8-25	P	15	6.7	13.3
GA8-26	P	15	9.4	26.7

F. Conclusions

The 2018 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 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 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 monitors Growing Area 8 in accordance with the guidelines set forth in the Greenwich Bay Conditional Area Management Plan (CAMP) established in January 1996. Although the document is outdated it is still valid due to the positive improvements within the watershed to deal with stormwater impacts as recommended in the TMDL, reduction of OWTS and improvements to the WWTF. This document is currently being rewritten in response to the 2017 FDA PEER evaluation recommendations. The CAMP for Greenwich Bay Growing Area 8 was re-evaluated during for this annual review and the monitoring and management actions were in compliance with the management plan as currently written and going forward.

GA9 Annual Update: West Middle Bay

Contents

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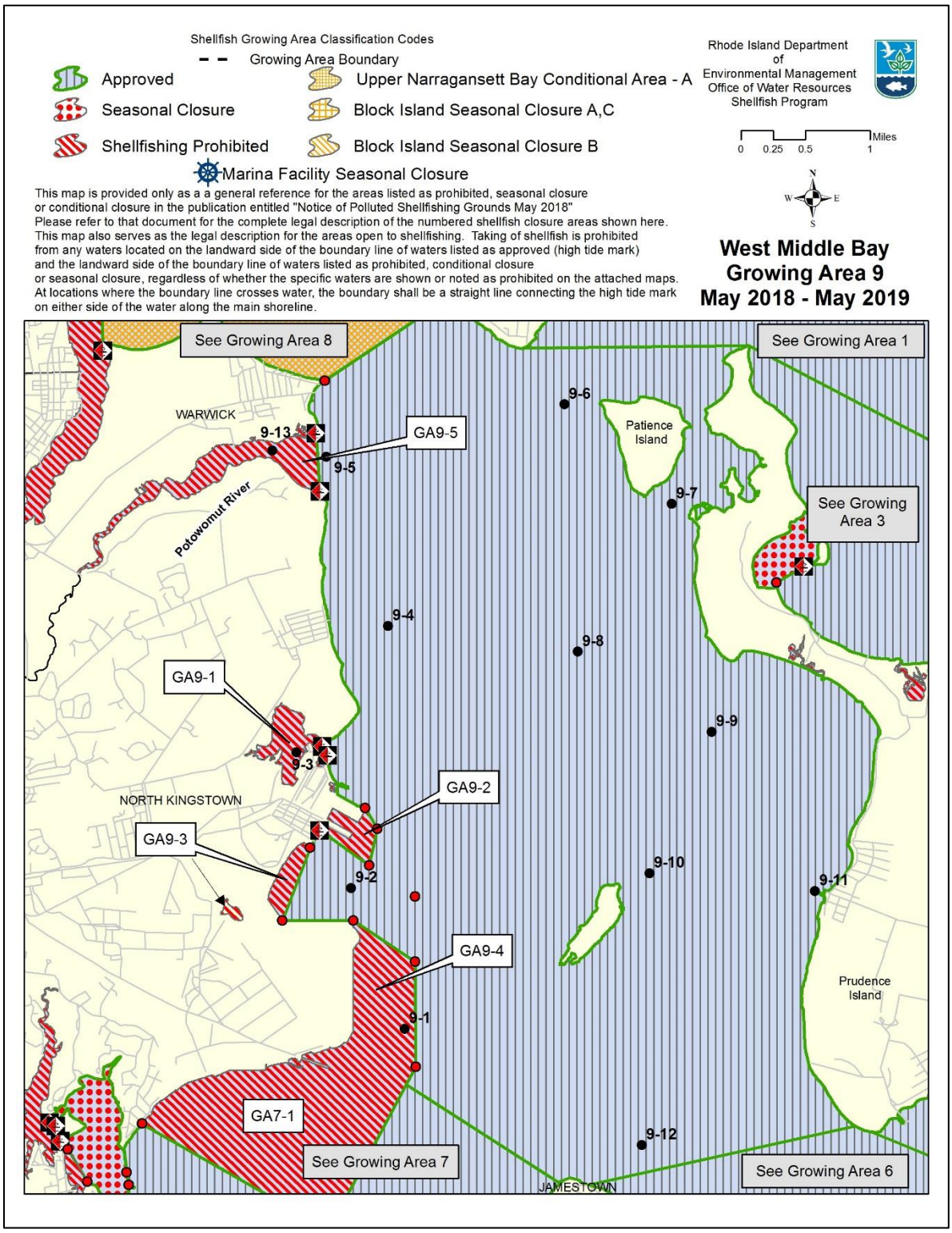
A. Introduction

A triennial re-evaluation shoreline survey of West Middle Bay (Growing Area 9; Figure 1) was performed in 2016. A total of five (5) pollution sources were visited and all of them had flow during the 2016 survey. During the 2017 annual update two (2) sources were re-visited (9-201 and 9-011) and sampled. These same two sources (9-201 and 9-011) were re-surveyed during 2018.

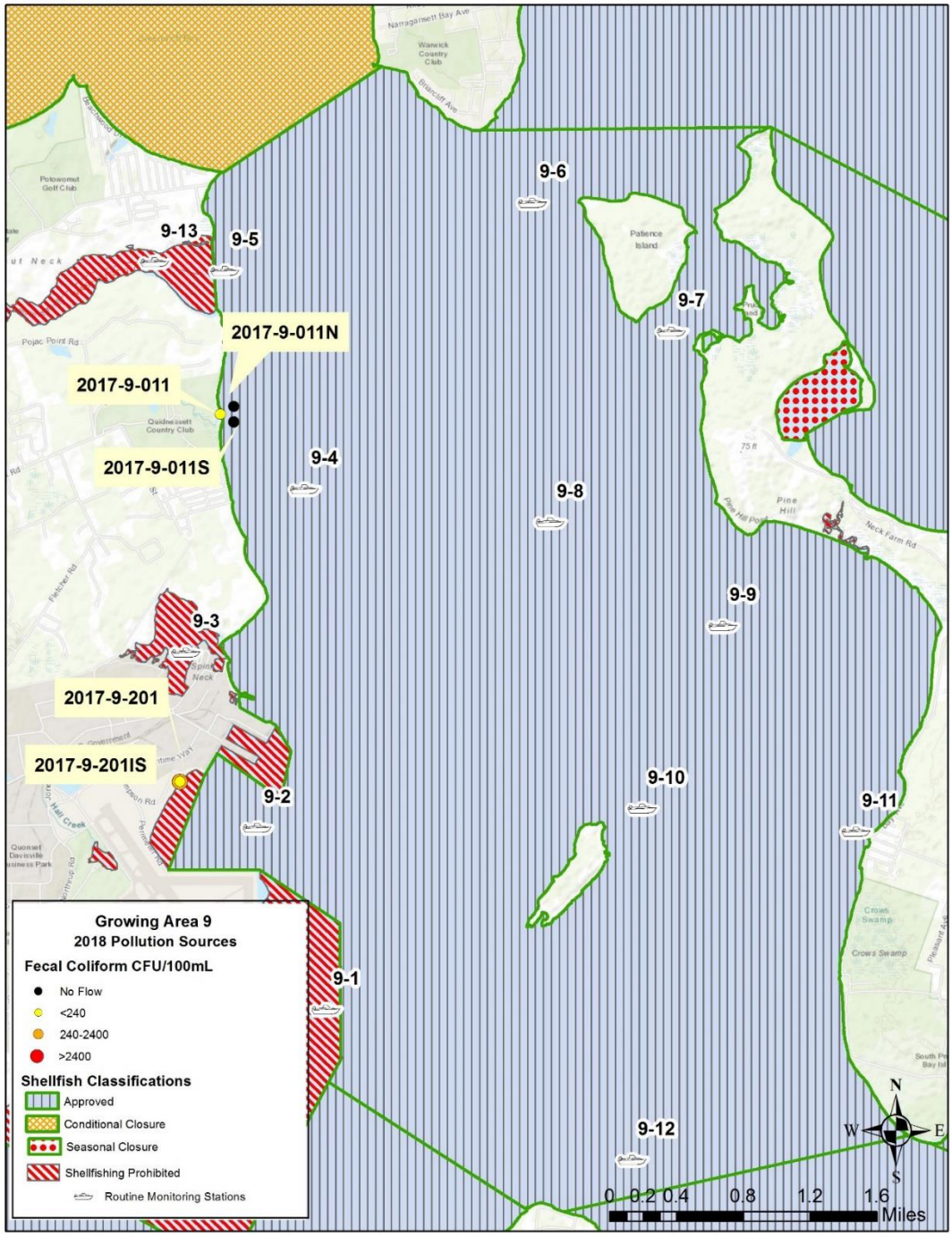
Figure 1: Growing Area 9 current classification.



B. 2018 Annual Update

A map of 2018 sources (Figure 2) and a table of 2018 fecal coliform results (Table 1) from the 2018 sanitary survey of GA9 is below. Based on results from previous shoreline surveys two sources were sampled during the 2018 annual update.

Figure 2: 2018 West Middle Bay Growing Area 9 Pollution Sources.



A follow-up of source 9-011 (Tibbet's Creek flowing into GA9 near Quidnesset Country Club) was completed on 10/3/2018 (Figure 3). The autumn of 2018 was exceptionally wet (24.4" of rain compared to a long-term average of 12.4" during September 1 to November 30, 2018) and the sample at Tibbett's Creek was collected 1 day after 1.16" of rain had fallen at TF Green Airport. Despite the wet weather, a result of < 2 cfu/100 ml was obtained at source 9-011 during the 2018 follow-up.

Figure 3: Source 9-011 Tibbet's Creek flows through a salt marsh (left photo) and enters the waters of Growing Area 9 in the West Passage of Narragansett Bay (right photo). Photos taken 10/4/2018.

Source 9-201 is a small stream (Figure 4; approximately 2 feet wide by 3 inches deep) draining an upland marsh and entering a portion of GA9, Fry Cove, that is classified as prohibited to shellfish harvest. The fecal coliform concentration in this stream was 320 cfu/100 ml on 10/4/2018. At that time the flow rate of the stream was approximately 0.25 cfs; this was on 10/4/2018 which was one day after a substantial rainfall (1.61" of rain at nearby TF Green Airport). In stream samples taken adjacent to the source in prohibited waters indicated a reduction due to dilution in the receiving waters and nearby shellfish program monitoring station 9-4, located in approved waters, was in compliance during 2018. Follow-up sampling of source 9-201 and nearby receiving waters should be conducted during the 2019 triennial update of the West Middle Bay.

Figure 4: Source 9-201, a small stream draining an upland marsh (left photo) and flowing across a sandy beach (right photo) to the receiving waters of Fry Cove in the West Passage of Narragansett Bay.

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 August 2017.

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 (West Middle Bay) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

Table 1: Summary of 2018 Shoreline Survey Results for GA 9 West Middle Bay

*Highlighted sources >240 CFU/100ml.

IS = In stream sample NS = Not sample

Source ID	Date Visited	Lat	Long	Description	Receiving waters classification	2016 Results mTEC CFU/100 ml	2017 Results mTEC CFU/100 ml	2017 Flow (cfs)	2017 Follow-up Results	2017 Follow-up Flow (cfs)	2018 Results mTEC CFU/100 ml	2018 Flow (cfs)
2017-9-201	10/4/2017	41.61019	-71.4132	Small stream draining upland tidal marsh/wetland	Prohibited	400	200	0.71			320	0.25
2017-9-201IS	10/4/2017	41.61019	-71.4132	In stream	Prohibited	4	99				100	
2017-9-011	10/4/2017	41.64204	-71.4086	Tibbets Creek at Quidnessett Country Club	Approved	480	909	17.44	100	4.25	2	
2017-9-011N	10/4/2017	41.64272	-71.407	Tibbets Creek IS North	Approved	2	300		38			
2017-9-011S	10/4/2017	41.64136	-71.407	Tibbets Creek IS South	Approved	4	99		122			

d NF = No flow CNL = Could not locate

C. Marinas

There are five (5) marinas/mooring fields located within the waters of the West Middle Bay (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 by following this link:

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 2018 was 0.535 mg/d, well within the permit limits. A review of this WWTF DMR data indicated two (2) daily maximum *Enterococci* violations during the 2016 to 2018 period. Both were minor violations: an observation of 280 cfu/100 ml on 3/31/2016 and an observation of 590 cfu/100 ml on 4/30/2018 compared to a 276 cfu/100 ml daily maximum limit. No fecal coliform or flow violations were noted during 2016-2018. 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.

E. 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, 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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 9 – WEST MIDDLE BAY

HIGHLIGHTS

* Sampled 6X during 2018.
* Statistics represent combined wet (n= 17) and dry (n= 13) weather data collected between 5/7/2014 to 10/10/2018.
* All samples analyzed by the MTEC method.
* Data run 11/9/2018.
* All approved stations in compliance.

COMMENTARY

The West Middle Bay (Growing Area 9) was sampled six times during 2018, 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= 17) and dry (n= 13) weather conditions.

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 the river was suitable for approved harvest of shellfish. The 2018 statistical evaluation indicated that the freshwater end of the Potowomut River (station 9-13) exceeds the 90th percentile variability criteria and that shellfish harvest should remain prohibited for that region. Station 9-5 at the mouth of the Potowomut River has slightly elevated bacteria levels but continues to meet criteria for approved waters and should remain approved for shellfish harvest. The 2018 statistical review indicated that all approved stations in the growing area were in program compliance. 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 2: Annual Statistical Summary

RIDEM SHELLFISH GROWING AREA MONITORING: GA9

Recent 30 all weather.
(4/15/2013 or 7/30/2013 to 10/31/2017 or 11/3/2017; all mTEC, 19 wet and 11 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA9-1	P	30	2.1	2.7
GA9-2	A	30	2.1	2.6
GA9-3	P	30	3.7	12.8
GA9-4	A	30	2.7	6.8
GA9-5	A	30	3.6	17.3
GA9-6	A	30	2.4	4.8
GA9-7	A	30	2.0	2.5
GA9-8	A	30	2.1	2.6
GA9-9	A	30	2.1	2.7
GA9-10	A	30	2.3	4.0
GA9-11	A	30	2.0	2.4
GA9-12	A	30	2.0	2.5
GA9-13	P	30	6.3	32.2

GA10 Annual Update: Point Judith & Potters Pond

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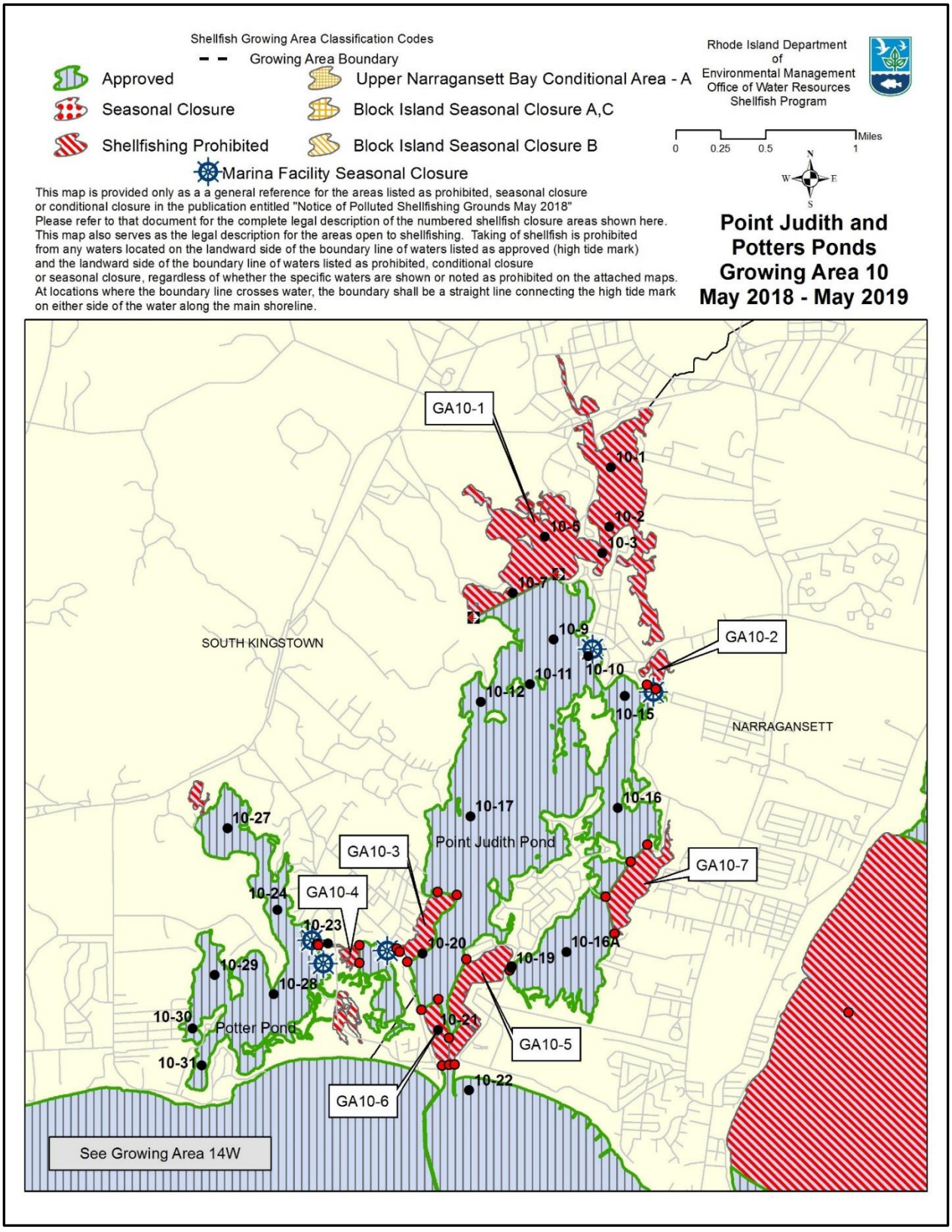
A. Introduction

A 12-year sanitary shoreline survey of the Point Judith Pond / Potters Pond Growing Area 10 (Figure 1) was conducted in 2011. There was a total of ninety-seven (97) actual or potential sources identified during this shoreline survey. 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. A triennial survey was completed in 2017 of which twenty-nine (29) potential pollution sources were sampled.

Figure 1: GA10 (Pt Judith & Potter Pond) current classification map & monitoring stations



B. 2018 Shoreline Survey

The 2018 shoreline survey update of GA10 was completed on October 4th and October 18th of 2018 by DEM Shellfish Program staff. In 2018 seven (7) sources were re-sampled, four (4) of which flow into receiving waters currently classified as Approved. Of the seven (7) sources sampled during the 2018 reevaluation, three (3) of the seven (7) had results greater than 2,400 cfu/100ml in previous years. For 2018, two (2) of the seven sources had no flow at the time of sampling and the remaining five (5) were sampled and results are shown in Table 1. All resampled sources were well below 2,499 cfu/100 ml during the 2018 annual reevaluation of GA10 (Table 1). While fecal coliform concentration decreased at these sources in 2018, they should be reevaluated in the 2019 annual update. Figure 2 indicates the location of potential pollution sources in GA10 and Table 1 shows 2018 sanitary survey results.

Figure 2: Location of 2018 pollution sources in GA10.

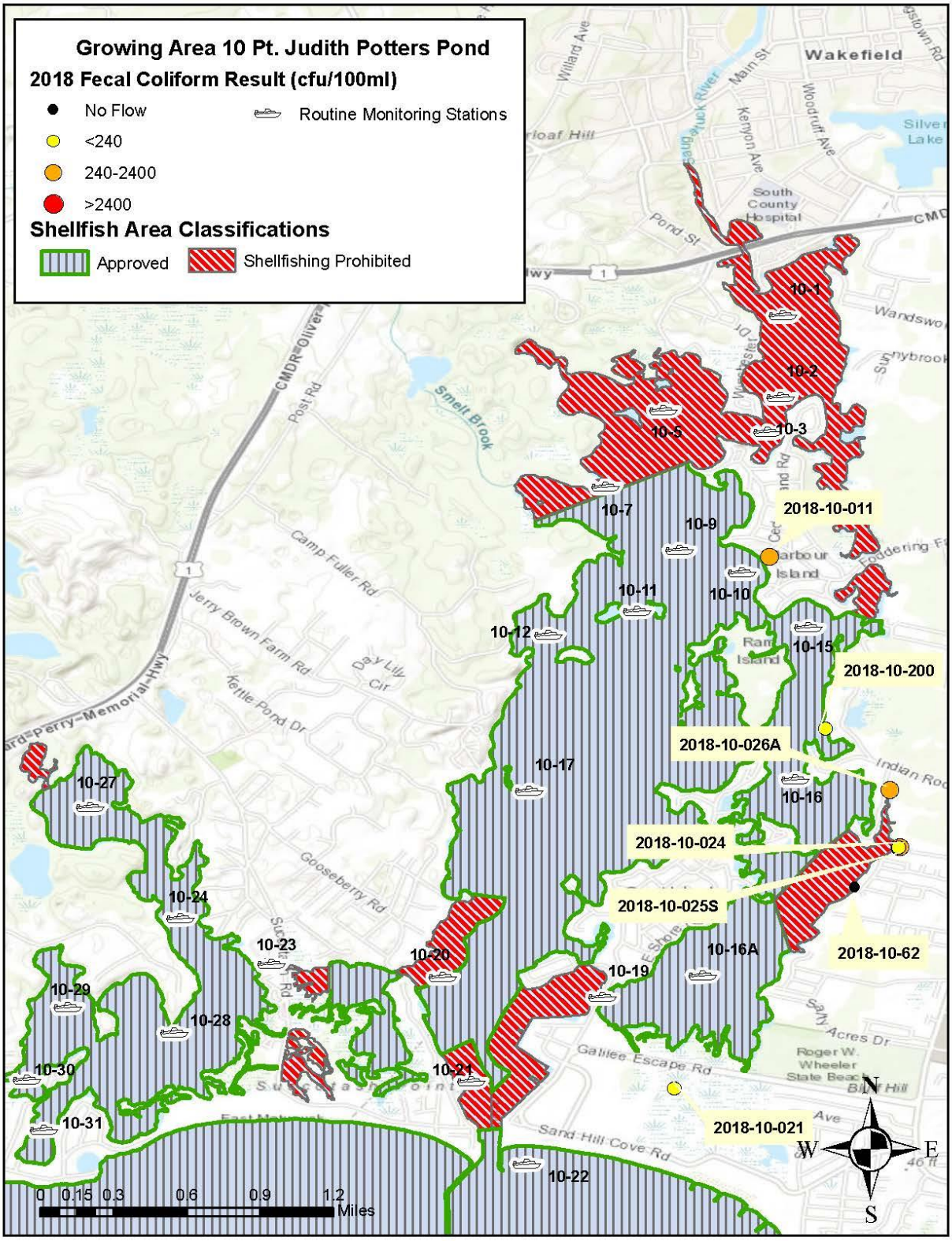


Table 1: 2018 Shoreline Survey Pollution Sources in GA10.

Source ID	Lat	Long	Description and Location	2011 Results (mpn/100 ml)	2017 Results (cfu/100 ml)	2018 Results (cfu/100 ml)	2018 Flow (cfs)
2018-10-011	41.41023	-71.4973	RCP outfall-near Cedar Island Rd, Harbour Island, Narr. Not reaching receiving waters	4,300	100	320	NF
2018-10-025S	41.39305	-71.4897	In stream in front of flared end	1,100	10,000	240	Trickle
2018-10-026A	41.39645	-71.4902	Rye cove in stream sample	NS	1,000	300	
2018-10-62	41.39073	-71.4923	RCP flared end outfall, pondview ave	46,000	2,900		NF
2018-10-200	41.40009	-71.494	Culvert draining pond at Kenyon farm	4,600	2,400	64	0.003
2018-10-021	41.37877	-71.503	18" CMP, Galilee salt marsh outlet	430	NS	110	
2018-10-024	41.39308	-71.4896	Flared end RCP outfall, cove east of Rye Point	430	4,000	520	Trickle

Source 2012-10-011 is an RCP outfall located on Harbor Island adjacent to the Harbor Island Assoc. marina (Figure 3). There is 25' seasonal marina radius closure associated with these docks that is in effect from Memorial Day to Columbus Day. This source had no flow during the time of sample, however water pooled at the source was sampled with a result of 320 cfu/100ml. Given there was no actual flow this source is of limited concern. It appears that this is a wet weather source as there were no flows observed on several dry weather sampling runs. Routine monitoring station GA10-10 representing the receiving waters is located just offshore of this source. Water column samples collected at station GA10-10 indicated that the receiving waters meet NSSP criteria, but fecal coliform concentration is variable (2018 geometric mean and variability 90th percentile are 4.5 cfu/100ml and 25.7, respectively).

Figure 3: GA10, Source 10-11

Source 10-025 are two small PVC pipes buried in the hillside above the pond. 2018 sampling indicated that both pipes had fecal coliform levels of 240 cfu/100ml. Despite this fecal coliform level, the flow was only a trickle.

Source 10-26A is located in Rye Cove. This source was sampled and had a fecal coliform result of 300 cfu/100ml.

Source 10-200 is a culvert draining the pond at Kenyon Farm. At the time of the previous 12-year survey this source had fecal coliform results of 4,600 cfu/100ml. Agricultural best management practices in the area appear to have decreased fecal coliform at this source. The 2018 follow-up sample had a result of 64 cfu/100ml, a dramatic decrease compared to previously recorded levels. This source does not appear to have an impact on downstream receiving waters.

Sources 10-021 is the tidal channel connecting Pt Judith Pond with the Galilee saltmarsh to the south of the Escape Road. This source had a fecal coliform result of 110 cfu/100 ml, therefore this source is not of concern. Both follow-up sample results were low indicating that this source has limited impact on shellfish waters in the southern section of Bluff Hill Cove.

The final source 10-24 in the GA10 update for 2018 was a round concrete pipe with a flared outlet located east of Rye Point (Figure 4). This source had a result of 520 cfu/100ml when sampled in 2018. Source 10-24 had flow that was only a trickle and this source flows into a prohibited area that provides a sufficient dilution zone.

Figure 4: GA10, Source 10-24

Many of the sources described above are in the Bluff Hill Cove area of Pt. Judith Pond (the southeast corner, near water quality monitoring station 10-16A in Figure 1). Bluff Hill Cove has experienced increasing and variable fecal coliform concentration in recent years. Investigation of sources in the adjacent watershed has raised concern of illicit discharges into the storm drain systems in the neighborhood of Pond View Rd. The storm drain system eventually flows into Pt. Judith Pond, east of Goose Island and south of Rye and Frank Points. In 2018 a reclassification of this area in the form of a downgrade from Approved to Prohibited was implemented due to investigation of elevated shoreline stormwater sources and resultant increasing and variable water column fecal coliform. A request to address the issue of elevated fecal coliform in

stormwater draining to Bluff Hill Cove was submitted to the Town of Narragansett in June of 2018 and as of January 2019, a plan is in place for Narragansett to test the storm drain system to identify illicit discharges. This plan also includes public outreach to educate the public on the issue of stormwater runoff and fecal coliform pollution and to inform residents of ways to reduce their impact. Proposed mitigation strategies include a vegetative buffer program including tree planting to reduce runoff and improve filtration before the runoff reaches Pt. Judith Pond and a wet weather control plan to identify source(s) of elevated bacteria counts in the stormwater system. DEM Shellfish Program staff will continue to monitor the receiving waters to evaluate the effectiveness of these remediation efforts on the water quality of Bluff Hill Cove. The recent Bluff Hill Cove prohibited zone will remain in effect until remediation efforts are completed and water quality statistics demonstrate that the area reliably meets NSSP criteria for Approved waters.

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 August 2017.

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.

C. GA10 Routine 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 and/or the multiple tube fermentation test (sm01 MPN) method utilized prior to August 2012. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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 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.

D. GA10 Annual Statistical Summary

HIGHLIGHTS

* Sampled 6X during 2018.
* Statistics represent recent 30 samples collected during both wet (n= 15) and dry (n= 15) weather during 4/4/2014 to 10/3/2018.
* All approved stations in compliance.
* All samples analyzed by the MTEC method.
* Data run 11/5/2018.

COMMENTARY

Point Judith and Potter Pond (Growing Area 10) was sampled six times (3 times under wet weather and 3 times under dry weather conditions) during 2018, complying with the minimum systematic random sampling monitoring requirements for approved areas. The recent 30 samples included in the 2018 evaluation were representative of both wet (n= 15) and dry (n= 15) weather.

Results of the 2018 statistical evaluation demonstrated that all approved stations in this growing area were in program compliance. A review of fecal coliform data indicated that the area of Upper Point Judith Pond classified as prohibited (north of the closure line near station 10-7) is adversely affected during wet weather. In addition, the northern region of Pt. Judith Pond in the area of stations 10-9, 10-10 (Wheatfield Cove) and 10-15 (Champlin Cove) had 90th percentile values of greater than 20 cfu/100 ml, suggesting a recent increase in fecal coliform bacteria in that region. Similarly, stations 10-24 and 10-27 in the north-central region of Potter Pond have had moderate increases in fecal coliform variability over the past two years. A TMDL study of Upper Point Judith Pond was completed in 2008 and monitoring in the prohibited section and adjacent approved areas of the pond will continue to track changes in water quality after TMDL-recommended improvements are implemented. In 2018 a section of Bluff Hill Cove was downgraded from approved to prohibited after identification of elevated bacteria sources in that region. Monitoring of the Bluff Hill Cove area will continue to track water quality changes in response to remediation actions implemented in the watershed.

RECOMMENDATIONS.

* No other actions recommended based on 2018 ambient monitoring results.
* Maintain Bluff Hill closure.

