Rhode Island Department of Environmental Management

Office of Water Resources – Shellfish Program

2020 Shellfish Program Classification Report

Growing Area 1
Upper Narragansett Bay 2020
Annual Update

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1. Introduction

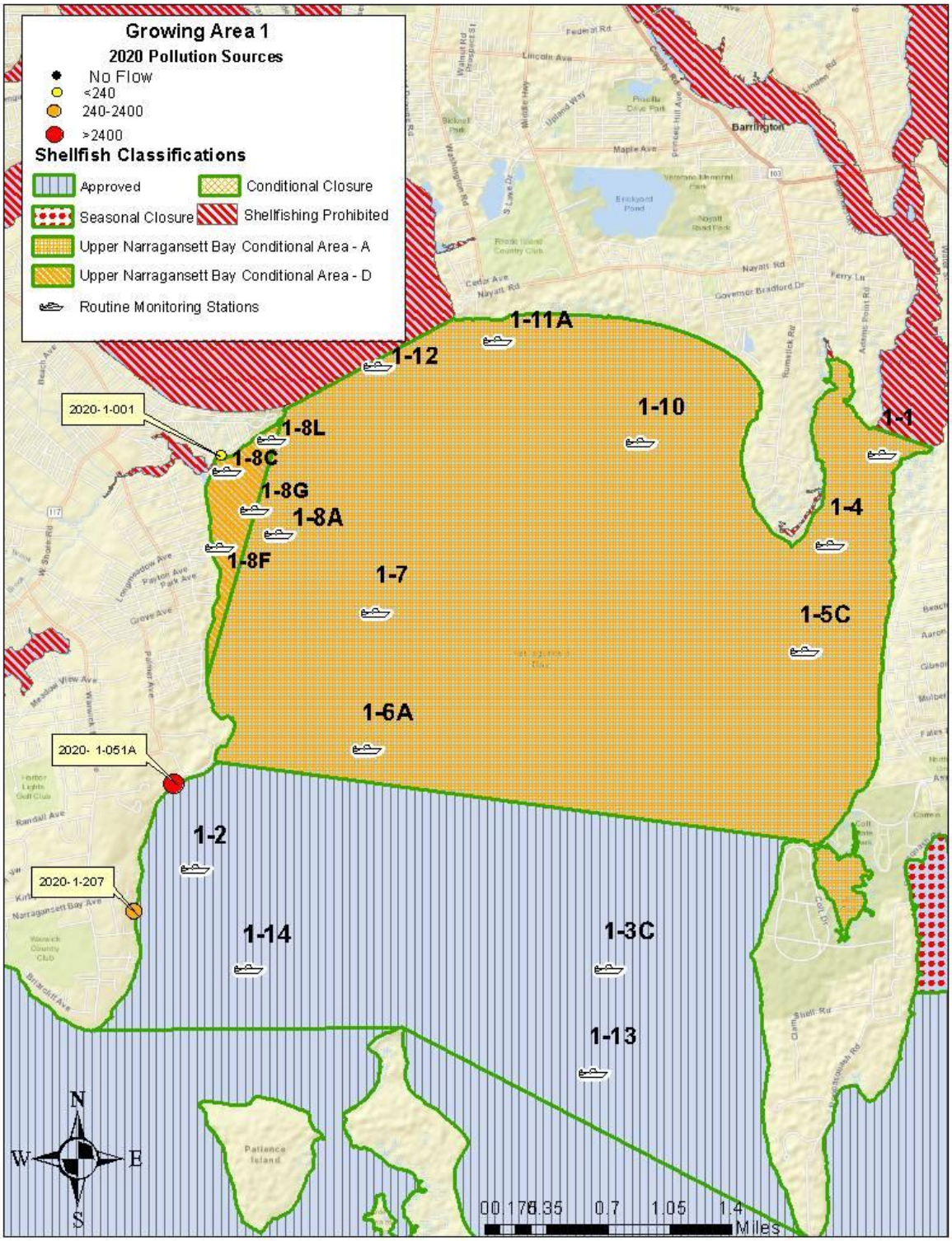
A twelve (12) year sanitary survey of Upper Narragansett Bay Growing Area 1 was conducted in 2009. The next 12-year comprehensive sanitary survey will be conducted in 2021. A triennial update was completed in 2018. A total of seventy- seven (77) actual or potential sources were identified during the 12-year sanitary survey. A total of twenty-eight of the seventy-seven sources were not actively flowing at the time of the shoreline survey with the remaining forty-nine having flows warranting sampling. The 2009 12-year survey identified two (2) sources that were greater than the 2,400 mpn/100 ml threshold at the time warranting annual follow ups. In 2020 follow-up sampling was done of three (3) sources of actual or potential pollution that were identified in the 2009 shoreline survey report to be elevated but less than the 2,400 mpn/100 mL threshold. Eight (8) sources were planned to be visited in 2020 for sampling, due to the Covid-19 pandemic, staff had limited abilities to visit and sample all necessary sources. Of those three sources sampled in 2020, one of the results (Source 1-051A) exceeded 2,400 cfu/100 ml requiring follow-up sampling. Source 1-207 originally exhibited elevated bacteria counts in 2009 (above 2,400 mpn), and source 1-001, which was not elevated during the 2009 survey but has had fluctuating results in the past few years, were below the

2,400 cfu / 100 mL threshold in 2020.

2. Pollution Source Survey

The 2020 annual shoreline survey took place on 7/3/2020 under dry weather conditions when the conditionally approved portion of the growing area was in the open status. There had been virtually no rain (0.13" measured at KPVD weather station at TF Green Airport) in the seven days prior to the shoreline survey. Four (4) sources (1-001, 1-051A, 1-202, 1-207) were revisited for this annual survey (Table 1). Three (3) sources were flowing at the time of sample. One source (Source 2020-1-202) could not be located when revisited. Of the three (3) sources actually sampled, only one (1) source that was sampled had a result higher than 2,400 cfu/100 mL.

Figure 1: 2020-2021 Pollution Sources in GA1



Source 2020-1-001 (Figure 2) is a stream that's 10 ft wide by 3 inches deep draining a small marsh that flows into the downstream portion of Buckeye Brook also referred to as Old Mill Creek before entering Upper Narragansett Bay. In 2018 this source was sampled with a fecal coliform result of >1,600. When resampled in 2019 the source had a result of 100 cfu/100 ml. This source was sampled again in 2020 with a result of 100 cfu/100 mL. The receiving waters of source 2020-1-001, Old Mill Creek, are classified as prohibited. Old Mill Creek which is the outlet of Buckeye Brook flows into the Conditionally Approved waters of Upper Bay Conditional Area D. Since source 2020-1-001 was less than 240 cfu/100 ml this source does not require annual follow up sampling.

Figure 2: Source 2020-1-001

Figure 3: Source 2020-1-051A

The other two sources sampled during this annual survey were both over the 240 cfu/100 mL threshold Source 2020-1-051A with a result of 6,300 cfu/100 mL and Source 2020-1-207 with a result of 1,800 cfu/100 mL. Source 2020-1-051A is a stream draining uplands that is approximately 1 ft wide and 2 inches deep and had an estimated flow of 0.136 cfs. Instream samples taken north of where the stream flows into receiving waters had a result of 44 cfu/100 mL, instream samples taken south had a result of 32 cfu/100mL indicating rapid dilution of the source after it enters the receiving waters. This source flows into approved waters of GA1 Upper Bay Area "B" just south of Rocky Point. The minimal flow of this source and the fact that instream samples had low fecal coliform abundance demonstrate rapid dilution and show that this source has minimal impact on the microbiological water quality of the growing area. Further, the acceptable fecal results at nearby routine monitoring station 1-2 demonstrate that this source does not negatively impact the water quality of the growing area and no further action is needed.

Source 2020-1-207 is a ground water stream that had a trickle flow that was not visible in the photo taken at time of sample collection. This source had a result of 1,800 cfu/100 mL at a trickle flow. Companion instream samples collected north of (300 cfu /100 mL) and south of (220 cfu /100 mL) the source in the receiving waters demonstrated rapid dilution of the source once it reached the receiving waters. The acceptable fecal results observed at nearby routine monitoring stations 1-2 and 1-14

demonstrates that source 1-207 does not have a negative impact on the microbiological water quality of the growing area. This source will be sampled again during the 2021 12-year survey.

Upper Narragansett Bay Growing Area 1 was reclassified in May 2017, due to improvements in water quality after the Narragansett Bay Commission (NBC) completed Phase I and II of a CSO project which captures combined sewage in a tunnel for pump back and treatment at the Fields Point WWTF. The Conditionally Approved "Area B" was reclassified to Approved after additional wet weather monitoring showed significant improvements in bacteria levels that 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 "1A". Wet weather sampling and data analysis showed improvements in water quality to both conditionally approved subareas after the NBC WWTF completed of Phase I and II of the NBC CSO project, 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 and Mill Cove. 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. DEM staff completed extensive monitoring of Buckeye Brook and the receiving waters during September to December 2018. This was a period of wet weather, with almost twice the average amount of rain received during that time period; 29.2" of rain fell at nearby TF Green Airport (NOAA KPVD weather station) during September to December 2018 compared to a mean rainfall average of 17.9" of rain for the September to December period. Elevated fecal coliform concentration observed in Buckeye Brook, Mill Cove and the nearshore receiving waters indicated that the Buckeye Brook fecal coliform source was negatively impacting the microbiological water quality of the growing area during wet weather. In response to this, a new conditional area labeled "Area 1D" was implemented in January 2019 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. Available data demonstrated that a rainfall closure threshold of 0.80" is protective of public health in 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 are used to monitor Conditional Area 1D (Figure 5).

Area 1D (GA1-5) was successfully managed with a 0.8", 7-day rain closure during 2019. However, routine monitoring of Area 1D, near Buckeye Brook and the mouth of Mill Cove during 2020 revealed unacceptable fecal coliform levels while the area was in the open status. A series of moderately elevated fecal coliform observations of 42-110 cfu/100 ml were made during May to October 2020 when the area was in the open status. These elevated observations resulted in two stations (1-8C and 1-8L) exceeding

NSSP criteria for conditionally approved areas. Analyses indicated that the fecal coliform exceedances were during dry weather (< 0.5" rain in prior 7-days) so a conditional rain closure would no longer be effective in managing safe shellfish harvest in the area. Accordingly, the area near the mouth of Buckeye Brook and Mill Cove encompassing the out of compliance stations 1-8C and 1-8L will be reclassified as Prohibited to shellfish harvest (see 2021-2022 growing area map).

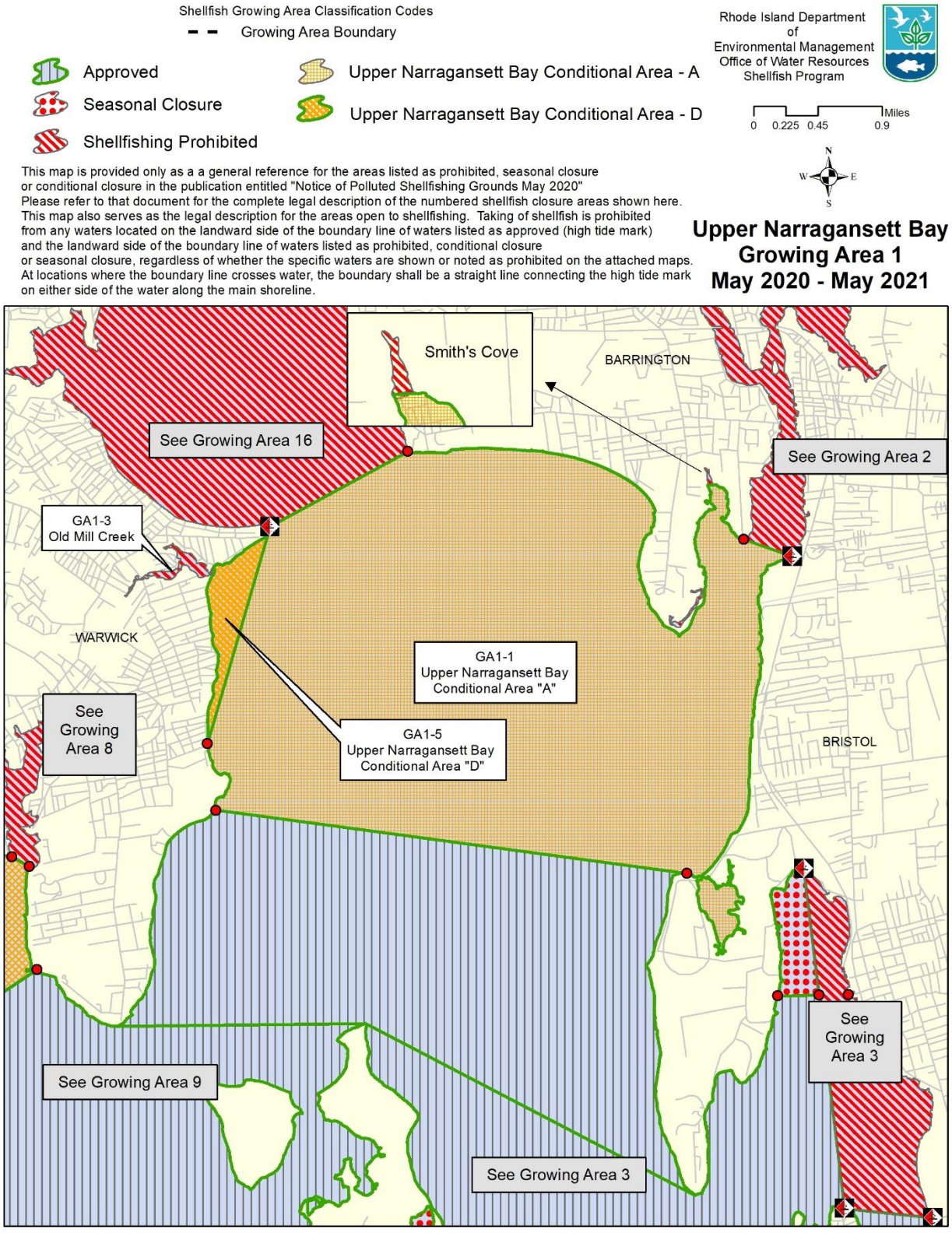
Table 1: 2020 Summary of Pollution Sources in GA 1

*****Highlighted sources >240 CFU/100ml.

Source ID	Date Visited	Lat	Long	Description	Receiving waters classification	Act /Pot	Dir /Ind	2019 Results mTEC cfu/100ml	2020 Results mTEC cfu/100ml	2020 Volumetric Flow (cfs)
2020-1-001	7/3/2020	41.71385	-71.3645	Stream flowing into outflow of Buckeye Brook at Old Mill Creek into upper bay	Prohibited	Actual	Direct	100	100	2.4
2020-1-51A	7/3/2020	41.68684	-71.3697	Stream from uplands, not present in 2019	Approved	Actual	Direct	240	6300	0.136
2020-1-202	7/3/220	41.670962	-71.37427	24” RCP, broken overgrown	Approved	Potential	Direct	80	CNL	
2020-1-207	7/3/2020	41.676323	-71.374119	Gw stream	Approved	Actual	Direct	NS	1800	Trickle

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

Figure 4: 2020-2021 Shellfish Classification Map of GA 1



3. Marinas and Mooring Fields

Upper Narragansett Bay Growing Area 1 does not contain any marinas. During sanitary surveys moorings are to be noted. Moorings located in Smith Cove and north of Bristol Town Beach were evaluated during the survey and determined to have no impact on the classification of waters within the Upper Bay.

4. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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

5. Waste Water Treatment Facilities

There are currently no wastewater treatment facilities that discharge directly to this growing area; however several existing WWTF plants discharge into the nearby Providence and Warren rivers upstream of Growing Area 1. These WWTF may have an indirect impact on the water quality of the Upper Bay (GA1).

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

The Fields Point facility is permitted to discharge a maximum of 65 million gallons per day (MGD) of flow to secondary treatment. In 2020 average flow was 38.8 MGD. The Bucklin Point facility is permitted to discharge 31 MGD and averaged 17.76 MGD also below permit limits. Bucklin Point had 1 violations in 2020 for exceeding daily enterococci limits of 276 mpn/100mL . On 10/31/202 the facility had a recording of 525.5 mpn/100mL.

The East Providence facility is permitted to discharge 14.2 MGD and the average discharges for 2020 were 5.27 MGD well within permit limits. No fecal coliform or flow violations were reported by this facility, however there was one daily max enterococci violation reported on 11/30/2020. This facility has a permit limit of 276 CFU/100mL, and they reported 2420 CFU/100mL.