Table 2: 2018 Statistical Summary of GA10

RIDEM SHELLFISH GROWING AREA MONITORING: GA10

Recent 30 all weather.
(4/4/2014 to 10/30/2018; all mTEC, 15 wet and 15 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31)***
GA10-1	P	30	27.0	356.9
GA10-2	P	30	21.9	296.8
GA10-3	P	30	13.9	137.5
GA10-5	P	30	6.6	40.2
GA10-7	P	30	5.6	37.2
GA10-9	A	30	4.8	24.8
GA10-10	A	30	4.5	25.7
GA10-11	A	30	3.6	14.0
GA10-12	A	30	3.2	9.8
GA10-15	A	30	4.4	22.4
GA10-16	A	30	3.2	10.9
GA10-16A	A	30	4.8	18.2
GA10-17	A	30	3.3	10.7
GA10-19	P	30	5.2	21.5
GA10-20	P	30	3.8	11.4
GA10-21	P	30	4.0	14.6
GA10-22	A	30	2.7	6.5
GA10-23	P	30	3.2	9.1
GA10-24	A	30	4.5	15.3
GA10-27	A	30	3.5	12.9
GA10-28	A	30	2.8	7.6
GA10-29	A	30	2.5	5.2
GA10-30	A	30	3.0	9.2
GA10-31	A	30	3.0	7.9

Ninigret Pond and Green Hill Pond

Growing Area 11 NG
Triennial Re-Evaluation
For Calendar Year 2018

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

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A. Introduction

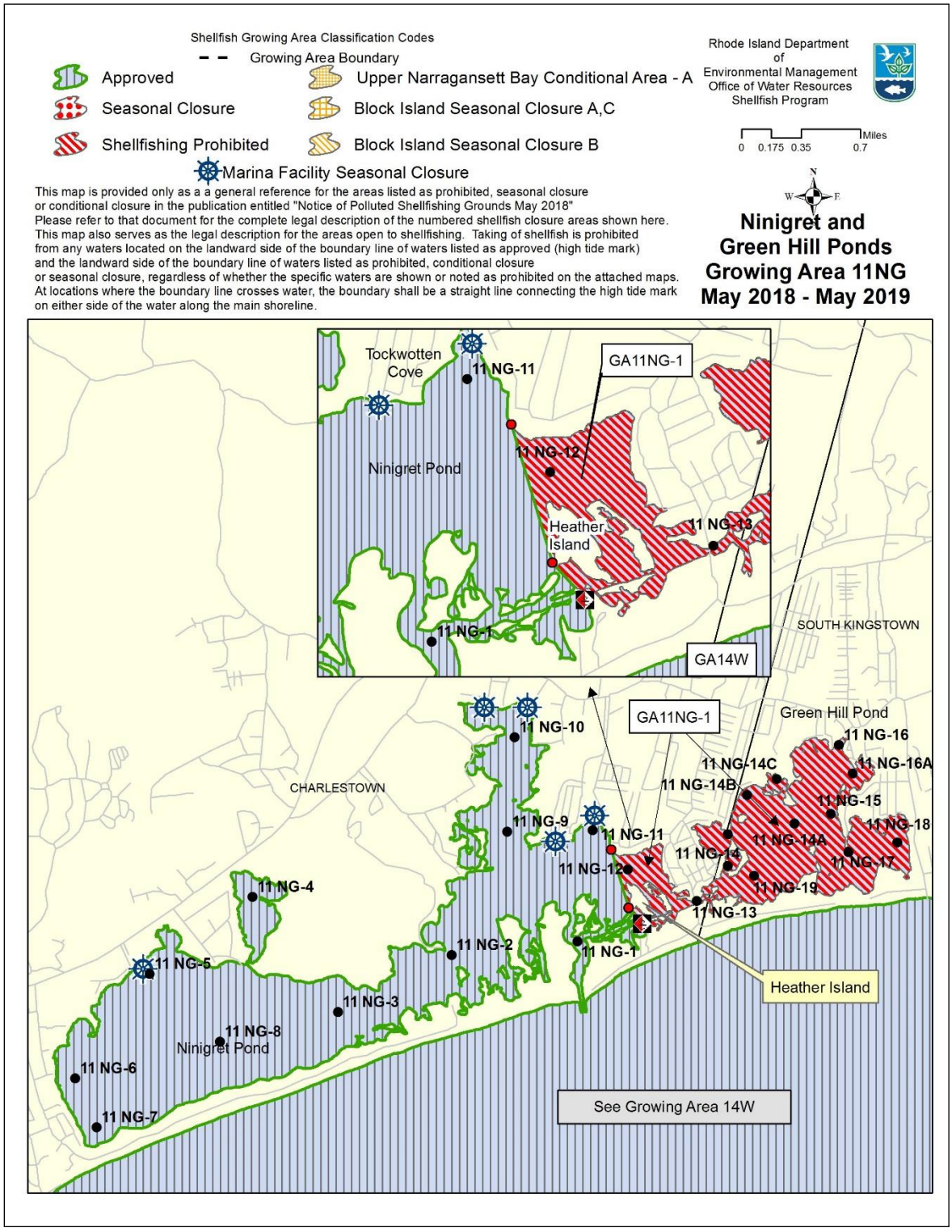
A triennial re-evaluation shoreline survey of the Ninigret Pond and Green Hill Pond shellfish growing area (GA11NG; Figure 1) was conducted in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline 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.

The Ninigret Pond and Green Hill Pond - Growing Area 11NG presently has two classifications: Prohibited and Approved. The entire Green Hill Pond and the easterly section of Ninigret Pond adjoining Green Hill Pond are presently classified as prohibited to shellfishing due to elevated bacteria counts in routine monitoring station samples. 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 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. 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.

Figure 1: GA11NG current classification map and monitoring station locations.



B. 2018 Sanitary Survey

The 2018 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 cfu/100ml in previous surveys and identification of any new pollution sources. Four (4) sources were sampled during the 2018 survey (Table 1, Figure 2).

Table 1: Fecal coliform results of 2018 shoreline survey GA 11NG

Source ID	Date Visited	Lat	Long	Description	Receiving Waters Classification	Act/Pot	Dir/Ind	2002 Results MPN FC/100ml	2012 Results mTEC cfu/100ml	2018 Results mTEC cfu/100ml	2018 Flow (cfs)
11GH-01	10/18/2018	41.37954	-71.6107	Factory Brook	Prohibited	A	D	460	1600	160	2.98
11GH-02	10/18/2018	41.37832	-71.6088	Teal Brook	Prohibited	A	D	23	380	220	0.67
11GH-010	10/18/2018	41.37751	-71.6146	Culverted stream	Prohibited	A	D	0	560	240	Trickle
11N-1000	10/18/2018	41.38056	-71.644	Stream from Cross Mill Pond	Approved	A	D	0	120	56	Trickle

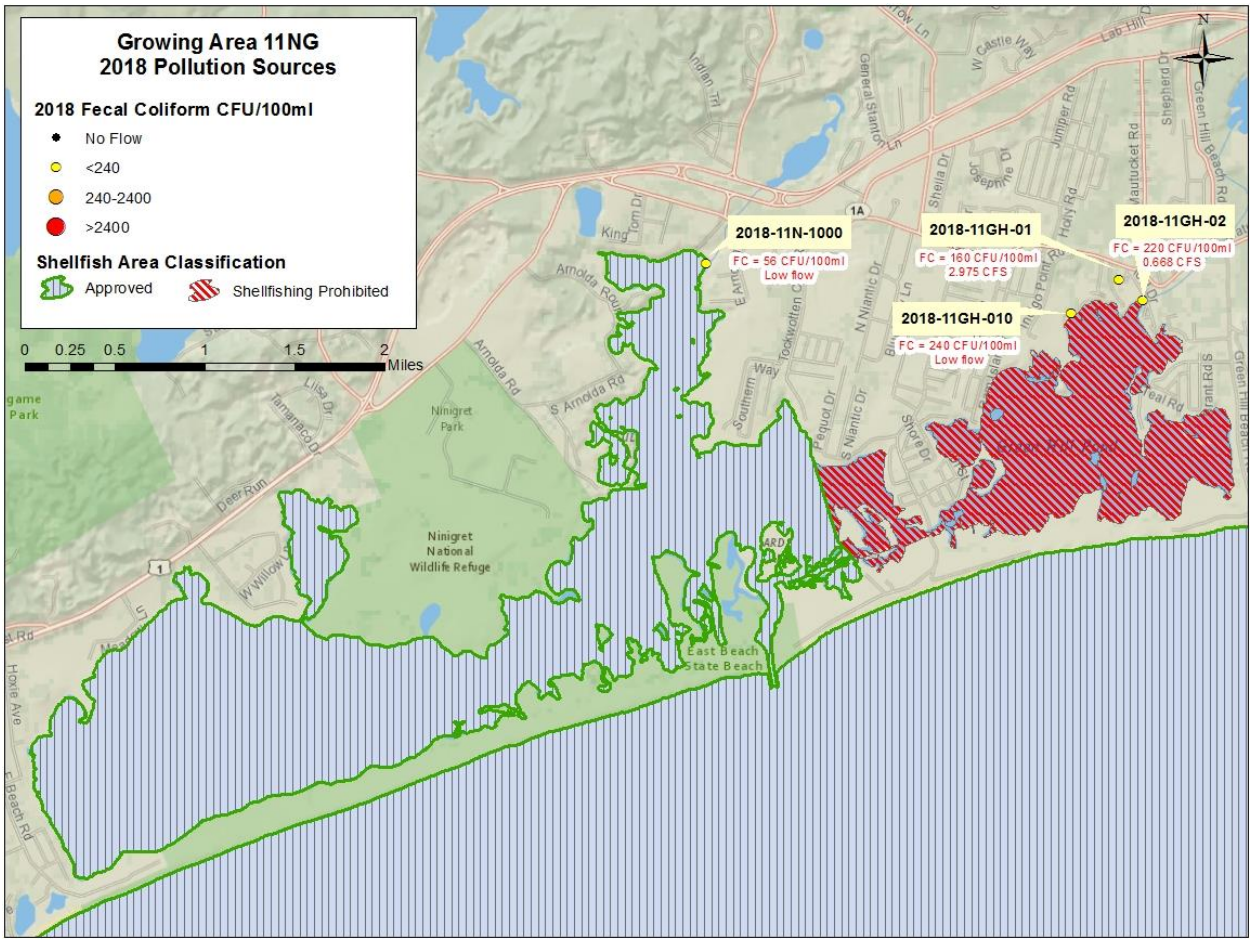


Figure 2: GA11NG 2018 potential pollution sources.

Source 11GH-01 (Factory Brook), source 11GH-02 (Teal Brook) and source 11GH-101 (a culverted stream) all flow into the prohibited waters of Green Hill Pond (Figure 2). As such, these sources do not have an impact on the approved waters of Ninigret Pond because there is sufficient dilution between the source and approved waters. Source 11N-1000 is a stream that flows from Cross Mills Pond to Ninigret Pond (Figure 3). This source had extremely low flow out of the pond (a trickle) and a fecal coliform observation of 56 cfu/100 ml during the 2018 survey which was six days after 2.03" of rain fell at the Westerly Airport. Given the low flow and moderate bacteria concentration, this source is expected to have limited impact on the receiving waters.

Figure 3: Source 11N-1000, a stream flowing from Cross Mills Pond to tidal Ninigret Pond.

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 August 2017.

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.

C. 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. Green Hill Pond lies to the east of Ninigret Pond with a physical connection between the two that consists of a narrow channel under Charlestown Beach Road. Ninigret Pond has a constructed narrow breachway that connects to the ocean and provides the tidal inputs for both Ninigret and Green Hill Ponds.

Green Hill Pond is approximately 430 acres in size with an average depth of 2.5' . The multiple tidal restrictions between Block Island Sound and Green Hill Pond drastically reduce tidal amplitude and tidal flushing in Green Hill Pond (Isaji and Spaulding, 1985; RIDEM TMDL, 2006; RIGIS). Ninigret Pond encompasses an area of approximately 1666 acres with an average depth of 4.3' ((RIDEM TMDL, 2006; RIGIS).

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. The Town of Charlestown has adopted minimum standards for onsite wastewater treatments systems (OWTS) pursuant to RIDEM's new rules adopted January 2008. In summary, cesspools are not an approved method of wastewater disposal and all existing cesspools are to be considered substandard and removed within approximately five years. 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 shall be 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 consist of; groundwater, several 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. RIDEM Office of Water Resources has produced a TMDL (Total Maximum Daily Load) plan that was approved by EPA in early 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.

In addition to inputs from septic systems and freshwater inputs, poor flushing due to the restricted channel between the two ponds limits the exchange of pond water with clean seawater, allowing pollutants to accumulate in Green Hill Pond whereas Ninigret Pond's breachway allows for a larger exchange between the pond and the waters of Block Island sound.

D. 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
Lavins	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 nature of the small (most boats are less than 25' long) fishing and recreational day boats that dock at these marinas the sanitary shoreline survey does not recommend any change in the classification of the marina area. 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. 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 on our website by following this link:

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

E. 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.

F. 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-three (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, 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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 2018 annual statistical evaluation of GA11NG fecal coliform monitoring is shown in Table 3.

G. GA11NG Annual Statistical Evaluation

GA11NG 2018 HIGHLIGHTS

* Sampled 6X during 2018.
* Statistics represent recent 30 samples collected under both wet (n= 11) and dry (n= 19) weather conditions during 11/20/2013 or 5/7/2014 to 11/15/2018.
* All approved stations in compliance.
* All samples analyzed by the mTEC method.
* Data run 11/21/2018.

COMMENTARY

Ninigret Pond and Green Hill Pond (Growing Area 11NG) was sampled six times (3X during dry weather and 3X during wet weather) during 2018, consistent with the minimum systematic random sampling monitoring requirements for approved areas. The recent 30 sample results are representative both wet (n= 11) and dry (n= 19) weather conditions.

The 2018 statistical review demonstrated that all approved stations in Ninigret Pond met criteria for shellfish harvest for direct human consumption. Two stations, 11NG-10 located at the northern end of Ninigret Pond near Marshneck Point and 11NG-4 (located in Foster Cove) have had recent increases in fecal coliform variability. Future observations will track water quality changes in that area. The sentinel station (11NG-12) located on the closure line between the approved area of western Ninigret Pond and the prohibited area of eastern Ninigret and Green Hill Ponds met criteria indicating that this closure is protective of public health.

Shellfishing is prohibited in Green Hill Pond 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. 2018 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 just below NSSP threshold) and unpredictable fecal coliform levels. A new station (station 11NG-19, located in the southwestern corner of Green Hill Pond) was added in 2017 to monitor water quality in that region of the pond. Future monitoring will continue in Green Hill Pond to track and support TMDL and other water quality improvement efforts in the watershed. All approved stations in the growing area are in program compliance and GA11NG (Ninigret and Green Hill Pond) is properly classified.

RECOMMENDATIONS

* No action recommended based on 2018 ambient monitoring results.

* Continue sampling in shellfishing-prohibited Green Hill Pond to support TMDL study and to track changes in fecal coliform concentration.

Table 3: GA11NG Annual Statistical Analysis

RIDEM SHELLFISH GROWING AREA MONITORING: GA11NG

Recent 30 all weather.
*(*11/20/2013 or 5/7/2014 to 11/15/2018*; all mTEC, 11 wet and 19 dry weather)*

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31)***
GA11NG-1	A	30	3.1	10.7
GA11NG-2	A	30	2.4	4.9
GA11NG-3	A	30	2.3	4.6
GA11NG-4	A	30	4.4	18.3
GA11NG-5	A	30	2.5	4.9
GA11NG-6	A	30	2.2	3.7
GA11NG-7	A	30	3.1	10.6
GA11NG-8	A	30	2.5	4.5
GA11NG-9	A	30	3.3	12.0
GA11NG-10	A	30	3.9	21.1
GA11NG-11	A	30	2.8	7.2
GA11NG-12	P	30	4.7	16.2
GA11NG-13	P	30	5.3	25.4
GA11NG-14	P	30	7.6	60.2
GA11NG-14A	P	30	8.5	46.9
GA11NG-14B	P	30	4.7	21.4
GA11NG-14C	P	30	23.1	201.5
GA11NG-15	P	30	4.4	20.0
GA11NG-16	P	30	18.6	193.0
GA11NG-16A	P	30	8.2	54.3
GA11NG-16B	P	30	5.7	28.0
GA11NG-17	P	30	4.6	20.5
GA11NG-18	P	30	3.8	13.0
GA11NG-19**	P	4	3.6	9.6

**** new station added in 2017; number of observations is low (n= 4) and insufficient data to calculate representative statistics for compliance.

H. Conclusions and Recommendations

The triennial update did not include follow-up sampling of previously identified sources due to relatively low bacteria counts in the results from previous sampling, or because the elevated samples were located in prohibited areas. GA11NG has a low number of potential sources and the limited impact of the sources identified in previous surveys indicates that these point-sources of pollution are likely to have little impact on the microbiological water quality of the growing area. Green Hill Pond is classified as Prohibited due to non-point source pollution and limited tidal flushing of this salt pond. The 2018 triennial reevaluation indicated that all water quality monitoring stations in the Ninigret and Green Hill Pond growing area (GA11NG) are in program compliance and that the growing area is properly classified.

Quonochontaug and Winnapaug Ponds
Growing Area 11 QW
2018 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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A. Introduction

A triennial re-evaluation shoreline survey of the Quonochontaug Pond and Winnapaug Pond shellfish growing area was conducted during 2018 in order to comply 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.

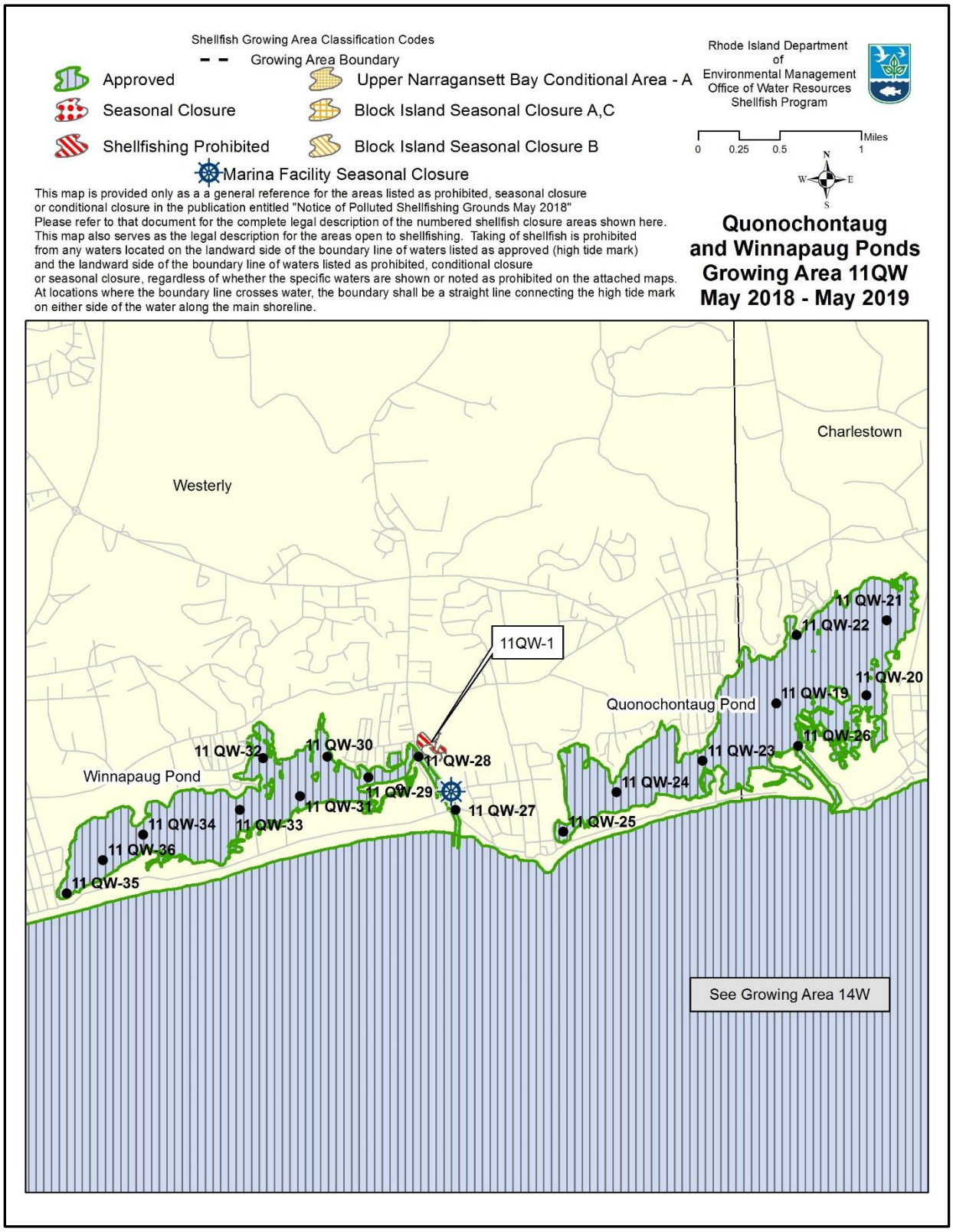
A shoreline survey of Quonochontaug and Winnapaug Ponds Growing Area 11QW was conducted in 2012 and the last triennial update was completed in 2015. The 2015 shoreline survey identified a total of twenty-six (26) actual or potential sources, seventeen (17) in Quonochontaug Pond and nine (9) in Winnapaug Pond excluding marinas. Eight (8) sources required follow up in this Triennial survey, five (5) of which were within compliance or had no flow at the time of the survey. The remaining three (3) will be resampled again during the next triennial survey in 2021.

This 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.

B. Description of Growing Area

Growing area 11QW is located within the Salt Pond Region, which 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



C. 2018 Shoreline Survey

A shoreline survey of growing area 11QW was completed on 18 October 2018 by DEM Shellfish Program biologist Anna Gerber-Williams. This survey took place 6 days after a rainfall of 2.03" was received at nearby Westerly, RI (NOAA weather station KWST). A total of eight (8) sources were identified, with three (3) having no flows at the time of the survey. Five (5) actual or potential fecal coliform sources were sampled during the 2018 shoreline survey of GA11QW (Figure 2). Fecal coliform concentration in flowing sources ranged from 11 to 500 cfu/100 ml (Table 1).

Table 1: GA11QW Shoreline survey pollution sources and 2018 results

Source ID	Latitude	Longitude	Description and Location	Receiving Waters Classification	Act/ Pot	Dir/ Indir	2012 Results	2018 Results	Volumetric Flow (cfs)
11QW-4	41.3484	-71.72383	Stream	Approved	A	D	660	160	0.02
11QW-5	41.3475	-71.72417	Stream in cove west side	Approved	A	D	0	500	0.08
11QW-6	41.34545	-71.72892	Stream at end of ROW at end of Warren Rd	Approved	A	D	460	480	0.33
11QW-9	41.3368	-71.7513	Stream at culvert crossing Havesham road draining pond	Approved	A	D	132	120	0.17
11QW-11A	41.33712	-71.767336	Culvert at upstream Weekapaug Rd draining pond	Approved	A	D	60	11	5

Sources 11QW-40, 41 and 60 were not flowing at the time of the 2018 shoreline survey.

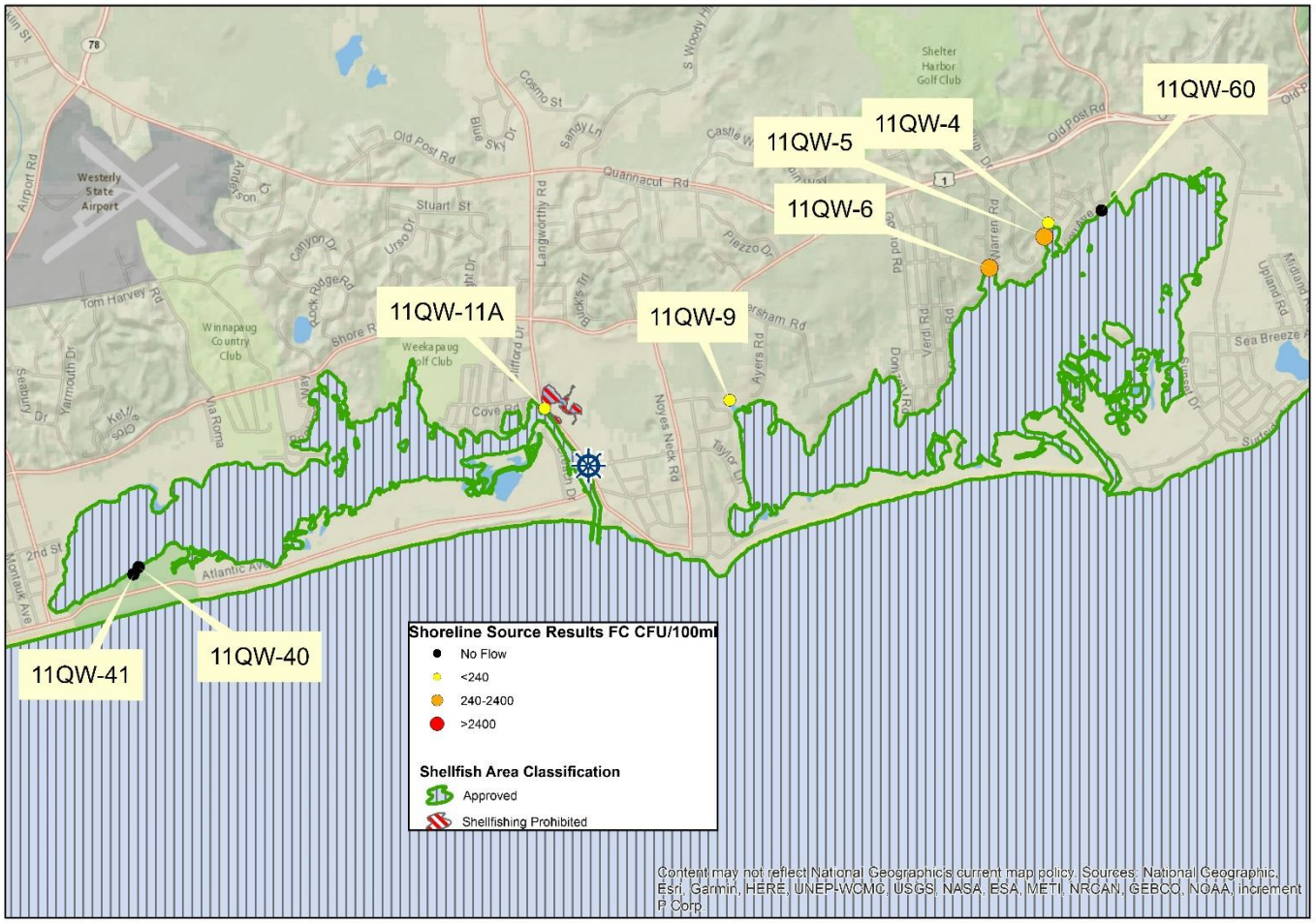


Figure 2: GA11QW potential pollution sources from 2018 shoreline survey.

Source 11QW-4 is a stream with a trickle (0.02 cfs) flow that had a fecal coliform level of 160 cfu/100 ml. Given the low flow and low fecal concentration, source 11QW-4 is not a major fecal coliform source to the growing area. Source 11QW-5 is an unnamed stream located on the west side of a cove flowing into Quonochontaug Pond. This source when sampled during this triennial survey, had a result of 500 cfu/100mL. However, given its estimated flow of 0.08 cfs, this source is likely to have limited impact on the growing area.

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 similar result in 2018 as it did during the 12-year survey in 2012 (Table 1). The results from 2018 (480 cfu/100 ml) was slightly higher than when previously sampled in 2012 (460 cfu/100 ml). Based on the current and historic results and the fact that there is a wooded upland wetlands and minimal potential anthropogenic sources it would appear that this source is not having a negative impact on the classification of the receiving waters.

Source 11QW-9 had a result of 120 cfu/100ml with a low flow and source 11QW-11A with a flow of 5 cfs had a very low result of 11 cfu/100ml. All sources sampled as part of this triennial survey either had low fecal coliform concentration, low flow rates or a combination of both low concentration and low flow. This indicates that the potential sources in GA 11QW have minimal impact on the microbiological water quality of the receiving waters.

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 August 2017.

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.

D. 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). There is a mix of types of systems ranging from antiquated cesspools, conventional and innovative and advanced systems located in the towns of

Charlestown and Westerly (bordering communities). 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. Hurricane Sandy in 2010 and lack of maintenance by the Town of Westerly have rendered this stormwater system mostly inoperable and is no longer discharging to the pond. We will continue to sample adjacent to the discharge, newly established station 11QW-36, and will monitor the rehabilitation of the stormwater system during shoreline survey events.

E. 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 ocean-going fishing vessels under 25' in length which typically do not contain marine sanitation devices (MSDs). However, 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 called the Weekapaug Yacht Club. The yacht club is home to a small sailing club with on land storage of small sunfishes and other sailboats. There are also approximately 40 moorings offshore in the southeast cove of Quonochontaug Pond suitable to moor small fishing or sailing vessels under 25 feet in length, again 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 on our website by following this link:

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

F. 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 large 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 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

G. GA11QW Annual Statistical Evaluation

HIGHLIGHTS

* Sampled 6X during 2018.
* For approved stations, statistics represent recent 30 samples collected under both wet (n= 15) and dry (n= 15) weather conditions during 5/8/2014 to 12/11/2018.
* All approved stations in compliance.
* All samples analyzed by the mTEC method.
* Data run 12/13/2018.

COMMENTARY

Quonochontaug and Winnapaug Ponds (GA11QW) were samples six times during 2018, complying with minimum systematic random sampling monitoring requirements for approved areas. Compliance statistics represent the recent 30 samples collected during both wet (n= 15) and dry (n= 15) weather since 5/8/2014.

The results of the 2018 statistical evaluation demonstrate that all approved stations meet criteria and are in program compliance. The area is properly classified.

RECOMMENDATIONS

* No actions recommended based on 2018 ambient monitoring results.

Table 2: 2018 Statistical Summary of GA11QW

Recent 30 samples all weather.
(5/8/2014 to 12/11/2018; all mTEC, 15 wet and 15 dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA11QW-19	A	30	2.2	3.2
GA11QW-20	A	30	2.3	3.7
GA11QW-21	A	30	2.5	4.9
GA11QW-22	A	30	3.6	12.6
GA11QW-23	A	30	2.3	3.8
GA11QW-24	A	30	2.3	3.7
GA11QW-25	A	30	3.0	10.9
GA11QW-26	A	30	2.2	3.2
GA11QW-27	A	30	2.6	4.9
GA11QW-28	A	30	2.8	5.7
GA11QW-29	A	30	2.5	4.7
GA11QW-30	A	30	3.2	7.9
GA11QW-31	A	30	2.3	4.1
GA11QW-32	A	30	2.9	6.8
GA11QW-33	A	30	2.3	3.9
GA11QW-34	A	30	2.1	2.8
GA11QW-35	A	30	2.7	5.9
GA11QW-36	A	30	2.3	3.9

H. Conclusions and Recommendations

Due to the low number of sources and the low flow and bacteria concentration of sources, there is an insignificant impact of the sources identified on the water quality of the growing area. The results of this review combined with previous water quality statistical evaluations of the routine monitoring station results demonstrate that all stations are in program compliance and that the area is properly classified. No changes in growing area classification are recommended at this time.

GA12 Annual Update: Little Narragansett Bay & Pawcatuck River

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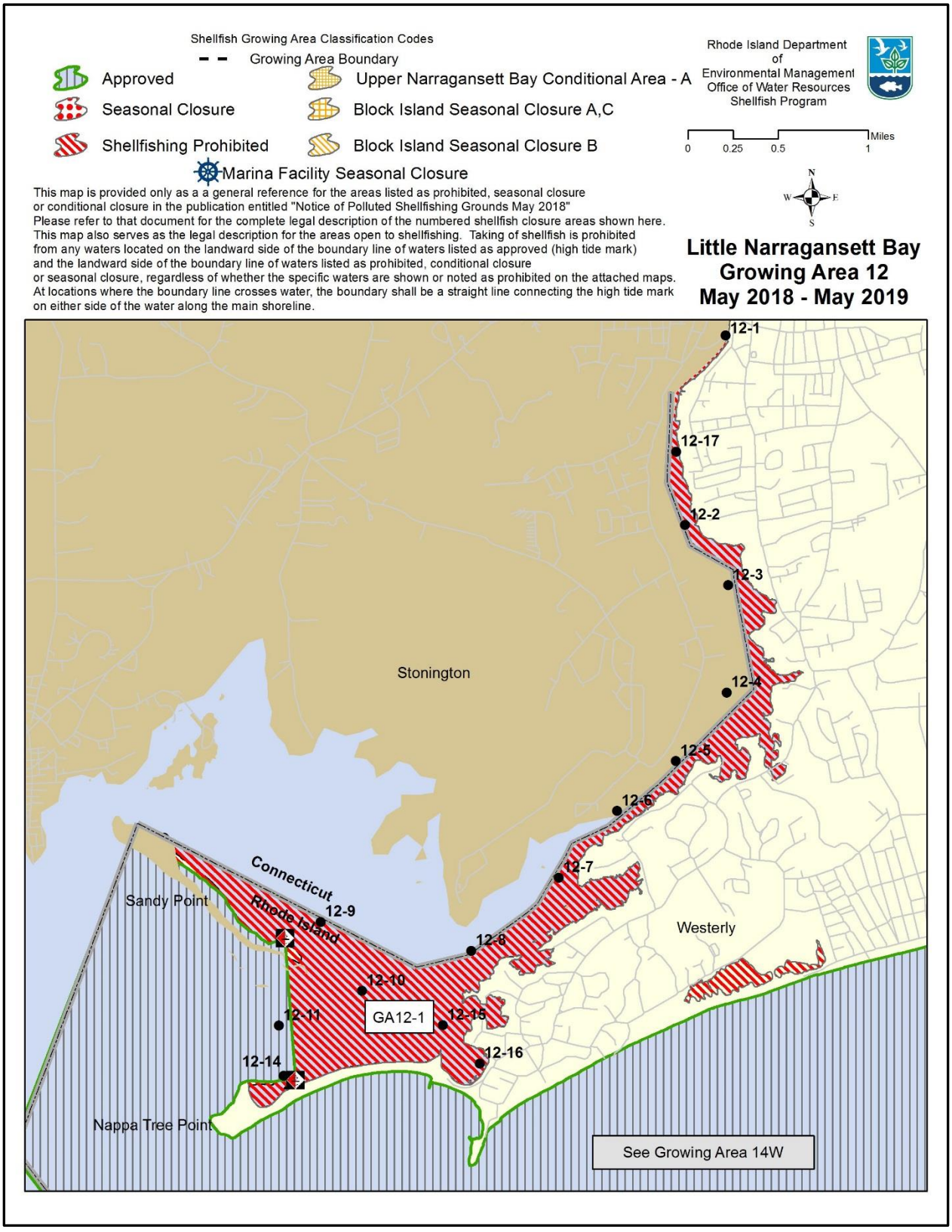
A. Introduction

All waters of the Little Narragansett Bay, Growing Area 12 are currently prohibited to shellfishing. A TMDL study of Little Narragansett Bay was approved by EPA in December of 2010. The recommended implementation activities for the study area focus on stormwater, wastewater, and waterfowl management. As part of that ongoing effort sampling has been conducted in the past several years by RI DEM TMDL staff and Shellfish staff in partnership with the Save the Bay. This has allowed for more frequent sampling as a Save the Bay boat is readily available in the Westerly area. The collaborative sampling effort with Save the Bay has resulted in more frequent sampling of this growing area (five or six times per year) for the past several years. This current data is more representative of the conditions in Little Narragansett Bay and the Pawcatuck River versus historic sampling that had been sporadic due to limited resources.