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 from November 1st to April 30th, and a permit limit of 2.53 MGD from May 1st- October 31st. In 2020 the monthly average flow was 1.68 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 no violations reported in 2020.

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 11 MGD was not exceeded with average flows of 5.03 MGD with no violations reported in 2020. Cranston has a permitting flow of 20.2 MGD, and had average flows of 7.26 MGD in 2020. Warwick's average monthly flow was 4.5 MGD, well below the permitted flow of 7.7 MGD, with no violations reported in 2020.

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 available in the program's permanent files. These recent analyses and changes in the routine wet weather closure criteria are incorporated into the most recent version of the Growing Area 1 CAMP, available in the program's permanent files.

6. Water Quality Studies

2020 Review of Growing Area Statistics

HIGHLIGHTS

Upper Bay – Area 1A ('Area A')

*** Area A sampled 12X in 2020 (11X when open, 1X when closed).**
*** Statistics represent most recent data collected 8/21/2019 to 12/16/2020 (n = 15) for Area 1A.**
*** All conditionally approved areas in compliance.**
*** Data run 1/4/2021**

Upper Bay – Area 1D ('Area D')

*** Conditional Area 1D near mouth of Mill Cove created in January 2019.**
*** Conditional area with 0.8", 7-day rain closure.**
*** Stations 1-8C and 1-8L exceed criteria and are out of compliance.**
*** Area to be reclassified as Prohibited**
*** Data run 1/4/2021 and 5/5/2021.**

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 10X during 2020, 8X when open (2 wet and 6 dry weather).**
*** Statistics for stations 1-2, 1-3C, 1-13 and 1-14 represent recent 30 samples collected during 12/1/2017 or 1/16/2018 to 12/10/2020 under all weather conditions (14 wet and 16 dry weather samples).**
*** All approved stations in area in compliance.**
*** Data run 1/4/2021.**

COMMENTARY

Area 1A: Upper Narragansett Bay Conditional Area 1A (Growing Area 1A) was sampled twelve times during 2020, with 11 samples collected while the area was in the open status. The 2019 statistical review demonstrated that all conditionally approved station in Upper Bay Area 1A ('Area A') met fecal coliform water quality criteria while the area was in the open status and that the area is properly classified.

Area 1D: Upper Bay Conditional Area 1D near the mouth of Buckeye Brook and Mill Cove was created in 2019 in an attempt to manage the area which is impacted by fecal coliform pollution from Buckeye Brook and Mill Cove. The area was successfully managed with a 0.8", 7-day rain closure during 2019. However, a series of moderately elevated fecal coliform observations of 42-110 cfu/100 ml during May to October 2020 when the area was open resulted in two stations (1-8C and 1-8L) exceeding NSSP criteria for conditionally approved areas. The data were re-valuated with additional observations collected during January to May 2021. However, all analyses indicated that fecal coliform exceedances were during dry weather (< 0.5" rain in prior 7-days) so a conditional rain closure would no longer be effective in managing safe shellfish

harvest in the area. Accordingly, the area near the mouth of Buckeye Brook and Mill Cove encompassing the out of compliance stations 1-8C and 1-8L should be reclassified as Prohibited to shellfish harvest (see May 2021 growing area map).

Area 1B: Upgrades of wastewater treatment and storm water facilities in the Providence area resulted in improved fecal coliform water quality and a change in the classification of the southern portion of the Upper Bay (formerly known as Area B) from conditionally approved to approved in May 2017. Subsequent sampling of the four stations (1-2, 1-3C, 1-13, 1-14) in the southern portion of the Upper Bay followed the systematic random sampling protocol recommended by the NSSP for approved areas. The southern portion of the Upper Bay (Area 1B) was sampled eight times when open (2 wet weather and 6 dry weather) during 2020, exceeding minimum sampling requirements for approved areas. 2020 sampling included acceptable results 4.5 days after 2.65" rain, indicating that the microbial water quality of the area is not impacted by elevated rainfall of up to approximately 3". The southern portion of Upper Narragansett Bay (Area 1B or 'Area B') has met criteria for approved waters since 2017 (2017 – 2020). The 2020 statistical summary demonstrated that the southern portion of the Upper Bay (former Area B) is properly classified as Approved.

RECOMMENDATIONS

*** All conditionally approved stations in Area 1A in compliance and conformance when open.**
*** All approved stations in Area 1B in compliance.**
*** Two conditionally approved stations in Area 1D are out of compliance.**
*** A portion of Area 1D near Buckeye Brook and the mouth of Mill Cove should be reclassified to Prohibited due to unacceptable fecal coliform levels that exceed NSSP criteria.**
*** When possible, continue optional wet weather sampling to track fecal coliform concentration response and to monitor effects of upgrades in wastewater and storm water treatment on Upper Bay water quality.**

Table 2: GA1 Annual compliance statistics 2020

RIDEM SHELLFISH GROWING AREA MONITORING: GA1
Upper Bay Area 1A when open (8/21/2019 to 12/16/2020, all mTEC)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
1-1	CA	15	4.1	6.7
1-4	CA	15	6.9	6.7
1-7	CA	15	2.6	0.0
1-10	CA	15	2.8	0.0
1-12	CA	15	3.1	0.0
1-11A	CA	15	4.0	6.7
1-5C	CA	15	4.0	0.0
1-6A	CA	15	2.0	0.0
1-8A	CA	15	2.7	0.0

Upper Bay Area 1D when open (8/21/19 to 12/16/2020; all mTEC)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
1-8C	P	15	9.1	26.7
1-8F	P	15	3.6	0.0
1-8G	CA	15	2.5	0.0
1-8L	P	15	7.0	26.7

Upper Bay (Area 1B; 12/1/2017 or 1/16/18 to 12/10/20; all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
1-2	A	30	3.3	10.4
1-3C	A	30	3.3	12.7
1-13	A	30	2.9	9.0
1-14	A	30	2.8	9.3

7. Summary and Recommendations

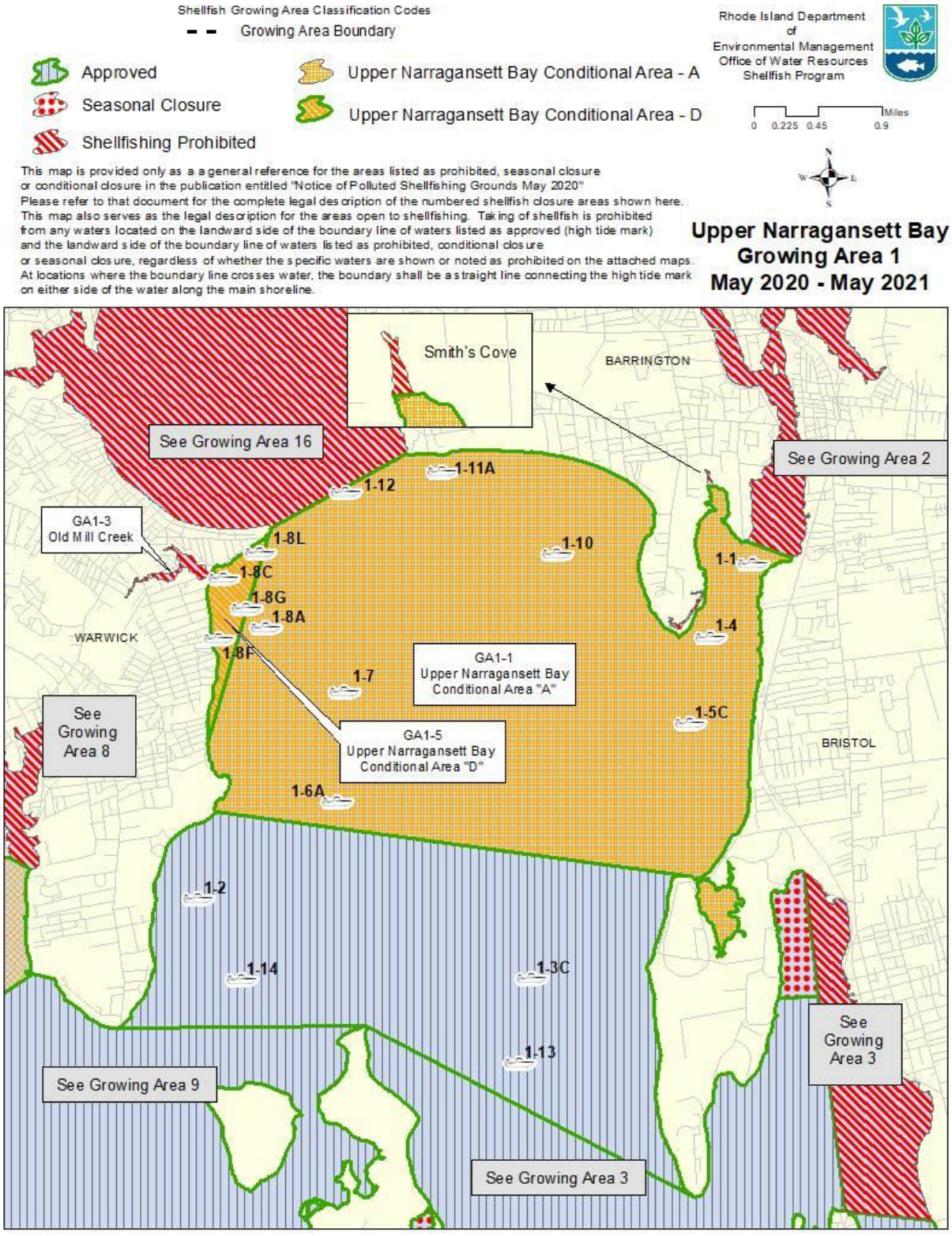
The 2020 annual re-evaluation of Upper Narragansett Bay shellfish Growing Area 1 (GA1) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area when this conditionally approved area is in the open status for shellfish harvest. In addition, the one WWTF potentially impacting the growing area were shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform collected while the conditionally approved area was in the open status indicated that all conditionally approved stations in sub-area 1A and that all Approved stations in sub-area 1B met NSSP criteria and that these areas of the Upper Narragansett Bay Growing Area (GA1) are in program compliance and is properly classified.

The 2020 statistical review of Upper Bay Conditional Area 1D (GA1-5) near the mouth of Buckeye Brook and Mill Cove indicated that two stations in that area had unacceptable fecal coliform water quality and that these stations did not meet NSSP criteria for conditionally approved shellfish waters. Multiple fecal coliform exceedances of 31 cfu/100 ml during dry weather indicated that the previous conditional area management strategy of a 0.8" rain closure was no longer effective in ensuring safe shellfish harvest in the area. Accordingly, it is recommended that the area near the mouth of Buckeye Brook and Mill Cove encompassing the out of compliance stations 1-8C and 1-8L should be reclassified as Prohibited to shellfish harvest. This change was enacted in May 2021 (see May 2021 growing area maps). The remainder of Conditional Area 1D should be merged with Upper Bay Conditional Area 1A.

Growing Area 1 is a conditionally approved growing area, impacted by precipitation events and also potentially impacted by discharge from sewage treatment facilities. Therefore, the RIDEM Shellfish Program monitors Growing Area 1 in accordance with the guidelines set forth in the Upper Narragansett Bay Conditional Area Management Plan (CAMP) amended in 2017 (amendment #3) and 2021 (amendment #4). The Upper Bay (Growing Area 1) CAMP was re-evaluated during this review and the monitoring and management actions were consistent with the management plan (CAMP).

No classification changes are recommended for Area 1A or 1B. A downgrade classification from Conditionally Approved to Prohibited is recommended for portions of Area 1D near Buckeye Brook and the mouth of Mill Cove.

Figure 5: 2020-2021 classification map and routine monitoring stations.



GA 2
Barrington, Palmer and Warren Rivers
2020 Annual Update

Contents

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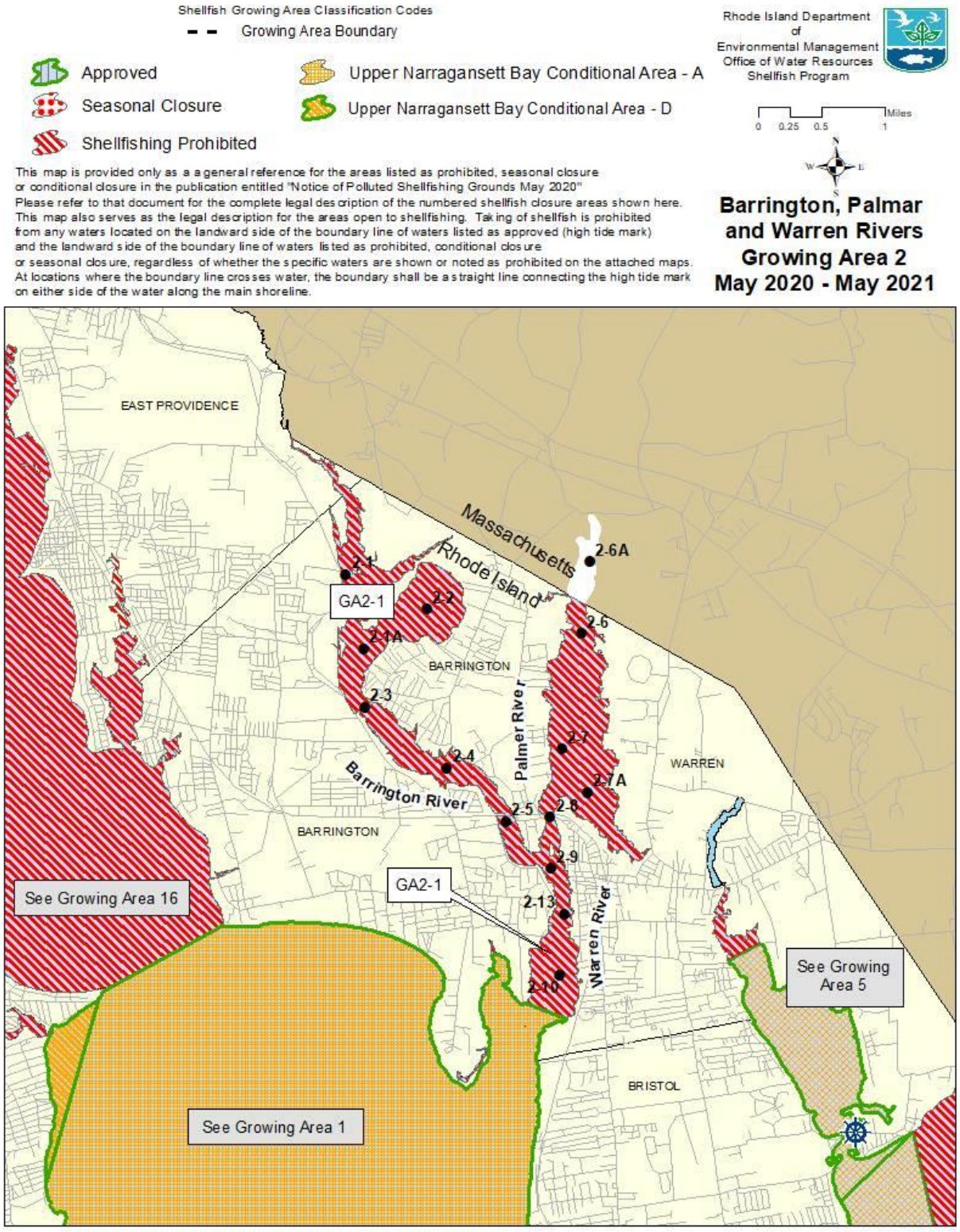
1. Introduction

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 (Figure 1), are currently classified as prohibited to shellfishing. The area was sampled two (2) times during 2017 (both during wet weather), (5) times during 2018 (1 dry weather, 4 wet weather) and twice (2 times) during 2019 (one dry, one wet). The area was not sampled during 2020 due the COVID-19 outbreak. Results from recent sampling and statistical evaluation (based on the most recent 30 samples collected under all weather conditions; an 'Approved' status scenario) indicate that five (5) of fourteen (14) stations (~36%) are in compliance. Under a 'Conditionally Approved' scenario with a 0.5" rainfall closure trigger, nine (9) of fourteen (14) stations (~64%) 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. 2020-2021 Shellfish Classification Map of GA 2 with Routine Monitoring Stations



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

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 help to reduce bacteria loadings to the watershed and result in improved water quality. Efforts will be made to sample the growing area more frequently during 2020 to document these results with the goal of re-classifying some of this growing area.

2. Waste Water Treatment Facilities

The receiving waters of the Warren Wastewater Treatment Facility are within Growing Area 2. An analysis to determine the necessary dilution zone for compliance with the NSSP MO is contained in the program's permanent files. EPA's PLUMES model was utilized in determining the extent of impacts of the WWTF discharge in the event of an upset in treatment at the plant should it occur. Performance records of plant treatment quality and records of any unusual events at the plant that would cause a discharge of partially treated sewage are maintained by the department's operations and maintenance division and reported immediately to shellfish staff should such an unlikely event occur. There were no reports of permit violations warranting re-evaluation of the prohibited zone during 2020.

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

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

3. Water Quality Studies

Annual Statistical Analysis 2020

HIGHLIGHTS

* The area was not sampled during 2020.
* Sampled 2X during 2019.
* Area is currently classified as prohibited; statistics calculated for informational purposes only, not for compliance.
* Statistics calculated for recent 30 combined wet and dry weather data 7/16/2010 to 9/24/2019, 16 wet weather and 14 dry weather samples, 9 MPN and 21 mTEC samples.
* Statistics also calculated for recent 15 samples collected during dry weather only (<0.5" rain in prior 7 days) during (6/4/2009 to 9/24/2019); 7 mTEC and 8 MPN.
* Data run 12/16/2019.

COMMENTARY

The Barrington, Palmer and Warren Rivers (Growing Area 2) were not sampled during 2020 due to the Covid-19 outbreak. The area was sampled twice during 2019 (1 dry weather, 1 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 17 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; 0.5" rain closure). Only five stations (stations 2-4, 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. Most of these stations are located in marina areas and adjacent to a WWTF outfall which keeps the area classified as prohibited to shellfishing. Under dry weather conditions (less than 0.5" rain in prior 7 days), 9 of 14 stations met criteria, but these stations are located in the lower Barrington and Warren Rivers (marina and WWTF 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 station 6A in the Palmer River) are also out of compliance during dry weather. TMDL work in RI and MA portions of the watershed continues in an effort to improve water quality. Given current water quality and the unpredictable fecal coliform response after rainfall, the area is properly classified.

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: Statistical summary of recent GA2 fecal coliform data

Approved scenario: recent 30 all weather
(7/16/2010 to 9/24/19; 16 wet and 14 dry weather; 9 MPN / 21 mTEC)

			FECAL-GEO	
Station Name	*Status*	*N*	*MEAN*	*90th Percentile (<36 cfu/100 ml)*
GA2-1	P	30	45.0	433.8
GA2-1A	P	30	13.3	133.6
GA2-2	P	30	5.8	36.1
GA2-3	P	30	8.2	44.6
GA2-4	P	30	5.7	31.0
GA2-5	P	30	5.7	26.8
GA2-6	P	30	65.1	875.5
GA2-6A	P	30	163.6	1753.0
GA2-7	P	30	10.0	93.6
GA2-7A	P	30	11.8	135.7
GA2-8	P	30	6.2	32.4
GA2-9	P	30	5.2	21.0
GA2-10	P	30	4.1	14.4
GA2-13	P	30	4.5	17.1

Conditionally Approved scenario: recent 15 dry weather (<0.5" rain prior 7 days) only
(6/4/2009 to 9/24/2019; 11 mTEC, 4 mpn)

			FECAL-GEO	
Station Name	*Status*	*N*	*MEAN*	*%>CRITICAL 35 cfu/100 ml*
GA2-1	P	15	27.9	40.0
GA2-1A	P	15	8.7	26.7
GA2-2	P	15	3.8	6.7
GA2-3	P	15	5.6	6.7
GA2-4	P	15	4.0	0.0
GA2-5	P	15	4.3	6.7
GA2-6	P	15	29.4	40.0
GA2-6A	P	15	116.2	86.7
GA2-7	P	15	5.8	6.7
GA2-7A	P	15	7.9	13.3
GA2-8	P	15	5.8	0.0
GA2-9	P	15	4.2	0.0
GA2-10	P	15	4.0	6.7
GA2-13	P	15	4.8	6.7

4. Summary and Conclusions:

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 (Figure 1), are currently classified as prohibited to shellfishing. Monitoring of prohibited areas is not required, but, as resources allow, DEM Shellfish staff complete limited monitoring of the area. The 2020 review has demonstrated that the fecal coliform water quality does not meet NSSP criteria for Approved or Conditionally Approved waters. The area is properly classified as Prohibited and no change in classification is recommended.

GA 3 Annual Update: East Middle Bay

Contents

Figures

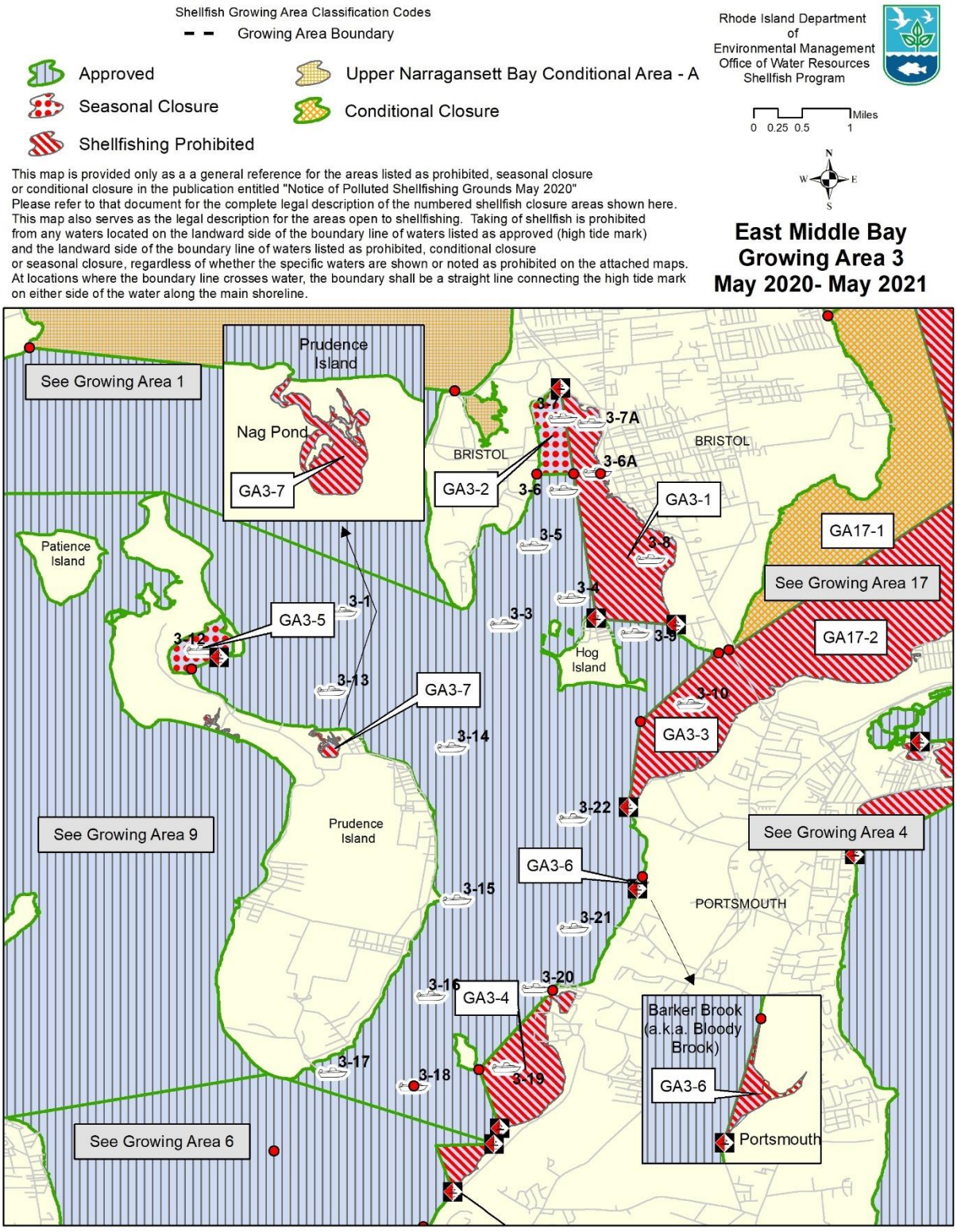
Tables

A. Introduction

A 12-year sanitary shoreline survey of the East Middle Bay Growing Area Growing Area 3, Figure 1) was conducted in 2010 and the last Triennial Update was performed in 2019. A total of sixty-one (61) actual or potential sources were identified during the 2010 12-year 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/100 ml threshold and six (6) of those eight (8) sources were located adjacent to approved waters, which required a follow-up sampling in 2016. These sources were due to be sampled as part of the 2020 annual update.

During the 2020 annual shoreline survey a total of six (6) sources were visited and of those sources four (4) sources (Source 2020-3-060, 2020-3-018, 2020-3-005, 2020-3-039) had no flow and the remaining two (2) had results less than 240 cfu/100 mL.

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



B. 2020 Shoreline Survey

During the 2020 shoreline survey six (6) sources which had bacteria levels above 240 cfu/100 ml in the 2010 12- year survey were re-visited. Sources 2020-3-005, 2020-3-018, 2020-3-039 and 2020-3-060 either could not be located or had no flow at the time of the 2020 survey. Source 2020-3-201, a 6' by 4" deep stream flowing under a railroad trestle bridge) was sampled on 7/16/2020. On that date, source 3-201 had a fecal coliform reading of 100 cfu/100 ml and the stream was flowing at 3.36cfs. Source 2020-3-209, a 3' wide by 3" deep stream that drains uplands in the Melville Pond area was also sampled on 7/16/2020 with a result of 100 cfu/100mL. When sampled, this stream dissipated into the sand/gravel beach above the high tide line before reaching the receiving waters of Growing Area 3, so it was not impacting the waters of GA3. Table 2 shows the results of sources sampled during the 2020 survey.

Figure 2: Sources 2020-3-201 (left) and source 2020-3-209 (right).

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 at the source were slightly elevated, in stream results demonstrated that this source is not impacting the waters of GA3.

Table 1:2020 GA3 Annual Survey Sources

Source ID	Date Visited	Lat	Long	Description	Receiving waters classification	Actual Or Potential	Dir Or Ind	2019 Results cfu/100 mL	2020 Results cfu/100 mL	2020 Flow (cfs)
2020-3-201	7/16/2020	41.57333	-71.28805	Stream at R/R tressel Burma Rd.	Prohibited	Actual	D	100	100	3.37
2020-3-209	7/16/2020	41.59298	-71.28131	Stream from upland pond stops 50' from water, flow undergr ound	Approved	Actual	It	NS	100	No flow

Table 2: 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)

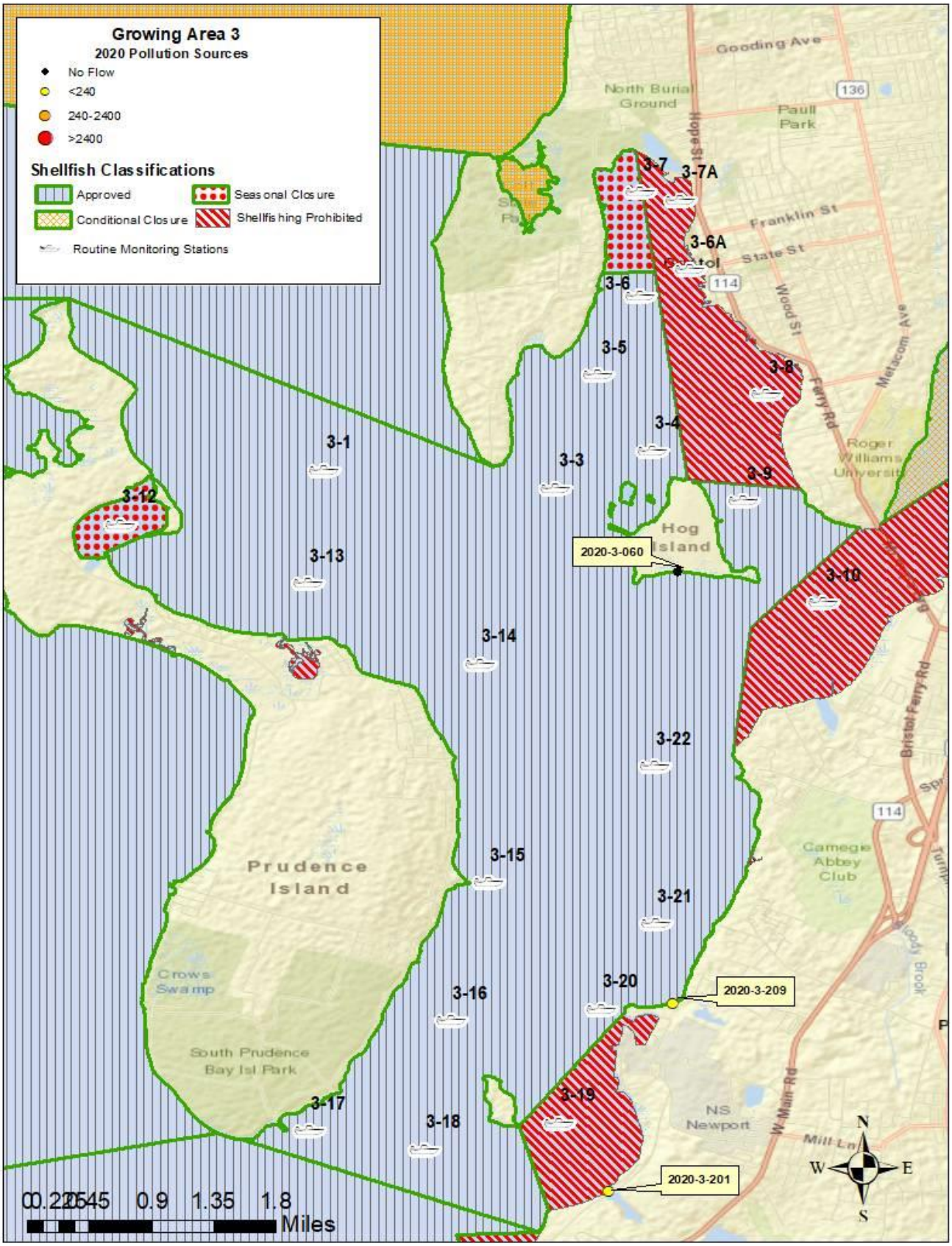


Figure 4: Map of GA 3 shoreline survey sources.

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 three (3) pump-out facilities located within the area of Bristol Harbor: Stone Harbor Marina, Rockwell Town Pier, and the Bristol Town pump-out boat. For additional information refer to the 2020 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 2020 indicated that Growing Area 3 is properly classified and that all pollution sources have adequate 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.

D. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing the shoreline survey report. Follow-up sampling or further field work and evaluation is conducted as warranted. There were no indications that any of the sources identified during this survey have the potential to impact the approved waters of Growing Area 3

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

E. Wastewater Treatment Facilities

The most significant point source discharge into this growing area is from the Bristol wastewater treatment facility 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 2020 was 2.9 MGD which is well below the permit limits. In 2020 this facility reported four (4) permit violations. Two (2) violations of their *Enterococci* permit limit occurred on 9/30/2020 with an average concentration of 69 cfu/100 mL and a maximum concentration of 613 cfu/100 mL. Fecal coliform concentration at this time was well-below permitted levels. They also had two (2) monthly average flow violations, the first was for January with a monthly average of 3.82 MGD, approximately 1% above the permitted flow. In April 2020 the plant had an average flow of 4.74 MGD, approximately 25% above the permitted level. April 2020 was wetter than normal, with 5.45" rain (including 1.52" in a single day, 4/13/2020) compared to an average April rainfall of 4.36" which likely explains the moderately elevated April flow rate.

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.

F. Annual Statistical Analysis

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

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

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

GROWING AREA 3 – EAST MIDDLE BAY

HIGHLIGHTS

* Sampled 6X during 2020 (2 wet weather, 4 dry weather).
* Statistics represent recent 30 combined wet (n=20) and dry (n=10) weather data 11/4/2015 or 8/4/16 to 10/15/2020 for approved stations.
* Statistics represent recent 15 combined wet (n=11) and dry (n=4) weather data when the area was open 4/6/2016 or 11/1/16 to 10/15/2020 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 11/23/2020.

COMMENTARY

All stations in Growing Area 3 (East Middle Bay) were sampled 6 times during 2020, in compliance with systematic random sampling monitoring requirements. The 2020 statistical evaluation includes the most recent 30 samples collected during both wet and dry weather (20 wet weather, 10 dry weather) since 11/4/2015. Two stations in GA3 (3-7 and 3-12) are classified

as seasonally approved. The statistical analysis for these seasonally approved stations includes the most recent 15 samples collected during wet and dry weather (11 wet and 4 dry weather) when the area was in the open status since 4/6/2016.