In addition to closures due to unacceptable water quality as a result of the highly urbanized areas adjacent to the river 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 shellfish harvesting. 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.

Figure 1: 2018-2019 Classification Map



B. Annual Statistical Evaluation: GA12

HIGHLIGHTS

* Monitoring stations (Figure 1) sampled 6X during 2018.
* 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 at the mouth of the bay.
* For approved station 12-11, statistics represent recent 30 samples collected under both wet (n= 11) and dry (n= 19) weather conditions during 7/16/2012 to 10/24/2018.
* Informational statistics calculated for conditionally approved management scenario of 7-day closure after greater than 0.5" rain in 24 hours.
* Approved station 12-11 is in compliance.
* All samples analyzed by the mTEC method.
* Data run 11/7/2018.

COMMENTARY

Little Narragansett Bay (Growing Area 12) was sampled six times during 2018 through a cooperative partnership between DEM Office of Water Resources and Save the Bay. The area is classified as prohibited, so there is no minimum sampling requirement. The sentinel station (12-11) on the line between approved and prohibited waters was in compliance for 2018, demonstrating that the current closure line is appropriate. 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 2018 statistical review indicated that there are signs of improving fecal coliform water quality in the central region of Little Narragansett Bay currently classified as prohibited to shellfish harvest. Stations 12-9, 12-10, 12-14 and 12-15 all met the criteria for approved waters (although variability criteria are still elevated) based on the recent 30 samples collected between 8/14/2013 and 10/24/2018. Eleven of these 30 samples were collected during wet weather, including five sets of samples collected less than seven days after storms of greater than 1" rainfall. While water quality appears to be improving, fecal coliform levels still exceed criteria during some wet weather conditions. This 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 changing water quality and to support TMDL work in the watershed.
* No other actions recommended.

Table 1: 2018 Statistical summary of GA12

The prohibited stations in GA12 (Little Narragansett Bay and Pawcatuck River) were evaluated under two potential management scenarios (below). Statistics shown for informational purposes only, not for compliance.

Approved scenario: Recent 30 all weather.
(8/14/2013 to 10/24/2018; all mTEC, 11 wet and 19 dry weather)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA12-1	P	30	201.7	743.1
GA12-2	P	30	133.9	620.4
GA12-3	P	30	120.6	628.0
GA12-4	P	30	44.4	299.4
GA12-5	P	30	35.9	280.3
GA12-6	P	30	18.8	102.1
GA12-7	P	30	13.1	109.0
GA12-8	P	30	9.1	59.8
GA12-9	P	30	3.9	24.1
GA12-10	P	30	4.3	17.3
GA12-11	A	30	3.3	16.8
GA12-14	P	30	3.6	14.4
GA12-15	P	30	5.9	28.9
GA12-16	P	30	11.6	95.2
GA12-17	P	30	68.1	291.8

Conditionally approved scenario: Recent 15 dry (<0.5" in prior 7 days) weather only.
(7/31/2014 to 10/24/2018, all mTEC, all dry weather)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA12-1	P	15	131.5	100.0
GA12-2	P	15	89.5	93.3
GA12-3	P	15	81.9	93.3
GA12-4	P	15	24.8	33.3
GA12-5	P	15	18.6	33.3
GA12-6	P	15	8.2	20.0
GA12-7	P	15	6.8	13.3
GA12-8	P	15	4.0	6.7
GA12-9	P	15	2.5	0.0
GA12-10	P	15	2.6	0.0
GA12-11	A	15	2.4	6.7
GA12-14	P	15	2.6	0.0
GA12-15	P	15	4.8	6.7
GA12-16	P	15	8.9	20.0
GA12-17	P	15	53.6	73.3

Growing Area 13
Great Salt Pond
12-Year Sanitary Shoreline Survey
Calendar Year 2018

Rhode Island
Department of Environmental Management

Office of Water Resources

Shellfish Program

GA13 12-year Sanitary Survey: Great Salt Pond, Block Island

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A. Introduction

A sanitary survey of Great Salt Pond, Harbor Pond and Trims Pond (Growing Area 13) was conducted from August 20th to 22nd, 2018 by staff from RIDEM's Office of Water Resources Shellfish Program with assistance from staff of the TMDL program. The survey involved a shoreline reconnaissance of the study area to locate and catalog pollution sources and collect bacteriological samples from all sources actively flowing into the study area. All locations within the growing area were surveyed regardless of their classification.

The primary objective of the sanitary survey was to identify and characterize any new sources of pollution impacting the growing area, to reevaluate point and nonpoint sources identified during previous surveys, and to update information regarding the sampling of previously identified sources.

Thirteen (13) sources were identified. These sources include tributaries, pipes, and seeps. There were no large concentrations of waterfowl or wildlife observed during the field reconnaissance. Several small-scale hobby "farms" with resident livestock are scattered about the island, but do not appear to actually or potentially impact the receiving waters.

B. Description of the Growing Area

Great Salt Pond 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**).

i. Physical Description

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. It 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. To 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, with a small portion of the northwest section of the Pond being 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.

ii. Previous Surveys

A 12-year sanitary survey was conducted in 2006 of the Great Salt Pond, Block Island, Growing Area 13. During this survey eleven potential sources were identified. Of the eleven (11) sources sampled, eight (8) had fecal concentrations of 240 MPN/100ml or greater. The sample with the highest fecal concentration was the outfall from Cormorant Cove that drains a wetland complex. Triennial updates were completed in 2009, 2012, 2015 and annual updates of the growing area have been completed each year.

iii. Previous Classification Maps

The current (2018-2019) classification map differs from the 2005-2006 classification map in that Trim's Pond was classified as prohibited in May 2005 (Figure 2) and was classified as seasonally approved in 2018- 2019 (Figure 1). The Trims Pond section of inner Great Salt Pond was precautionarily closed to shellfish harvest from May 2005 until October 2006 because of elevated fecal coliform concentration. Intensive water quality monitoring demonstrated improved water quality in Trims Pond and the area was re-opened (seasonally approved) for shellfish harvest in October 2006. Annual evaluations have demonstrated that the Trims Pond area has met water quality criteria since the 2006 reopening.

iv. Legal Description of Growing Area

The most recent (May 2018-May 2019 revised annually) RIDEM document entitled Annual Notice of Polluted Shellfishing Grounds provides the legal description of GA13 as shown in Figure 1 and as described below:

Growing Area 13 - Block Island

GA13-1:

Closure 'A': Effective at sunrise of the Saturday immediately prior to Memorial Day through sunrise of the last Saturday in June - the waters of Great Salt Pond south of a line from the northern most extremity of Cormorant Point to the western most extremity of Harris Point including all waters of Trims Pond and Harbor Pond.

Closure 'B': Effective at sunrise of the last Saturday in June through sunrise of the third Monday in September - all waters of Great Salt Pond, south of a line from the northern most extremity of Cormorant Point to the northern most landward dock located at the Block Island Club, including all waters of Trims Pond and Harbor Pond.

Closure 'C": Effective at sunrise of the third Monday in September through sunrise of the Tuesday immediately following Columbus Day - the waters of Great Salt Pond south of a line from the northern most extremity of Cormorant Point to the western most extremity of Harris Point, including all waters of Trims Pond and Harbor Pond.

Figure 1: Growing Area 13 Current Classification Map

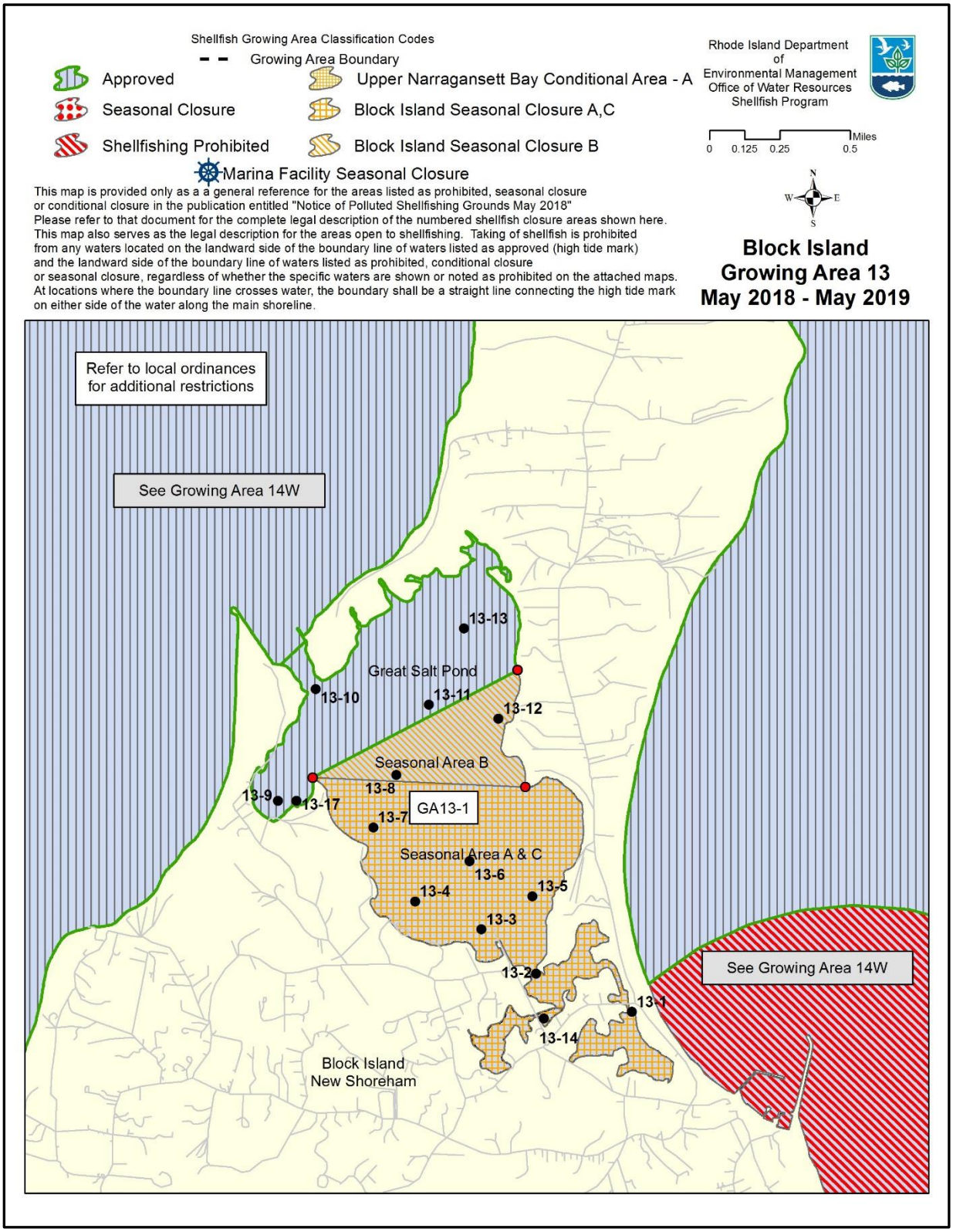
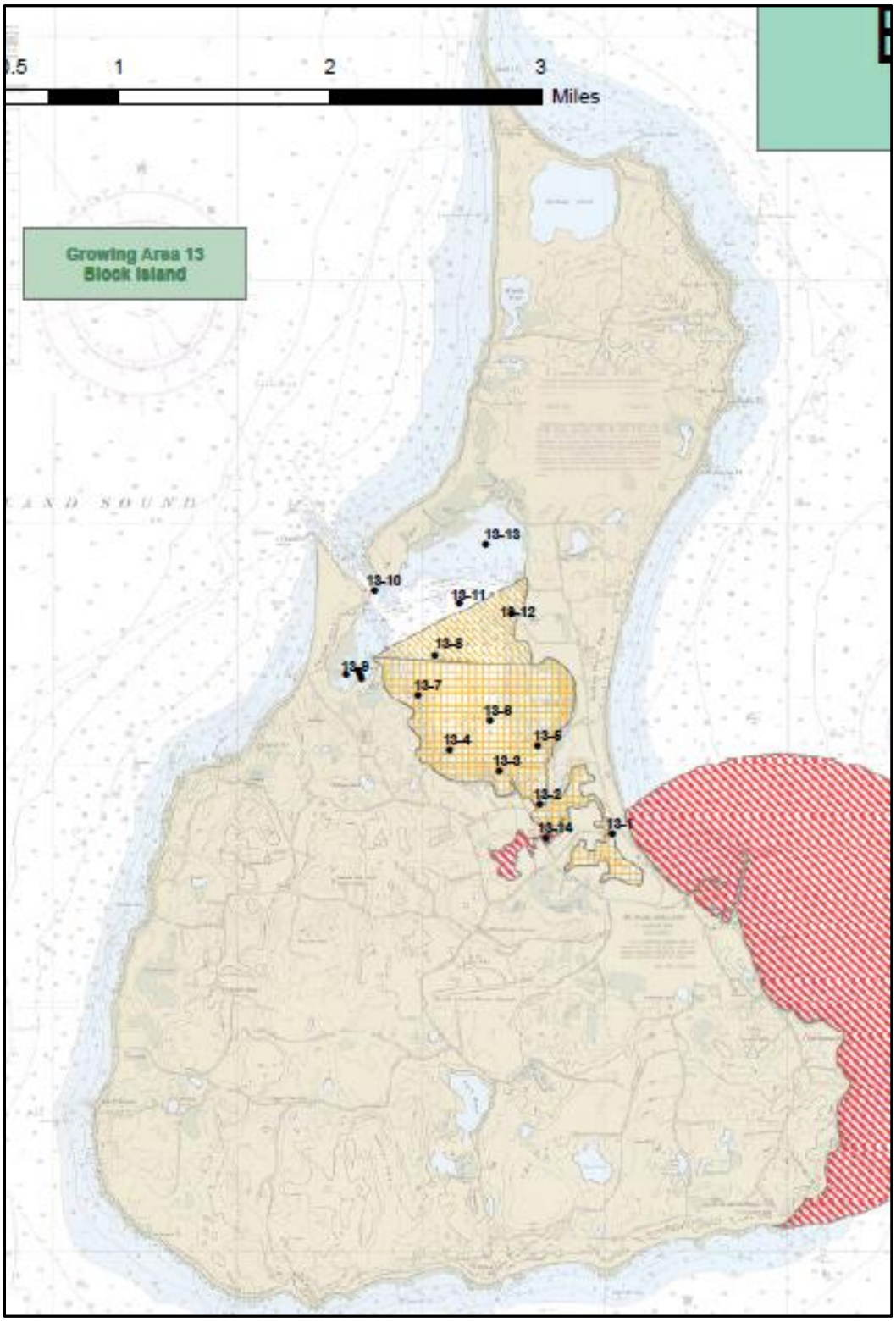


Figure 2: 2005-2006 Growing Area 13 Classification Map with Monitoring Stations



C. 2018 Shoreline Survey

i. Survey Procedures

Anna Gerber-Williams, Marine Biologist for RIDEM Office of Water Resources Shellfish Program, coordinated and conducted a shoreline reconnaissance of Growing Area 13 with the assistance of Skip Viator (RIDEM Office of Water Resources, TMDL Program). The team of two surveyors inspected the entire GA13 shoreline over a three-day period, August 20th-22nd 2018. All necessary survey materials including aerial maps created using ArcMap GIS software that displayed the locations of all previously identified sources were used during the survey. The appropriate map; pre-filled field sheets including source IDs, descriptions, and geographic coordinates; information on public access points and street maps for parking; and extra field sheets and laboratory sample submission chain of title forms were available during the survey. In addition, the survey team was equipped with a GPS-enabled digital camera or their personal cell phone, a means for measuring flows such as a bucket or float, coolers, extra sample bottles, and first-aid kits.

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, 125 mL 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.

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 August 2017.

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 GA13 (Block Island Great Salt Pond) due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

ii. Description of Pollution Sources

Thirteen (13) potential pollution sources were identified and sampled during the 2018 sanitary survey. One potential source had no flow and six sources had flow rates of a trickle or less (Table 1). The remaining six sources having flow greater than a trickle had relatively low fecal coliform concentration that ranged from 100 to 600 cfu/100 ml (Table 1; Figure 3).

Table 1: 2018 Growing Area 13 Shoreline Survey Sources

Source ID	Lat	Long	Description	2018 Survey Date	Act_Pot	Dir_Ind	2006 Results (MPN)	2009 Results (MPN)	2012 Results (CFU)	2016 Results (CFU)	2018 Results (CFU)	2018 Flow
13-001	41.17522	-71.5634	Tributary upper Harbor Pond	8/21/2018	A	D	430	1,100	525	1000	600	1 CFS
13-002	41.17195	-71.56702	Tributary upper Harbor Pond Noted 2 Deer	8/21/2018	P	D	230				No sample	No flow
13-003	41.17608	-71.57	Tributary into Harbor Pond near power station	8/22/2018	A	D	210				100	Trickle
13-004	41.1834	-71.56863	Tributary into Trims Pond	8/22/2018	A	D	930	15	167		100	Trickle
13-005	41.17708	-71.5732	Upper Trims pond tributary	8/21/2018	A	D	430	NF	NF		100	Trickle
13-006	41.17733	-71.57678	Upper Tributary	8/22/2018	A	D	93				910	Trickle
13-007	41.17562	-71.5748	Trims Pond Tributary	8/22/2018	A	D	1100	NF	8000	340	100	Trickle
13-008	41.19922	-71.57368	Great Salt Pond Andy's Way seep green growth	8/22/2018	A	D	2100	460	NF		100	Trickle
13-009	41.1936	-71.57425	Great Salt Pond marine railway wetlands pond dra	8/22/2018	A	D	2300	36	NF		100	0.3 CFS
13-010	41.18915	-71.58882	Cormerant Cove outfall drains wetland complex	8/22/2018	A	D	9300	9 sample)			300	0.61 CFS
13-011	41.18202	-71.57935	west of Harbor Master shack drains wetland	8/22/2018	A	D	1500	1,100	818	1600	600	1 CFS
2018-13-012	41.1985690	-71.584409	streaming draining upland marsh	8/20/2018	A	D					100	1.01 CFS
2018-13-013	41.1998610	-71.581805	stream draining upland marsh at old breach cut	8/20/2018	A	D					100	0.35 CFS

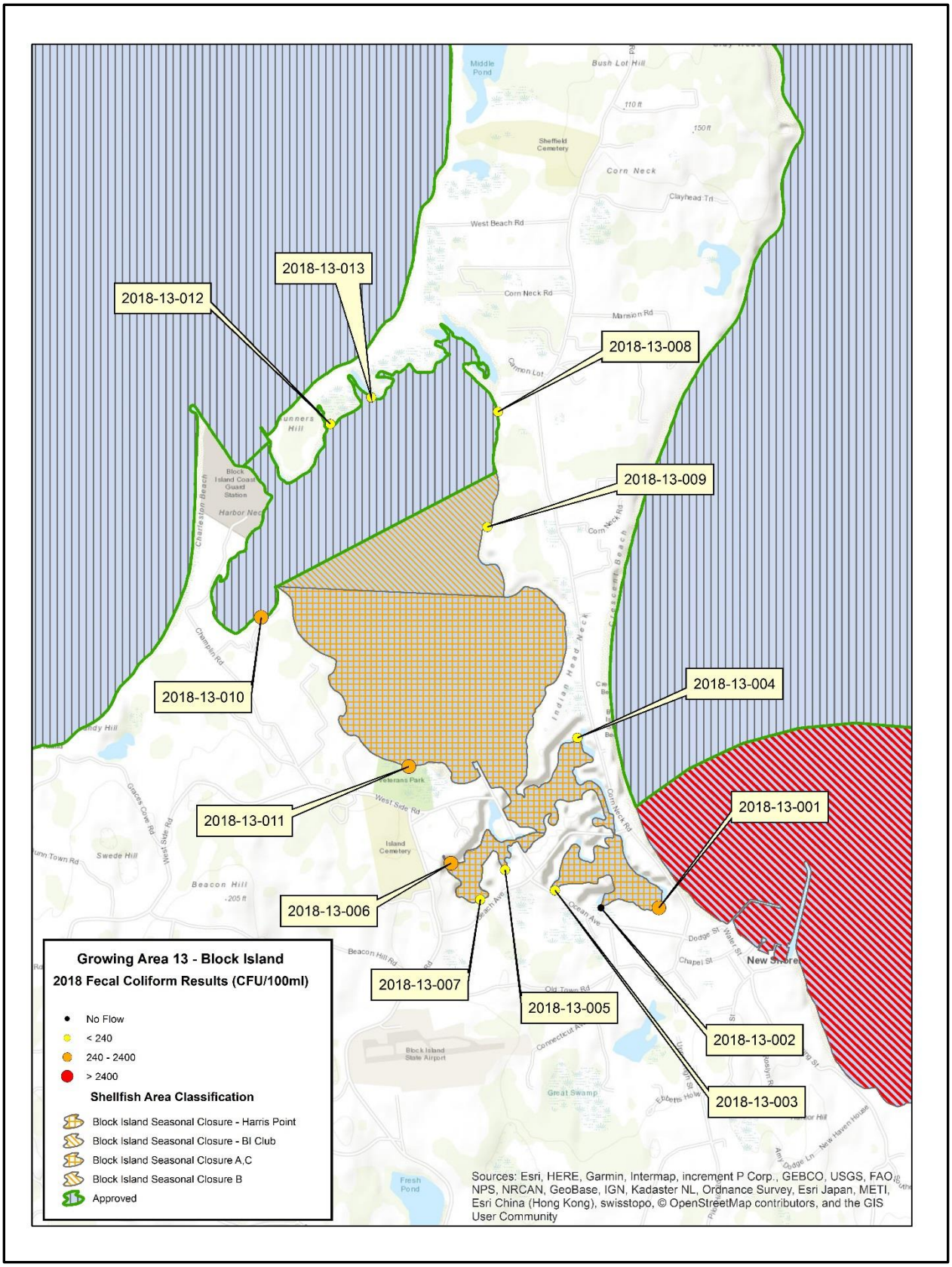


Figure 3: GA13 potential pollution source locations.

Source 13-001 is a corrugated plastic pipe that discharges a small stream to Upper Harbor Pond (Figure 4). This source had a 2018 result of 600 cfu/100 ml and flow rate of 1 cfs on 8/21/2018 which was five days after 1.63 inches of rain fell at the NWS Block Island weather station. The low flow and relatively low fecal coliform concentration of this source during wet weather and the fact that nearby water quality monitoring station 13-1 has met water quality criteria under all weather conditions (Table 3) suggests that source 13-001 has minimal impact on the growing area.

Figure 4: Source 2018-13-001.

The following five sources (13-009, 13-010, 13-011, 13-012, 13-013) discharge to the outer portion of Great Salt Pond (Figure 3). Source 13-009 is a small tidal stream that drains a tidal wetland and discharges to the outer portion of Great Salt Pond (Figure 5). This source has historically had low flow (Table 1). During 2019 sampling this source had a fecal coliform result of 100 cfu/100 ml and a flow of 0.3 CFS on 8/22/2018 which was six days after 1.63 inches of rain fell at the NWS Block Island weather station.

Figure 5: Source 13-009 (left) and source 13-010 (right).

Source 13-011 is a small tidal stream draining a wetland and flowing across a sandy beach before reaching the receiving waters at low tide (Figure 6). 2018 results were 600 cfu/100 ml on 8/22/2018 (six days after 1.63 inches of rain fell at the NWS Block Island weather station). On this day, flow at the upland edge of the salt marsh tidal stream was 1 cfs. However, most of this flow dissipated into the sand before it reached the receiving waters (Figure 6) indicating this source has little direct impact on the receiving waters.

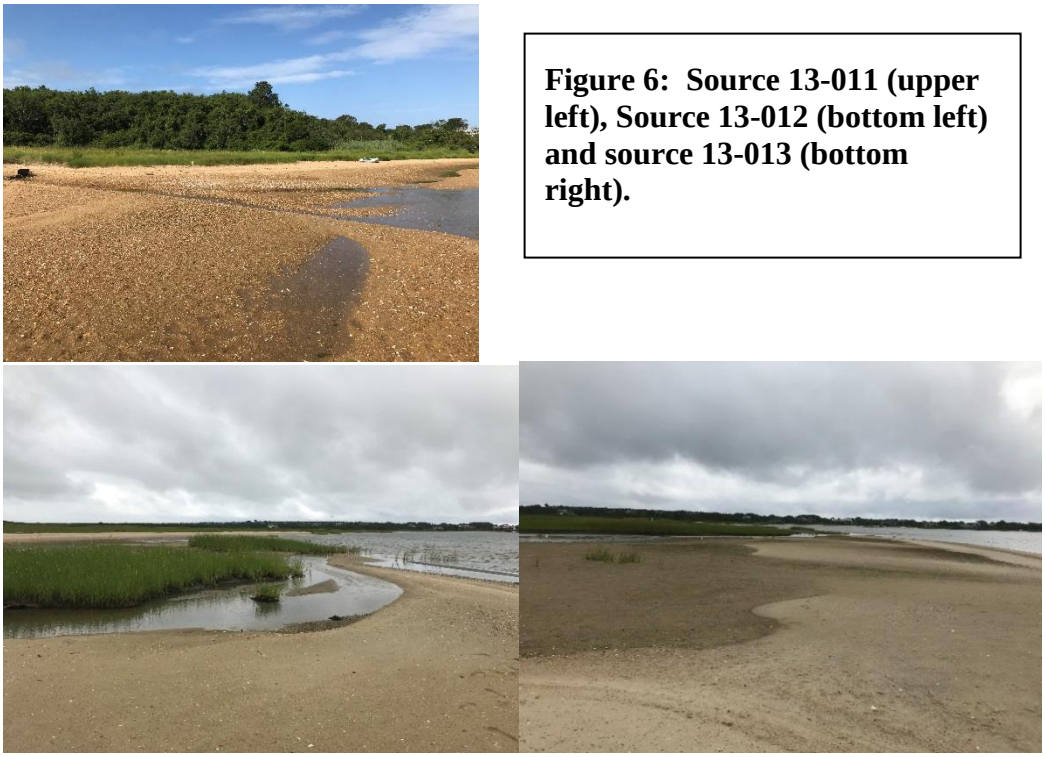


Figure 6: Source 13-011 (upper left), Source 13-012 (bottom left) and source 13-013 (bottom right).

Source 13-012 and source 13-013 are both located on the northwestern side of GA13 (map; Figure 3). Source 13-012 is a small tidal stream draining an upland marsh (Figure 6). This source had a fecal result of 100 cfu/100 ml and a flow rate of 1.01 cfs during the 2018 sanitary survey which was conducted during wet weather (sampled on 8/20/18 which was four days after 1.63" of rain fell at NWS Block Island station). These 2018 wet weather results were much lower than those observed in prior surveys (Table 1). Nearby source 13-013 is also a small tidal stream draining the same marsh complex (Figure 6). During the 2018 survey this source also had a fecal coliform result of 100 cfu/100 ml and had a flow rate of 0.35 cfs. Sources 13-009, 13-010, 13-011, 13-012, 13-013 all discharge to the outer portion of GA13 near the connection of the Pond with Block Island Sound (Figure 3). Water quality monitoring at nearby stations indicates that these small sources have no negative impact on the microbial water quality of the growing region (Figure 2; Table 3). Source 2018-13-006 is a tidal stream that flows at a trickle rate into Trims Pond. Although slightly elevated bacteria results, the low volume does not appear to be impacting the receiving waters. The 2018 evaluation of data indicated that all water quality monitoring stations in GA13 met NSSP criteria while in the open status (Table 3). Further, an informational analysis (not for compliance) indicated that all stations also met criteria when both open and closed season data were included in the analysis (Table 3). This further supports that the sources identified in the 2018 sanitary survey have relatively little negative impact on the water quality of Block Island's Great Salt Pond (GA13).

D. Identification and Evaluation of Pollution Sources

i. Domestic Wastes

Sources of domestic wastes that may convey fecal coliform bacteria to the growing area include dry wells, cesspools, and on-site wastewater treatment systems (OWTS). The method of transport of pollutants is normally through the groundwater, either to the growing area itself or to

a tributary that ultimately drains to the growing area. Although less common, fecal coliform bacteria can also be transported via surface seepage or by illegal pipes.

New Shoreham has a centralized 0.45 MGD waste water treatment facility that serves approximately 50% of the population during winter and approximately 20% of the population during summer (New Shoreham Comprehensive Plan, 2016). The New Shoreham WWTP discharges treated effluent to Block Island Sound. The southern portion of the Great Pond watershed, namely the densely populated region from Champlin's Marine east to Old Harbor is serviced by sewer. The remainder of the watershed is served by on-site wastewater treatment systems (OWTS). Block Island has implemented increased inspection of the island's OWTS recently and 272 (of 1,674) OWTS systems have been identified as sub-standard and have been repaired or upgraded since 2015 (New Shoreham Comprehensive Plan, 2016).

ii. Stormwater

Although storm water may be a contributor to closures of shellfishing waters, the storm water runoff from this growing area's watershed does not appear to have a significant or accountable effect on the water quality. Samples for the routine monitoring protocol are taken randomly and would be representative of the water quality under all conditions, favorable or adverse. Since the statistical evaluation of the routine monitoring results indicates that all stations significantly comply with the water quality criteria there is no indication that this area is classified incorrectly or is impacted by weather events.

iii. Marinas

Three (3) commercial marinas having a total of approximately 400 slips are located in Great Salt Pond. The Pond presently 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 on our website by following this link: http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php

iv. Agricultural Waste

There are no commercial farms in Growing Area 13 listed on the "Farms List" of the Department of Agriculture website. There are relatively little agricultural lands located on Block Island, just several "hobby farms" with resident livestock scattered about the island. None of these farms appear to be actually or potentially impacting the receiving waters in growing area 13.

v. Wildlife

No appreciable numbers of waterfowl or wildlife were observed during the 2018 shoreline surveying. It should be noted however that Block Island is one of the most important migratory bird habitats on the east coast. The island is also home to the largest gull colony in the state. Additionally, the White-Tailed Deer was introduced to the island in 1967 and the herd has grown to a nuisance population because of the lack of any natural predators on the island. This has resulted in the development of a Deer Task Force, established by the Town of New Shoreham to prioritize the management of these mammals in ordinance with state regulations.

vi. Industrial Wastes

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).

E. Hydrographic and Meteorological Characteristics

i. Tides

Tides in Rhode Island are semi-diurnal. This means that the tides have a period or cycle of approximately one-half of a tidal day (12.84 hours), characterized by two similar high waters and two similar low waters each tidal day. The tidal current is said to be semi-diurnal when there are two flood and two ebb periods each day. A semi diurnal constituent has two maxima and two minima each constituent day. The shoreline survey was scheduled to coincide with ebb and/or low tide, which represents the most opportune time for observing stormwater outfalls that may otherwise be hidden by tidal water, and sampling streams and pipes that, may otherwise be receiving tidal waters.

ii. Rainfall

In Rhode Island there are normally no seasonal patterns in the frequency and amounts of precipitation during the year, however two major storm patterns exist. 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 directly affected Rhode Island 9 times during the last 350 years (RI Emergency Management Agency). 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 nor-easters.

Growing area response to these precipitation events varies according to storm duration, storm intensity, and watershed characteristics such as land use, vegetative cover, and soil characteristics. Changes in land use and vegetative cover are typically accompanied by increases in impervious areas. Of slight concern for the growing area is the close proximity of impervious surfaces to stream channels. This allows for the rapid and efficient transport of runoff of concomitant pollutants including fecal coliform bacteria to river and stream channels that ultimately drain to the growing area.

The shoreline survey date for Great Salt Pond was primarily August 22nd. The rainfall data listed in **Table 2** was observed at the weather station on Block Island. Highlighted rows indicate days in which surveying was conducted, with yellow representing dry weather days and blue representing wet weather days.

Table 2: Rainfall Data for August 2018 from Block Island Airport. 2018 survey conducted 8/20 to 8/22 2018

Date	Precipitation
2018-08-01	T
2018-08-02	0.00
2018-08-03	0.00
2018-08-04	0.00
2018-08-05	0.62
2018-08-06	0.00
2018-08-07	0.01
2018-08-08	0.00
2018-08-09	0.00
2018-08-10	0.00
2018-08-11	0.05
2018-08-12	1.27
2018-08-13	0.36
2018-08-14	0.03
2018-08-15	T
2018-08-16	0.00
2018-08-17	0.00
2018-08-18	0.15
2018-08-19	0.10
2018-08-20	0.01
2018-08-21	0.00
2018-08-22	0.01
2018-08-23	0.00
2018-08-24	0.00
2018-08-25	0.00
2018-08-26	0.00
2018-08-27	T
2018-08-28	0.00
2018-08-29	0.00
2018-08-30	0.00
2018-08-31	T
Sum	2.61
Average	-
Normal	M

Precipitation data included in this report is rainfall amounts for the month of August 2018 at the Block Island Airport weather station. The RI Shellfish Program criteria for wet weather conditions is 0.5 inches or greater rainfall during the previous seven days. The 2018 survey began under “wet weather’ conditions (7 days after 1.63” rain at the Block Island Airport)

F. Winds/Climate

i. Climate

Rhode Island's climate may be summarized as having an equitable distribution of precipitation throughout the four seasons, large ranges of temperature, both daily and annually, great differences in the same season of different years and considerable diversity of the weather over short periods of time, or as we say in New England, if you don't like the current weather wait a minute it will change. These varying conditions are greatly influenced across the state by the nearness to Narragansett Bay or the Atlantic Ocean and by elevation and nature of the local terrain. Day to day variety is the norm with no regular or persistent rhythm to the changes in weather other than a tendency to a roughly twice-weekly alternation from fair weather to cloudy or stormy weather.

Weather averages in Rhode Island are not very useful for important planning purposes due to the large variety of weather patterns. However, the following averages can be used for general understanding of the area's climate. The mean annual temperature ranges from 48°F to 51°F with the higher mean temperature more representative of the areas of Narragansett Bay. The average daily minimum temperature in January and February is 25°F in coastal sections.

Precipitation is evenly distributed throughout the year, with annual averages of 42 to 46 inches with the southeastern bay area tending to be more like 40 inches. Average yearly snowfall along the shoreline is about 20 inches and the region is known to have years in which snowfall totals can be significantly less than average as a result of milder winters. Total precipitation however averages around 3 to 3.5 inches per month regardless of season with the lesser amounts in the period between May and July.

2018 was unusual in that it was a wet year. Precipitation at nearby Westerly Airport (Station KWST) was a total of 52.99" compared to a long-term mean of 43.20". However, the month of August 2018, during which the 2018 survey took place, was relatively dry with an August total of 2.78" compared to a long-term August average precipitation of 4.15".

ii. Winds

Literature could not be found that links bacterial contamination to wind direction in RI waters. However, two predominate wind directions can be observed dependent on season. In the spring and summer months when the temperature of the land is warmer than that of the ocean, sea breezes occur that transfer air over the ocean landward under the warmer, lighter air over the land. Consequently, in Rhode Island, the most common spring and summer wind flow direction is south to southwest. When the southwesterly breeze is prevalent, winds travel in a northeast direction towards the upper portions of the growing area. In the fall and winter, the opposite tends to occur. Cold, dense air over the land surface creates a north/northwesterly wind direction during winter months. Furthermore, wave action as a result of wind velocity may also stir sediments that have bacteria in them.

iii. River Discharges

There are no named streams flowing into GA13 but there are several unnamed streams that discharge directly to the Great Salt Pond Growing Area. The unnamed streams are mostly

wetland drainage or small tributaries. The only unnamed stream that does not flow into a seasonally prohibited shellfish area is located in Cormorant Cove. This unnamed stream drains a wetland complex just south of source 2018-13- 010. A precautionary closure was placed around this Cormorant Cove discharge in 2008. Fecal coliform in the nearby receiving waters was monitored monthly from 2008 through 2016. Analysis of these data indicated improving water quality in the receiving waters and the Cormorant Cove closure was lifted in May of 2017.

G. Water Quality Studies

i. Overview

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 continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at fifteen (15) different monitoring stations throughout the growing area. Ten stations are located in Great Salt Pond; one station is located in Cormorant Cove, one at the connection of Harbor Pond and Trims Pond, one in Trims Pond and one at the connection of Trims Pond into Great Salt Pond. See **Figure 1** for a map of these locations.

ii. 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 through a collaborative effort between RIDEM OWR Shellfish Program and the Block Island Harbor Master staff. Transport of samples from Block Island is coordinated with RIDEM for submittal the same day as sampling to the RIDOH laboratory for analysis. 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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated

August 2012 (RIDEM, 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).

The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary 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.

iii. Sampling Plan and Justification

Growing area 13 has approved and conditional-seasonal approved waters in the growing area; it is not impacted by sewage treatment facilities or combined sewer overflows or major riverine input. Therefore, the RIDEM Shellfish Program monitors Growing Area 13 in accordance with the guidelines set forth in the NSSP Manual of Operations for systematic random sampling. Water quality monitoring stations within the growing area are typically sampled a minimum of six times per year unless otherwise noted. However, given the high intensity of seasonal (summer) recreational boater use of the Pond, growing area 13 is sampled 12 times per year in cooperation with the Block Island Harbor Master's office.

v. GA13 Annual Statistical Evaluations and Comments

GROWING AREA 13- GREAT SALT POND

HIGHLIGHTS

* Sampled 12X during 2018.
* For approved stations, statistics represent recent 30 samples collected under both wet (n= 15) and dry (n= 15) weather conditions during 6/16/2016 or 7/19/2016 to 12/11/2018.
* For seasonally approved stations, statistics represent recent 15 samples when area was open 12/21/2016 to 12/11/2018 during both wet (n= 9) and dry (n= 6) conditions.
* Al approved stations in compliance.
* All seasonally approved stations in compliance.
* All samples analyzed by the mTEC method.
* Data run 12/14/2018.

COMMENTARY

Growing Area 13, the Great Salt Pond at Block Island, was sampled twelve (12) times during 2018, meeting minimum systematic random sampling requirements for conditionally or seasonally approved waters. Block Island sampling was done through a cooperative agreement between the Town of New Shoreham Harbor Master's Office and DEM 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 15 wet weather and 15 dry weather samples. Similarly, statistics for seasonally approved areas are representative of both wet (n= 9) and dry (n= 6) weather conditions collected when the area was in open status.

The closure of Cormorant Cove (within 200 feet of the tidal pond outlet at Cormorant Cove Road) was lifted in 2017 based on improving water quality in that area and sampling at station 13-16 in Cormorant Cove was discontinued in 2017. All approved and seasonally approved stations in GA13 (Block Island Great Salt Pond) are in program compliance. 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 3: 2018 Statistical summary of GA13

RIDEM SHELLFISH GROWING AREA MONITORING: GA13

Approved stations, recent 30 all weather.
(6/16/16 or 7/19/16 to 12/11/2018; all mTEC, 15 wet and 15 dry weather)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31)***
GA13-9	A	30	3.6	11.3
GA13-10	A	30	2.2	3.9
GA13-11	A	30	2.1	2.9
GA13-13	A	30	2.2	3.8

Results for all observations at seasonally approved and prohibited stations (below) for reference only and not for compliance. Recent 30 all weather. (6/16/16 or 7/19/16 to 12/11/2018; all mTEC, 15 wet and 15 dry weather)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31)***
GA13-1	SA	30	5.4	21.5
GA13-2	SA	30	4.6	16.5
GA13-3	SA	30	3.0	10.0
GA13-4	SA	30	3.2	9.6
GA13-5	SA	30	2.9	7.2
GA13-6	SA	30	2.4	5.0
GA13-7	SA	30	2.7	7.0
GA13-8	SA	30	2.0	2.7
GA13-12	SA	30	2.5	5.3
GA13-14	SA	30	4.9	18.0
GA13-17	P	30	4.1	14.0

Table 3 (continued): 2018 Statistical summary of GA13

RIDEM SHELLFISH GROWING AREA MONITORING: GA13

Results for recent 15 samples at seasonally approved stations in seasonal closure areas A & C when area was open. Recent 15 samples (12/21/2016 to 12/11/2018, 9 wet and 6 dry weather, all mTEC)

			FECAL-GEO	
Station Name	*Status*	*N*	*MEAN*	*%>CRITICAL 31*
GA13-1	SA	15	3.4	6.7
GA13-2	SA	15	3.5	6.7
GA13-3	SA	15	2.2	0.0
GA13-4	SA	15	2.4	0.0
GA13-5	SA	15	2.1	0.0
GA13-6	SA	15	2.0	0.0
GA13-7	SA	15	2.5	0.0
GA13-14	SA	15	2.8	0.0

Results for recent 15 samples at seasonally approved stations in seasonal closure area B when area was open. Recent 15 samples (6/15/2015 to 12/11/2018, 7 wet and 8 dry weather, all mTEC)

			FECAL-GEO	
Station Name	*Status*	*N*	*MEAN*	*%>CRITICAL 31*
GA13-8	SA	15	2.0	0.0
GA13-12	SA	15	2.6	0.0

H. Other Water Quality Studies

The Harbor Pond and Trim's Pond sections of Great Salt Pond (waterbody ID #RI0010046E-01C) had previously been on Rhode Island's "List of Impaired Waters" for that water body not meeting all uses due to elevated fecal coliform concentration. Analysis of fecal coliform data by the RI DEM TMDL group indicated that fecal coliform concentrations in this area, which included Shellfish Program stations 13-1, 13-2 and 13-14, had declined significantly in recent years. In addition all Shellfish program monitoring station in this area now consistently meet fecal coliform water quality criteria. As a result, this portion (WBID #RI0010046E-01C) of Block Island Great Salt Pond was removed from the list of impaired waters in 2016 (RI DEM Final De-listing Document, March 2018; available at http://dem.ri.gov/programs/benviron/water/quality/ surfwq/pdfs/iwlr16.pdf).

I. Interpretation of Data

i. Effects of Meteorological and Hydrographic Conditions

A more extensive investigation would be required to link meteorological and hydrographic conditions to bacterial loading. Based on the statistical results from routine monitoring under all weather and hydrographic conditions there does not appear to be a direct link between meteorological events (rain and snow precipitation) and an increase in bacteria loadings and within this growing area.

J. Recommendations

i. Monitoring Schedule

The current monitoring schedule is adequate for maintaining the current classification. Water quality statistical evaluations indicate that the area meets NSSP criteria when the seasonally approved areas are in the open status and that the approved areas meet criteria under all conditions. There are no recommendations for changes in classification at this time.

ii. Legal description

Based on regular RIDEM Shellfish Program monitoring data and the data acquired during this 12-year sanitary survey, it is recommended that the existing legal description of the growing area be maintained.

K. Conclusions

The sanitary reconnaissance of the Great Salt Pond uncovered twelve sources that were flowing at the time of the survey. These sources can be generally categorized as tributaries or streams draining wetlands/intertidal areas. Most (seven of 13) sources had either no flow or extremely low (trickle) flow. All sources investigated in the 2018 survey had fecal coliform concentration of less than 2,400 cfu/100 ml and most (eight of twelve) flowing sources had fecal coliform values of less than 240 cfu/100 ml. All water quality monitoring stations in the growing area meet NSSP fecal coliform criteria as demonstrated by the 2018 annual statistical review.

The results of this survey, combined with the 2018 water quality statistical evaluation for the Great Salt Pond, indicate that the growing area (GA13) conforms to all of the requirements set forth by the National Shellfish Sanitation Program (NSSP) and is appropriately classified. No changes for reclassification are recommended at this time.

L. References

Joubert, Lorraine B. et. al., Water Quality Impacts of Changing Land Use on Block Island, Rhode Island, October 1996.

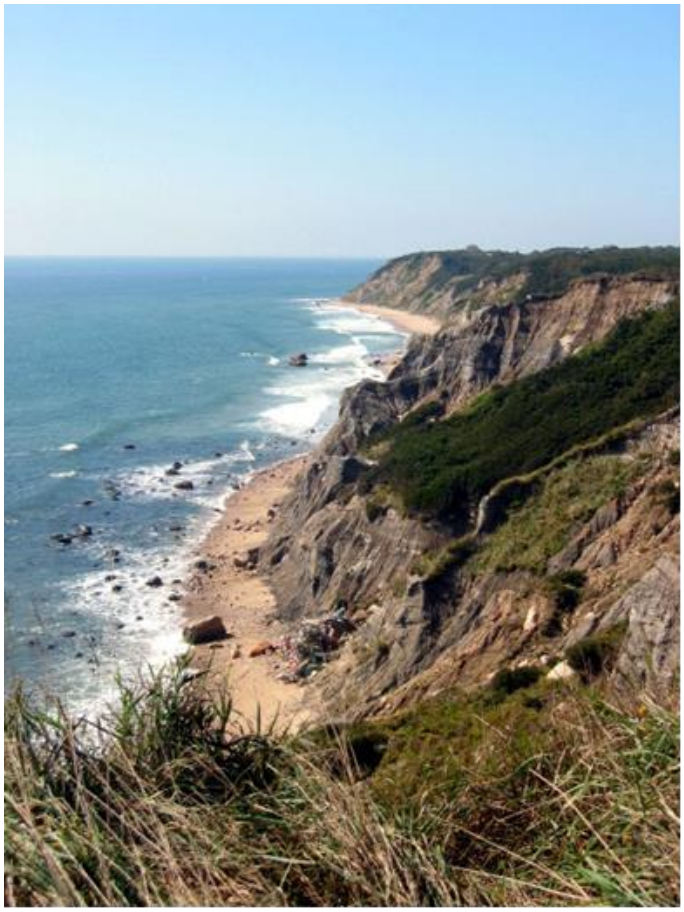
New Shoreham Comprehensive Plan, 2016. Comprehensive Management Plan adopted by the New Shoreham Town Council November 2016. 390 pages.

Rhode Island Department of Environmental Management. 2003. *Block Island and Great Salt Pond Shoreline Survey*. Office of Water Resources. Providence, RI.

Rhode Island Department of Environmental Management. 2005. *West Passage Growing Area 7 12-Year Sanitary Shoreline Survey.* Office of Water Resources. Providence, RI.

Rhode Island Department of Environmental Management. 2016. *Final 2016 Delisting Document*. Office of Water Resources. Providence, RI

Offshore
Growing Area 14 East and 14 West
Including Offshore Block Island
12-Year Sanitary Shoreline Survey
Calendar Year 2018



Rhode Island
Department of Environmental Management

Office of Water Resources

Shellfish Program

12-Year Sanitary Shoreline Survey GA14 East & 14 West including Offshore Block Island

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Acronyms and Terms

FDA: Food and Drug Administration
ISSC: Interstate Shellfish Sanitation Conference
MPN: Most Probable Number
NSSP: National Shellfish Sanitation Program
RIDEM: Rhode Island Department of Environmental Management
SGAM: Shellfish Growing Area Monitoring
SSCA: State Shellfish Control Authority
NOAA: National Oceanographic and Atmospheric Administration

A. Introduction

A sanitary survey of the Offshore Growing Areas including Offshore Block Island was conducted during the summer and fall of 2018 by staff from RIDEM's Office of Water Resources Shellfish Program with assistance from staff of the TMDL program. The survey involved a shoreline reconnaissance of the study area to locate and catalog pollution sources and collect bacteriological samples from all sources actively flowing into the survey area. The entire shoreline from Napatree Point in Westerly to Westport at the Massachusetts state line and the accessible outer shoreline of Block Island were surveyed. The respective teams surveyed as much of their areas as possible within a one-week period in July. Any remaining areas were surveyed by Shellfish Program staff in the fall. All locations within the growing area were surveyed regardless of their classification.

The primary objective of the shoreline survey was to identify and characterize any new sources of pollution 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.

B. Description of the 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 are predominate on Block Island and the shoreline to the east of Pt. Judith to the state line in Little Compton.

The towns of Westerly, Charlestown, South Kingstown, Narragansett, Jamestown, Newport, Middletown, and Little Compton form the boundary of this growing area along with the exterior shoreline of the Town of New Shoreham on Block Island.

Growing Area 14E and 14W including Offshore Block Island is presently comprised of sections classified as either approved or prohibited for shellfishing (Figure 1). Five distinct portions of this growing area are prohibited to shellfishing. There is a one thousand five hundred and ninety-nine (1,599) acre section in Narragansett closed to shellfishing due to the presence of a discharge from the Scarborough Municipal Wastewater Treatment Facility (WWTF). A six hundred and seventy-nine (679) acre portion of the growing area along the eastern shore of Narragansett is closed to shellfishing due to the presence of a discharge from the South Kingstown WWTF. There is a one thousand four hundred and seven (1,407) acre area on Block Island where shellfishing is prohibited due to the presence of a discharge from the New Shoreham Municipal WWTF. Easton Beach in Newport is prohibited to shellfishing and this closure encompasses approximately three hundred and thirty-nine (339) acres of the offshore growing area. A small portion of the Newport harbor prohibitive closure encroaches on the offshore growing area equal to an area of approximately ninety (90) acres.

i. Location

The Offshore Growing Area ranges from miles of open beach from the state line in Westerly to the causeway at Point Judith to rocky, steep cliffs that are predominate on Block Island and the shoreline to the east of Pt. Judith to the state line in Little Compton.

The shoreline of the growing area is compromised of the towns of Westerly, Charlestown, South Kingstown, Narragansett, Jamestown, Newport, Middletown, and Little Compton from the boundary of this growing area along with the exterior shoreline of the Town of New Shoreham on Block Island.

ii. Physical Description

The Offshore growing area encompasses all of the southern shoreline of Rhode Island to the three-mile state waters limit. It also includes all of the ocean shoreline of Block Island out to the three-mile state waters statutory limit. Growing area 14W is approximately 54,962 acres and additionally includes the offshore Block Island growing area of approximately 62,633 acres for a total of 117,595 acres. The easterly portion of the growing area designated GA-14E is approximately 83,512 acres of offshore waters.

iii. Latest Survey

RIDEM's Office of Water Resources personnel conducted a sanitary survey in 2006 to assess the relative importance of pollution sources impacting the growing area water quality.

iv. Previous Classification Maps

The 2006 classification map is shown in Figure 2, it does differ from the current classification maps which are shown in Figure 1. There is one change that is apparent in the current classification map that directly effects Growing Area 14. A small portion (approximately 120 acres) of the growing area (the area east of Fort Adams in the lower East Passage of Narragansett Bay) was reclassified from prohibited to approved in May 2015. This change was based on water quality sampling in Castle Hill Cove during 2015 that demonstrated that the area met water quality criteria.

v. Current Classification Map & Legal Description

The most recent (May 2018-May 2019 revised annually) RIDEM document entitled Notice of Polluted Shellfish Grounds documents five prohibited shellfish areas in the offshore growing area. The legal descriptions of these closure areas are described below and are shown in Figure 1.

Shellfishing Prohibited:

Shellfishing is Prohibited in the following areas of GA14:

Growing Area 14E –Offshore Pt. Judith/ Narragansett to Westport:

GA14E-1	Castle Hill Cove in its entirety.
GA14E-2	Easton's Bay north of a line from the southeast extension of Tuckerman's Terrace in Middletown to the south-east extension of Narragansett Avenue in Newport meant to include "Forty Steps".

Growing Area 14W –Offshore Napatree Point to Point Judith / Narragansett Including Block Island, Rhode Island Sound:

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

GA14W-2 The waters in the vicinity of Tucker's Dock which are within 4,000 feet of the marine outfall sewer located 41 .4212º N, 71 .4526º W. New Shoreham (Block Island).

GA14W-3 The waters in the vicinity of Pebbly Beach which are within 5,900 feet of the marine outfall sewer located 41 .1678º N, 71 .5512ºW, including Old Harbor in its entirety.

Figure 1: Offshore Growing Area 14E

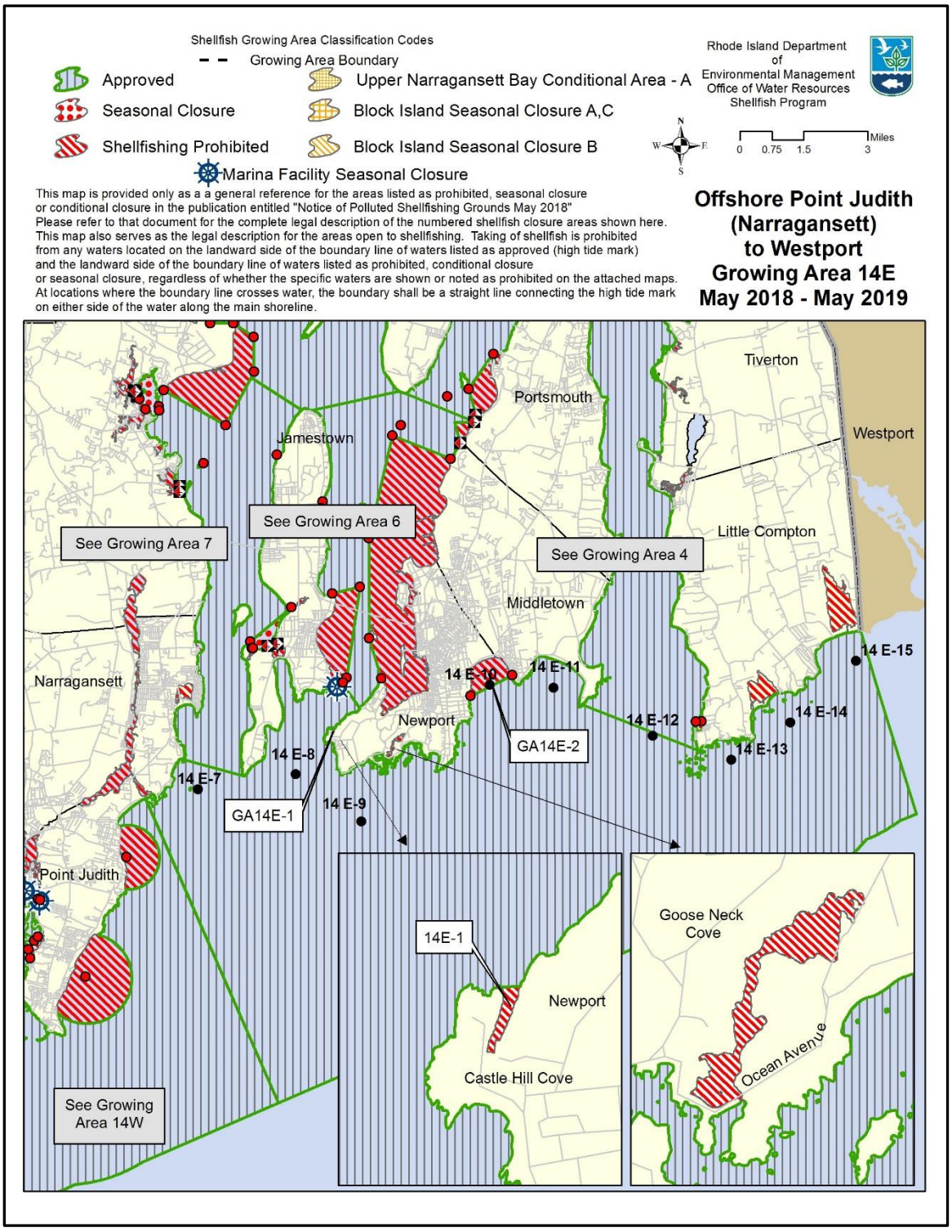

Figure 1 (continued): Offshore Growing Area 14W and Offshore Block Island

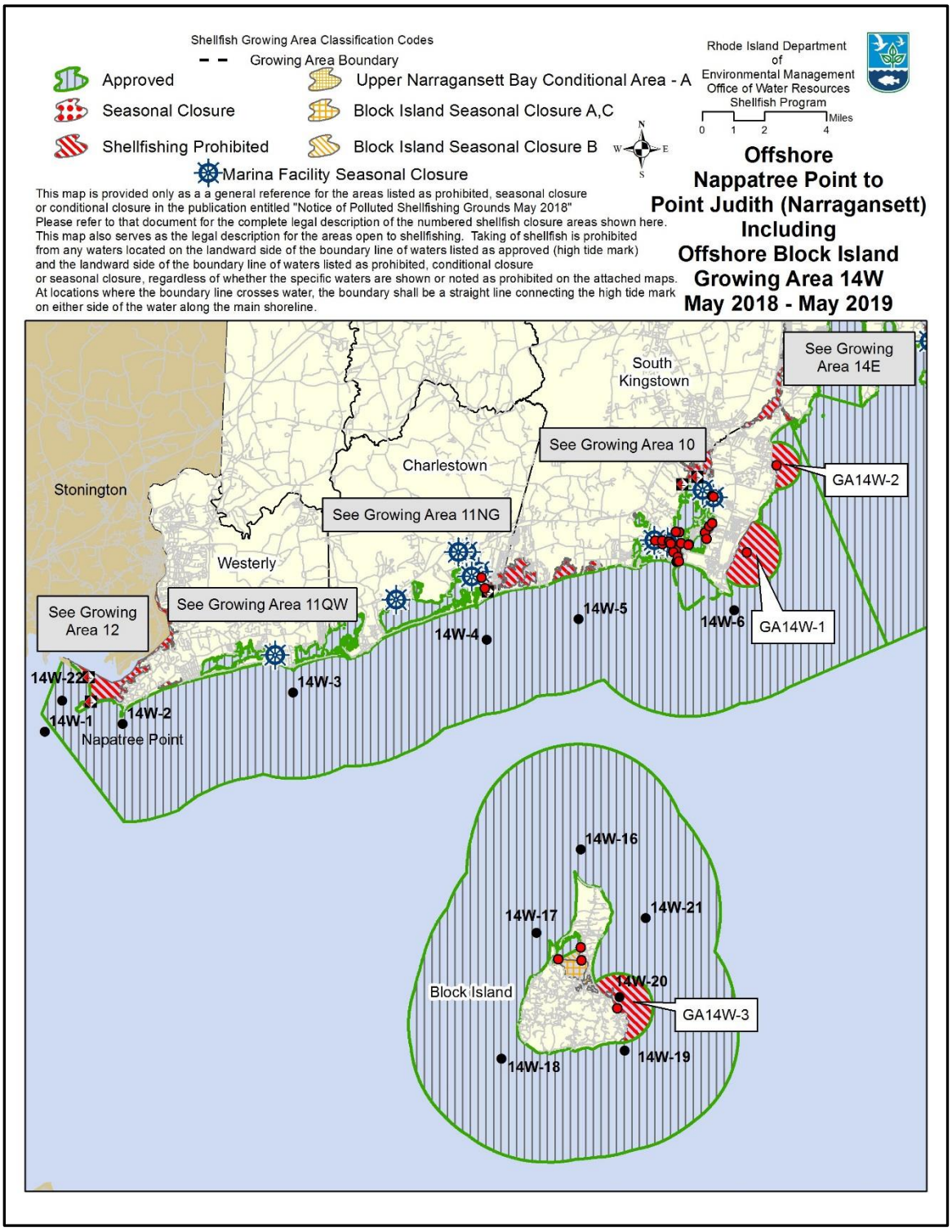

Figure 2: 2006 Classification Map of Offshore Growing Area 14 and Offshore Block Island

C. Pollution Source Survey

i. Personnel

Anna Gerber-Williams, Marine Biologist for RIDEM Office of Water Resources Shellfish Program, coordinated and conducted a shoreline reconnaissance of Offshore Growing Area and Offshore Block Island with the assistance of other RIDEM Office of Water Resources Shellfish and TMDL staff members. Teams of surveyors were organized and assigned to each section of the bay to inspect the entire shoreline.

ii. Survey procedures

In early July 2018, a planning meeting was arranged in which staff from RIDEM discussed the logistics necessary to meet and complete the requirements of a 12-year sanitary shoreline survey for the Offshore Growing Area and Offshore Block Island. The southern shoreline of RI was divided into four sections (**Figure 3**), Napatree to Point Judith, Jamestown, and Middletown to the RI state border in Little Compton. Teams of two were assigned to survey each area over a two-day period, July 24th and 25th 2018, those areas that could not be covered during those two days were sampled later in the fall by RIDEM Office of Water Resources Shellfish staff. The sanitary survey of the Offshore Block Island growing area was completed by a 2-person team on August 21 – 23, 2019.

All necessary survey materials were provided to each team, including aerial maps created using ArcMap GIS software that displayed the locations of all previously identified sources. Each team assigned to an area was given the appropriate map; pre-filled field sheets including source IDs, descriptions, and geographic coordinates; information on public access points and street maps for parking; and extra field sheets and laboratory sample submission chain of title forms. In addition, each team was equipped with a GPS-enabled digital camera or their personal cell phone, a means for measuring flows such as a bucket or float, coolers, extra sample bottles, and first-aid kits. One team was assigned to the areas that are more densely populated with marinas and used a 16-foot aluminum Jon boat to locate sources under docks and along bulk-heads. Those teams tasked with surveying marina areas were also provided with marina survey field sheets to make note of number of slips, type and number of pump outs, occupancy and boat types and lengths and the general state of the marina facilities.

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). Samples were collected near the water surface (using 4-ounce sterile Nalgene bottles) or other pre-sterilize bottles provided by RIDOH, after which they are stored in a cooler packed with ice. They are then transported to the Rhode Island Department of Health Laboratories for analysis. The mTEC membrane filtration method, as described in *Standard Methods for the Examination of Water and Wastewater* (APHA, 1999) was used for fecal coliform sample analysis. The mTEC method allows for a holding period of 30 hours and all samples were stored on ice and delivered to the Health Lab within the 30-hour holding time.

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 August 2017.

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 14 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

D. Identification and Evaluation of Pollution Sources

i. Summary of Sources

There were two hundred ninety-two (292) actual or potential pollution sources identified during the shoreline survey in 2018. Twenty-six (26) of the sources could not be located in 2018, leaving 266 potential sources that were investigated during the 2018 survey (Table 1). 155 of the potential sources were not flowing and 111 potential sources were flowing at the time of the 2018 survey (Table 1). Of these flowing sources, 82 had flows too small to measure or were located in locations too hazardous to sample (steep cliffs), 21 had a trickle flow, and eight had a flow of greater than 0.1 cfs. Of the eight sources having greater than 0.1 cfs flow, only four were flowing into approved waters (Table 1).

Table 1: Counts of potential sources by region of GA14, receiving water classification and source flow rate during the 2018 sanitary survey.

	14E		14W		14W-BI	
2018 Flow	**Approved**	**Prohibited**	**Approved**	**Prohibited**	**Approved**	**Prohibited**
> 0.1 cfs flow	3	3	0	0	1	1
Trickle flow	3	11	1	0	4	2
No flow	107	27	13	0	4	4
Flow not measured	46	8	5	0	20	3
Could not find	12	9	4	0	1	0

The RI DEM Shellfish program uses a 0.5" rainfall in the prior seven days as a guideline for 'wet weather'. Using this guide, most of the 2018 sanitary survey of GA14 took place in wet weather (Table 2).