All approved stations met criteria during the 2020 evaluation. Results of the 2020 statistical evaluation also indicated that all conditionally approved / seasonally approved stations in Growing Area 3 are in compliance and that the area is properly classified.

RECOMMENDATIONS

* No action recommended based on 2020 monitoring results.

Table 3: Annual statistical summary of GA3

RIDEM SHELLFISH GROWING AREA MONITORING: GA3

Recent 30 all weather
(1/4/2015 or 8/4/2016 to 10/15/2020; all mTEC, 20 wet and 10 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
3-1	A	30	2.7	8.2
3-3	A	30	2.6	5.9
3-4	A	30	2.3	4.9
3-5	A	30	2.9	11.3
3-6	A	30	2.9	9.4
3-6A	P	30	3.7	16.6
3-7	SA	30	3.0	8.5
3-7A	P	30	4.2	21.2
3-8	P	30	3.8	15.2
3-9	A	30	3.1	11.6
3-10	P	30	2.8	7.8
3-12	SA	30	2.6	6.3
3-13	A	30	2.4	4.9
3-14	A	30	2.6	5.7
3-15	A	30	2.5	6.2
3-16	A	30	2.2	3.8
3-17	A	30	2.6	6.5
3-18	A	30	2.3	4.9
3-19	P	30	2.3	4.9
3-20	A	30	2.4	4.6
3-21	A	30	2.1	3.0
3-22	A	30	2.3	5.3

Seasonally Approved stations, recent 15 when open

(4/6/2016 or 11/1/2016 to 10/15/2020, all mTEC, 11 wet and 4 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
3-7	SA	15	2.9	0.0
3-12	SA	15	2.5	0.0

G. Summary and Conclusions

The 2020 annual evaluation of the East Middle Bay (GA3) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area 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 (seasonal) area was in the open status indicated that all approved and seasonally approved stations met NSSP criteria and are in compliance.

The 2020 annual review demonstrated that the East Middle Bay growing area (GA3) is in program compliance and is properly classified. No classification changes are recommended.

GA 4 Annual Update: Sakonnet River

Contents

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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. A total of one hundred and sixty-seven (167) actual or potential sources were identified during the 2013 shoreline survey, excluding marinas. One-hundred and eight (108) of the sources were not actively flowing at the time of the shoreline survey with the remaining fifty-nine (59) having flows warranting sampling. Fourteen (14) of the sources from the 2013 survey had results greater than 240 cfu/100 ml and of those sources five (5) were located in prohibited areas of the growing area. The remaining sources did not have bacteria counts exceeding 2,400 cfu/100 ml, which would warrant follow-up sampling.

This 2020 Annual Survey identified seven (7) sources that warranted follow up sampling. At the time of the 2020 survey, three (3) of the seven were not actively flowing and one source (2020-4-2001) could not be located. The remaining three (3) sources were sampled as part of the 2020 update.

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

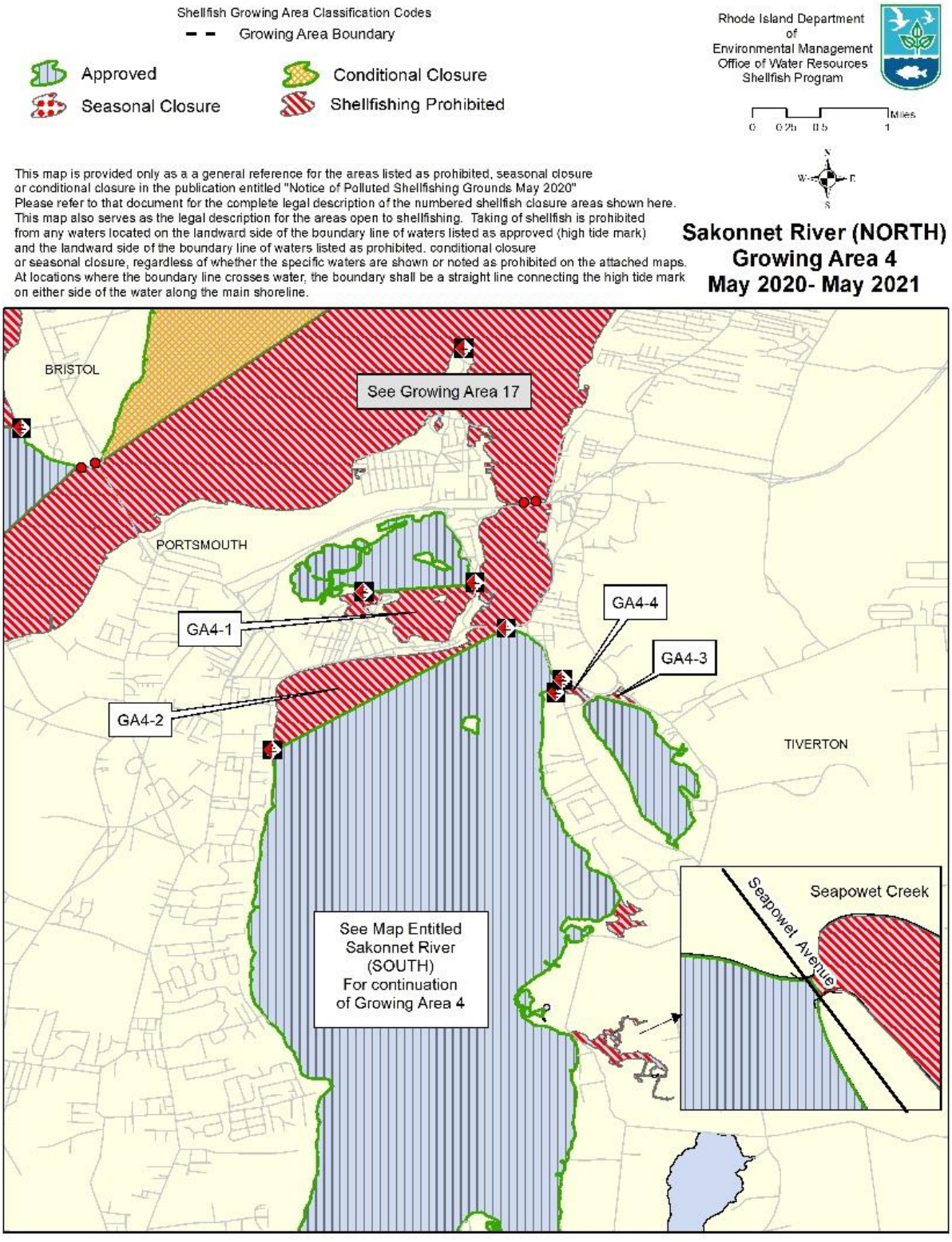
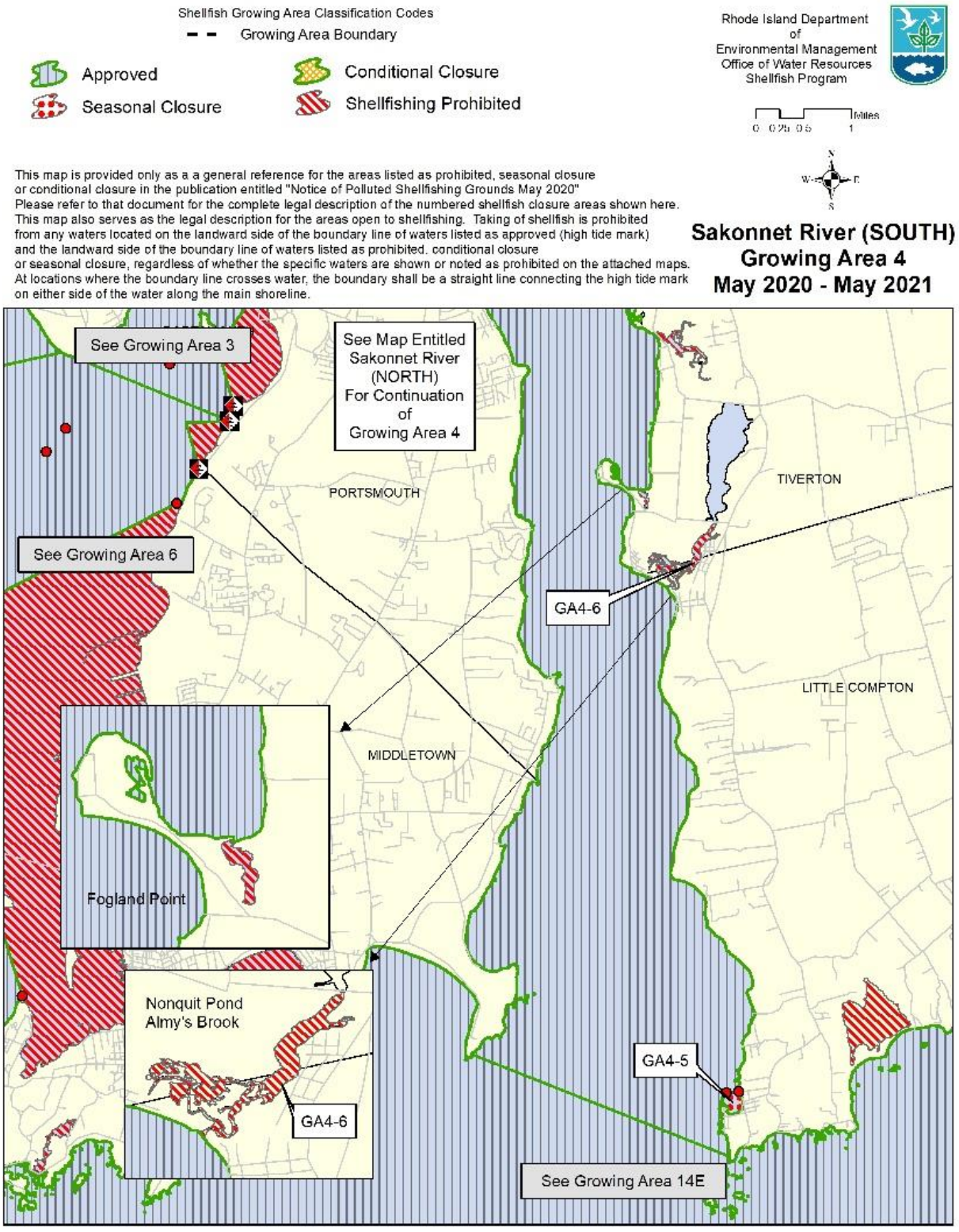


Figure 2: Growing Area 4 (South) Current Classification Map



B. 2020 Shoreline Survey

The 2020 Annual survey was conducted under wet weather conditions, there had been 0.45" of rain recorded at TF Green Airport and 0.59" of rain at the Taunton weather station within two days prior to the survey date of 7/30/2020. During the 2020 annual update a total of seven (7) sources were revisited (Figure 3). The fecal coliform results for sources sampled during the 2020 are summarized in Table 3. Three (3) sources (2020-4-013, 2020-4-107, 2020-4-540) were dry and were not sampled. One source could not be located (source 2020-4-2001), and another source (Source 2020-4-550) was found but the pipe was submerged, and no sample could be taken.

Figure 3: 2020 Sakonnet River Growing Area 4 Pollution Sources

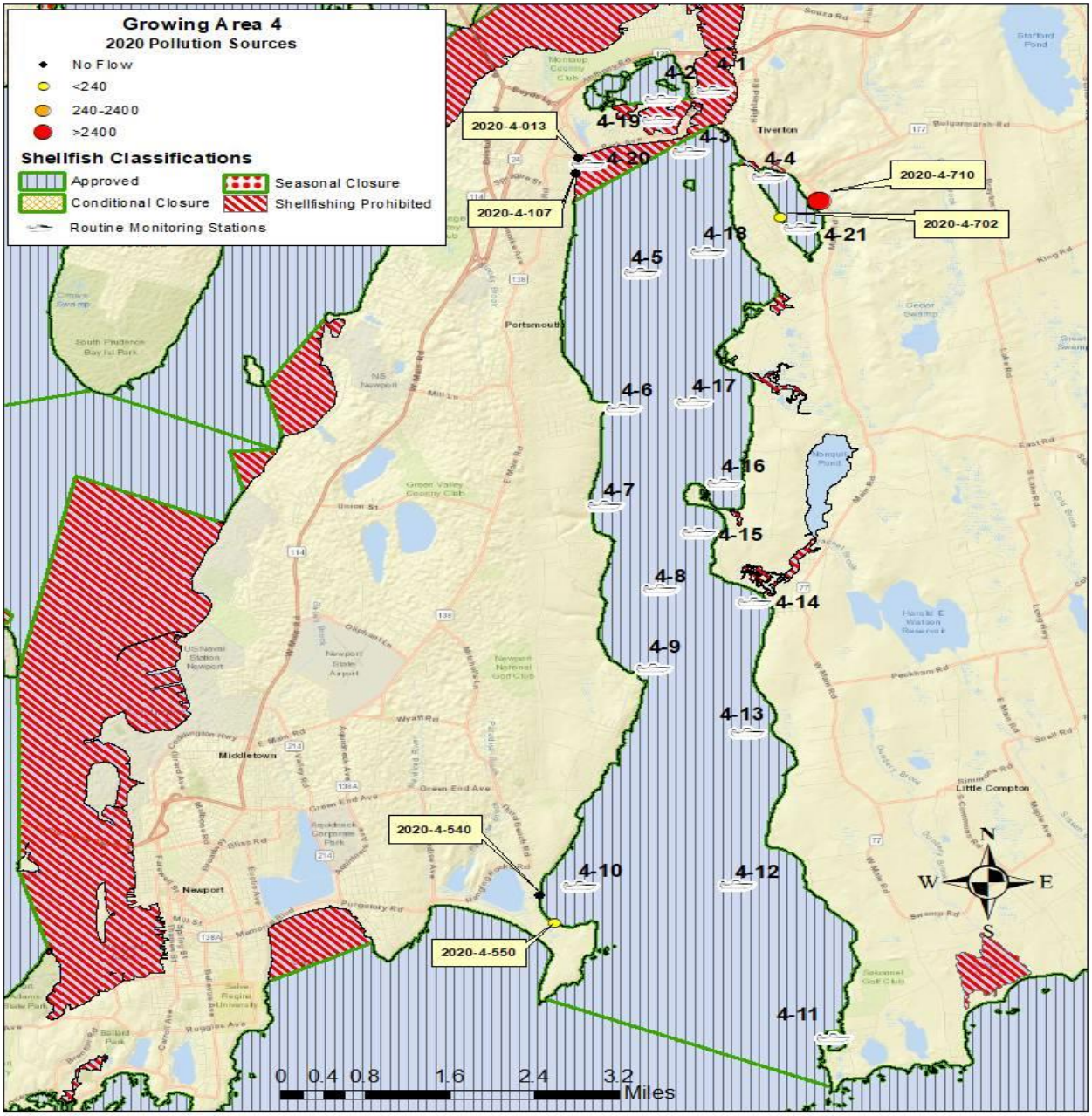


Table 1: Summary of 2020 Shoreline Results for Growing Area 4 Sakonnet River

*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**	**Act/Pot**	**Direct/Indirect**	**2019 Results mTEC** cfu/100ml	**2020 Results cfu/100mL**	**2020 Volumetric Flow** (cfs)
2020-4-550	7/30/2020	41.4861	-71.2449	Outlet of upland tidal pond, 2 gates both submerged. Sampled taken of "receiving waters"	Approved	Actual	Direct	200	100	No flow calculated
2020-4-702	7/30/2020	41.60937	-71.20287	4" diameter pipe from yard	Approved	Actual	Direct	1600	<100	0.002
2020-4-710	7/30/2020	41.61236	-71.19585	White wine brook at road crossing 24" diameter cmp	Approved	Actual	Direct	3500	3000	5.1

Source 2020-4-550 is the outlet drainage of an upland tidal pond. This outlet drains through two culverts into the approved waters of Third Beach. However, this sources outlet is submerged under water during the entire tide cycle. During this annual survey, a sample was taken directly in front of the outlet as seen in Figure 4. No flow could be calculated during this survey due to the submerged pipe, however results from this source were 100 cfu/100 ml, demonstrating rapid dilution and that this source should not have a large impact on the water quality of the growing area.

Figure 4: Source 4-550 view looking to receiving waters (left photo) downward view of exit of pipe (right photo).

Source 2020-4-702 is a 4" diameter PVC pipe that exits the backyard of 224 Nanaquacket Rd, Tiverton RI. Water flowed out of this PVC pipe and flowed across the shoreline and subsided into the sand before entering the receiving waters. The house, at the time of survey, was being remodeled and the source was flowing approximately 0.002 cfs. The source was not flowing at the time of follow-up visits. The results for this source in 2020 was less than 10 cfu/100 mL. This low fecal coliform concentration and the low flow rate indicate that source has little impact on the water quality of the receiving waters and therefore no further action is needed.

Source2020- 4-710 is White Wine Brook, which drains through a 24-inch CMP into Nanaquaket Pond in Tiverton. The source had an elevated fecal coliform result of 1,600 cfu /100 ml in 2018 but the volumetric flow was a trickle. The source waters must exit the CMP pipe and cross a dense *Phragmites* stand and travel over 100 feet before reaching the receiving waters. A follow-up sample was taken on 5/8/2018 with a result of 100 cfu/100 ml and an instream of 31 cfu/100 ml. In 2019 this source had a result of 3,500 cfu/100 mL thus requiring a resample in 2020. The 2020 results were 3,000 cfu/100 mL at the pipe and an instream sample of 700 cfu/100 mL. Despite initial 2020 samples having elevated fecal results, follow up sampling on March 24, 2021 provided results of 5 cfu/ 100mL for the actual source and an in-stream sample had fecal coliform of <2 cfu/100 ml. Growing Area 4 monitoring station 4-21, located approximately 1,800 feet southwest of source 4-710, had acceptable fecal coliform levels during 2020.

Figure 5: Source2020- 4-710 White Wine Brook. The Brook was a trickle running through the dense Phragmites stand (left photo on 9/19/2018). The draining of this source into Nanaquacket Pond is shown in the right photo.

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

D. Waste Water Treatment Facilities

Public sewers service only a small portion of the growing area watershed in a portion of Middletown near the Sachuest Point area. All other areas of the watershed are serviced by on-site wastewater treatment systems (OWTSs). There are currently two RIPDES permits that discharge into the general area. One permitted discharge is minor sanitary discharge from Tiverton High School, which is over a mile away from Nanaquaket Pond, 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. Poisonous and Deleterious Substances

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

algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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.

F. 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. All samples in the current evaluation period were analyzed by the mTEC method. The procedure for water sample holding times and temperature control for the sm48 and sm01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (copy in the Program's permanent file).

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

HIGHLIGHTS

* Sampled 6X during 2020 (1 wet weather, 5 dry weather).
* Statistics represent recent 30 samples collected 3/16/2016 to 10/27/2020 during wet (n = 15) and dry (n = 15) weather for approved stations; all samples analyzed by mTEC method.

* Statistics represent recent 15 samples (7 wet weather, 8 dry weather) collected 4/18/2016 to 10/27/2020 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 11/23/2020.

COMMENTARY

The Sakonnet River (Growing Area 4) was sampled six times during 2020 which meets minimum systematic random sampling requirements for approved areas. The statistical evaluation of approved areas includes the recent 30 samples collected since 3/16/2016 during both wet (n=15) and dry (n=15) weather conditions. All approved stations are in program compliance and the area is properly classified.

While all approved stations in GA4 are in compliance, the station located in the northern end of Nanaquaket Pond (station 4-4; south of Nanaquaket Bridge) had a fourth consecutive year of increased frequency of elevated fecal coliform observations. The 90th percentile variability criteria calculated for station 4-4 was 25.0 cfu/100 ml during 2020. While slightly improved since 2019, the 2020 90th percentile was close to exceeding the variability criteria threshold of 31 cfu/100 ml. Two of the recent 30 observations at this station were elevated, with these elevated observations occurring following wet weather (2 to 5 days after rain of 1.1" to 2.3" rain). 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.

Classification of station 4-11 in Sakonnet Harbor was upgraded from prohibited to seasonally approved in 2016 due to improvements in water quality. The 2020 update indicated that seasonally approved station 4-11 was in compliance during the open season and that the area is properly classified.

RECOMMENDATIONS

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

Table 2: 2020 Statistical summary of GA4

Recent 30, all weather
(3/16/2016 to 10/27/2020; all mTEC, 15 wet and 15 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
4-1	P	30	2.1	3.0
4-2	A	30	2.2	3.4
4-3	A	30	2.3	3.6
4-4	A	30	4.5	25.0
4-5	A	30	2.2	3.2
4-6	A	30	2.1	3.5
4-7	A	30	2.1	3.0
4-8	A	30	2.0	2.9
4-9	A	30	2.3	4.4
4-10	A	30	2.3	5.1
4-11	SA	30	2.2	3.0
4-12	A	30	2.1	3.6
4-13	A	30	2.1	3.8
4-14	A	30	3.6	15.2
4-15	A	30	2.1	3.1
4-16	A	30	2.1	3.6
4-17	A	30	2.2	3.6
4-18	A	30	2.2	3.2
4-19	P	30	2.4	4.8
4-20	P	30	2.6	6.9
4-21	A	30	3.4	13.3

Recent 15, when OPEN
(4/18/2019 TO 10/27/2020; all mTEC, 7 wet and 8 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
4-11	SA	15	2.1	0.0

G. Summary and Conclusions

The 2020 annual evaluation of the Sakonnet River (GA4) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A statistical review of water column fecal coliform observations indicated that all approved and seasonally approved stations in the growing area met NSSP criteria and are in program compliance.

The 2020 annual review demonstrated that the Sakonnet River growing area (GA4) is in program compliance and is properly classified. No classification changes are recommended.

Kickemuit River
Growing Area 5

12-Year Sanitary Shoreline Survey
Calendar Year 2020

Photo Courtesy of Laurel Park Imp. Assoc

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

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1 Acronyms and Terms

cfu/100 ml: colony forming units per 100 ml seawater

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

2 Introduction

A shoreline survey of the Kickemuit River was conducted during the summer (main survey) and fall (follow-up sampling) of 2020 by staff from RI DEM's Office of Water Resources Shellfish Program. The survey involved a shoreline reconnaissance of the entire study area to locate and catalog pollution sources and collect fecal coliform samples from all sources actively flowing into the shellfish growing area.

The primary objectives of the shoreline survey were to identify and characterize any new sources of pollution that may impact the growing area and to reevaluate point and non-point sources identified during previous surveys.

3 Description of the Growing Area

A. Location

The Kickemuit River growing area (GA5; Figure 1) is considered by the shellfish program to be that area of water generally bounded by the towns of Warren and Bristol from the dam at Route 103 south to Mount Hope Bay, including that portion of the bay north and west of a line encompassing routine monitoring stations 5-1 and 5-2. The Kickemuit River originates as a freshwater stream in Massachusetts and flows south into Rhode Island ending at the impoundment and dam at Child Street (Rt. 103) in Warren. Downstream (south) of the dam the Kickemuit River is subject to tidal flow and the waters becomes brackish / estuarine with a gradient of increasing salinity as one moves southward from the headwaters (Child Street dam) towards the Narrows (near station 5-3) and Mt. Hope Bay.

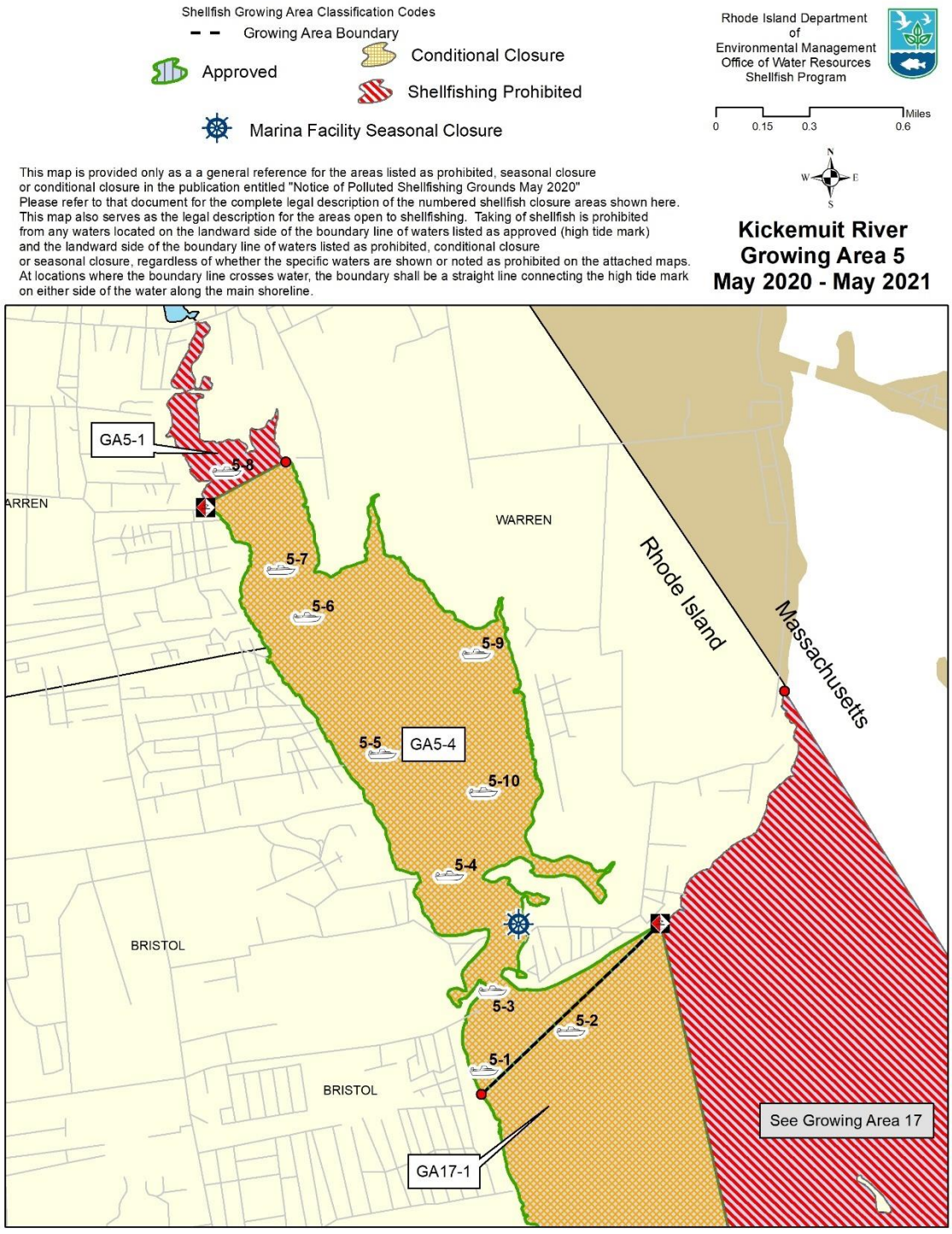

Figure 1: Kickemuit River Growing Area 5

B. Description of the Area

i. Physical Description

Growing Area 5 consists of approximately 643 acres (RI DEM GIS). The Kickemuit River is bordered by the towns of Bristol, RI on the southeastern shore and by the town of Warren, RI on the western, northern, and eastern shores. The Kickemuit River originates in Massachusetts as a freshwater river crossing over the MA-RI state border and continuing to a retaining dam at Rt. 103, Child Street in Warren. From that point south the river continues as a tidally influenced, brackish inlet, which terminates in Mount Hope Bay. The shellfish growing area (GA5) is that tidally influenced portion of the Kickemuit River proper plus the portion of Mount Hope Bay north of a line from the neighborhood south of routine monitoring station 5-1, northeast to station to the shoreline of Coggeshall Point represented by the line on Figure 1.

The watershed to the estuary is relatively small, covering an area of approximately 8 square miles (2,072 hectares). The watershed is largely residential along its western shore, while the eastern shore is evenly distributed between forest, residential, and agricultural land uses.

The growing area has both conditionally approved and prohibited waters. The prohibited shellfishing area encompasses the northern-most portion of the area adjacent to the dominant freshwater source at the Kickemuit Dam near Child Street. The prohibited area acts as a dilution zone upstream of the conditionally approved waters of the growing area. Monitoring station 5-8 is in the northern prohibited area. The remaining portion of the growing area is operated on a conditionally approved basis, with a 0.5" rainfall in a 24-hour period (as measured at Taunton Airport, NOAA weather station KTAN) triggering a 7-day closure. The precipitation that initiates the conditional rain closure may be in the form of rain and/or snowmelt.

The following information describes the physical geography of this growing area.

Area of Shellfishing Prohibited Kickemuit River	44.5 acres
Area of Seasonally Closed Mooring Fields	86.4 acres
Area of Remaining Conditional Areas	598.4 acres

Longest reach	4.5 km (2.8 miles)
Widest reach	1.1 km (0.7 miles)
Deepest point	4.9 m (16 feet)

ii. Latest Surveys

RIDEM's Office of Water Resources personnel conducted a comprehensive 12-year shoreline survey in 2008 to assess pollution sources impacting the growing area's water quality. Triennial updates were completed in 2011, 2014 and 2017. Annual updates were completed in the intervening years between triennial updates. The most-recent 12-year sanitary survey was completed in 2020 (this report).

iii. Previous Classification Maps

The 2008 classification map (Figure 2) does vary from the current map in that the seasonal (Memorial Day to Columbus Day) closures for the western shore area (described in the map inset) and the area near the 'Narrows' that were in effect in 2008 were not in effect for 2020. In addition, the southern boundary of GA5, adjacent to Mt. Hope Bay was changed to a straight line-of-sight line (see 2020 map; Figure 1) to allow more efficient enforcement monitoring.

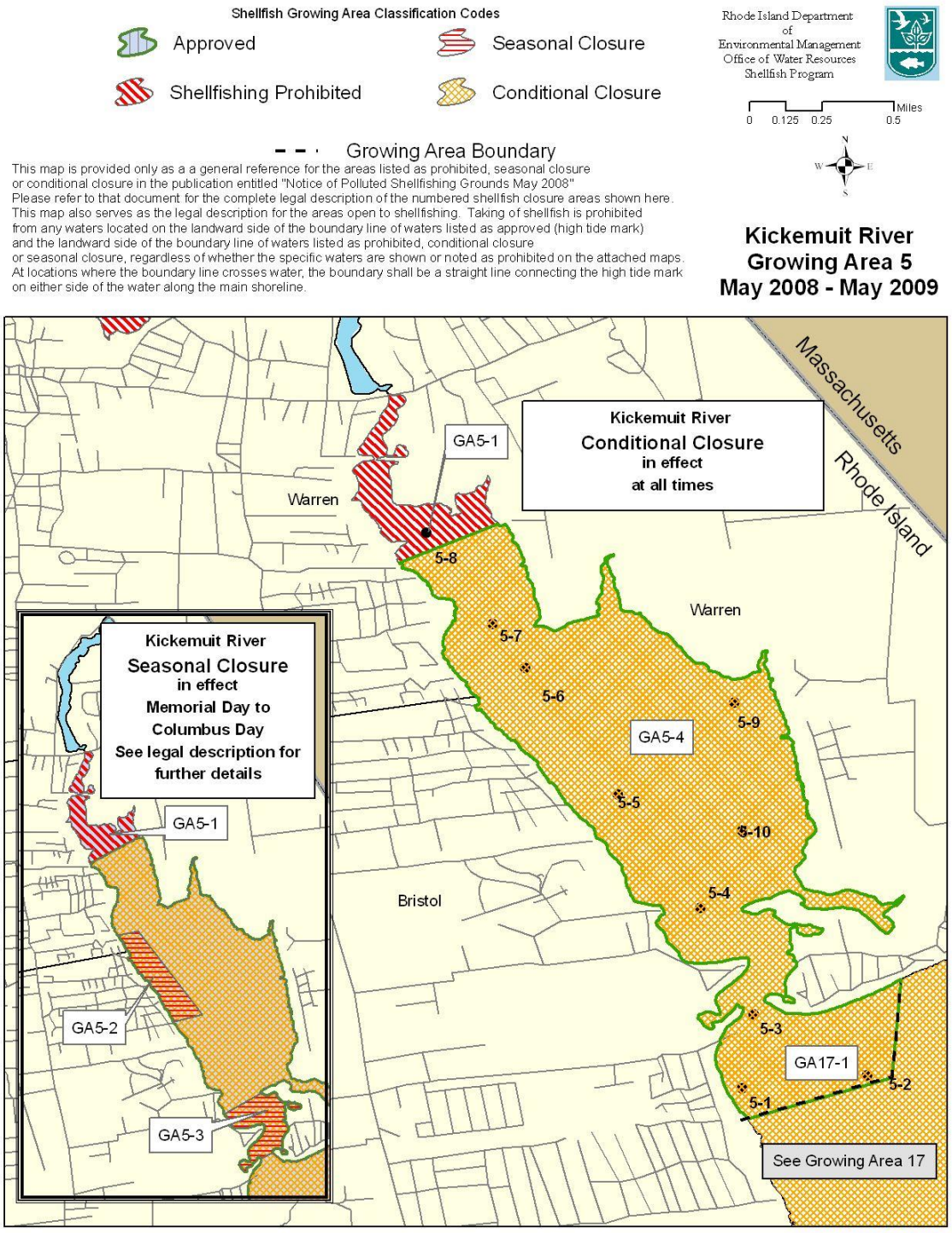

Figure 2: 2008 GA5 Classification Map

iv. Current Classification Map

Prohibited areas in the current (2020-2021) classification of GA5 are described below and the current classification map is shown in Figure 1.

v. Legal Descriptions

Prohibited areas

GA5-1 The northern portion of the Kickemuit River north of a line from the Rhode Island Department of Environmental Management range marker located at the eastern extension of Patterson Avenue in the Laurel Park section of Warren to the flagpole on the opposite eastern shore on the property of #61 Asylum Road in Touisset.