Table 2: Rainfall conditions prior to GA14 2018 shoreline survey.

Area	Survey dates	Rain
14E	7/24 to 7/26/2018	2 to 4 days since 0.67" rain at Westerly Airport
14W	7/24 to 7/26/2018	2 to 4 days since 0.67" rain at Westerly Airport
14W-BI	8/20 to 8/23/2018	7 to 10 days after 1.63" rain at Block Island Airport

The locations of all potential sources that exceeded the 240 cfu/100mL standard operating procedure minimum criteria within Growing Area 14 are shown in Figures 4, 9, 13 and 16 Details of each source investigated during the 2018 sanitary survey are listed in **Table 2**.

The sample ID for each source is coded to indicate the area in which the source was located as follows:

2018 – 14 – 000

Year - Growing Area - Source ID

Table 3: Bacteriological results of flowing sources in 2018

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14E-006	41.3806200	-71.478280	24" diameter flared end with metal grate 50 ft north of 49 Major Arnold	Prohibited	7/25/2018	D	930	200		Not measured
2018-14E-007 Left	41.3844800	-71.476120	(2) 36" diameter concrete and (1) 18" diameter plastic from concrete structure at WWTF	Prohibited	7/25/2018	D	11000	6300	>1600	Trickle
2018-14E-007 Right	41.3844800	-71.476120	(resampled on 08 Aug 18 by SV result 300 CFU/100mL, flow was a trickle)	Prohibited	8/8/2018	D	Not Sampled	300	300	Not measured
2018-14E-013	41.4120200	-71.453850	seep draining upland about 100 yds north of Newton Ave	Prohibited	7/24/2018	D	3	1600	640	Not measured
2018-14E-018	41.4049900	-71.458010	Outlet draining manmade pond 4" diameter CI pipe south of Bass Rock Rd (found 4" CI pipe but no flow. Stream from pond is more gw trickle than defined stream	Approved	8/8/2018	D	Not Sampled	240		Trickle
2018-14E-020*	41.4248200	-71.455580	8.5" diameter CI pipe across from Congdon Ave	Prohibited	7/24/2018	D	93	100		Trickle
2018-14E-024A	41.4194400	-71.453610	seep with phragmites behind 268 Ocean Rd	Prohibited	8/8/2018	D	Not Sampled	200		Trickle
2018-14E-024B	41.4186100	-71.453330	seep below fly pale @ 268 Ocean Rd	Prohibited	8/8/2018	D	Not Sampled	2		Trickle
2018-14E-024C	41.4166700	-71.453230	seep at head of cove behind 298 Ocean Rd	Prohibited	8/8/2018	D	Not Sampled	56		Trickle
2018-14E-024D	41.4163900	-71.453060	seep behind 320 Ocean Rd	Prohibited	8/8/2018	D	Not Sampled	40		Trickle
2018-14E-024E	41.4147200	-71.453060	seep behind 4 Hazard Ave	Prohibited	8/8/2018	D	Not Sampled	<2		Not measured
2018-14E-024F	41.4138900	-71.453330	seep behind 356 Ocean Rd	Prohibited	8/8/2018	D	Not Sampled	1600	44	Not measured
2018-14E-024G	41.4181690	-71.452969	Stream flowing through rocks, most likely storm drain	Prohibited	10/29/2018	D	Not Sampled	1600	100IS	Not measured
2018-14E-026	41.4266000	-71.455860	36" diameter concrete in seawall 10 yds north of #25	Prohibited	7/24/2018	D	Not Sampled	300		Not measured
2018-14E-E013	41.4129200	-71.453850	seep approximately 300 yds North of Newton Ave	Prohibited	8/8/2018	D	Not Sampled	1600		0.00071
2018-14E-105	41.4495000	-71.432200	7" pvc, trickle flow, orange	Approved	7/24/2018	D	Not Sampled	100		Not measured
2018-14E-200B	41.4628600	-71.389840	gw seep spanning 20' along rock edge next to stairwell	Approved	7/24/2018	D	Not Sampled	2800	40, <100 IS	Not measured
2018-14E-200C	41.4626700	-71.389820	gw seep ~30' south of 200B	Approved	7/24/2018	D	Not Sampled	No sample		Trickle

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14E-200D	41.4621800	-71.389720	small stream from upland discharging across large rock and into high tide line	Approved	7/24/2018	D	Not Sampled	100		1
2018-14E-200E	41.4624300	-71.389890	gw seep below set of stairs	Approved	7/24/2018	I	Not Sampled	No sample		Trickle
2018-14E-200F	41.4623400	-71.389880	gw seep below reinforced rock wall	Approved	7/24/2018	I	Not Sampled	100		Not measured
2018-14E-200G	41.4621700	-71.389680	gw seep flowing across rock and reaching low tide line 20' south of 200F	Approved	7/24/2018	D	Not Sampled	100		Not measured
2018-14E-200I	41.4619700	-71.389700	gw seep 50' south of 200G	Approved	7/24/2018	I	Not Sampled	No sample		Trickle
2018-14E-200J	41.4616100	-71.389680	gw seep 100' south of 200I and 50' section of seeps	Approved	7/24/2018	D	Not Sampled	100		Not measured
2018-14E-200K	41.4602500	-71.390030	gw seep	Approved	7/24/2018	D	Not Sampled	No sample		Trickle
2018-14E-200L	41.4598100	-71.389860	gw seep off top of cliff	Approved	7/24/2018	D	Not Sampled	No sample		Trickle
2018-14E-200M	41.4597600	-71.389860	pooled water from gw seep on top of cliffs, lots of green slime along cliffs were water drains	Approved	7/24/2018	D	Not Sampled	100		Not measured
2018-14E-200N	41.4597500	-71.389890	gw seep	Approved	7/24/2018	D	Not Sampled	No sample		Trickle
2018-14E-200O	41.4570700	-71.390180	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-200P	41.4559600	-71.390420	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-200Q	41.4550900	-71.391190	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-200R	41.4548800	-71.391340	gw seep	Approved	7/24/2018	NA	Not Sampled	1600		Trickle
2018-14E-200T	41.4534900	-71.393650	gw seep, flowing across rocks and pooling	Approved	7/24/2018	NA	Not Sampled	100		Trickle
2018-14E-200U	41.4535000	-71.393900	gw seep flowing over rocks	Approved	7/24/2018	D	Not Sampled	100		Trickle
2018-14E-200V	41.4533000	-71.394200	gw seep	Approved	7/24/2018	D	Not Sampled	100		Trickle
2018-14E-202	41.4511800	-71.397130	seep with runoff associate debris	Approved	7/26/2018	D	Not Sampled	100		Trickle
2018-14E-202A	41.4518000	-71.396400	gw seep dripping from many locations across rock ledge, lots of green slime	Approved	7/26/2018	I	Not Sampled	100		Trickle
2018-14E-203A	41.4849000	-71.385400	gw seep	Approved	7/26/2018	I	Not Sampled	No sample		Trickle
2018-14E-203B	41.4839000	-71.835300	gw seep	Approved	7/26/2018	I	Not Sampled	No sample		Trickle

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14E-203C	41.4838000	-71.385300	gw seep 40' section	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203D	41.4836000	-71.385100	gw seep not reaching receiving waters	Approved	7/26/2018	I	Not Sampled	100		Trickle
2018-14E-203E	41.4836000	-71.385100	gw seep not reaching receiving waters	Approved	7/26/2018	I	Not Sampled	No sample		Trickle
2018-14E-203F	41.4834000	-71.385100	gw seep	Approved	7/26/2018	D	Not Sampled	3700	60	Trickle
2018-14E-203G	41.4817000	-71.384900	gw seep pooling on rocks	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203H	41.4816000	-71.384900	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203I	41.4813000	-71.384800	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203J	41.4799000	-71.384800	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Drip
2018-14E-203K	41.4799000	-71.384800	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Drip
2018-14E-203L	41.4798000	-71.384800	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Drip
2018-14E-203M	41.4788000	-71.384700	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203N	41.4788000	-71.384700	gw seep multiple location across rocks	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-203O	41.4787000	-71.384700	gw seep multiple location across rocks	Approved	7/26/2018	D	Not Sampled	No sample		Drip
2018-14E-203P	41.4773000	-71.384400	gw seep	Approved	7/26/2018	D	Not Sampled	No sample		Trickle
2018-14E-204A	41.4531500	-71.394310	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-204B	41.4524800	-71.395580	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-204C	41.4521000	-71.396170	gw seep	Approved	7/24/2018	NA	Not Sampled	No sample		Trickle
2018-14E-300A	41.4826900	-71.377960	stream source. Does reach the water, very low flow	Approved	9/6/2018	D	Not Sampled	80000	8, <100IS	Trickle
2018-14E-300B	41.4778600	-71.367650	gw seep	Approved	9/6/2018	D	Not Sampled	200		Trickle
2018-14E-300C	41.4777200	-71.367130	gw seep phragmites present	Approved	9/6/2018	D	Not Sampled	100		Drip
2018-14E-606	41.4527700	-71.346470	36" diameter CMP submerged in sand	Approved	7/25/2018	D	Not Sampled	100		0.2 cfs
2018-14E-624	41.4598300	-71.322580	15" diameter concrete half filled with sand/submerged (Gooseberry Beach)	Approved	7/24/2018	D	Not Sampled	100		0.01 cfs

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14E-727	41.4706000	-71.297330	6" diameter CI pipe bottom of wall (cliff walk) (need to sample this using sample bottle on a line that is lowered to the pipe while standing on ledge)	Approved	7/24/2018	D	Not Sampled	100		Trickle
2018-14E-800	41.4891000	-71.285590	stream at the end of first beach	Prohibited	7/25/2018	D	Not Sampled	100		0.01 cfs
2018-14E-900	41.4552500	-71.332730	cove at Ocean Drive	Prohibited	7/25/2018	D	Not Sampled	100		Not measured
2018-14E-909	41.4560800	-71.340170	8" CI pipe gw flow from pipe- iron floc present trickle discharge	Approved	7/25/2018	D	Not Sampled	100		Not measured
2018-14E-910	41.4758700	-71.297020	stormdrain outlet at forty steps at end of Narragansett ave on cliff walk. (must be sampled in spring during low -low tide cycle) dangerous to get to source during a neap tide if wave action is moderate to rough	Prohibited	8/8/2018	D	460	1600		0.5 cfs
2018-14E-1100	41.4813000	-71.145980	Outlet from Long Pond (Little Compton)	Approved	7/25/2018	D	23	270		Stagnant
2018-14W-102	41.3315200	-71.718430	Quonochontaug Breachway at end of Sandy Beach	Approved	7/24/2018	D	Not Sampled	100		Breachway
2018-14W-200	41.3565500	-71.638700	Charlestown Breachway	Approved	7/24/2018	D	Not Sampled	100		Breachway
2018-14W-202A	41.3325000	-71.711390	4" wide x 1/2" deep seep	Approved	7/24/2018	D	Not Sampled	100		Trickle
2018-14W-001	41.3293500	-71.763050	Weekapaug Breachway	Approved	7/24/2018	D	Not Sampled	100		Trickle
2018-14W-500	41.3663500	-71.492400	coastal pond outlet between Sand Hill Cove Beach and East Wall (gw seeps at 30' stretch of beach in front of pond)	Approved	7/23/2018	D	Not Sampled	100		Trickle
2018-14W-500A	41.3641000	-71.489200	gw seep at sand and rock intersection located in front of broken seawall and house on beach, submerged at high tide	Approved	7/23/2018	D	Not Sampled	100		Trickle
2018-14W-1301	41.1519000	-71.555600	groundwater flow from bluff- not reaching receiving waters	Approved	8/21/2018	D	Not Sampled	400		Trickle
2018-14W-1302	41.1502000	-71.563100	flow from bluffs- reaches high tide line	Approved	8/21/2018	D	23	5000		Trickle
2018-14W-1304	41.1485300	-71.575800	from stream near houses in between bluffs	Approved	8/22/2018	D	Not Sampled	100		Trickle
2018-14W-1306	41.1659300	-71.610800	pond wetland drainage	Approved	8/21/2018	D	Not Sampled	300		Trickle

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14W-1310	41.1472500	-71.594700	from bluff houses above green algae, gw stream flowing through rocks at high tide line	Approved	8/21/2018	D	Not Sampled	100		Not measured
2018-14W-1312	41.1628700	-71.611000	drainage stream from pond wetland lots of algae	Approved	8/21/2018	D	Not Sampled	500		Trickle
2018-14W-1314	41.2146900	-71.555900	gw stream running down side of cliff 2 more within 50 ft of the first one with too little to sample	Approved	8/20/2018	D	Not Sampled	200		Not measured
2018-14W-1315	41.2117900	-71.555200	gw streams at base of cliffs coming from phragmites stand	Approved	8/20/2018	D	Not Sampled	1100		Trickle
2018-14W-1316	41.1469100	-71.593620	gw seep at base of bluffs. Not reaching receiving waters	Approved	8/21/2018	D	Not Sampled	300		Trickle
2018-14W-1317	41.1469500	-71.592230	gw seep at base of bluffs. Not reaching receiving waters	Approved	8/21/2018	D	Not Sampled	300		Trickle
2018-14W-1318	41.1473900	-71.591170	gw stream flowing down bluffs. Reaches high tide	Approved	8/21/2018	D	Not Sampled	100		Trickle
2018-14W-1319	41.1503000	-71.563010	gw stream flowing down bluffs	Approved	8/21/2018	I	Not Sampled	300		Trickle
2018-14W-1320	41.1509200	-71.560880	gw stream flowing down side of bluffs. Reaches high tide line, seep extends 40 ft at base of bluffs	Approved	8/21/2018	D	Not Sampled	100		Trickle
2018-14W-1321	41.1491700	-71.565930	gw seep flowing down side of bluff. Reaches high tide line	Approved	8/21/2018	D	Not Sampled	100		Trickle
2018-14W-1321A	41.1490800	-71.566160	gw seep flowing through phragmites on side of bluff. Reaches high tide line, multiple flows from seep	Approved	8/21/2018	D	Not Sampled	100		Trickle
2018-14W-1322	41.1491400	-71.580830	gw stream flowing at base of bluff reaches high tide line. Water appears to bubble up out of sand	Approved	8/22/2018	D	Not Sampled	600		0.08 cfs
2018-14W-1323	41.1481700	-71.578450	gw seep flowing through rocks. Reaches high tide line	Approved	8/22/2018	D	Not Sampled	400		Trickle
2018-14W-1324	41.1484200	-71.576070	gw seep flowing through phragmites at base of bluff. Water doesn't reach high tide line	Approved	8/22/2018	D	Not Sampled	100		Trickle
2018-14W-1325	41.1490800	-71.573380	gw seep not reaching high tide line	Approved	8/22/2018	D	Not Sampled	200		Trickle
2018-14W-1326	41.1494700	-71.570500	gw seep	Approved	8/22/2018	D	Not Sampled	200		Trickle
2018-14W-1327	41.1494700	-71.568940	gw stream	Approved	8/22/2018	D	Not Sampled	80000		Trickle
2018-14W-1328	41.1518700	-71.553960	gw stream	Approved	8/22/2018	D	Not Sampled	500		Trickle
2018-14W-1329	41.1519000	-71.553840	gw stream	Approved	8/22/2018	I	Not Sampled	100		Trickles
2018-14W-1330	41.1526500	-71.549600	gw seep	Approved	8/22/2018	I	Not Sampled	400		Trickle

Station ID	Latitude	Longitude	Description	Receiving Waters Classification	Survey Date	Direct/ Indirect	2006 FC Results (MPN/ 100ML)	2018 FC Results (CFU/100ML)	2018 FC Results follow ups	Volumetric Flow (ft3/s)
2018-14W-1331	41.1528000	-71.549460	gw seep	Approved	8/22/2018	I	Not Sampled	2300		Trickle
2018-14W-1332	41.1567100	-71.546380	gw seep	Prohibited	8/22/2018	I	Not Sampled	2400		Trickle
2018-14W-1333	41.1568100	-71.546050	gw seep	Prohibited	8/22/2018	I	Not Sampled	100		Trickle
2018-14W-1336	41.1678400	-71.552220	stream draining from pond	Prohibited	8/23/2018	D	Not Sampled	900		0.08 cfs
2018-14W-1337	41.1691800	-71.553060	gw seep down embankment in front of pond. Water pooled in front, not reaching high tide line	Prohibited	8/23/2018	D	Not Sampled	820		Trickle
2018-14W-1339A	41.1731100	-71.556610	pipe 1	Prohibited	8/23/2018	D	Not Sampled	730		Trickle
2018-14W-1339	41.1731100	-71.556610	pipe 2	Prohibited	8/23/2018	D	Not Sampled	540		Trickle

ii. Description of Sources greater than 240 cfu/100 ml

Nineteen (19) sources that potentially flow into the receiving waters of GA14 having the Approved classification had greater than 240 cfu/100 ml fecal coliform concentration during the 2018 sanitary survey (Table 4). Seven (7) greater than 240 cfu/100 ml sources were identified in the 14E (GA14 East) region of GA14, twelve (12) greater than 240 cfu/100 ml sources were identified in the 14W-BI (Block Island offshore), and zero (0) greater than 240 cfu/100 ml sources were identified in the western region (14W) of GA14. All of these sources were groundwater seeps that had extremely low flow rates (trickle flow) or small streams that had no flow and are likely to have little impact on the water quality of GA14. Fecal coliform results (Table 4) and detailed descriptions of the sources exceeding 240 cfu/100 ml are below. Locations of all sources greater than 240 cfu/100 ml in area 14E (Figure 3) and area 14W-BI (Block Island, Figure 9) are below. No sources greater than 240 cfu/100 ml that flow into Approved waters were identified in the 2018 sanitary survey of GA14W (western section of GA14).

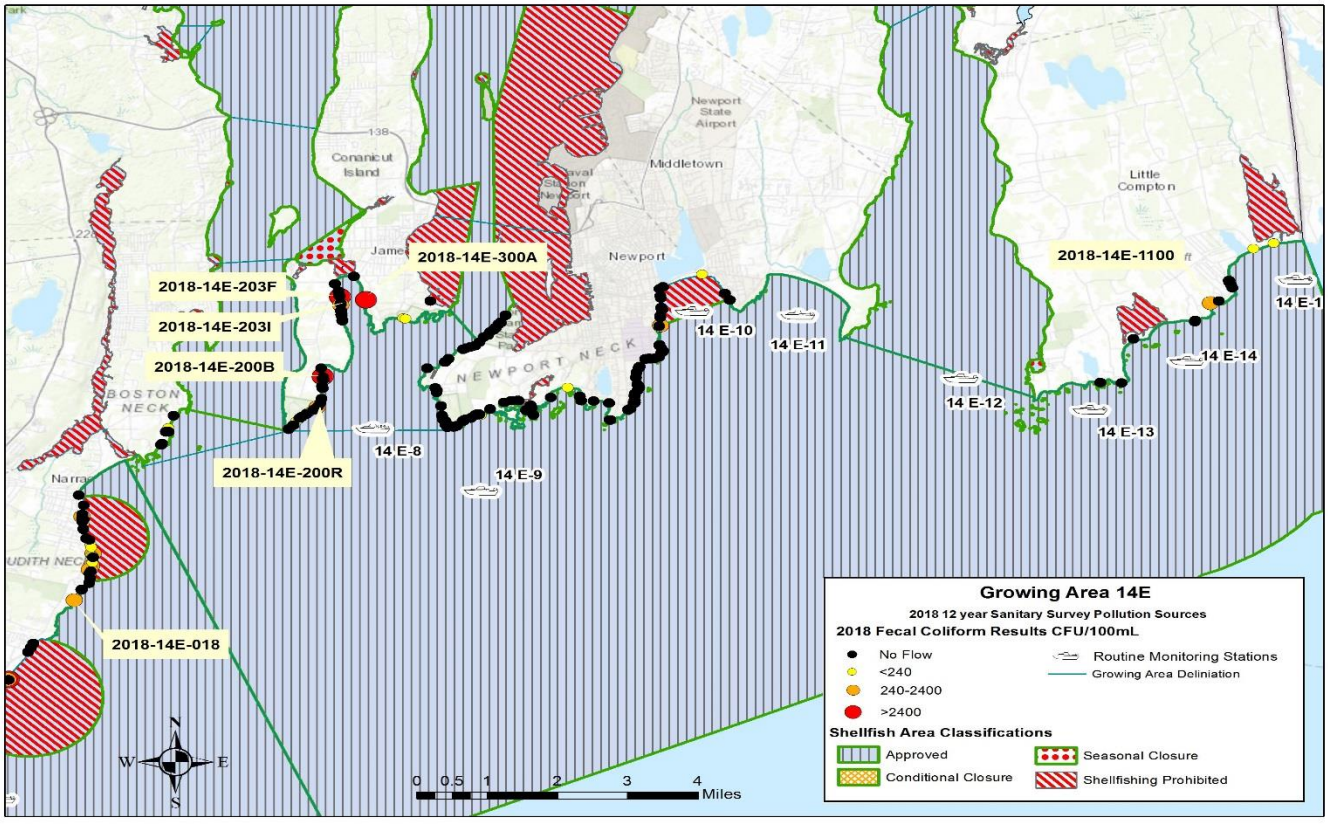

Figure 3: Location of >240 cfu/100 ml sources in GA14-East.

Table 4: 2018 sources greater than 240 cfu/100 ml discharging to Approved waters of GA14

Station_ID	Lat	Long	Description	Classification	Act_Pot	Dir_Ind	2006_FC	2006_cfs	2018_survey_Date	2018_flow	2018_Fecal Col	2018 Follow Up results
2018-14E-018	41.4049900	-71.458010	Outlet draining manmade pond 4" diameter Ci pipe south of Bass Rock Rd, GW trickle	Approved	A	D	No sample	No flow	8/8/2018	Trickle	240	
2018-14E-200B	41.4628600	-71.389840	gw seep spanning 20' along rock edge next to stairwell	Approved	P	D	No sample		7/24/2018	Trickle	2,800	40 cfu/100 ml , <100 IS on 10/23/18
2018-14E-200R	41.4548800	-71.391340	gw seep	Approved	A	D	No sample		7/24/2018	Trickle	1,600	
2018-14E-203F	41.4834000	-71.385100	gw seep	Approved	P	D	No sample		7/26/2018	Trickle	3,700	60 cfu/100 ml on 10/23/18
2018-14E-203I	41.4813000	-71.384800	gw seep	Approved	P	D	No sample		7/26/2018	Trickle	300	
2018-14E-300A	41.4826900	-71.377960	stream source. Does reach the water, very low flow	Approved	A	D	No sample		9/6/2018	Trickle	80,000	8 cfu/100 ml, <100IS on 1/29/19
2018-14E-1100	41.4813000	-71.145980	outlet from Little Pond (litle compton)	Approved	P	D	23	Trickle	7/25/2018	No flow	270	
2018-14W-1301	41.1519000	-71.555600	groundwater flow from bluff- not reaching receiving waters	Approved	P	D	11000		8/21/2018	Trickle	400	
2018-14W-1302	41.1502000	-71.563100	flow from bluffs- reaches high tide line	Approved	P	D	23		8/21/2018	Trickle	5,000	
2018-14W-1306	41.1659300	-71.610800	pond wetland drainage	Approved	A	D	93		8/21/2018	Trickle	300	
2018-14W-1312	41.1628700	-71.611000	drainage stream from pond wetland lots of algae	Approved	A	D	93		8/21/2018	Trickle	500	
2018-14W-1315	41.2117900	-71.555200	gw streams at base of cliffs coming from phragmites stand	Approved	P	D	No sample		8/20/2018	Trickle	1,100	
2018-14W-1316	41.1469100	-71.593620	gw seep at base of bluffs. Not reaching receiving waters	Approved	P	D	No sample		8/21/2018	Trickle	300	
2018-14W-1317	41.1469500	-71.592230	gw seep at base of bluffs. Not reaching receiving waters	Approved	P	D	No sample		8/21/2018	Trickle	300	
2018-14W-1319	41.1503000	-71.563010	gw stream flwoing down bluffs	Approved	P	I	No sample		8/21/2018	Trickle	300	
2018-14W-1322	41.1491400	-71.580830	gw stream flowing at base of bluff reaches high tide line. Water appears to bubble up out of sand	Approved	P	D	No sample		8/22/2018	Trickle	600	
2018-14W-1323	41.1481700	-71.578450	gw seep flowing through rocks. Reaches high tide line	Approved	P	D	No sample		8/22/2018	Trickle	400	
2018-14W-1327	41.1494700	-71.568940	gw stream	Approved	P	D	No sample		8/22/2018	Trickle	80,000	
2018-14W-1328	41.1518700	-71.553960	gw stream	Approved	A	D	No sample		8/22/2018	Trickle	500	

GA14E (East region of GA14)

Seven (7) greater than 240 cfu/100 ml sources that could potentially discharge to Approved waters were identified in the 14E (GA14 East) region of GA14 (Figure 3). Source 2018-14E-018 (Figure 4) had a 240 CFU/100mL bacteria concentration and a trickle flow on 8/8/2018. This source is an outlet draining a manmade pond through a 4" diameter cast iron pipe just south of Bass Rock Rd. This source appears to resemble a ground water seep more than a defined stream as it flows through the rocks on the beach and trickles into the receiving waters. This source discharges to a rocky area with heavy surf from RI Sound and the trickle flow is likely quickly diluted. Therefore, this source is not likely to have a negative impact on the water quality of GA14. This source will be sampled in the next Triennial Survey.

Figure 4: Source 14E-018 a small stream (trickle) draining a pond near Bass Rock Rd., Narragansett, RI.

Source 2018-14E-200B is a ground water seep near Lions Head Rock located on the eastern side of Beavertail. This source is a ground water seep that spans ~ 20 ft along a rock edge next to the stairwell and flows directly into an area of GA14 that is classified as Approved. This source was sampled on one of the primary sampling days 7/24/2018 and was then followed up on 10/23/2018. The initial result was 2,800 cfu/100 ml, and the follow-up result was 40 CFU/100mL. The flow on both sample days was only a trickle as shown in the photo below. The low flow and the reduced fecal coliform concentration in the follow-up sample suggest that this source has little impact on the receiving waters of GA14. This is a source that we will continue to monitor and will sample again in the annual survey. Source 2018-14E-200R (Figure 5) is also a ground water seep located close to Lions Head rock had a result of 1,600 CFU/100mL and no previous sample has been collected from this source. This source had a trickle flow and therefore is not a concerning source. It will be followed up in the next triennial survey.

Figure 5: Source 14E-200B (left), a groundwater seep near Lion's Head Rock on the east side of Beavertail, Jamestown, RI. Source 2018-14E-200R (right) a ground water seep on the east side of Beavertail, Jamestown, RI.

Sources 2018-14E-203F and 2018-14E-203I are both groundwater seeps on the western side of Mackerel Cove in Jamestown (Figure 6). Source 14E-203F had a fecal coliform result of 3,700 cfu/100 and a trickle flow on 7/26/2018. Follow-up sampling on 10/23/2018 had a fecal coliform result of 60 cfu/100 ml and a trickle flow. Nearby source 14E-203I had a fecal coliform result of 300 cfu/100 ml and a trickle flow on 7/26/2018. The low flow (trickle) and the moderate fecal coliform concentration of these sources suggests that they have little impact on the receiving waters of GA14.

Figure 6: Source 2018-14E-203F (left) and 2018-14E-203I (right) are both groundwater seeps that trickle over the rocks on the west side of Mackerel Cove, Jamestown, RI.

Source 2018-14E-300A (Figure 7), it is a stream that flows through uplands on the eastern side of Mackerel Cove in Jamestown and discharges into the waters of GA14. This is un-named stream that drains a wetland area and flows through suburban residential area then the property of 126 Highland Drive and into Mackerel Cove. At the initial time of sampling on 9/6/2018, there was only a trickle flow with an elevated 80,000 cfu/100mL fecal coliform result. When this source was visited again for a follow up on 10/23/2018, the result was 78 cfu/100 ml, a dramatic reduction. Companion instream result taken approximately 6 ft out into the receiving waters had a result of 400 CFU/100mL. Given that the results are higher when collected in stream, it could be possible that the stream is running primarily under ground and most of the flow could be emptying into the cove without being at the surface. When inspecting the

surrounding area of the stream on the follow up, the soil on either side of the stream was very soft and wet despite the flow being a trickle which suggests that there is groundwater flow in the area.

Follow up sampling was conducted again on 1/28/19, the results were 8 cfu/100ml with an increased flow (not measured) due to recent large rain event (2.33" of rain fell on 1/24/19), and the in-stream sample had a result of < 100 cfu/100ml (lab dilution limited precision of results to <100 cfu/100 ml). Given the most recent results demonstrating reduced fecal coliform concentration at this source and the rapid dilution of the source in the exposed ocean waters of outer Mackerel Cove, no reclassification of this area is recommended at this time. This source will be checked in the next annual update.

Figure 7: Source 2018-14E-300A a small stream that flows through uplands and residential area into the eastern side of Mackerel Cove, Jamestown, RI.

The final source in the eastern area of GA14 (area 14E) having a fecal coliform result of greater than 240 cfu/100 ml was source 2018-14E-1100. This source is the outlet from a small pond, Little Pond, in Little Compton, RI. It was sampled on one of the initial survey days of 7/25/2018. This source was not flowing and was considered stagnant or sitting water that was not reaching the receiving waters of GA14 on the survey date. The results were 270 CFU/100mL, with no flow. When this source was sampled in 2006 it was found to be actively flowing and had a fecal coliform concentration of 23 MPN 100/mL. This source should be revisited during the next triennial survey in 2021.

Figure 8: Source 2018-14E-1100 a small stream draining Little Pond in Little Compton, RI this source was not flowing during the 2018 survey.

GA14W (Western region of GA14)

No sources having fecal coliform of greater than 240 cfu/100 ml that could potentially discharge to Approved waters were identified in the western region (GA14W) of GA14 during the 2018 sanitary survey (Figure 9,Table 4).

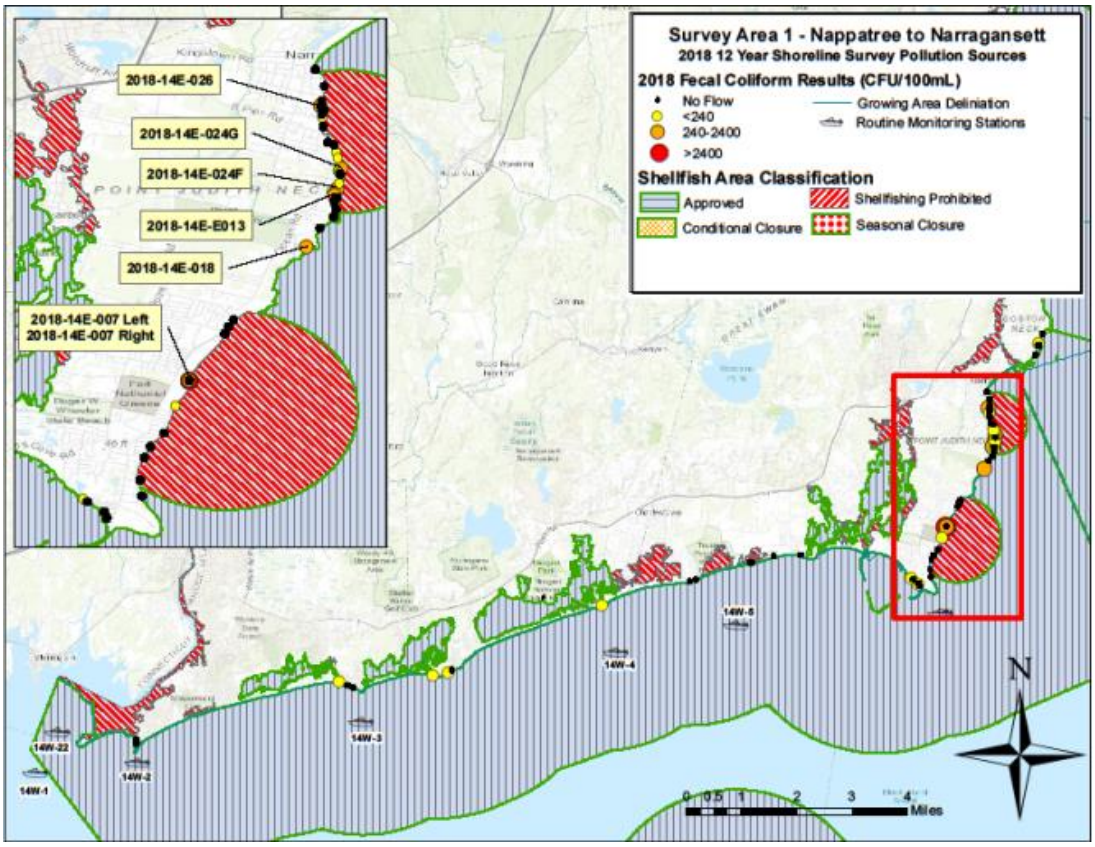

Figure 9: Location of sources investigated in GA14W. No sources that discharged to Approved waters were greater than 240 cfu/100 ml.