Conditional Areas

GA5-4 All waters of the Kickemuit River and Mt. Hope Bay south of a line from the Rhode Island Department of Environmental Management range marker at the eastern extension of Patterson Avenue in the Laurel Park section of Warren to the flagpole on the opposite eastern shore on the property of #61 Asylum Road in Touisset, and north and west of a line from the eastern landward side of the Mt Hope Bay bridge abutment at Bristol Point to the Buoy "R4" channel marker located on the southerly side of the Mount Hope Bay channel, that intersects with a line from the Rhode Island Department of Environmental Management range marker located approximately midway on Touisset Point in Warren to the Rhode Island Department of Environmental Management range marker located on Common Fence Point in Portsmouth.

4 Pollution Source Survey

A. Personnel

Steve Rogers and Steve Engborg, Biologists for the RIDEM Office of Water Resources Shellfish Program, coordinated and conducted a shoreline reconnaissance of the Kickemuit River 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.

B. Survey procedures

A virtual planning meeting was arranged in which staff from RIDEM discussed the logistics for the 12-year sanitary shoreline survey of the Kickemuit River. Staff decided that this survey would be completed with minimal staffing due to Covid-19 pandemic concerns. Teams of two were assigned to survey each area over several days in August 2020. Due to limited shore access, some of the northern sections of the growing areas were accessed using Shellfish Programs Jon boat.

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 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 custody 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. The entirety of the 2020 survey was completed in three days (August 17-19, 2020).

The 2020 shoreline survey was completed under dry weather conditions (<0.5" rain in prior 24-hours). The first day of the survey (August 17th) occurred one (1) day after rain of 0.44" at Taunton Municipal Airport. An additional 0.15" of rain occurred on August 19th.

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 125 ml sterile Nalgene bottles) or other pre-sterilize bottles provided by RIDOH, after which they are stored in a cooler packed with ice. They were 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 April 2020.

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

C. Summary of Sources and Locations

Thirty-six (36) actual and potential pollution sources were identified during the 2020 shoreline survey of GA5. Eight (8) sources identified in the previous 2008 12-year survey could not be located during the 2020 survey. Twenty-one (21) sources were found to be not flowing at the time of survey. Seven (7) sources that were flowing at the time of survey were sampled. Five (5) sources had bacteria counts that exceeded 240 CFU/100 ml, and two (2) of these sources exceeded 2,400 CFU/100 ml. The locations of all

sources are shown in Figure 3 and the fecal coliform results and the flow rates for each source are shown in Table 1.

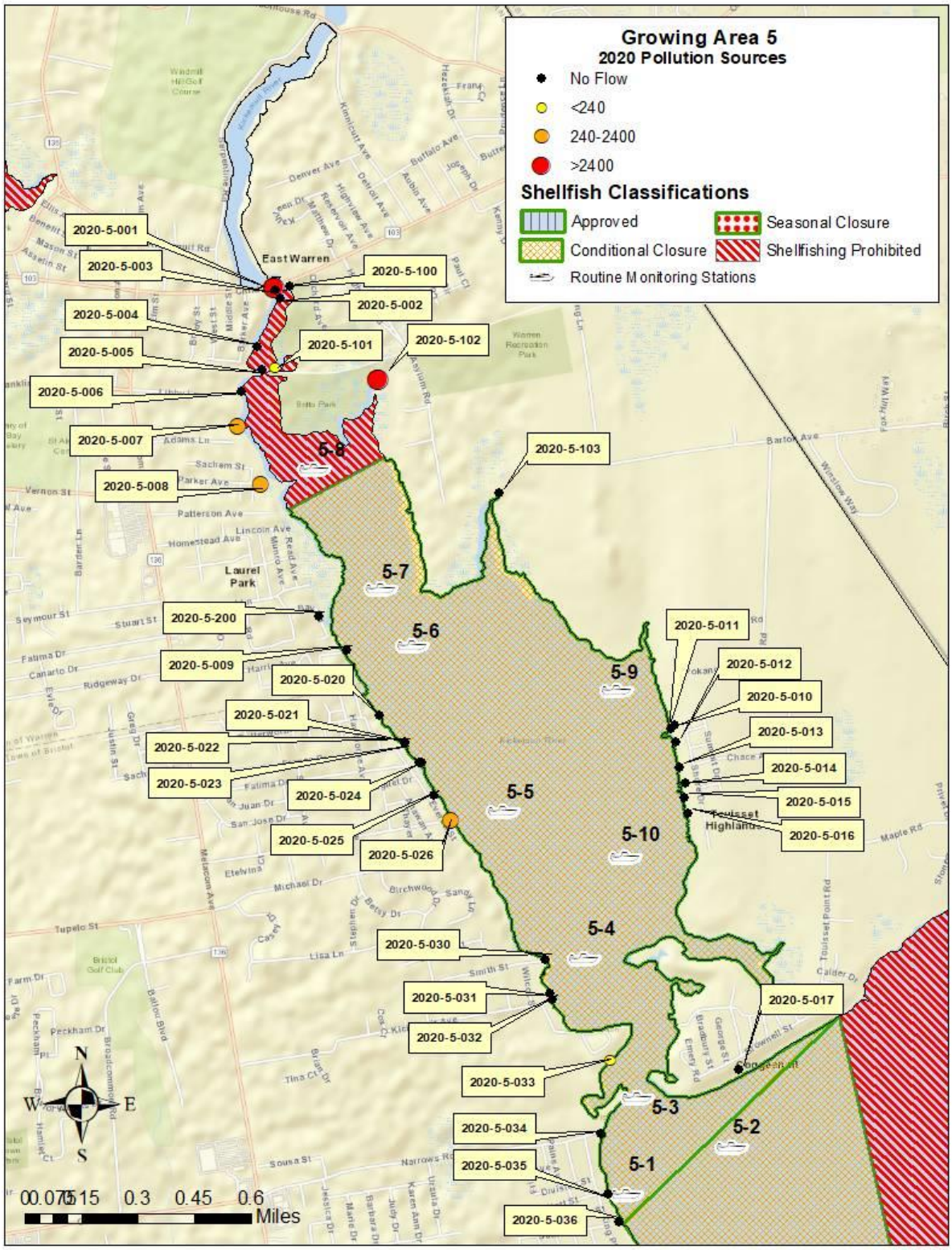

Figure 3: 2020 GA5 Shoreline Survey Sources

Table 1: 2020 GA5 Sources

Source #	Latitude	Longitude	Description and Location	Receiving Waters Classification	Actual / Potential	Direct / Indirect	2008 Results (MPN)	2020 Results (cfu/100mL)	Flow (cfs)
2020-5-001	41.72937	-71.26271	Kickemuit River freshwater source @ dam	P	A	Direct	0	6000	
2020-5-002	41.72927	-71.26268	24" RCP just south of bridge, west side	P	P	Direct	23	CNL	NF
2020-5-003	41.72896	-71.26238	4" PVC pipe at rear of elderly housing	P	P	Direct	NF	CNL	NF
2020-5-004	41.7271	-71.26357	(2) 15" PVC drains from small detention pond	P	P	Direct	NF	CNL	NF
2020-5-005	41.72622	-71.26333	18" steel pipe with capped cistern	P	A	Direct	NF	NF	NF
2020-5-006	41.72537	-71.26443	24" dia. Steel capped outfall from storm drain system	P	A	Direct	NF	NF	NF
2020-5-007	41.72406	-71.26457	Small stream from damned pond at cow farm	P	A	Direct	430	1100	Trickle
2020-5-008	41.72181	-71.2634	(2) discharges at end of Parker Ave (1) not flowing	P	A	Direct	43	1400	Trickle
5-009	41.71544	-71.25906	ASSF at end of pavement Harris Ave	CA	P	Direct	NF	CNL	NF
5-010	41.7125	-71.24222	Small stream	CA	A	Direct	23	CNL	NF
5-011	41.71239	-71.24244	3" PVC pipe out of wall into sand	CA	A	Direct	NF	CNL	NF
5-012	41.71184	-71.24218	4" PVC pipe from stone seal wall	CA	A	Direct	NF	CNL	NF

5-013	41.71089	-71.242	Groundwater stream at end of ROW	CA	P	Direct	93	NF	NF
5-014	41.71026	-71.24168	Seepage from under concrete retaining wall	CA	A	Direct	110000	NF	NF
5-015	41.70973	-71.24174	Multiple 4 - 8" PVC pipes in face of wall	CA	A	Direct	NF	NF	NF
5-016	41.70913	-71.2416	4" PVC pipe in stone seawall no evidence of flows	CA	A	Direct	NF	NF	NF
5-017	41.69925	-71.23903	12" PVC corrugated drainpipe at end of ROW	CA	A	Direct	NF	NF	NF
5-020	41.71292	-71.25738	ASSF at end of Butterworth Ave.	CA	A	Direct	NF	CNL	NF
5-021	41.71189	-71.2561	4" PVC pipe in concrete seawall	CA	A	Direct	NF	NF	NF
5-022	41.71186	-71.25607	18" CMP at end of ROW	CA	A	Direct	NF	NF	NF
5-023	41.71112	-71.25523	(2) 18" CMP at end of ROW	CA	A	Direct	230	NF	NF
5-024	41.71111	-71.25533	18" RCP unable to locate but sampled flow under boat	CA	A	Direct	75	NF	NF
5-025	41.70984	-71.25458	18" PVC corrugated drainpipe at end of ROW	CA	A	Direct	16	NF	NF
5-026	41.70887	-71.25372	18" CMP at end of ROW	CA	A	Direct	39	500	trickle
5-030	41.70351	-71.2489	18" CMP at end of Smith St. No detectable flow going into marsh but might be slowly seeping into receiving waters.	CA	A	Direct	430	NF	NF
5-031	41.70219	-71.2487	Groundwater seep under concrete ramp	CA	P	Direct	2	NF	NF

5-032	41.70196	-71.24858	ASSF at end of Kickemuit Ave	CA	A	Direct	NF	NF	NF
5-033	41.69963	-71.2456	Stream north of Narrows Road	CA	A	Direct	430	200	trickle
5-034	41.69683	-71.24611	24" RCP at end of Narrows Road	CA	A	Direct	NF	NF	NF
5-035	41.69447	-71.2457	10" CMP in seawall	CA	A	Direct	NF	NF	NF
5-036	41.6934	-71.2452	36" RCP at end of ROW	CA	A	Direct	930	NF	NF
5-100	41.7294	-71.26189	18" flared end	P	A	Direct	93	NF	NF
5-101	41.72631	-71.26267	Stream from cove outlet	P	A	Direct	23	100	11
5-102	41.72583	-71.25737	Stream through salt marsh	P	A	Direct	93	2900	NF
5-103	41.72144	-71.25122	Stream through salt marsh	CA	A	Direct	11000	NF	NF
5-200	41.71672	-71.26044	Northern outfall pipe from duel vortechnic storm drains	CA	A	Indirect	NS	NF	NF

Two sources exceeded the 2,400 cfu/100 mL threshold during the 2020 12-year survey: sources 5-001 and 5-007. Both sources flow into Prohibited classification waters. Source 2020-5-001 is the outfall of the dam that separates the freshwater upper reaches of the river at the Warren Reservoir from the tidal waters of the Kickemuit River growing area. When this source was visited in 2008, this source was not sampled due to having only a trickle flow. The 2020 survey yielded a result of 6,000 cfu/100 mL with a low flow rate of approximately 0.04 cfs at the outflow of the Warren Reservoir dam to the Kickemuit River. Source 5-001 (Figure 4) is located approximately 3,500 feet (1.07 km) upstream from the conditionally approved waters of Growing Area 5. The waters between source 5-001 at the Child Street dam and the Conditionally Approved waters of the area are classified as Prohibited. This Prohibited area acts as a dilution zone before the freshwater input of the Kickemuit River enters Conditionally Approved waters. The low flow rate and the large Prohibited zone provide adequate dilution of potential fecal coliform contamination from source 5-001 as evidenced by the results recorded at sentinel station 5-8 located in the Prohibited zone.

Figure 4: source 2020-5-001 flow over dammed reservoir at Kickemuit Reservoir.

Source 2020-5-007 (Figure 5) is a small stream that drains a pond within a cow grazing pasture located on the northwestern shore of the growing area. The stream splits the property line between the pasture located at the end of Adams Lane in Warren, RI and a 3-acre property of 113 Libby Lane in Warren, RI. The water flows from the pond into a concrete trench (Figure 5) before exiting out through a stone retaining wall and flowing across a marshy shoreline before entering the receiving waters. Source 5-007 had a fecal coliform concentration of <100 cfu/ 100 mL and a flow rate of 0.05 cfs during the 2017 triennial survey. This source had a low (trickle) flow and a fecal coliform concentration of 1,100 cfu/100 mL during the 2020 shoreline survey. This source flows into Prohibited waters approximately 1,300 feet (0.4 km) from the northern-most Conditionally Approved waters of the growing area. The low flow rates observed for this source and the dilution provided within the Prohibited zone this source discharges to are protective of the microbiological water quality of the Conditionally Approved waters of the growing

area. Given the proximity of livestock to the growing area, this source will be monitored regularly to ensure that there continues to be no impact on the fecal coliform water quality of the growing area.

Figure 5: Source 2020-5-007 a small stream exiting a grazing pasture that is bound by a concrete trench (left) and exits to the growing area through a retaining wall (right).

Source 2020-5-008 (Figure 6) is two drainpipes at the end of Parker Avenue in Warren, RI. Prior surveys documented that this source had a low (trickle) flow and a fecal coliform result of 43 mpn/100 mL (2008 survey). At the time of the 2020 survey only one of the two pipes was flowing. The flow was a trickle and fecal coliform concentration was 1,400 cfu/100 mL during the 2020 survey. This source flows into prohibited receiving water. Results of instream samples demonstrated rapid dilution with results of 100 cfu/100 ml ~20 feet north of the source and 400 cfu/100 mL ~20 feet south of the source. The Prohibited waters that this source flows into provide sufficient dilution to safeguard the fecal coliform water quality of Growing Area 5.

Figure 6: Source 2020-5-008, drainpipes at the extension of Parker Avenue, Warren, RI.

Source 2020-5-026 is an 18" diameter corrugated metal pipe located at the shoreward extension of Sherman Ave in Bristol, RI. This source flows into Conditionally Approved receiving waters. Previous surveys showed a trickle flow and 39 mpn / 100 mL in 2008. 2020 results indicated a trickle flow and a fecal coliform result of 500 cfu/100 mL. Instream samples had results of less than 100 cfu/100 mL in the receiving waters north and south of the source, demonstrating rapid dilution in the receiving waters. Source 5-026 is likely influenced by runoff since the street drainage is steeply sloped down towards the growing area. While the 2020 survey was completed during dry weather (< 0.5" rain in a 24-hour period in prior week), the survey did take place one day after 0.44" rain which may have contributed to the elevated fecal coliform result observed during the 2020 survey. Since source 5-0026 was elevated above the 240 cfu/100 mL fecal coliform threshold, it is slated for monitoring in future follow-up surveys.

The final source with elevated fecal coliform results was source 2020-5-102, a small tidal stream that flows across a marsh in the northeast corner of the growing area. This source flows into Prohibited waters. Access to this source is difficult due to the marsh being soft and muddy. The source stream is shallow, muddy, and stagnant; the stream was not flowing at the time of the 2020 survey. A fecal coliform result of 2,900 cfu/100 ml was observed during the 2020 survey, but there was no flow at the time of 2020 sampling. This source would have to flow approximately 430 feet (131 m) before entering the Prohibited waters of the growing area proper. Instream samples were taken where the tidal stream exits the marsh with results of less than 2 cfu/100 mL, demonstrating ample dilution and no impact to the water quality of the growing area.

D. Identification and Evaluation of Pollution Sources

i. Domestic Wastes/ Industrial Wastes

Public sewers service the western and northern shorelines of the growing area. The more sparsely populated eastern shoreline, which includes Touisset Highlands and Touisset Point, are dependent upon OWTS for wastewater disposal. As previously discussed, failure of septic systems in this area does not appear to be a chronic issue. A cesspool phaseout act was approved and signed into law as the "Rhode Island Cesspool Act of 2007" in June of 2008. This act requires that any cesspool located within 200 feet of the inland edge of all shoreline features bordering tidal waters be replaced by January 1, 2013, with an expedited schedule (within 1 year) for any cesspool identified as "failing" to properly handle wastewater. This 200-foot buffer would capture the homes along the shore of the Kickemuit River that are served by OWTS.

A review of OWTS complaints was conducted in March of 2021, there were no OWTS complaints within the reaches of the Kickemuit River. One complaint was filed in Warren for an overflowing septic system that is approximately 1 mile away from the Kickemuit River. Given the distance needed to reach receiving waters and the nature of the complaint, this has no impact on the growing area classification.

There are currently no RIPDES permits for sanitary or industrial discharges to the growing area.

ii. Stormwater

Stormwater from rain events and/or snow melt has been documented to negatively impact the microbial water quality of the Kickemuit River (GA5; RI DEM, 2008, 2010). During dry weather (less than 0.5" rain in prior 7 days), the waters of GA5 are not impacted by fecal coliform from local sources (RI DEM, 2008, 2010). In addition, sources in Mt. Hope Bay, such as the Taunton River and the Fall River WWTF do not negatively impact the water quality of GA5 (Rippey and Watkins, 1987; FDA, 2018). Analysis of fecal coliform in Mt. Hope Bay and the southern portion of GA5 over several tidal cycles indicated that while fecal coliform bacteria were present at levels in the hundreds of colonies per 100 ml in the Taunton River and along the Fall River shoreline, fecal coliform remained below 14 mpn/100 ml in the Kickemuit River, even under 'worst case' conditions of low tide (Rippey and Watkins, 1987). Since that study in the 1980s, numerous improvements in the Fall River WWTF and related capture of CSO discharges (Force, 2013) has led to improvements in the fecal coliform water quality of Mt. Hope Bay. A dye study conducted in 2013 demonstrated that permitted discharge from the Fall River WWTF receives at least a 10,000 to 1 dilution in the closed safety zone (shellfishing prohibited) before reaching the waters of the Kickemuit River (FDA, 2018). Simulations indicated that loss of disinfection during a wet weather flow of 50 MGD from the Fall River WWTF would receive greater than 10,000 to 1 dilution prior to reaching the Kickemuit River growing area (FDA, 2018). Therefore, distant Mt. Hope Bay fecal coliform sources are not having a major impact on water quality in the

Kickemuit River. Local sources such as the freshwater Kickemuit River and stormwater run-off negatively impact the fecal coliform water quality of GA5.

The Kickemuit River and Reservoir, which is the largest freshwater source to the tidal Kickemuit River (GA5), is listed as an impaired water body due to elevated fecal coliform concentration (RI DEM, 2018). With the exception of the Warren Reservoir (located in Massachusetts), the freshwater Kickemuit River in both RI and MA exceed water quality standards for fecal coliform bacteria. Surveys by RI DEM indicated that fecal coliform concentration in the freshwater Kickemuit increase dramatically during wet weather (RI DEM, 2006). A TMDL plan to address fecal coliform loading in the freshwater Kickemuit was completed in 2006. In order to meet water quality standards, the TMDL plan called for a 66% reduction in fecal coliform loading in the Kickemuit Reservoir region of the watershed and a 99% reduction in fecal coliform loading in the RI portion of the freshwater Kickemuit River (RI DEM, 2006).

A total of 41 storm water outfalls or other potential sources within the watershed were identified in the TMDL study (RI DEM, 2006). Roadways in the watershed, including Rt. 6 and Rt. 195, Serpentine Road, and the numerous local roads within the residential areas may also contribute bacteria to the Kickemuit (RI DOT, 2007). Impairments to the Kickemuit River and Reservoir come from a combination of point and nonpoint sources including failing or substandard septic systems, agriculture, impervious surfaces, residential areas, waterfowl/wildlife, and roadways. To date, TMDL implementation activities to restore Kickemuit River water quality have focused on improved wastewater management, phasing-out cesspools and failed septic systems, agricultural controls, and mitigation of storm water.

While the freshwater Kickemuit River itself is impaired due to elevated fecal coliform concentration, this freshwater source has a low flow rate and freshwater input during dry weather is a small fraction of the tidal volume entering the tidal Kickemuit (GA5). The large tidal exchange at the 'Narrows' results in rapid flushing of GA5 such that the growing area has a mean flushing time of approximately 1.58 days (Abdelrhman, 2005). A TMDL for Mount Hope Bay and the estuarine portion of the Kickemuit River was approved by the EPA in January 2010 (RI DEM, 2010). This study demonstrated that the tidal Kickemuit River (GA5) experiences elevated levels of fecal coliform bacteria following rain events, hence the conditional classification of this growing area. Fecal coliform reduction strategies recommended in the TMDL plan are ongoing so that the Kickemuit River can meet numeric water quality targets for all designated uses affected by bacteria pollution including shellfishing and primary and secondary contact recreational use under all weather conditions.

iii. Marinas

One (1) small marina, Senn's Marina in Warren (Touisset), is located within the growing area (ships wheel symbol in Figure 1). Shellfishing is prohibited in all waters within 25 feet of any in-water structure for docking vessels (e.g. dock, piling, floating dock, etc.).

During the survey approximately 120 boats were moored within the Kickemuit River. Roughly 78 of those boats had the capability of having a marine sanitary device aboard, with a majority being sailboats and or cabin cruiser style vessels.

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 Kickemuit and Mount Hope Bay growing areas. The closest pumpout facilities in the Sakonnet River approximately 3.5 nautical miles to the south and in Fall River, MA approximately 3 miles east of the Kickemuit River. The Bristol Harbor Master provides pump out services by boat to the GA5 growing area at least twice per week during the peak summer season.

iv. Agricultural Wastes

Approximately seventeen percent (17%) of the growing area watershed is currently used for agricultural purposes (RI DEM, 2006). A review of RI agricultural operations indicated that there are no commercial animal farms in the watershed adjacent to the growing area. A single small-scale 'hobby farm' with livestock was noted adjacent to the growing area (see source 2020-5-007 description). A TMDL of the estuarine portion of the Kickemuit River was completed in 2010 (RI DEM, 2010). This study indicated that agricultural wastes were not a major contributor to fecal coliform loading to the estuarine waters of the Kickemuit River (GA5). Therefore, agricultural waste is not a dominant source of fecal coliform to Growing Area 5.

v. Wildlife

A variety of terrestrial wildlife such as birds, raccoons, fox, deer, muskrat, and rodents that inhabit the open space lands, as well as urban and suburban lands, adjacent to the Kickemuit River, may contribute pathogens through stormwater runoff or direct deposition. No information as to the magnitude and geographic distribution of potential wildlife waste sources is available.

Marine birds and mammals are also present in the Kickemuit River. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of waterfowl it is difficult to assess their impact on water quality. The presence of marine birds is noted when collecting water samples in the growing area.

vi. Poison and Deleterious Materials

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 April 2020.

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

5 Hydrographic and Meteorological Characteristics

A. Tides

The Kickemuit River has a tidal connection with Mt. Hope Bay, and eventually Narragansett Bay, through the 'Narrows' a narrow tidal strait having high velocity tidal currents. Tides in the region are semi-diurnal and have a tidal range of approximately 3.5 feet (1 meter). The combination of high tidal range and relatively shallow depth of the Kickemuit results in a residence time of 0.79 days (minimum) to 6.25 days (maximum) and an approximately 1.58-day flushing time for the tidal Kickemuit River (Abdelrhman, 2005). The combination of a small watershed area, low flow rate of freshwater sources contributing fecal coliform to the Kickemuit and the relatively high tidal flushing rate (Abdelrhman, 2005) results in rapid dilution and flushing such that fecal coliform concentration in the growing area recovers and returns to acceptable levels several days after the wet weather and elevated fecal coliform loading ends (Rippey and Watkins, 1987; RI DEM, 2008).

The 2020 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.

B. 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 have hit Rhode Island 71 times during the last 350 years. In the summer, most precipitation results from

thunderstorms and smaller convective systems. These typically produce short-duration high-intensity precipitation events and are more localized than 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 particular concern for the growing area is the 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. Rainfall has been shown to cause water quality degradation of the waters of the Kickemuit River growing area and have necessitated the operation of this area as conditionally approved, closed following rainfall events exceeding one-half of an inch within any twenty-four hour time period.

A review of recent (2010-2020) rainfall data indicated that the area receives an average of approximately 47" of rain per year (range of 41" to 56") and the average monthly rainfall is 3.98. (Source: https://w2.weather.gov/climate/xmacis.php?wfo=box) Typically the higher rainfall events occur in the months of November through March. In addition to the above sources, the program maintains a closure document recording all the data, rainfall, and emergencies that initiated closures of Conditionally Approved areas of the Kickemuit River (GA5). Based on the recent ten years of program records, the area will receive an average of 33.1 rainfall events exceeding 0.5" per year and that the area is predicted to be in the open status for an average of 47.7% of days per year.

The dates for the 2020 12-year Kickemuit River shoreline survey were August 17th-19th 2020. August 2020 precipitation at Taunton Municipal Airport (NOAA KTAN weather station) was less than usual with 1.63" total rain for August 2020 compared to the mean August rainfall of 3.35". The following rainfall data was observed at the NOAA KTAN weather station in Taunton Massachusetts (Table 2). The Taunton weather station (NOAA KTAN) is used to measure rainfall for closure decisions in Growing Area 5.

Table 2:Observed Weather at Taunton Weather Station, days of sampling are highlighted

Date	Precipitation (Inches)	Avg. Temp (°F)	Max Temp (°F)	Min Temp (°F)
8/1/20	0	76	92	60
8/2/20	T	76.5	88	65
8/3/20	0	83	94	71
8/4/20	0.14	79	87	71
8/5/20	0	81	92	70
8/6/20	0	74	87	71
8/7/20	T	72	84	60
8/8/20	0	75	87	63
8/9/20	0	76	91	61
8/10/20	T	83	94	72
8/11/20	0	84.5	94	75
8/12/20	0	84	95	73
8/13/20	0.01	77	89	65
8/14/20	0	74	88	60
8/15/20	T	66.5	73	60
8/16/20	0.44	68.5	71	66
8/17/20	0.03	70.5	78	63
8/18/20	0.15	73.5	86	61
8/19/20	T	67.5	81	54
8/20/20	0	66.5	83	50
8/21/20	0	72	87	57
8/22/20	0.09	76.5	91	62
8/23/20	0	75	91	59
8/24/20	0.06	79.5	91	68
8/25/20	T	80.5	92	69
8/26/20	0	66	78	54
8/27/20	0.42	65	75	55
8/28/20	0	72.5	84	61
8/29/20	0.29	69	77	61
8/30/20	0	65	81	49
8/31/20	0	61.5	77	46

C. Winds/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 proximity 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 7- to 10-day 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 variation in daily weather patterns. Seasonally, the average air temperature ranges from a low of 30.1 F (-1.1 C) during January to a maximum of 74.6 F (23.7 C) during July.

Daily winds are variable throughout the year, but a general pattern of NW winds in winter and SW winds during summer prevails. Along the coast there is a daily land-breeze, sea-breeze patterns during the summer months.

D. River Discharges

There are no direct discharges of any named rivers or streams other than the freshwater Kickemuit River to the growing area. There is no gauge station on the Kickemuit River. Flow over the lower Kickemuit Dam (source 5-001) was a low during 12-year surveys, with a trickle flow in 2008 and a flow rate of only 0.04 cfs in 2020. There are several small streams noted in the survey and identified in Table 1 but none of these streams had significant flow to the growing area.

6 Water Quality Studies

A. Overview

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, 2019). 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 to maintain certification of these waters for shellfish harvesting for direct human consumption.

Growing Area 5 (the Kickemuit River) is a conditionally approved area, that closes for 7 days following a 0.5" or greater rainfall within a 24-hour 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 open to shellfish harvesting.

Water samples are collected 1-2 feet below the water surface (using 125mL sterile Nalgene bottles) 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. Since June 2012, RIDOH has analyzed samples using the mTEC membrane filtration method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of the most recent annual evaluation of these data is below.

B. RIDEM Shellfish Program Monitoring

HIGHLIGHTS

*** Sampled 9X during 2020 season.**
*** Statistics represent recent 15 dry-weather samples collected 8/20/2019 to 4/12/2021 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 4/19/2021.**

COMMENTARY

The conditionally approved Kickemuit River (Growing Area 5) was sampled nine times during 2020; a deviation from the usual 12 samples per year. Monitoring was limited during spring 2020 due to Covid-19. In addition, October 2020 was a wet month in the area, with 5.9" of rain compared to an October long-term mean level of 4.3"at the Taunton Airport (KTAN) weather station. The wet October 2020 weather resulted in the area being closed 18.5 of 31 days in the month. Of these, there were only five business days on which growing area was in the open status and the laboratory was available to analyze samples. The area was also sampled 9 times during 2019 mainly due to wet weather. This resulted in a moderately reduced number of samples (9 vs. the usual 12) collected during both 2020 and 2019. Note that samples were not collected in six of last 15 months (wet in Oct-Dec 2019, Covid preventing sampling for April 2020, July 2020, wet Oct 2020). Because of this, the sampling window for calculation of 2020 compliance statistics was extended through April 2021.

The Kickemuit River growing area (GA5) was sampled 15 times during 8/20/2019 through 4/12/2021. All samples were collected during dry weather (<0.5" rain in prior 7 days) when the area was in the open status. 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. Improved January fecal coliform water quality results were documented during January 2017 through January 2020 such that this seasonal (January) closure was removed in the May 2020 reclassification. Therefore, January 2021 results were included in calculation of the 2020 compliance statistics. The 2020 statistical review demonstrated that all conditionally approved stations in the growing area are in program compliance. The single Prohibited station (station 5-8) located near the dominant freshwater source to the Kickemuit River also had acceptable water quality. The 2020 statistical review

demonstrated that the Kickemuit River growing area is properly classified and that all conditionally approved stations are in program compliance.

RECOMMENDATIONS

*** All stations are in program compliance since the removal of the seasonal (January) closure.**

*** No other recommendations based on the 2020 review of monitoring data.**

Table 3: Growing Area 5 (Kickemuit River) fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA5

Recent 15 observations while the area is in the open status, all dry weather. (8/20/2019 to 4/12/2021; all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
5-1	CA	15	3.8	6.7
5-2	CA	15	3.2	0.0
5-3	CA	15	3.5	6.7
5-4	CA	15	2.9	0.0
5-5	CA	15	3.0	0.0
5-6	CA	15	2.5	6.7
5-7	CA	15	3.4	6.7
5-8	P	15	3.4	6.7
5-9	CA	15	3.2	6.7
5-10	CA	15	2.6	0.0

C. Sampling Plan and Justification

Growing Area 5 is potentially influenced by non-point sources of pollution. However, the Kickemuit River growing area is sampled in tandem with the adjacent Mt. Hope Bay growing area. The Mt. Hope Bay growing area (GA17) is potentially impacted by point sources (the Fall River WWTF), so GA17 is monitored monthly. Therefore, the Kickemuit River growing area (GA5) is sampled monthly (12 times per year), exceeding NSSP requirements for monitoring conditional areas potentially impacted by only non-point sources. The GA5 conditional area is monitored when in the Open status and the most recent 15 observations taken while in the Open status are used for statistical evaluation.

Water samples are collected at ten (10) monitoring stations throughout the growing area (Figure 1). Water quality monitoring station locations (Figure 1) and number of stations were selected to be representative of all conditions in the growing area. One station (5-8) is located in the prohibited waters at the northern end of the growing area, while the other nine stations are in the conditionally approved portions of the growing area. The station (5-8) in the Prohibited waters most affected by freshwater input is used to demonstrate that the Prohibited zone is protective of water quality in the Conditionally Approved areas of Growing Area 5.