GA14W-BI (Block Island offshore region of GA14)
Twelve (12) greater than 240 cfu/100 ml sources that could potentially discharge to Approved waters were identified in the Block Island offshore region (region 14W-BI) of GA14 (Table 4; Figure 10). All twelve greater than 240 cfu/100 ml potential sources identified in GA14W-BI had low flow (trickle flow) at the time of the survey (8/20 to 8/23/2019 which was 7 to 10 days after rainfall of 1.63" at the Block Island Airport weather station).

Sources 2018-14W-1306 and 2018-14W-1312 (Figure 10) are located on the west side of Block Island in the area of Cooneymus Road. Both of these sources drain small freshwater ponds and associated wetlands. The area is sparsely populated with less than 10 residences within a 1,000 foot radius of each source. Source 14W-1306 had a fecal coliform result of 300 cfu/100 ml, but this source was not flowing on the day of the survey (8/21/18). Source 14W-1312 had a fecal coliform result of 500 cfu/100 ml on 8/21/18 and had only a trickle flow. The 2006 survey of this area had a fecal result of 93 cfu/100 ml at both sources 14W-1306 and 14W-1312. The low flow of these sources and the rapid dilution experienced in the open ocean of Block Island Sound immediately adjacent to the sources suggest that these sources will have little negative impact on the bacteriological water quality of GA14.

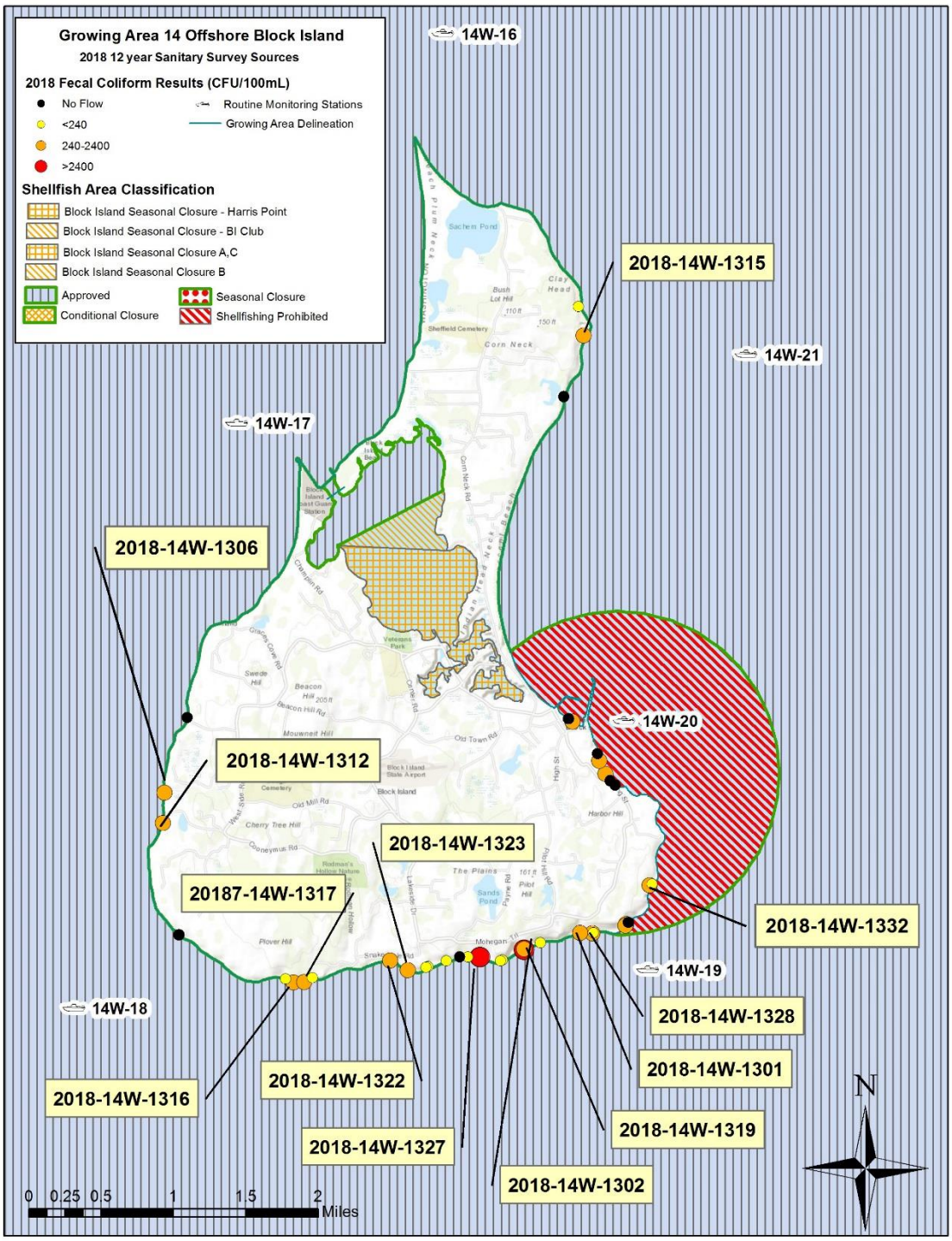

Figure 10: Location of greater than 240 cfu/100 ml sources identified during 2018 survey in GA14W-BI (Block Island offshore).

Figure 11: Source 14W-1306 (left) and source 14W-1312 (right). Both are small streams draining wetlands and small ponds on the west side of Block Island.

Sources 14W-1316 and 14W-1317 (Figure 12) are both ground water seeps at the base of a bluff on the southwest corner of Block Island. Both of these sources had fecal coliform results of 300 cfu/100 ml on 8/21/18. However, both of these sources had only a trickle flow and were not reaching the receiving waters during the 2018 survey. Because these sources dissipated before reaching the receiving waters, they are not impacting the water quality of GA14.

Figure 12: Sources 2018-14W-1316 (left) and 2018-14W-1317 (right) are ground water seeps at the base of cliffs on the southwest corner of Block Island.

Sources 14W-1322 and 14W-1323 (Figure 13) are both ground water seeps at the base of bluffs located on the coast between Black Rock and Snake Hole Roads on the south side of Block Island. Source 14W-1322 had a fecal coliform result of 600 cfu/100 ml and a trickle flow on 8/22/18 and a trickle flow. Source 14W-1323 had a fecal coliform result of 400 cfu/100 ml and also had a trickle flow on 8/22/18. Both of these sources would reach the receiving waters of GA14 at high tide. The area of GA14 adjacent to these sources is open ocean with heavy surf that is expected to quickly dilute the low, trickle flow of these sources and minimize their impact on GA14.

Figure 13: Sources 14W-1322 (left) and source 14W-1323 (right) are both ground water seeps at the base of cliffs on the south side of Block Island.

Source 2018-14W-1327 (Figure 14) is a ground water seep at the base of the cliff near Great Point. It had a fecal coliform result of 80,000 CFU/100 ml and a flow rate of only a trickle on 8/22/2018. The area is sparsely populated with seven (7) residences within a 1,000 foot radius of the source. However, the low flow rate (trickle) and the rapid dilution from the high surf and open ocean of GA14 are expected to rapidly dilute this source and minimize impacts on the growing area. This source will be followed up in the next annual survey and no reclassification is recommended at this time.

Figure 14: Source 2018-14W-1327, a ground water seep at the base of a cliff near Mohegan Bluffs on Block Island.

Sources 14W-1302 and 14W-1319 (Figure 15) are both groundwater seeps flowing down the bluffs to the west of the Mohegan Bluffs trail head parking area. Source 2018-14E-1302 was sampled in 2006 and had a result of 23 MPN/100mL, and in 2018 had a result of 5,000 CFU/100mL and a trickle flow. At the time of sample this trickle flow was reaching the high tide mark. Nearby source 14W1319 had a result of 300 cfu/100 ml and a trickle flow on 8/21/18. The area up the bluff from these sources is sparsely populated, with nine (9) residence within approximately 1,000 feet of the sources. Both of these sources are located on the southern end of Block Island and the area is in proximity of Mohegan Bluffs which is a popular summer day-tourist destination. As with other seeps in the area, the adjacent portion of GA14 is open ocean

with high surf action that is expected to rapidly dilute the sources and minimize the impact on the water quality of GA14. This source should be followed up in the next annual survey.

Figure 15: Sources 14W-1302 (left) and 14W-1319 (right) are both groundwater seeps flowing down the bluffs to the west of the Mohegan Bluffs trail head parking area

Figure 16: Sources 14W-1301 (left) and 14W-1328 (right) are groundwater seeps flowing down the bluffs to the east of the Mohegan Bluffs trail head parking area.

Sources 14W-1301 and 14W-1328 (Figure 16) are groundwater seeps flowing down the bluffs to the east of the Mohegan Bluffs trail head parking area. Source 14W-1301 had a fecal coliform result of 400 cfu/100 ml and a trickle flow on 8/21/18. However, this source dissipated into the sand and was not reaching the receiving water and therefore would not negatively impact the receiving waters of GA14. Source 14W-1328 is a ground water seep at the base of Mohegan Bluffs that had a trickle flow and a fecal coliform of 500 cfu/100 ml on 8/22/2018. The area up the bluff from this source is sparsely populated with only two residences within a 1,000 foot radius of the source. The low (trickle) flow combined with the surf mixing of the adjacent open ocean is expected to rapidly dilute the source and minimize the impact on the water quality of GA14. This source should be followed up in the next annual survey.

Source 14W-1315 is a ground water seep at base of cliff that runs through a small stand of Phragmites spp. and then dissipates into the sand before reaching the receiving waters of GA14

(Figure 17). The location is on the northeast shore of the island (east of Corn Neck Road) on Ball Cove. The area up the cliff from the source is largely open land with scrub and brush and there are no residences within a 1,000 foot radius of the source. This source had a result of 1,100 cfu/100 ml and less than a trickle flow on 8/20/2018. Because source 14W-1315 does not reach the receiving waters, it is not negatively impacting the receiving waters of GA14.

Figure 17: Source 14W-1315 a small ground water seep on the northeast shore of Block Island. This source dissipates into the sand before reaching GA14 receiving waters.

iii. Waste Water Treatment Facilities

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) waste water treatment facilities that discharge into GA14 (Figure 18).

The Scarborough waste water treatment facility is in Narragansett and located at the southernmost end of Scarborough State Beach. This WWTF discharge is located 2,000 feet offshore at a location that is approximately 1,500 feet south of Scarborough State Beach so it is imperative that the WWTF remain in compliance to protect public health. This facility has not reported any violations for the year 2018. They have an average flow of 0.67 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. This facility is currently in the process of upgrading their aeration system located in their oxidation ditch. They will be upgrading to high efficiency blowers and mixers that are controlled by dissolved oxygen probes and will be compatible with VFD drives and their current SCADA system. These upgrades will improve the performance of the facility by allowing operators to have more control over the system. Per NSSP Model Ordinance requirements there is a prohibited safety zone established around this WWTF outfall. The PLUMES model analysis used to establish the size of the closed safety zone is available for review in the program's permanent files.

The South Kingstown Waste Water Treatment facility is located just over a mile from the Narragansett Pier. Its sewer system serves just over 20,000 people, which includes the University of Rhode Island Campus. In 2018 they averaged a daily flow of 2.86 million gallons, and staff reported no violations of their permitted biochemical oxygen demand, total suspended solids, and total residual chlorine. Per NSSP Model Ordinance requirements there is a prohibited safety zone established around this WWTF outfall. The PLUMES model analysis used to establish the size of the closed safety zone is available for review in the program's permanent files.

The Town of New Shoreham Waste Water Treatment Facility is located on the South Eastern portion of the island close to Old Harbor. This is the only facility on the island and during the peak of summer can service 4,000 customers whereas during the winter season, this facility serves anywhere from 300-700 customers. Given the lower population found on the island for most of the year, the average daily flow for this facility is 0.12 million gallons. This facility has not reported any violations of its permit limits in the year 2018. Per NSSP Model Ordinance requirements there is a prohibited safety zone established around this WWTF outfall. The PLUMES model analysis used to establish the size of the closed safety zone is available for review in the program's permanent files.

New Shoreham closed landfill site

The Town of New Shoreham formerly used a shoreside site that is adjacent to GA14 (located at the western extension of West Beach Road on the west side of Block Island) as a landfill. This site was abandoned decades ago and contains primarily residential waste from before the 1950s. Shoreline erosion accelerated by Hurricane Sandy in 2012 has begun to re-expose the abandoned landfill site. Storm surges and other weather events has resulted in erosion, with debris being exposed and has caused a hazard to those walking/swimming in the area. A remediation project

to remove debris and cap the former landfill site has begun as of September 2018 and is projected to tentatively be completed in May 2019. The plan includes the removal of waste, grading of slope, placement of large stone at the toe of the slope, and recapping of the area. As of November 29th, 2018, 16 tons of scrap metal and one truckload of tires, has been removed and approximately 30 more tons of metal is to be removed before capping may begin. Samples of the current Landfill Cover material indicated that the substances previously used meet requirements, however a higher level of lead than currently accepted has been found. Dredged material that meets RIDEM Criteria for Residential Exposure will be used to recover the landfill after most of the waste (scrap metal, tires, etc.) is removed and will be combined with woodchips for the last 6 inches of cover. Capping also will not begin until sea grass is available for planting to restore the area and protect from further erosion. These remedial actions are expected to contain all materials within the former landfill site and remove the threat of transfer of potentially poisonous or deleterious substances to growing area 14.

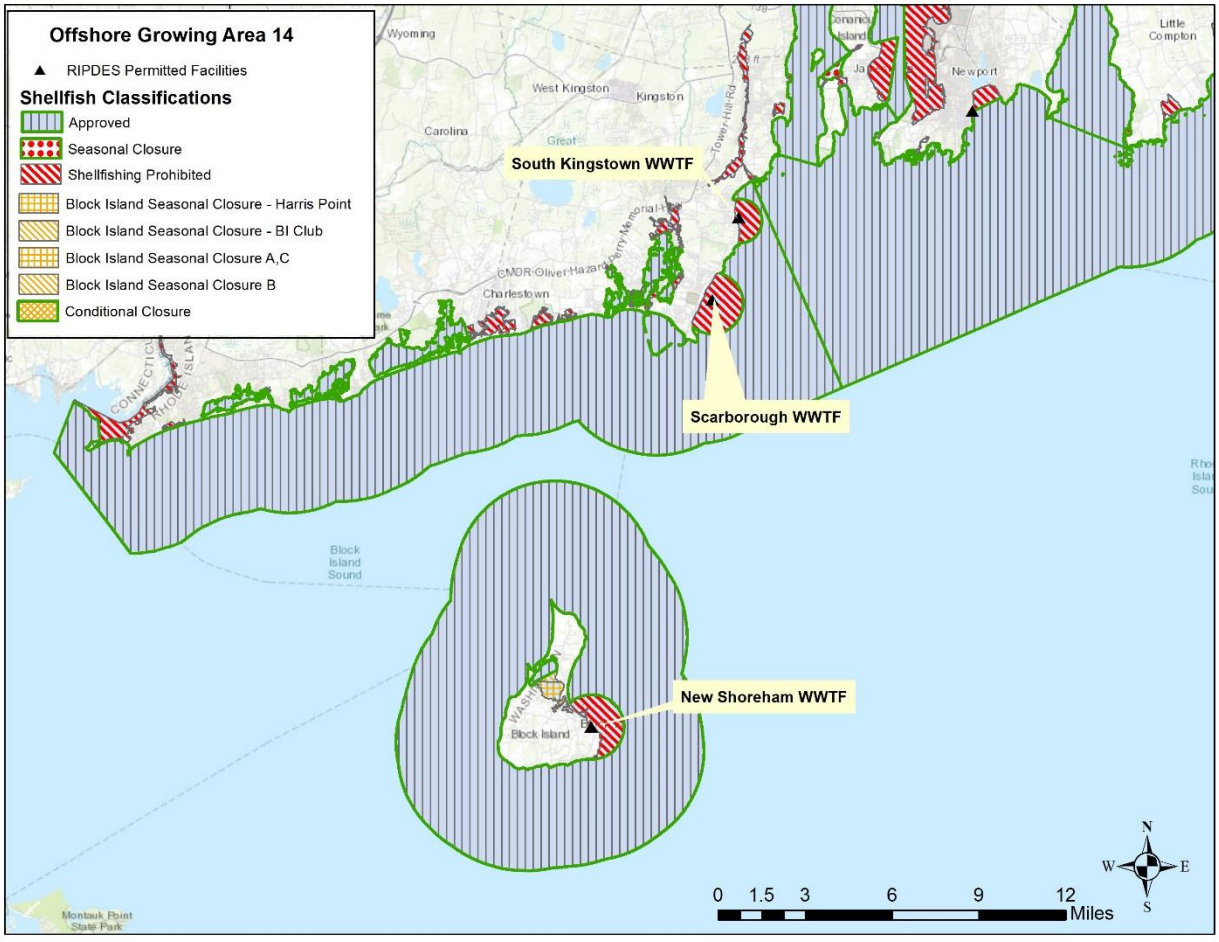

Figure 18: RIPDES Discharge Locations in GA14.

iv. Storm water

Although storm water is attributable to closures of shellfishing waters, the storm water runoff from this growing area's watershed does not appear to have a significant or accountable effect on the water quality.

Samples from the routine monitoring program are taken randomly and would be representative of the water quality under all conditions, favorable or adverse. Since the statistical evaluation of the routine monitoring results indicates that all stations significantly comply with the water quality criteria there is no indication that this area is classified incorrectly or is impacted by random weather events.

v. Marinas

There is one (1) marina located in the Offshore Growing Area GA14; the marina located at Old Harbor in New Shoreham (Block Island). 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 2019 boating season. The entirety of Old Harbor, including the marina is located within the closed safety zone (shellfishing prohibited) for the New Shoreham WWTF.

vi. Agricultural Waste

Currently about 48% of the land in the in the GA14E and GA14W watershed is designated either agricultural, brush, forest or open lands. The remaining land use is 39% water/wetlands and 13% is urban/built land. Block Island (GA14W-BI) land use is primarily (56%) agricultural, brush, forest, or open lands, while the remaining land use is 19% water or wetlands and 25% urban or built. There are no major agricultural operations in the nearshore portion of the watershed of GA14 that might cause negative impacts on the water quality of GA14.

Samples for the routine monitoring protocol are taken randomly and would be representative of the water quality under all conditions, favorable or adverse. Resultant runoff from these agricultural lands would therefore be sampled during routine monitoring of the receiving waters. Since the statistical evaluation of the routine monitoring results indicates that all stations significantly comply with the water quality criteria there is no indication that this area is classified incorrectly or is impacted by runoff from agricultural lands. While monitoring sites in GA14 are sampled only twice per year (remote status), a fecal coliform value of greater than 2 cfu/100 ml has not been observed since 2013, indicating the lack of terrestrial influence on this growing area.

vii. Wildlife

The shores of the offshore growing area range from relatively sparsely developed barrier beaches along the southern coast and Block Island to densely developed along the shores of the towns of Narragansett, Jamestown, Newport, and Middletown. No appreciable numbers of waterfowl or wildlife were observed during the days of shoreline surveying. It should be noted however that Block Island is noted as one of the most important migratory bird habitats on the east Coast. The

island is also home to the largest gull colony in the state. Additionally, the White-Tailed Deer was introduced to the island in 1967 and the herd has grown to a nuisance population because of the lack of any natural predators on the island. The town of New Shoreham has developed a Deer Task Force to manage the island's deer population. Water quality monitoring in the growing area has not identified a significant wildlife impact on the bacteriological water quality of GA14.

E. Hydrographic and Meteorological Characteristics

i. Tides

Tides in Rhode Island are semi-diurnal. This means that the tides have 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. The tidal current is said to be semi-diurnal when there are two flood and two ebb periods each day. A semi diurnal constituent has two maxima and two minima each constituent day.

The shoreline survey was scheduled to coincide with ebb and/or low tide, which represents the most opportune time for observing storm water outfalls that may otherwise be hidden by tidal water, and sampling streams and pipes that, may otherwise be receiving tidal waters.

ii. Rainfall

In Rhode Island there are normally no seasonal patterns in the frequency and amounts of precipitation during the year, however two major storm patterns exist. 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 directly affected Rhode Island 9 times during the last 350 years (RI Emergency Management Agency). 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 nor-easters.

Growing area response to these precipitation events varies according to storm duration, storm intensity, and watershed characteristics such as land use, vegetative cover, and soil characteristics. Changes in land use and vegetative cover are typically accompanied by increases in impervious areas. Of slight concern for the growing area is the close proximity of impervious surfaces to stream channels. This allows for the rapid and efficient transport of runoff of concomitant pollutants including fecal coliform bacteria to river and stream channels that ultimately drain to the growing area. Given that this growing area is classified as remote, there is enough dilution to allow most, if not all sources to have no impact.

The shoreline survey for the Offshore Growing Area 14 was conducted primarily during July and August of 2018, but also included September 6 and October 29th, 2018. Most of the mainland

survey of GA14 (Westerly to Little Compton, GA14W and GA14E) took place on July 24 to 26, 2018 and most of the survey for the offshore region of Block Island (area 14W-BI) took place on August 20 to 22, 2018.

The following rainfall data was observed at the NOAA weather station at Westerly State Airport during July 2018. RI. Highlighted rows indicate days in which surveying was conducted. Using the RI DEM Shellfish Program convention of 0.5" rainfall in the previous seven days as 'wet weather', most of the GA14 survey was conducted under wet weather. 0.60" of rain had fallen at the Westerly Airport 2 to 4 days prior to the survey (Table 5). An additional 0.40" of rain fell during the primary mainland survey dates of 7/25 and 7/26/2018.

The GA14 portion of Block Island was surveyed primarily on August 2-22, 2019. This period was 7 to 10 days after 1.63" of rain fell at Block Island Airport (Table 5). Therefore, the GA14 Block Island survey included 'wet weather' on 8/20/2018 and dry weather days on 8/21 and 8/22/2018.

Table 5: Rainfall at Westerly State Airport, July 2018 (left) and at Block Island Airport during August 2018 (right). Survey dates shaded.

	Rainfall at Westerly Airport: July 2018				Rainfall at Block Island Airport: August 2018	
Date	**Temperature (max) F**	**Temperature (min) F**	**Precipitation (")**		**Date**	**Precipitation (")**
7/1/2018	92	69	0.00		8/1/2018	Trace
7/2/2018	88	71	0.00		8/2/2018	0.00
7/3/2018	85	72	0.00		8/3/2018	0.00
7/4/2018	89	73	Trace		8/4/2018	0.00
7/5/2018	87	73	0.00		8/5/2018	0.62
7/6/2018	80	67	0.16		8/6/2018	0.00
7/7/2018	75	55	0.00		8/7/2018	0.01
7/8/2018	78	52	0.00		8/8/2018	0.00
7/9/2018	80	55	0.00		8/9/2018	0.00
7/10/2018	87	62	0.00		8/10/2018	0.00
7/11/2018	83	63	0.19		8/11/2018	0.05
7/12/2018	80	60	0.00		8/12/2018	**1.27**
7/13/2018	78	57	0.00		8/13/2018	0.36
7/14/2018	77	59	0.00		8/14/2018	0.03
7/15/2018	82	70	Trace		8/15/2018	Trace
7/16/2018	87	66	0.00		8/16/2018	0.00
7/17/2018	83	71	0.32		8/17/2018	0.00
7/18/2018	87	65	Trace		8/18/2018	0.15
7/19/2018	78	58	0.00		8/19/2018	0.10
7/20/2018	82	56	0.00		8/20/2018	0.01
7/21/2018	76	56	0.07		8/21/2018	0.00
7/22/2018	78	68	**0.60**		8/22/2018	0.01
7/23/2018	81	73	0.00		8/23/2018	0.00
7/24/2018	81	73	0.00		8/24/2018	0.00
7/25/2018	79	73	0.19		8/25/2018	0.00
7/26/2018	82	73	0.21		8/26/2018	0.00
7/27/2018	84	73	0.05		8/27/2018	Trace
7/28/2018	84	71	0.23		8/28/2018	0.00
7/29/2018	83	66	0.00		8/29/2018	0.00
7/30/2018	83	63	0.00		8/30/2018	0.00
7/31/2018	83	63	0.00		8/31/2018	Trace
Sum			2.02		**Sum**	2.61

iii. Climate

Rhode Island's climate may be summarized as having an equitable distribution of precipitation throughout the four seasons and large ranges of temperature, both daily and annually, as well as variability in the same season year-to-year and considerable diversity of the weather over short periods of time. These varying conditions are greatly influenced across the state by the nearness to Narragansett Bay or the Atlantic Ocean and by elevation and nature of the local terrain. Day to day variety is the norm with no particular regular or persistent rhythm to the changes in weather other than a tendency to a roughly twice-weekly alternation from fair weather to cloudy or stormy weather.

Weather averages in Rhode Island are not very useful for important planning purposes due to the large variety of weather patterns. However, the following averages can be used for general understanding of the area's climate.

The mean annual temperature ranges from 48^{o} F to 51 ^{o} F with the higher mean temperature more representative of the areas of Narragansett Bay. The average daily minimum temperature in January and February is 25 ^{o} F in coastal sections.

Precipitation is evenly distributed throughout the year, with annual averages of 42 to 46 inches and the southeastern bay area tending towards 40 inches. Average yearly snowfall along the shoreline is about 20 inches, however the region is known to have years in which snowfall totals can be significantly less than average as a result of milder winters. Total precipitation averages around 3 to 3.5 inches per month regardless of season, but with the lesser amounts typically in the period between May and July. The survey periods of July and August 2018 were not abnormally wet or dry or hot or cold and were generally representative of the late summer climate of the region.

iv. Winds

Literature could not be found that links bacterial contamination to wind direction. However, two predominate wind directions can be observed dependent on season. In the spring and summer months when the temperature of the land is warmer than that of the ocean, sea breezes occur that transfer air over the ocean landward under the warmer, lighter air over the land. Consequently, in Rhode Island, the most common spring and summer wind flow direction is south to southwest. When the southwesterly breeze is prevalent, winds travel in a northeast direction towards the upper portions of the growing area. In the fall and winter, the opposite tends to occur. Cold, dense air over the land surface creates a north/northwesterly wind direction. Furthermore, wave action as a result of wind velocity may also stir sediments that have bacteria in them.

v. River Discharges

There are no large rivers or streams discharging directly into GA14. There are two named first order streams, Deadman Brook and Little Creek that discharge to the growing area. There are three un-named first order streams that discharge from the mainland to the offshore growing area. There are no significant fresh water streams discharging to GA14 on Block Island.

Deadman Brook is a small stream emanating from an upland golf course that flows thru several ponds prior to reaching the shoreline in Narragansett, RI. Sample 2018-14E-018 was identified as the outlet from this small stream had a fecal coliform result of 240 cfu/100 ml and had only a trickle flow during the 2018 survey. One of the un-named streams is identified as source 2018-14E-606 which had very little flow and had CFU results within compliance. The other two un-named streams one of which is the outlet of Briggs Marsh source 2018-14E-100B, was not sampled do to no flow at the time of survey. The final un-named stream was not located during the shoreline survey.

F. Water Quality Studies

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 continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

The offshore growing area is 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 main land of Rhode Island dispersed throughout the growing area (**Figure 1).** Only one of these stations is located in a prohibited area. There are six (6) stations (**Figure 1**) 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.

RIDEM personnel from the water resources division in co-operation with personnel from the Office of Fish and Wildlife 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. Samples are collected 1-2 feet below the water surface (using 4-ounce sterile Nalgene bottles) or other pre-sterilize bottles provided by RIDOH, after which they are stored in a cooler packed with ice. They are then transported to the Rhode Island Department of Health Laboratories for analysis. In July of 2012, the RIDOH converted from the MPN multi-tube fermentation process to the mTEC membrane filtration method, as described in *Standard Methods for the Examination of Water and Wastewater* (APHA, 1999). The protocol for collecting and storing samples is the same as for the MPN 3 tube method, however, the mTEC method allows for an extended holding period of 30 hours versus 6 hours. This method is now used for analyzing all shellfish water samples. The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. A summary report is written and recommendations regarding the classification of the growing area are made on a yearly basis. The 2018 report is incorporated into this report in the following section. Routine monitoring data is also part of this report and is shown in **Table 6**.

i. Routine Monitoring Station Statistical Analysis

HIGHLIGHTS

*** Sampled 2X during 2018.**
*** Statistics represent all data collected 12/9/2003 to 10/22/2018 (GA14-E); 11/26/2003 to 11/9/2018 (GA14-W) and 9/10/2004 to 10/25/2018 (GA14-BI).**
*** Area is remote in status.**
*** mTEC = 12 (90th percentile criteria adjusted to 41 cfu / 100 ml).**
*** All stations in program compliance.**
*** Data run 11/21/2018.**

COMMENTARY

The coastal offshore areas of Rhode Island (Growing Area 14) along the south coast of the mainland and the waters around Block Island are 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 2018 in a collaborative effort between DEM Water Resources and DEM Enforcement. Waters around Block Island (stations 14-16 to 14-21) were monitored twice during 2018 in collaboration with the Town of New Shoreham Harbor Master's Office. The statistical evaluation included the most recent 30 samples dating back to 2003 or 2004 (dependent on area). Samples were analyzed by a combination of MPN (n= 18) and mTEC (n= 12) methods which, per NSSP guidance, required an adjustment in the 90th percentile criteria analyses to 41 cfu/ 100 ml. Station 14-22 was first sampled during 2007 with 25 fecal coliform observations accumulated during 2007 to 2018. Fecal coliform concentration in the offshore waters is consistently low (2 cfu/100 ml or less), with the last observation of greater than 2 cfu/100 ml occurring in 2013.

The 2018 statistical evaluation demonstrated that all stations in the offshore area (GA14) meet criteria and are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** Continue collaborative monitoring efforts in GA14 Offshore remote waters.**
* No other actions recommended based on ambient monitoring results.

Table 6: 2018 Annual Statistical Summary for GA14

Recent 30 all weather.
(11/26/2003 to 10/25/2018; 18 mpn and 12 mTEC)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<42)***
GA14W-1	A	30	2.0	2.2
GA14W-2	A	30	2.2	4.0
GA14W-3	A	30	2.0	2.4
GA14W-4	A	30	2.1	2.6
GA14W-5	A	30	2.0	2.4
GA14W-6	A	30	2.3	4.2
GA14W-22	A	25	2.5	4.1
GA14E-7	A	30	2.4	6.0
GA14E-8	A	30	2.2	3.8
GA14E-9	A	30	2.1	3.0
GA14E-10	P	30	2.8	8.7
GA14E-11	A	30	2.1	3.0
GA14E-12	A	30	2.0	2.4
GA14E-13	A	30	2.4	5.8
GA14E-14	A	30	2.0	2.4
GA14E-15	A	30	2.0	2.4
GA14BI-16	A	30	2.0	2.0
GA14BI-17	A	30	2.0	2.4
GA14BI-18	A	30	2.0	2.0
GA14BI-19	A	30	2.2	3.9
GA14BI-20	P	30	2.3	5.6
GA14BI-21	A	30	2.0	2.0

ii. Sampling Plan and Justification

Growing Area 14 is an approved, prohibited "remote" status growing area. Therefore, the RIDEM Shellfish Program monitors Growing Area 14 in accordance with the guidelines set forth in the NSSP Manual of Operations for remote sampling. Water quality monitoring stations within the growing area are sampled two times per year and are statistically evaluated utilizing all the data available since establishment of the area in 1994. The geomean and 90th percentile values are used for statistical evaluation.

A random sampling plan for the growing area is scheduled yearly, with a statistically representative cross section of all meteorological, hydrographic, and/or other pollution events that may affect water quality and subsequent shellfish contamination. A reasonable attempt is made to collect samples on the pre-established days and sampling is rescheduled should sampling conditions delay sampling on the pre-established date.

iii. RIDEM TMDL Studies

There are currently no TMDL studies underway by RIDEM's Office of Water Resources within the Offshore Growing Area.

iv. RIDOH Beach Monitoring Program

Currently there are numerous licensed beaches within the Offshore Growing area. The Rhode Island Department of Health (RIDOH) monitors these beaches during the summer months. The RIDOH beach monitoring program has adopted new criteria for the swimming standard and is no longer routinely taking and analyzing water samples for fecal coliform but is analyzing for enterococci. HEALTH has determined for their program that enterococci is a better indicator of the risk of illness than fecal coliform, which HEALTH had used in the past therefore there are not fecal sampling results for all the beaches within the growing area.

G. Interpretation of Data

i. Effects of Meteorological and Hydrographic Conditions

A more extensive investigation would be required to link meteorological and hydrographic conditions to bacterial loading. Based on the statistical results from routine monitoring under all weather and hydrographic conditions there does not appear to be a direct link between an increase in bacteria loadings and meteorological events within this growing area in areas other than those currently closed to shellfishing.

H. Recommendations

i. Monitoring Schedule

The current monitoring schedule is adequate for maintaining correct classification.

ii. Comments

Water quality statistical evaluations indicate that the area conforms to the NSSP requirements as an approved growing area during all-weather periods. There are no recommendations for change in classification at this time.

iii. Legal Descriptions

Based on regular RIDEM Shellfish Program monitoring data and the data acquired during this 12-year shoreline survey, it is recommended that the existing legal description of the growing area be maintained.

Shellfishing Prohibited:

Shellfishing is Prohibited in the following areas of GA14:

Growing Area 14E –Offshore Pt. Judith/ Narragansett to Westport:

GA14E-1 Castle Hill Cove in its entirety.

GA14E-2 Easton's Bay north of a line from the southeast extension of Tuckerman's Terrace in Middletown to the south-east extension of Narragansett Avenue in Newport meant to include "Forty Steps".

Growing Area 14W –Offshore Napatree Point to Point Judith / Narragansett Including Block Island, Rhode Island Sound:

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

GA14W-2 The waters in the vicinity of Tucker's Dock which are within 4,000 feet of the marine outfall sewer located 41 .4212º N, 71 .4526º W. New Shoreham (Block Island).

GA14W-3 The waters in the vicinity of Pebbly Beach which are within 5,900 feet of the marine outfall sewer located 41 .1678º N, 71 .5512ºW, including Old Harbor in its entirety.

Other inland waters adjacent to the offshore waters of GA14 that are inland of the program's 'green line' as described in the annual 'Notice of Polluted Shellfish Grounds" are also classified as Prohibited as shown on reference maps and as also described individually.

GA15 Annual Update: Seekonk River

Contents

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A. Introduction

All waters of the Seekonk River, Growing Area 15 are currently prohibited to shellfishing. The area was not sampled in 2018. The area has historically been closed to shellfish harvesting because of consistently elevated fecal coliform levels, and the area's proximity to a large urban environment. The area is properly classified as prohibited.

B. Annual Statistical Analysis

HIGHLIGHTS

* Area was not sampled during 2018
* Harvest of shellfish is prohibited in Growing Area 15.
* Last sampled in 2008.
* Summary statistics not updated for 2018.

COMMENTARY

The Seekonk River (Growing Area 15) was not sampled during 2018. 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. Sampling Growing Area 15 is a very low priority for the Shellfish Program because of its prohibited status.

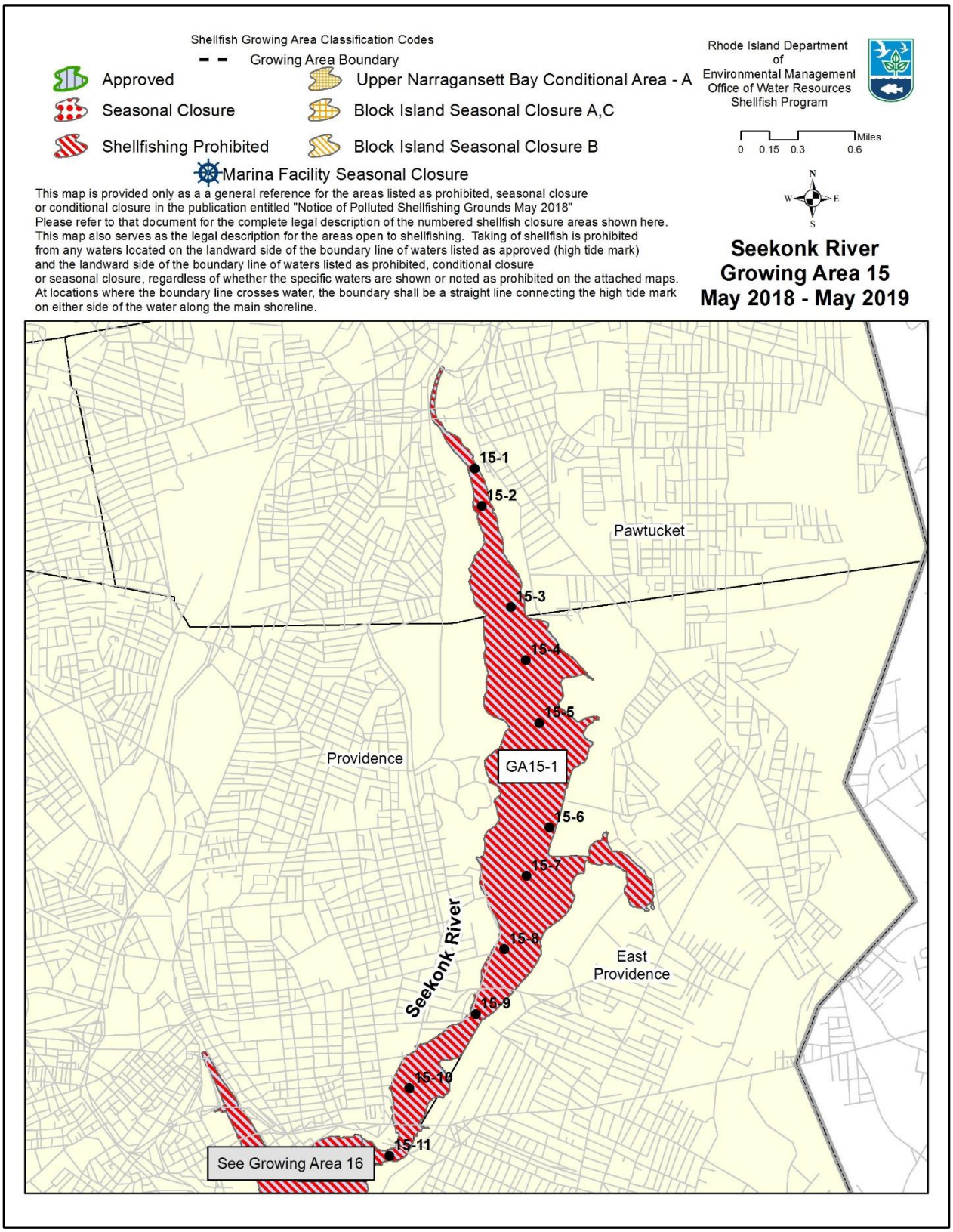
RECOMMENDATIONS

* 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 other 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 classification of GA15 (Seekonk River).



GA16 Providence River 2018 Annual Update

Contents

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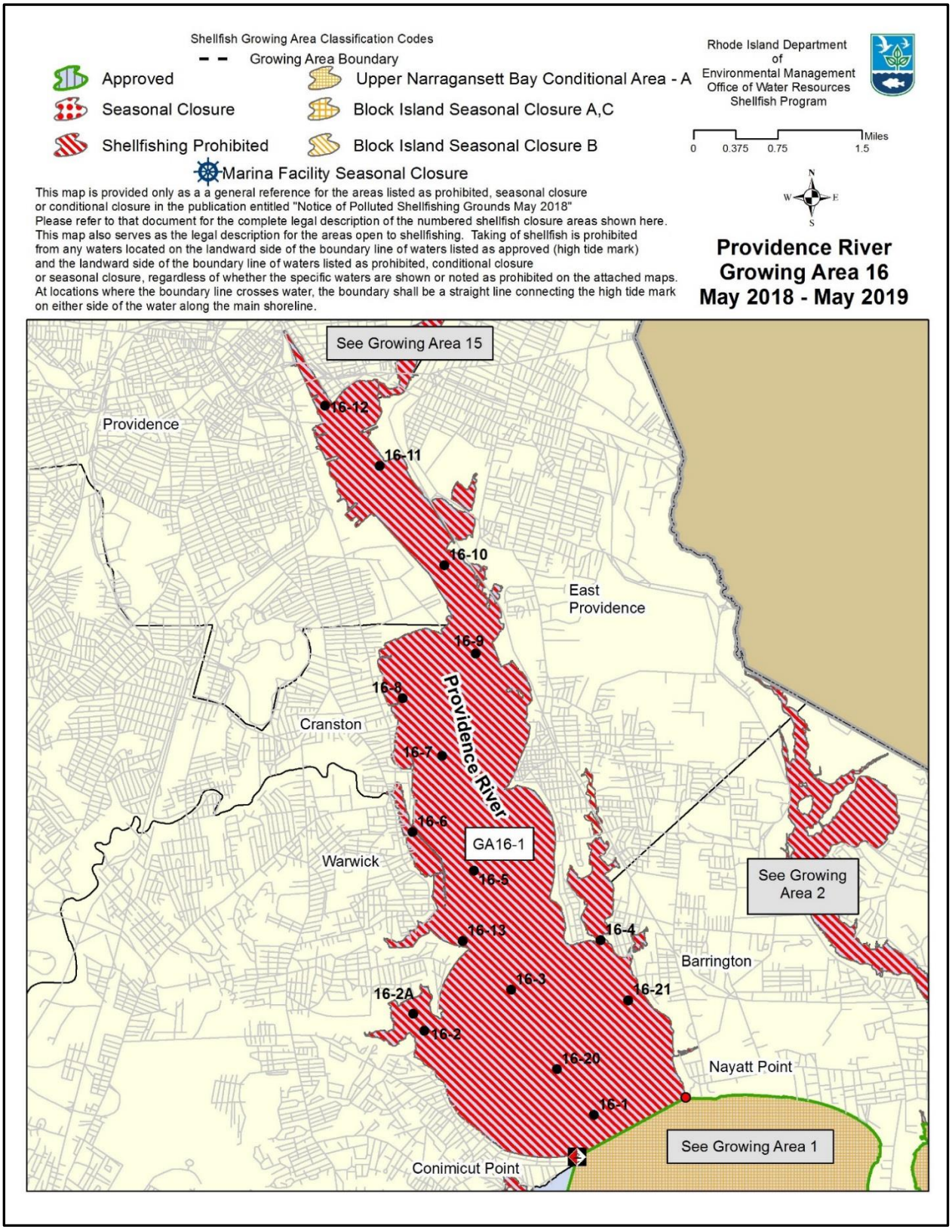
A. Introduction

A 12-year sanitary survey of the lower Providence River (area south of Gaspee Point to Conimicut Point. Figure 1) was completed in 2009 and a triennial update was completed in 2017. An annual resampling survey of the southern portion of the Providence River shoreline was conducted during the summer of 2018 by staff from RIDEM's Office of Water Resources Shellfish Program. The survey involved follow-up sampling on previously identified sources having elevated bacteria levels, a reconnaissance of the entire study area, including Bullocks Cove, to locate and catalog pollution sources and collect bacteriological samples from all actively flowing sources within the survey area to determine their impacts on the Providence River Shellfish Growing Area.

The primary objective of the sanitary survey was to identify and characterize any sources of pollution 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. This survey is in support of the potential re-classification of a portion of the Providence River growing area for limited use as either a conditionally approved or a restricted classification. Additional analysis of management conditions supporting such re-classification need to be developed. At this juncture no recommendations for re-classification of this area are proposed.

Figure 1: Current Growing Area 16 Classification Map & monitoring station locations.



B. 2018 Shoreline Survey

A total of six (6) actual sources and four (4) companion in-stream locations were sampled during the 2018 update of the area of GA16 bounded by Gaspee Point to the north, Bullock Cove to the northeast and Conimicut Point to the south (Figure 2). Fecal coliform values observed at sources sampled during the 2018 survey ranged from 40 to 1,000 cfu/100 ml and most sources had flow rates of less than 0.1 cfs (Table 1). The 2018 sanitary survey of the area was conducted on 10/22/2018 which was a relatively dry period with 0.30" of rain falling at nearby TF Green Airport (weather station KPVD) in the previous seven days. However, the autumn of 2018 was one of the wettest on record in the Rhode Island area with the Providence area receiving approximately 150% of its usual rainfall during October to December 2018. A total of 6.05" of rain fell at the KPVD weather station during October 2018 compared to an average October rain fall of 3.93".

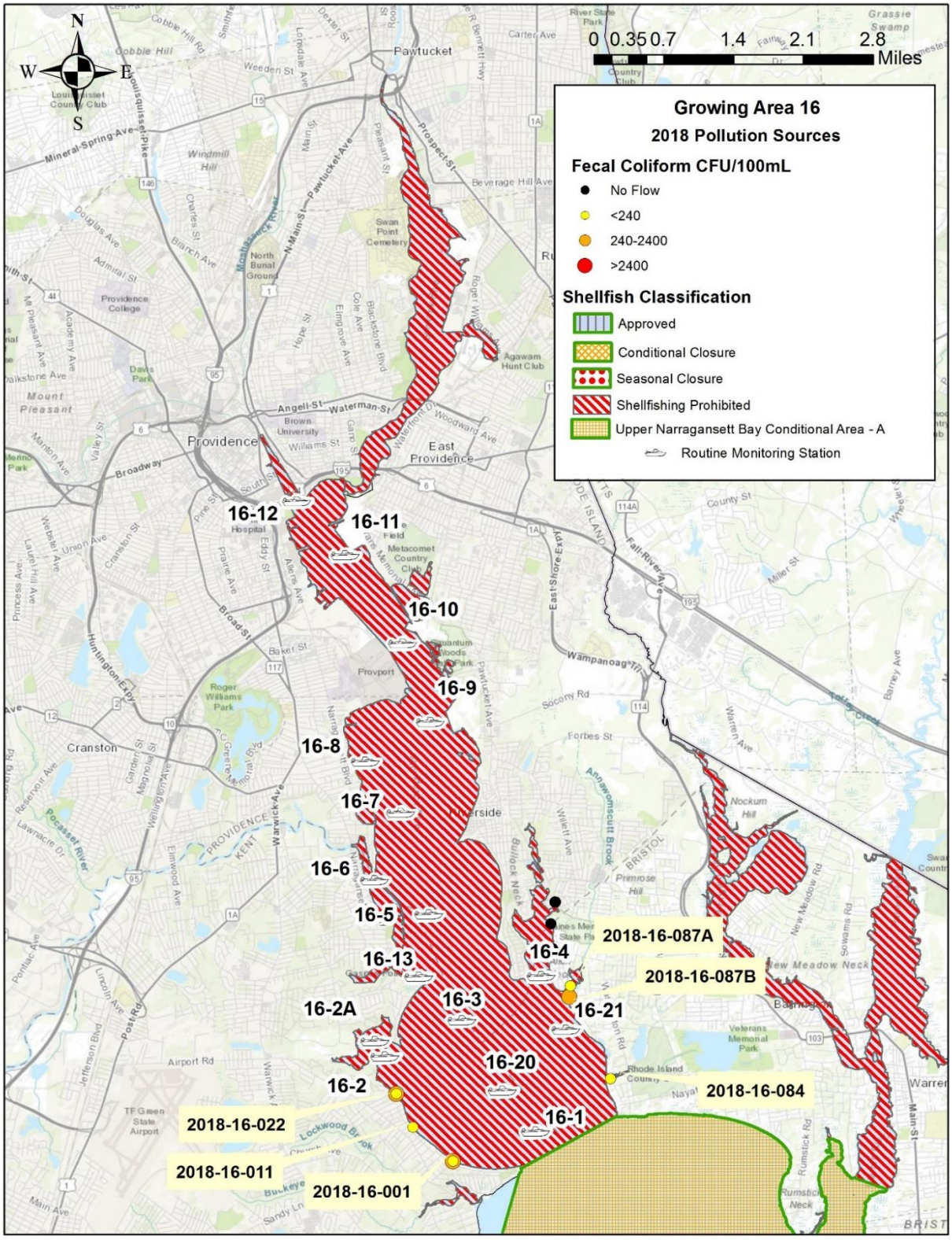


Figure 2: Map of sources examined during 2018 shoreline survey of the lower Providence River.

Table 1: 2018 GA16 source fecal coliform results

Source ID	Date of Sampling	Source Description	Actual/ Potential	Direct/ Indirect	Volume (cfs)	CFU/100ml		
						2009 Results	2017 Results	2018 Results
2018-16-001	10/22/2018	24" RCP	A	D	Trickle	15	160	880
2018-16-011	10/22/2018	24" RCP	A	D	Trickle	460	1,600	90
2018-16-022	10/22/2018	Small stream	A	D	0.056	43	160	1,000
2018-16-084	10/22/2018	Mussachuck Creek	A	D	16 (tidal)	15	134	130
2018-16-087A	10/22/2018	Allin's Cove	A	D	75 (tidal)	21	140	40
2018-16-087B	10/22/2018	Buried RCP	A	D	Trickle			340

Sources 16-001, 16-011, 16-022 are located on the western side of the growing area just north of Conimicut Point. Source 16-001 is a 24" reinforced concrete pipe that discharges onto the shoreline near the northern extension of Symonds Avenue (Figure 3). The flow then crosses the narrow beach in a shallow seep (24" wide by < 1" deep). During 2018 sampling the pipe was approximately 50% filled with gravel and sand, considerably decreasing its potential flow rate. When sampled on 10/22/18, the flow was a trickle and a fecal coliform concentration of 880 cfu/100 ml was observed. This source flows into prohibited waters and in stream sampling showed rapid dilution as a result of <100 cfu/100 ml was obtained in the nearby receiving waters.

Figure 3: Source 16-001 showing discharge out of 24" RCP (left) and trickle flow across narrow beach to receiving waters (right image). Photos taken 10/22/2018.

Source 16-011 is a 24" reinforced concrete pipe discharging on to the shoreline in the vicinity of the north east extension of Woodbury Street in Warwick, RI. On 10/22/18 the flow was 0.002 cfs (63 ml per second) and the flow was dissipated into the sand before it reached the receiving waters of GA16. A fecal coliform concentration of 90 cfu/100 ml was observed at source 16-011 on 10/22/18.

Source 16-022 is a small stream (approximately 1 foot wide) that drains a vegetated area near the end of the northeast extension of Rock Avenue in Warwick, RI (Figure 4). On 10/22/2018, a flow rate of 0.056 cfs was observed and most of the stream flow was dissipating into the sand before reaching the high tide line of GA16. The fecal coliform level was 1,000 cfu/100 ml in the trickle/stream as it crossed the beach. An in-stream sample in the nearby receiving waters

yielded a fecal coliform result of <100 cfu/100 ml indicating rapid dilution of this source in the receiving waters of GA16.

Figure 4: Source 16-022 showing point where small stream exits bank near the extension of Rock Avenue (left photo) and view of small stream as it crosses beach and flows towards GA16 (right photo). Photos taken 10/.22/2019.

Source 16-084 is Mussachuck Creek (approximately 8 feet wide, 2 feet deep; Figure 5) that drains Echo Lake and Brickyard Pond in Barrington, RI. Brickyard Pond, one of the freshwater sources of Mussachuck Creek, had a TMDL plan for elevated phosphorus and low dissolved oxygen completed in 2007 (RI DEM, 2007). Mussachuck Creek flows through uplands and a golf course (Rhode Island Country Club) before entering the receiving waters of GA16 between residences at #10 and #11 Nyatt Road. The creek and surrounding barrier beach and salt marsh have been the subject of restoration efforts (channel digging to improve seawater flow in and out of the marsh complex) completed during 2007 by NRCS and Save the Bay (Whitin and Twohig, 2007). An ebb-tide tidal flow of 16 cfs and a fecal coliform concentration of 130 cfu/100 ml was observed in Mussachuck Creek on 10/22/2018. A companion in stream sample taken in the nearby prohibited waters of GA16 provided evidence of rapid dilution as a fecal coliform value of <100 cfu/100 ml was observed ~25' from the point where the creek discharges into the receiving waters.

Figure 5: Source 16-084, Mussachuck Creek, Barrington, RI. View looking inland (left) and downstream towards the receiving waters of GA16 (right photo). Photos taken 10/22/2018.

Source 16-087A (Figure 6) is the tidal stream at the seaward end of Allin's Cove in Barrington, RI. This tidal stream connects the estuarine waters and fringing salt marsh of Allin's Cove with the receiving waters of the lower Providence River (GA16). A small creek Annawamscutt Brook, discharges freshwater to Allin's Cove (also known as Drown Cove). Allin's Cove has undergone salt marsh restoration and erosion control efforts during 2003-2004. (http://www.edc.uri.edu/restoration/html/intro/stories.htm) in an effort to improve habitat conditions in the area. A sample collected at the mouth of this tidal stream during ebb tide yielded a fecal coliform result of 40 cfu/100 ml on 10/22/2018. The receiving waters of GA16 are classified as prohibited to shellfish harvest.

Figure 6: Source 16-087A, tidal waters of Allin's Cove. View inland (left) and seaward towards the receiving waters of GA16 (right). Photos taken 10/22/2018.

Source 16-087B is a concrete pipe that is buried in the sand on the beach at the northern end of Willow Way in Barrington, RI. The opening of the pipe is completely buried by sand, but a trickle of flow was visible in the vicinity of the buried pipe. When sampled on 10/22/2018, source 16-087B had a flow of approximately 0.04 cfs and a fecal coliform concentration of 340

cfu/100 ml. The flow from this source was dissipating into the sand before reaching the receiving waters when sampled at low tide but would reach the receiving waters at high tide. Given the low flow, the fact that the flow percolates through sand, and that the receiving waters are classified as prohibited to shellfish harvest, this source is currently not impacting approved waters.

While the waters of GA16 are currently classified as Prohibited, the RI DEM Shellfish Program has consistently collected data at several stations within the southern portion (Gaspee Point south to Conimicut Point) of the growing area. This monitoring effort is to track water quality trends in the area in response to improved wastewater and stormwater treatment and also supports future classification decisions for the growing area. A review of these growing area data indicate that the shoreline sources identified during the 2018 survey have minimal impact on the growing area during dry weather (less than 0.5" rain in prior seven days). For example, at station 16-2 on the west side of GA16 (Figure 1) a geometric mean of 3.2 cfu/100 ml and 0% of the samples exceeded 31 cfu/100 ml for the recent 15 samples (Table 3). Similarly, station 16-4 on the west side of the southern portion of GA16 had a dry weather geometric mean of 2.9 cfu/100 ml and a 0% of samples exceeded 31 cfu/100 ml (Table 3). The wet weather response of the growing area would need to be characterized prior to considering any classification changes.

C. Marinas

The Providence River leads to New England's second largest deep-water port, with thousands of vessels a year traveling through these waters transporting goods to and from Rhode Island. In addition, hundreds of recreational vessels of various sizes use these waters for their enjoyment. There are a total of eighteen (18) marinas located within Growing Area 16 and the upstream Seekonk River. Currently all waters of GA16 are classified as prohibited. In addition, none of the marinas in GA16 are located in waters south of Gaspee Point being evaluated for reclassification.

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 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

D. Waste Water Treatment Facilities

The Providence River receives wastewater discharges from seventy-nine (77) Rhode Island Pollutant Discharge Elimination Systems (RIPDES) permitted dischargers from Rhode Island and seventeen (17) from Massachusetts within the Providence River watershed. Ten (10) of these are major sanitary dischargers, four (4) are minor sanitary dischargers while the remaining sixty-four (64) in RI are non-sanitary dischargers. Figure 7 indicates the location of these facilities within RI and Table 2 details the design and average flow volumes of the sanitary facilities. Of a total of roughly 795 MGD of freshwater inputs from the numerous larger tributaries to the Providence River a quarter (199 MGD) of those flows can be attributed to the discharges from the listed permitted facilities. The majority of effluent from Rhode Island

WWTF is discharged from either Narragansett Bay Commission's (NBC) treatment facilities at Field's Point and Bucklin Point. Most Massachusetts WWTF are miles upstream from GA16. For example, the Worcester WWTF is 75 km (47 miles) upstream from Gaspee Point in growing area 16.

A review of 2018 data indicated that the major WWTF in the Providence area had no significant violations of their NPDES discharge permits. The East Providence WPCF (RI0100048) reported no permitted discharge violations during 2018. The Narragansett Bay Commission Bucklin Point WWTF (RI0100072) reported a single (1) violation during 2018. On 11/30/2018 a flow of 32.73 MG was discharged which was greater than the permitted 31 MGD limit. The Narragansett Bay Commission Field's Point WWTF also reported a single (1) violation during 2018. This violation also occurred on 11/30/2018 when a flow rate of 72.65 MGD was discharged from the facility which was greater than the permit level of 65 MGD. Of note, November 2018 was an extremely wet month in which 10.57" of rain fell at nearby TF Green Airport compared to a long-term mean November rain of 4.51 inches (NWS data for KPVD, TF Green Airport). Further, the 11/30/2018 WWTF flow violations occurred two days after a rainstorm dropped 2.98 inches of rain on the area. Other than these two extreme wet weather flow violations, a review of DMR data demonstrated that the major WWTF in the Providence area were performing as designed and discharging well below permitted discharge flow and fecal coliform concentration levels.

Figure 7: Location of major and minor dischargers within the Providence River watershed.

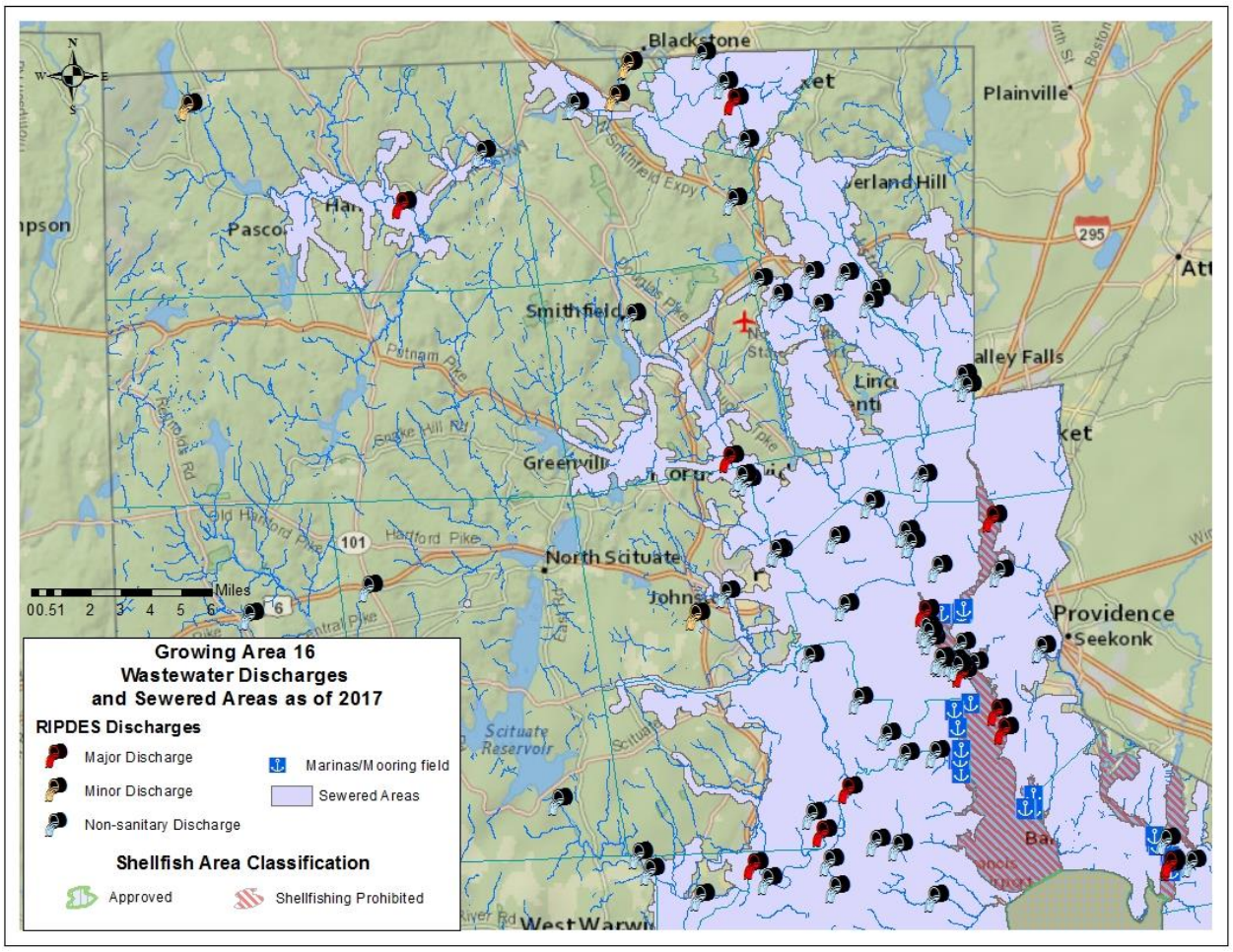


Table 2: Permitted Dischargers within the Providence River watershed

Facility Name	Major / Minor Sanitary Facility	Receiving Waters	Design Flows / Permitted Flows (MGD)	Average Daily Flows (MGD)
Rhode Island Facilities				
Woonsocket WWTF	Major	Blackstone River	16	9.3
Dart Industries Inc.	Minor	Blackstone River	UA	UA
Atlantic Thermoplastics	Minor	Branch River	UA	UA
Burrillville WWTF	Major	Clear River	1.5	0.7
Zambarano Hospital	Minor	Clear River	0.12	0.06
Medical Homes of RI	Minor	Dry Brook	UA	UA
Cranston WWTF	Major	Pawtuxet River	20.2	13.2
Warwick WWTF	Major	Pawtuxet River	7.7	4.5
West Warwick WWTF	Major	Pawtuxet River	7.9	5.2
NBC Fields Point WWTF	Major	Providence River	77	45.5
Exxon Mobil Shipping Terminal	Major	Providence River	0.95	UA
East Providence WWTF	Major	Providence River	14.2	6.7
NBC Bucklin Point WWTF	Major	Seekonk River	46	23.1
Smithfield Sewer Authority WWTF	Major	Woonasquatucket River	3.5	1.4
		TOTAL	**131.37**	**78.46**
Massachusetts Facilities				
Upper Blackstone WWTF	Major	Blackstone River	77	UA
Grafton WWTP	Major	Blackstone River	2.4	UA
Uxbridge WWTF	Major	Blackstone River	1.25	UA
Millbury WWTP	Major	Blackstone River	1.2	UA
Northbridge WWTP	Major	Blackstone River	2	UA
Riverdale Mills	Minor	Blackstone River	0.3	UA
Worcester DPW CSOs	Minor	Blackstone River	350*	UA
Cumberland ENGRG Inc.	Minor	Blackstone River	0.07	UA
Wyman Gordon Worcester	Minor	Blackstone River	UA	UA
Lewcott Corp.	Minor	Blackstone River	0.011	UA
Hopesdale WWTP	Major	Mill River	0.588	UA
Douglas WWTP	Minor	Mumford River	0.6	UA
Mantrose Haeuser Co.	Minor	Ten Mile River	0.65	UA
North Attleboro Nat'L Fish Hatchery	Minor	Ten Mile River	1.7	UA
Attleboro WPCF	Major	Ten Mile River	8.6	UA
North Attleboro WWTP	Major	Ten Mile River	4.61	UA
Upton WWTP	Major	West River	0.4	UA
		TOTAL	**80.38 or 430.38 with CSO**	

*Permitted flow is for combined sewerage and stormwater UA = Unavailable

E. Annual Statistical Summary (GA16: Providence River)

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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

HIGHLIGHTS

* Stations 16-2, 16-3, 16-4 and 16-20 in the lower Providence River were sampled fourteen (14) times during 2018 under both wet (n= 8) and dry (n= 6) weather conditions.
* Harvest of shellfish is prohibited in the Providence River (GA 16).
* Statistics calculated for informational purposes only, not for compliance.
* Recent 30 samples collected 4/27/2017 to 12/19/2018.
* Recent 15 dry weather samples collected 1/19/2017 to 8/27/2018.
* All samples analyzed by mTEC method.
* Data run 12/27/2018.

COMMENTARY

The southern portion of the Providence River (stations 16-2, 16-3, 16-4, 16-20 in Growing Area 16) was sampled 14 times during 2018 under a variety of wet (n= 8) and dry (n= 6) weather conditions. While this area is classified as prohibited to shellfish harvest, the Shellfish Program monitors the area in conjunction with the Upper Bay (Growing Area 1) to assess changes in water quality in response to WWTP and storm water control (Narragansett Bay CSO abatement projects) upgrades. Summary statistics for this shellfishing prohibited area were calculated for

informational purposes. The 2018 statistical update indicated that all stations in Growing Area 16 exceed NSSP criteria for approved waters due to elevated fecal coliform levels during wet weather (greater than 0.5" rain in 7 days prior). During dry weather (< 0.5" rain in prior 7 days) stations 16-2, 16-3, 16-4, and 16-20 met fecal coliform water quality criteria. The area is properly classified as prohibited to shellfish harvest.

RECOMMENDATIONS

* Continue to monitor lower Providence River stations 16-2, 16-3, 16-4 and 16-20 under all weather conditions to evaluate potential reclassification.

* Add additional stations to routine monitoring run to further evaluate near shore water quality in consideration of future reclassification.

* No other actions recommended based on ambient monitoring results.

Table 3: 2018 Statistical Summary of GA16

Four stations in GA16 (Providence River) were evaluated under two potential management scenarios (below). Statistics shown for informational purposes only, not for compliance.

Recent 30 all weather.
(4/27/2017or 6/7/2017 to 12/19/2018; 17 wet and 13 dry, all mTEC)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***90th Percentile (<31 cfu/100 ml)***
GA16-2	P	30	9.6	77.0
GA16-3	P	30	10.3	101.7
GA16-4	P	30	11.4	75.6
GA16-20	P	30	6.0	39.4

Recent 15 dry weather (<0.5" rain in previous 7 days) only.
(1/19/2017 to 8/27/2018, all mTEC)

		FECAL-GEO		
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31 cfu/100 ml***
GA16-2	P	15	3.2	0.0
GA16-3	P	15	3.2	0.0
GA16-4	P	15	4.2	0.0
GA16-20	P	15	2.9	0.0

F. Literature cited

RI DEM, 2007. Total Maximum Daily Loads for Phosphorus to Address 9 Eutrophic Ponds in Rhode Island. Final TMDL Plan date 09/2007. 173 pages. (http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/eutropnd.pdf)

Whitin, S. and Twohig, T. 2007 Restoration of Mussachuck Creek and RI Country Club – A federal and private partnership. ASCE World Environmental and Water Resources Congress 2007.

Mt. Hope Bay

Growing Area 17
Annual Re-Evaluation

Calendar Year 2018

Photo courtesy of the Town of Bristol, RI

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

GA17 Mt. Hope Bay Annual Update

Contents

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A. Introduction

A 12-year sanitary survey of Mount Hope Bay was conducted during August of 2014 by staff from RIDEM's Office of Water Resources Shellfish Program. The survey included a shoreline reconnaissance of the study area to locate and catalog pollution sources and collect bacteriological samples from all sources actively flowing into the survey area.

A triennial re-evaluation of this growing area was completed in 2017. As such, the 2018 survey involved review of previous sanitary surveys followed by 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. These previously identified pollution sources were re-evaluated to determine their bacteriological impacts on Mount Hope Bay.

The Mount Hope Bay - Growing Area 17 is presently managed on a conditionally approved or prohibited status. There are 16 routine monitoring stations located throughout the growing area between the state line of Massachusetts to the north and the Bristol Point / Arnold Point line and the Sakonnet River Bridge line to the south. Management of GA17 runs concurrently with management of the conditionally approved Kickemuit River (GA5) that discharges into the northwestern corner of Mt. Hope Bay.

B. Description of Growing Area

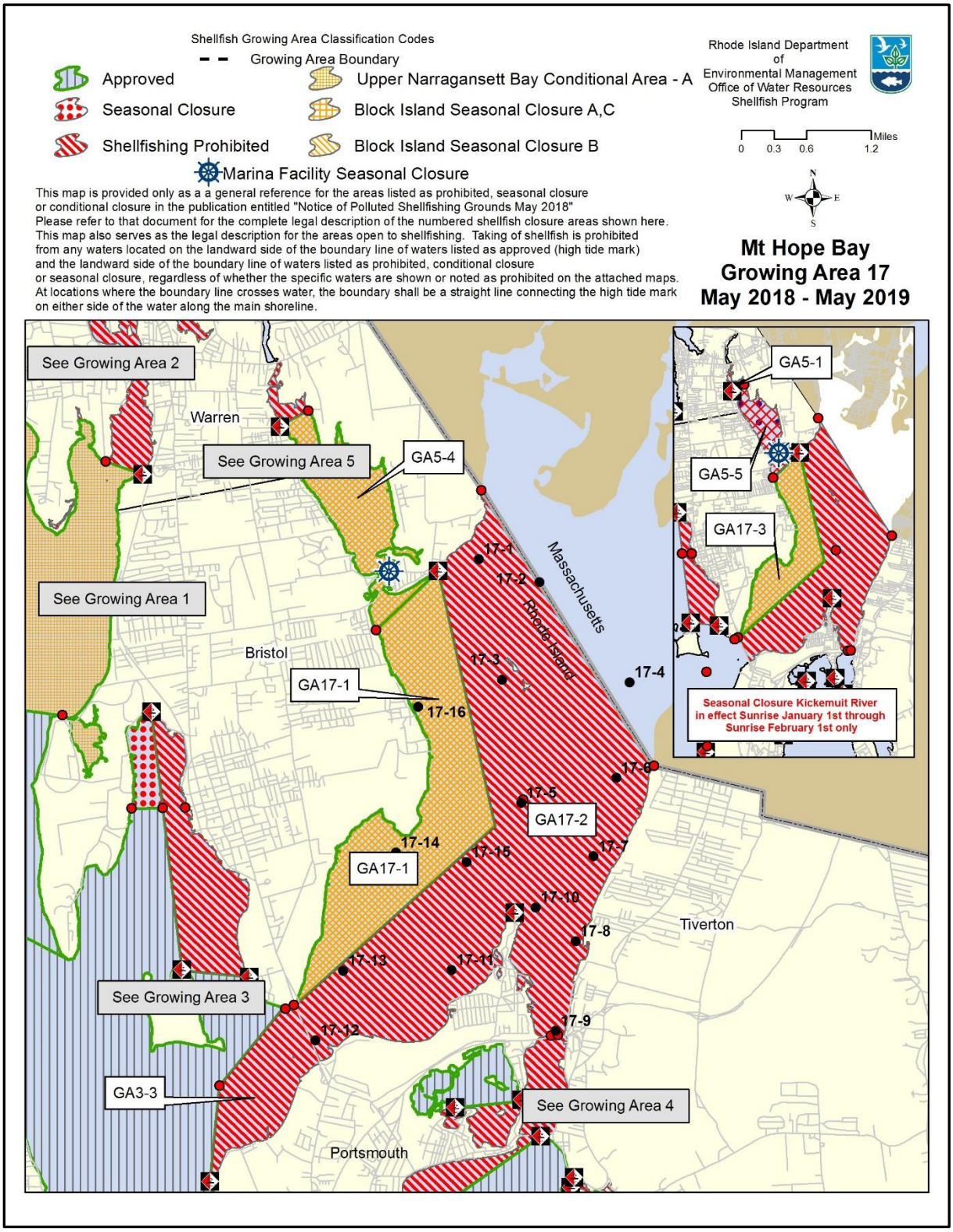
Mt. Hope Bay forms the northeast corner of Narragansett Bay, lying within both Rhode Island to the south and west and Massachusetts to the north and east. The southwest limit of the growing area is bounded by a line that parallels the Mt Hope Bridge from Bristol Point to Portsmouth. The southeast limit is the Sakonnet River Bridge. The northwest limit abuts the Kickemuit River Growing Area (GA5) just outside the mouth of the river, and the northeast limit is the state line traversing the Bay between Rhode Island and Massachusetts. Mount Hope Bay adjoins the East Passage of Narragansett Bay at the southwest corner of Mt. Hope Bay near the Mt. Hope Bridge and adjoins the Sakonnet River near the Sakonnet River Bridge. There are five major freshwater inputs to the Bay. The Taunton River is the largest and includes the Quequechan River, which discharges into the Bay from the north along with the smaller Kickemuit, Cole and Lee Rivers.

Growing Area 17 is presently comprised of sections classified as either prohibited or conditionally approved for shellfishing (Figure 1). This divide in classification runs generally north to south with the conditionally approved area being along the town of Bristol shoreline. The prohibited area has been established as a closed safety zone due to discharges from WWTF in the Massachusetts portion of the watershed. 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).

The following information describes the physical geography of the Mt. Hope Bay (GA17) growing area.

Area of Shellfishing Prohibited in Mt. Hope Bay	4246.8 acres
Area of Conditionally Approved waters	1508.4 acres
Longest reach	5.0 miles
Widest reach	2.6 miles
Deepest point	75 feet

Figure 1: Mount Hope Bay (GA17) current classification



C. Pollution Sources

i. Shoreline Survey

A triennial update of the Mt Hope Bay Growing Area 17 was conducted in 2017 and a sanitary survey of pollution sources in GA17 was completed by RIDEM Office of Water Resources Shellfish staff on October 15, 2018. The survey involved review of previous sanitary surveys and sampling of actual pollution sources with bacteriological results greater than 240 cfu/100ml as well as identification of any new sources of pollution if applicable (Figure 2) that discharge to conditionally approved waters. There were four sources identified from previous surveys that required follow-up sampling. The source bacteriological results from this survey are presented (Table 1) and a map showing the locations of all sources is presented (Figure 2).

The GA17 2018 survey was completed on 10/15/2018 which was during 'wet weather'(greater than 0.5" rain in prior 7 days). The autumn of 2018 was one of the wettest on record in the Rhode Island area with the area receiving approximately 150% of its usual rainfall during October to December 2018. A total of 6.35" of rain fell at the KTAN (Taunton) weather station during October 2018 compared to an average October rain fall of 4.29". 2.71 inches of rain had fallen at the NOAA Taunton weather station (KTAN) in the seven days prior to the 2018 survey. ***Because of this, the conditionally approved area of GA17 was in the closed status during the 2018 sanitary survey.***

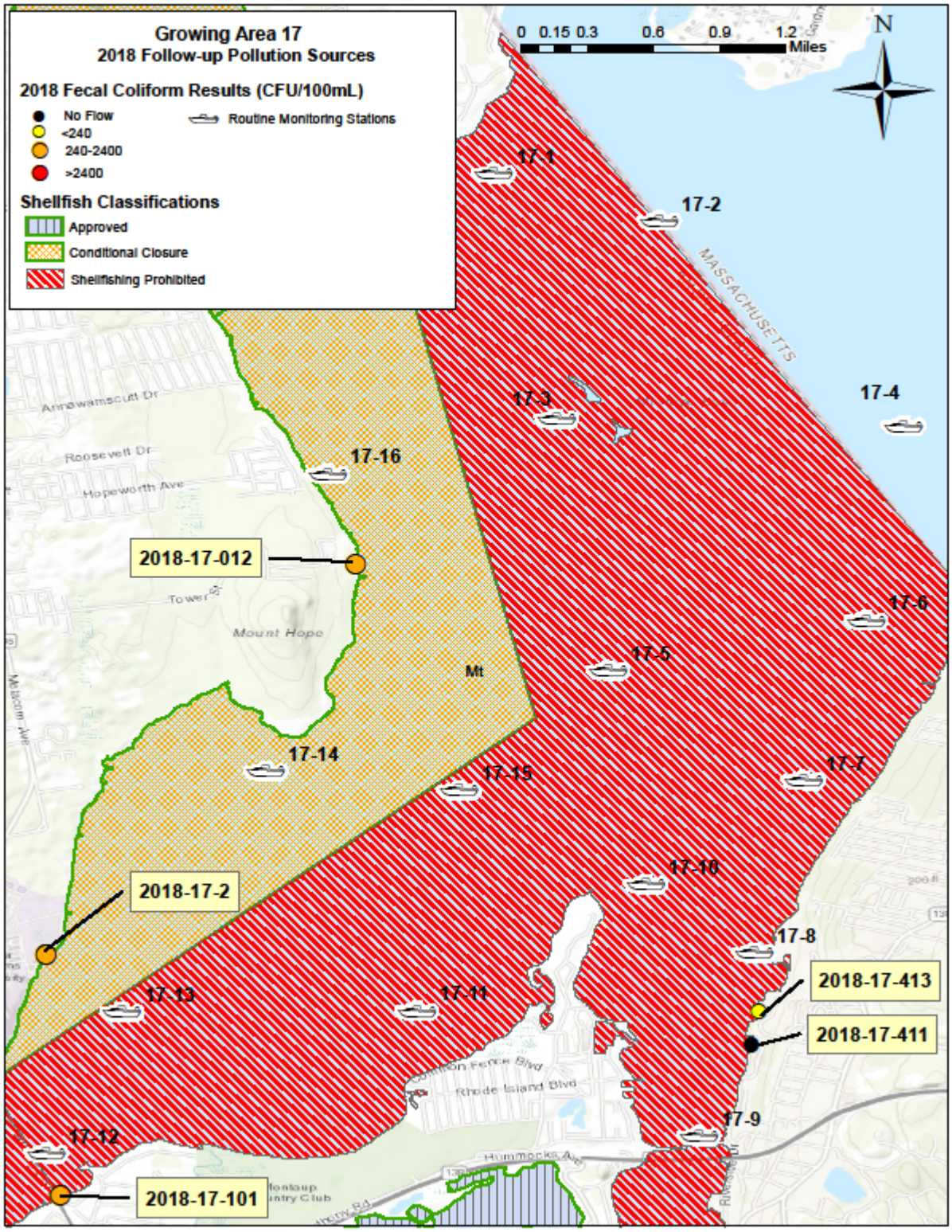
Table 1: Summary of 2018 Results

*Highlighted sources >240 CFU/100ml. NF=No Flow. DNE= Does not exist
* 2018 samples collected while GA17 was in 'Closed' status (4 days after 2.46" rain at Taunton)

Source ID	Latitude	Longitude	Description	Actual/ Potential	Direct/ Indirect	2017 Result	2018 Results	Volumetric Flow (cfs)	Survey Date
2018-17-2	41.65152	-71.256	Stream from detention basin thru apartment complex	A	D	818	920	Trickle	10/15/2018
2018-17-2IS	41.65152	-71.256	In Stream			200	500		10/15/2018
2018-17-012	41.6772	-71.2357	Small stream, in 2014 could not find	P	D		>1600	Trickle	10/15/2018
2018-17-101	41.6357	-71.2551	Drainage swale along property ROW. In 2017, could not find/no longer exists.	A	D	DNE	340	Trickle	10/15/2018
2018-17-101IS	41.6357	-71.2551	In Stream			DNE	100		10/15/2018
2018-17-411	41.6456	-71.2097	Drainage swale from wetland. In 2017, could not find/no longer exists.			DNE			
2018-17-413	41.6478	-71.2092	48" dia outfall at condo complex	A	D	NF	44	0.5	10/15/2018

Previous surveys identified one (1) pollution source that required re-sampling during 2018. Source 2018-17-2 had a fecal count of 818 cfu/100 ml and the flow was a trickle (0.085cfs) in 2017. This source was re-sampled in 2018 with results of 920 cfu/100mL and a flow of 0.5 cfs. The 2018 sample was collected during wet weather as the sample was collected four (4) days after 2.46 inches of rain fell at the Taunton Weather station (KTAN). A companion in-stream sample had fecal coliform results of 500 cfu/100mL which indicates dilution of this wet-weather source in the receiving waters.

Figure 2: 2018 Mt Hope Bay Growing Area 17 Pollution Sources



Although source 2019-17-2 was the only one required to be resampled during the 2018 annual update, all other sources sampled during the Triennial Survey were resampled while DEM Shellfish staff were in the field (Table 1). A total of five sources were investigated during the 2018 survey (Table 1). One source (17-411) could not be located during both the 2017 and 2018 sanitary surveys. The remaining four sources were located and sampled (Table 1). Three of these sources (sources 17-2, 17-012 and 17-101) had a trickle flow. Only sources 17-2 and 17-12 (Figure 2) discharge to the conditionally approved waters of GA17. The low flow rates during the 2018 survey which was conducted during wet weather indicates that these trickle-flow sources represent little threat to the receiving waters of GA17. Further, data collected at water quality monitoring stations (station 17-14 and 17-16; Figure 2) in the conditionally approved region of GA17 meet water quality criteria when the area is in the open status (Table 2).

The results of the 2018 shoreline survey indicate that no new major sources are discharging into the growing area. The growing area is properly classified and therefore no changes to the classification are recommended at this time.

ii. Mooring Fields and Marinas

There are two marinas located along the northeastern shore of Portsmouth within the prohibited portion of 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 (Brewer's Sakonnet Marina) that services the marine sanitation devices on these boats. All RI waters are designated as a "No Discharge Zone". 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 on our website by following this link: http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php

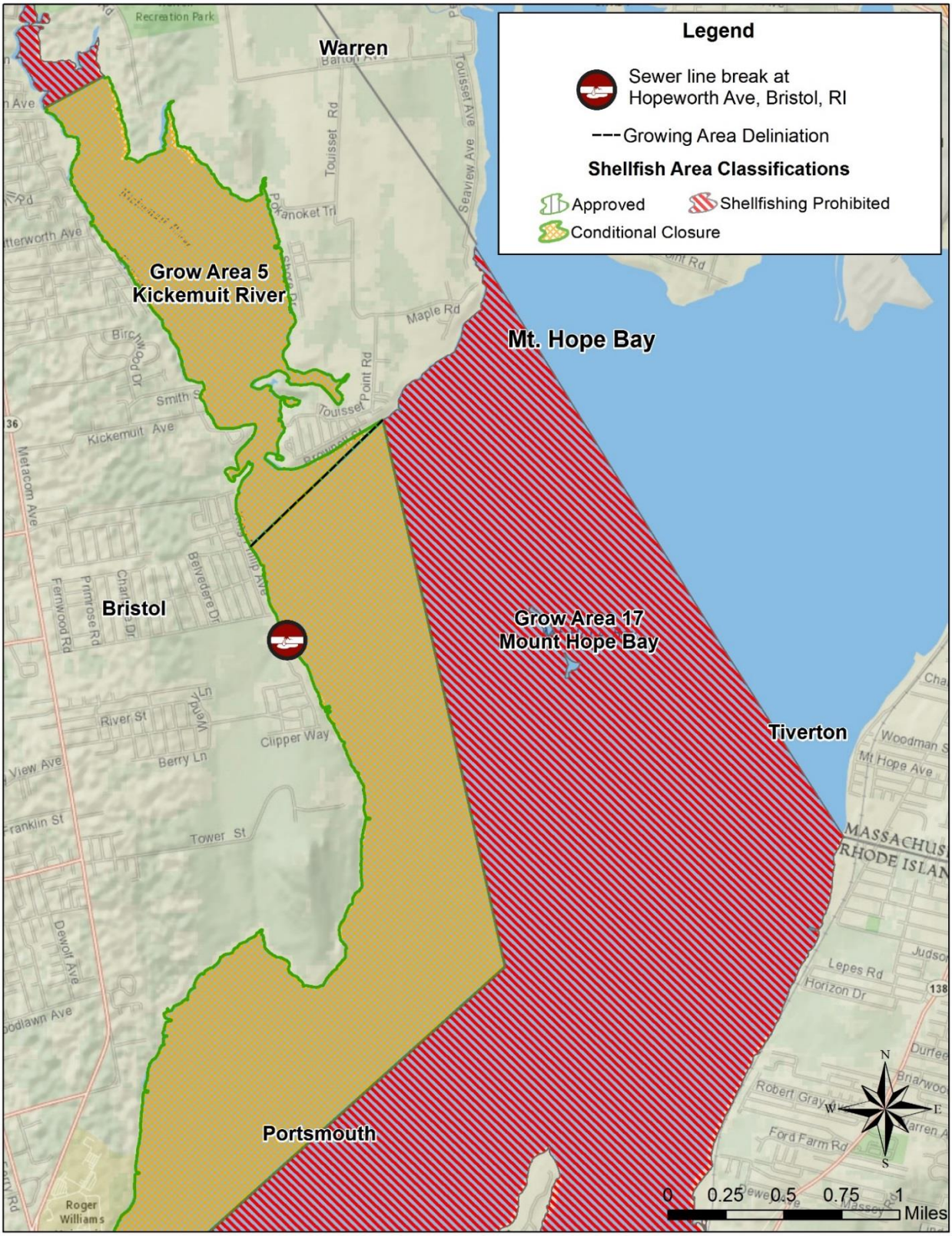
iii. Wastewater Treatment Facilities (WWTF)

There are three permitted non-sanitary water release pipes within the Rhode Island portion of the growing area. The Brayton Point power station formerly had a cooling water discharge into Mt. Hope Bay, but the plant has ceased operation as of June 1, 2017 and no longer discharges cooling water to the growing area. There are several sanitary discharges from wastewater treatment plants in the Massachusetts portion of the watershed to Mt. Hope Bay. The plants closest to the growing area are the Fall River Wastewater Treatment Facility (WWTF) approximately 2 miles from the growing area, the Somerset WWTF (~ 3 miles upstream of the GA) and the Taunton WWTF (approximately 16 miles up the Taunton River from the growing area). These sources potentially could have a significant impact on the status of the growing area and are the main impediments to shellfishing in these waters. Consequentially, the majority of Mount Hope Bay is classified as "Prohibited" in which shellfishing is not allowed. This prohibited area was originally established along the eastern and southern sides of the bay as a necessary closure in the case of a failure of the Fall River WWTF. Hydrographic time of travel dye studies in November 1989 (Rippey and Watkins, 1988) helped to originally establish the prohibited area and more recent hydrographic dye studies (FDA, 2018) have verified the suitability of the prohibited zone in the RI portion of Mt. Hope Bay (GA17). A dye study also

has verified that there is sufficient dilution between the Somerset WWTF and the conditionally approved waters of GA17 to be protective of public health in the event of loss of disinfection at the Somerset WWTF (FDA, 2017). The recent FDA hydrographic dye study was completed in cooperation with FDA that assessed both the Fall River and Somerset WWTF impacts on this growing area. The final report was completed in June of 2017. The recommendations for management of this conditionally approved harvest area that are contained within this recently completed report (FDA, 2018) confirm that the existing closure area provides adequate protection in the event of an upset in operations at the Fall River or Somerset WWTF. The 2017 FDA report also included a recommendation for adding a 6 MG Fall River WWTF bypass closure criteria to enhance protection of GA17. This additional closure criteria is to protect public health in the rare event of a 6 MG or larger bypass under rainfall of less than 0.5" (GA17 is managed with a 0.5" in 24 hour rain closure criteria). This added closure criteria will be incorporated into the next GA17 Conditional Area Management Plan (2019 update).

In January 2018, an emergency 21-day closure of shellfishing waters in Mount Hope was implemented due to a sanitary sewer overflow from the eastern shoreline of Bristol, RI. The overflow was a result of a break in a sewer line caused by work done on a water main in the same vicinity on 1/5/2018. Town officials were not made aware of the overflow until 1/24/2018 and DEM was notified immediately. The growing area was in the closed status due to rain for 14 of the 19 days between 1/5/19 and 1/25/19 that the sewer overflow went unreported. Repairs to the sewer line were made the morning of 1/25/2018. The overflow resulted in approximately 265,000 gallons of untreated sewage to enter a stream and discharge into the conditionally approved portion of the growing area (Figure 3). Due to numerous rain and snowmelt events, the area had been closed for much of the month of January, from sunrise on 1/13/2018 until sunrise on 1/20/2018, and again on sunrise 1/24/18, and extending the closure until February 15, 2018 due to the SSO event (resulting in a full 21-day closure after the source of the spill was repaired). The RI Department of Health Food Safety canvassed shellfish dealers and verified that no shellfish product from these waters had entered the market. Adjacent Massachusetts waters were also closed to shellfishing during the time period of the overflow, and no commercial shellfish product entered the MA market.

Figure 3: Location of Bristol Sanitary Sewer Overflow January 2018



iv. Poisonous and Deleterious Substances

Poisonous and deleterious substances are contaminants that can include metals, organic chemical compounds (such as pesticides, PAHs, and PCBS) and natural toxins that when released into the environment can cause degradation of habitat and harmful effects on organisms. These compounds can enter waters through runoff, industrial discharges, fossil fuel and waste burning, mining and ore processing, toxin-releasing organisms such as phytoplankton, and agriculture (Kimbrough et al. 2008).

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 August 2017.

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 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

D. Water Quality Studies

In 2008, the western portion of Growing Area 17 was re-classified as a conditionally approved area and closed for 7 days following a 0.5" or greater rainfall within a 24-hr period. Water quality monitoring is conducted on a monthly sampling regime during dry weather conditions when the conditionally approved portions of the growing area are in the open status.

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. Results from the different analytical methods are being co-mingled and statistical analysis is being performed according to the "SOP MPN to mTEC Transition" document dated August 2012 (RIDEM, 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).

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.

i. Annual Statistical Review

HIGHLIGHTS

* Mt. Hope Bay (Growing Area 17) was sampled nine times during 2018.
* For conditionally approved stations, statistics represent recent 15 samples when area was open during 7/5/2017 to 12/12/2018.
* 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 1/7/2019.

COMMENTARY

Mt. Hope Bay (Growing Area 17) was sampled nine times during 2018. Eight sets of samples were collected when the area was in the open status and one set of samples was collected when the area was in the closed status. Frequent wet weather during the autumn of 2018 prevented collection of 12 sets of samples when the area was open (< 0.5" rain in prior seven days). For example, Mt. Hope Bay was closed due to exceeding the conditional rain closure threshold on 21.5 of 22 weekdays during November 2018. Collectively, GA17 was closed 79% of the weekdays between September 1st and December 31st, 2018. Summary statistics for compliance represent the 15 most recent samples collected during 7/5/2017 to 12/12/2018 when Growing Area 17 was open.

Sixteen (16) stations are sampled in Mt, Hope Bay, with two stations classified as conditionally approved, and the remainder classified as prohibited because they are located in the closed safety zone surrounding the waste water treatment facility discharge for the city of Fall River, MA. The 2018 review demonstrated that both conditionally approved stations (17-14 and 17-16) in the Mt. Hope Bay (Growing Area 17) meet criteria and are in program compliance. The area is properly classified.

RECOMMENDATIONS

* No other actions recommended based on ambient monitoring results.

Table 2: GA17 Annual statistical summary

RIDEM SHELLFISH GROWING AREA MONITORING: GA17
Recent 15samples when growing area was open.
(7/5/2017 to 12/12/2018, all mTEC, all dry weather)

			FECAL-GEO	
Station Name	***Status***	***N***	***MEAN***	***%>CRITICAL 31***
GA17-1	P	15	4.0	0.0
GA17-2	P	15	3.1	0.0
GA17-3	P	15	5.0	6.7
GA17-4	P	15	2.7	0.0
GA17-5	P	15	2.7	0.0
GA17-6	P	15	2.8	0.0
GA17-7	P	15	2.8	0.0
GA17-8	P	15	2.2	0.0
GA17-9	P	15	2.6	0.0
GA17-10	P	15	2.2	0.0
GA17-11	P	15	2.2	0.0
GA17-12	P	15	3.2	0.0
GA17-13	P	15	3.5	0.0
GA17-14	CA	15	2.3	0.0
GA17-15	P	15	2.6	0.0
GA17-16	CA	15	3.7	6.7

E. Conclusions and Recommendations

The 2018 triennial update of the Mount Hope Bay (Growing Area 17) reevaluated several point sources in the study area. However, the sources appear to have no significant impact on the ambient receiving waters of the growing area even during wet weather (the 2018 source samples were collected during wet weather while the growing area was in the closed status). Only two sources (17-2 and 17-012) discharge to the conditionally approved portion of the growing area and both of these had low (trickle) flow even during the wet weather conditions experienced during the autumn of 2018. The 2018 triennial review also demonstrated that GA17 was managed according to the Mt. Hope Bay (GA17) Conditional Area Management Plan and the effluent from waste water treatment facilities discharging to GA17 did not exceed permitted flow rates or permitted fecal coliform concentration. All stations in the conditionally approved portion of GA17 met NSSP water quality criteria while the area was in the open status. The 2019 annual update will re-evaluate shoreline sources and potential impacts on the receiving waters while the growing area is in the open status.

Due to the low flow and limited impact of sources reevaluated during the triennial update of Mount Hope Bay, and the water quality statistical evaluation of the growing area, no changes in growing area classification are recommended. The results of this update, combined with previous water quality statistical evaluations of Mount Hope Bay, indicate that the growing area conforms to all requirements set forth by the National Shellfish Sanitation Program (NSSP) and is properly classified. No changes for reclassification are recommended at this time. A review of the current

Management Plan will be completed in 2019. The next 12-year shoreline survey is scheduled for 2026.

F. Literature Cited

American Public Health Association. 1999. Standard Methods for the Examination of Water and Wastewater, 20th ed. 1999. American Public Health Association, American Water Works Association, Water Pollution Control Federation. Washington D.C.

FDA, 2017. Evaluating the Dilution of Wastewater Treatment Plant Effluent, Treatment Efficiency, and Potential Microbial Impacts on Shellfish Growing Areas in Somerset, MA. Report of Findings from the September 8 – 19, 2014 study period. US Food and Drug Administration Assistance and Training Project. 41 pages.

FDA, 2018. Evaluating the Dilution of Fall River Wastewater Treatment Plant Effluent, Treatment Efficiency, and Potential Microbial Impacts on the Shellfish Growing Area in Mount Hope Bay, Massachusetts and Rhode Island. Report on findings from the December 3-1-, 2013 study period. US Food and Drug Administration Assistance and Training Project. 20 pages.

GIS map data provided by: RIDEM, ESRI (Environmental Systems Research Institute), National Geographic

Kimbrough, K. L., W. E. Johnson, G. G. Lauenstein, J. D. Christensen and D. A. Apeti. 2008. An Assessment of Two Decades of Contaminant Monitoring in the Nation's Coastal Zone. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 74. 105 pp

RI DEM, 2019. Conditional Area Management Plan for Mt. Hope Bay (Growing Area 17), 2018 revision. Copy on file in the DEM, OWR, Shellfish Program's permanent files.

RIDEM. March 2018. State of Rhode Island 303(d) List of Impaired Waters. Rhode Island Department of Environmental Management, Office of Water Resources, Total Maximum Daily Load Program. Providence, Rhode Island.

RIDEM. May 2017. Notice of Polluted Shellfishing Grounds. Rhode Island Department of Environmental Management, Office of Water Resources, Shellfish Section. Providence, Rhode Island.

Rippey, SR and Watkins, WD. 1988. Mt. Hope Bay sanitary survey – microbiological – 1986-1987. Final report. US Public Health Service, Food and Drug Administration, Northeast Technical Services Unit, Davisville, RI. 104 pages.