D. RIDEM TMDL Studies

Several studies have documented the increase in fecal coliform loading to the Kickemuit River during wet weather. The Kickemuit River and Reservoir, which is the largest freshwater source to the tidal Kickemuit River (GA5), is listed as an impaired water body due to elevated fecal coliform concentration (RI DEM, 2018). With the exception of the Warren Reservoir (located in Massachusetts), the freshwater Kickemuit River in both RI and MA exceed water quality standards for fecal coliform bacteria. Surveys by RI DEM indicated that fecal coliform concentration in the freshwater Kickemuit increase dramatically during wet weather (RI DEM, 2006). A TMDL plan to address fecal coliform loading in the freshwater Kickemuit was completed in 2006. In order to meet water quality standards, the TMDL plan called for a 66% reduction in fecal coliform loading in the Kickemuit Reservoir region of the watershed and a 99% reduction in fecal coliform loading in the RI portion of the freshwater Kickemuit River (RI DEM, 2006).

A total of 41 storm water outfalls or other potential sources within the watershed were identified in the TMDL study (RI DEM, 2006). Roadways in the watershed, including Rt. 6 and Rt. 195, Serpentine Road, and the numerous local roads within the residential areas may also contribute bacteria to the Kickemuit (RI DOT, 2007). Impairments to the Kickemuit River and Reservoir come from a combination of point and nonpoint sources including failing or substandard septic systems, agriculture, impervious surfaces, residential areas, waterfowl/wildlife, and roadways. To date, TMDL implementation activities to restore Kickemuit River water quality have focused on improved wastewater management, phasing-out cesspools and failed septic systems, agricultural controls, and mitigation of storm water.

While the freshwater Kickemuit River itself is impaired due to elevated fecal coliform concentration, this freshwater source has a low flow rate and freshwater input during dry weather is a small fraction of the tidal volume entering the tidal Kickemuit (GA5). The large tidal exchange at the 'Narrows' results in rapid flushing of the Conditionally Approved waters of GA5 such that the growing area has a mean flushing time of approximately 1.58 days (Abdelrhman, 2005). A TMDL for Mount Hope Bay and the estuarine portion of the Kickemuit River was approved by the EPA in January 2010 (RI DEM, 2010). This study demonstrated that the tidal Kickemuit River (GA5) experiences elevated levels of fecal coliform bacteria following rain events, hence the conditional classification of this growing area. Fecal coliform reduction strategies recommended in the TMDL plan are ongoing so that the Kickemuit River can meet numeric water quality targets for all designated uses affected by bacteria pollution including shellfishing and primary and secondary contact recreational use under all weather conditions.

In 20212 a Bristol-Kickemuit River Watershed Plan was developed to address current and future pollutants, particularly nonpoint sources, to improve water quality of the Kickemuit River (RI DEM et al., 2012). This report was developed with the Massachusetts DEP because the Kickemuit watershed spans portions of both Rhode Island and Massachusetts. The Watershed Plan utilized TMDL studies and other information to formalize steps required to achieve the end goal of improved water quality. Key steps included the needed to improve stormwater and wastewater management practices and to encourage low impact development in the watershed (RI DEM et al., 2012).

A feasibility study on the removal of the Upper and Lower Kickemuit River dams is currently (2020-2021) in progress (Bristol County Water Authority, 2020). The Kickemuit Dams (upper and lower dams) were built in 1961 to create the Warren Reservoir as a water supply for the surrounding communities and to protect the reservoir from saltwater intrusion from the tidal Kickemuit River. The resulting impoundment of the Warren Reservoir has a capacity of approximately 140 acre-feet of freshwater (Bristol County Water Authority, 2020). Due to the poor water quality (phosphorous and fecal coliform impairments) of the upper, freshwater portion of the river this reservoir is no longer in use as a drinking water supply. In 2012 RIDEM inspected the dams and in 2014 wrote a Notice of Violation due heavily vegetated banks on the dam and partially clogged intake and outlet channels (Bristol County Water Authority, 2020). Costs to rehabilitate the dams were prohibitive and removal of the dams is recommended because it will improve anadromous fish (river herring) and other wildlife habitat. A model study has indicated that average flow through the system will not be changed after dam removal, but that after dam removal peak flow rate at the upper Kickemuit Dam will increase approximately 3-fold immediately following 50-year storms (6.9 inches rain; Bristol County Water Authority, 2020). Given that the growing area has a low rainfall closure threshold of 0.5" rain in 24-hours and an extensive Prohibited zone area between the lower dam and the conditionally approved waters of the growing area, it is not expected that dam removal will alter the conditional management plan for the Kickemuit River growing area. The Kickemuit Dam removal project was in initial planning phases in early 2021. The RI DEM Shellfish Program will continue to monitor the Kickemuit Dam

removal plan and will evaluate potential impacts on the microbial water quality of the growing area.

7 Interpretation of Data

A. Effects of Meteorological and Hydrographic Conditions

As described above and as documented in the Kickemuit River TMDL, fecal coliform loading to the growing area via shoreline sources such as stormwater increases during wet weather. The Kickemuit TMDL study and analysis of DEM Shellfish Program fecal coliform data (summarized in the Kickemuit River Conditional Area Management Plan) has indicated that the waters of the growing area exceed NSSP criteria when excess of 0.5" rain falls in the watershed. The current management of the Kickemuit River growing area as a conditional area with a 0.5" rain, 7-day closure is protective of public health. Annual reviews demonstrate that the Kickemuit River growing area meets NSSP criteria when it is in the open status.

8 Recommendations

A. Monitoring Schedule

The current monitoring schedule of one sample per month exceeds NSSP requirements for Conditionally Approved areas non impacted by WWTF point sources. The current monitoring schedule is adequate for tracking water quality changes and maintaining the correct classification of the growing area.

B. Comments

Annual statistical evaluation of fecal coliform data demonstrate that the area conforms to NSSP requirements as a Conditionally Approved growing area when the area is in the open status. There are no recommendations for changes in classification.

C. Legal Description

Prohibited Area

GA5-1 The northern portion of the Kickemuit River north of a line from the Rhode Island Department of Environmental Management range marker located at the eastern extension of Patterson Avenue in the Laurel Park section of Warren to the flagpole on the opposite eastern shore on the property of #61 Asylum Road in Touisset

Marina Closures

All waters within 25 feet of any in water structure for docking vessels (e.g. dock, piling, floating dock, etc.) at the following marina facility: Senns Marina in Warren (Touisset).

Conditional Area Closure

GA5-4 All waters of the Kickemuit River and Mt. Hope Bay south of a line from the Rhode Island Department of Environmental Management range marker at the

eastern extension of Patterson Avenue in the Laurel Park section of Warren to the flagpole on the opposite eastern shore on the property of #61 Asylum Road in Touisset, and north and west of a line from the eastern landward side of the Mt Hope Bay bridge abutment at Bristol Point to the Buoy "R4" channel marker located on the southerly side of the Mount Hope Bay channel, that intersects with a line from the Rhode Island Department of Environmental Management range marker located approximately midway on Touisset Point in Warren to the Rhode Island Department of Environmental Management range marker located on Common Fence Point in Portsmouth.

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Growing Area 6
East Passage of Narragansett Bay
2020 Annual Update

Table of Contents

Figures

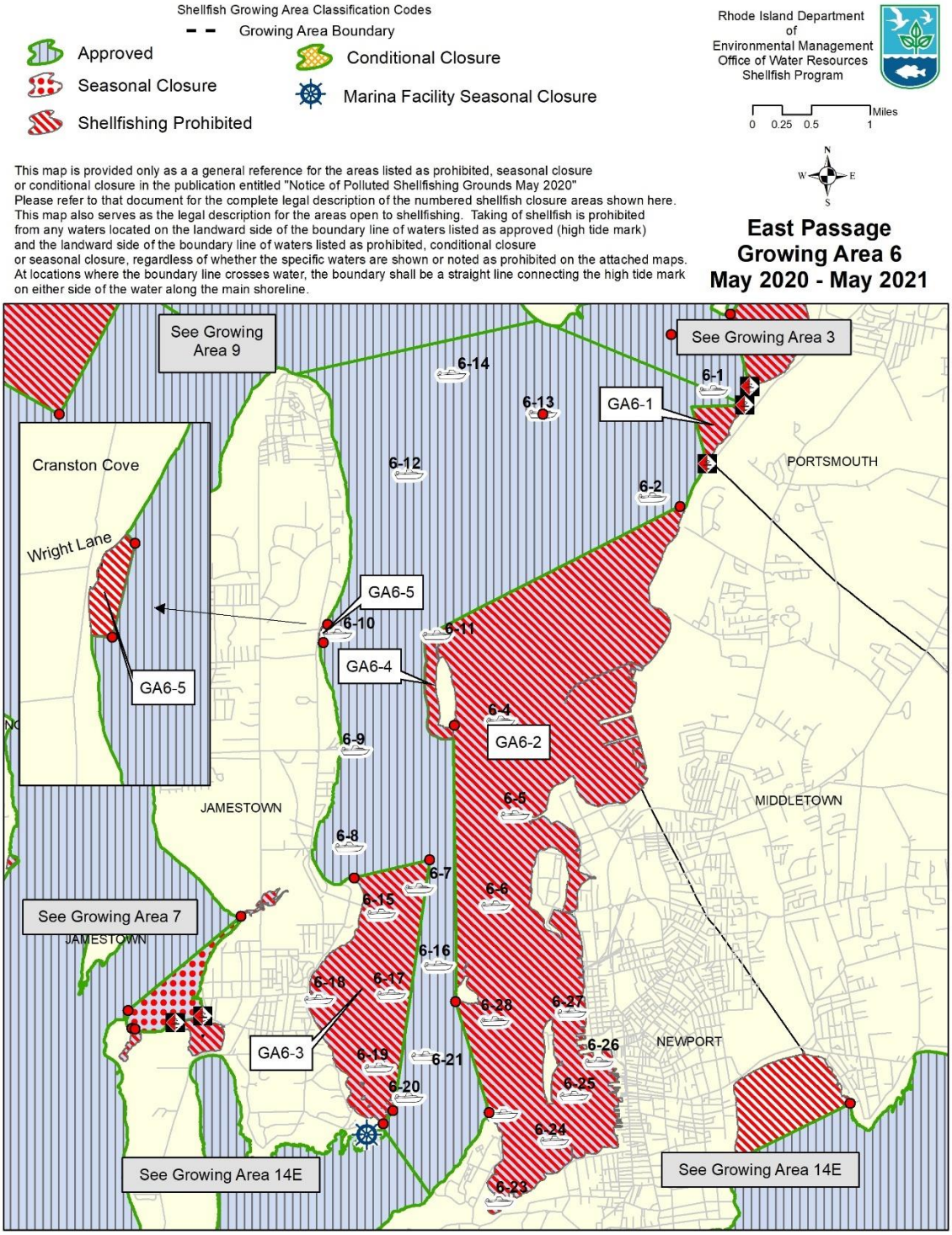
Tables

1. Introduction

An annual update survey of the East Passage (GA6) was completed during 2020. A twelve (12) year sanitary shoreline survey of the East Passage Growing Area 6 (Figure 1) was last conducted in 2015. Triennial surveys were completed in 2009, 2012 and 2018 and annual updates were completed in the intervening years.

The 2015 12-year survey identified seventy-two (72) actual or potential sources. Fifty-four (54) of the sources were not actively flowing at the time of the shoreline survey with the remaining eighteen (18) having flows warranting sampling. In 2015 six (6) sources had bacteria counts greater than 2,400 cfu/100ml warranting follow-up sampling. Three (3) of those sources discharge to prohibited classification waters and were not re-sampled as part of the 2016 annual update. None of the three (3) sources requiring a follow-up were flowing during the 2016 annual update survey. Sources (6-001 and 6- 003), which discharge into the Prohibited area near Cranston Cove in Jamestown (GA6-5 closure) were re-inspected in 2016. These two (2) sources showed no flow during 2016 which was a drier than normal year.

Figure 1: 2020-2021 Shellfish Classification Map of GA6 with Routine Monitoring Stations



In 2017, a follow-up visit was 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 (Table 1). 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, which did not require additional follow-up sampling. Source 2017-6-001 has had historically elevated bacteria levels (higher than 2017 sample results) and has a small closure around the source, thus there is enough dilution area for the source before reaching approved growing waters.

2. Pollution Source Survey

No follow up source sampling was required to complete the 2020 annual update because sources sampled during the 2018 12-year survey were either not flowing or had low fecal coliform results (Table 1). Of the six (6) sources that had bacteria results >2,400 CFU/100 mL during the 2015 12-year sanitary survey, three (3) were found to have no flow in 2018, and the remaining three (3) could not be located or no longer exist. Those sources that were previously found to have been flowing had results well below the 2,400 CFU/100 mL threshold (Table 1).

Table 1: GA6 Sources sampled during the 2018 12-year survey. No follow-up sampling was required for the 2020 update.

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

3. Marinas and Mooring Areas

There are thirty-five (35) marinas with more than 1,700 slips and moorings located within the waters of the East Passage growing area, the majority of which are within the Newport and Jamestown harbor areas. All waters surrounding the marina proper are classified as prohibited with sufficient dilution in adjoining water to be protective of shellfish harvest.

Calculations to determine adequacy of this closure zone are contained in the program's permanent files in the report entitled "Evaluation of Waters Adjacent to Marinas: Marina Dilution Analysis Background, June 2017, RIDEM" and is available for review. Mooring areas were noted and where adjacent to existing marinas such as in Newport and Jamestown harbors they are included in the boat counts. Individual moorings were evaluated for their potential to impact approved shellfish waters.

4. Waste Water Treatment Facilities

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 onsite waste water treatment systems (OWTS). There are currently two municipal WWTFs that discharge to Growing Area 6: The City of Newport and the Town of Jamestown.

The review of the City of Newport's WWTF performance data report for 2020 indicated that the average flow from the treatment plant was 7.68 MGD well under the 13.1 MGD permitted level. The Newport facility had no effluent fecal coliform exceedances during 2020. The Newport WWTF has recently increased their permitted flows from 19.7 to 30 MGD and is in the process of 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 Jamestown WWTF discharges to the deep waters of the East Passage (GA6) near the Newport Bridge. A review of DMR data for the Town of Jamestown WWTF showed that there were no reported violations of monthly average flow during 2020. The average monthly flow was 0.26 MGD well within the permitted flow of 0.73 MGD.

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 April 2020.

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

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

Water samples are collected at twenty-seven (27) monitoring stations throughout the growing area. Ten (10) of the stations are in Approved waters and seventeen (17) stations are located in prohibited waters. The stations in prohibited waters are predominantly in the extensive marina and mooring areas of Newport Harbor and Jamestown Harbor. Water samples are collected and handled following the Programs SOP (available in the Program's permanent files). Briefly, samples are collected 0.5 m (1.5 feet) below the water surface (using 4-ounce sterile Nalgene bottles) after which they are stored in a cooler packed with ice. Samples are then transported to the Rhode Island Department of Health Laboratories for analysis. Since June 2012, RIDOH has analyzed samples using the mTEC membrane filtration method; all samples used to calculate compliance statistics for GA4 were analyzed by the mTec method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

HIGHLIGHTS

*** Sampled 6X during 2020 (1 wet weather, 5 dry weather).**
*** Statistics represent recent 30 samples collected during wet (n = 11) and dry (n = 19) conditions during 2/2/2016 to 11/9/2020.**
*** All samples analyzed by the mTEC method.**
*** All approved stations are in compliance.**
*** Data run 12/2/2020.**

COMMENTARY

The East Passage (Growing Area 6) was sampled six times during 2020, 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=11) and dry (n=19) weather conditions. All approved stations met NSSP criteria. In addition, 10 of 11 stations located in Newport Harbor which are classified as prohibited met criteria. This improvement in Newport Harbor fecal coliform water quality likely reflects recent CSO and stormwater control upgrades completed by the City of Newport. Results of the 2020 statistical evaluation indicate that all approved stations are in program compliance and that the area is properly classified.

RECOMMENDATIONS

*** Continue to collect and evaluate Newport Harbor fecal coliform data for potential reclassification of outer Newport Harbor.**
*** No other recommendations based on the 2020 review of monitoring data.**

RIDEM SHELLFISH GROWING AREA MONITORING: GA6

Table 2: GA6 Fecal coliform compliance statistics for 2020.

Recent 30 all weather.
(2/2/2016 to 11/9/2020; all mTEC, 11 wet and 19 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
6-1	A	30	2.2	3.9
6-2	P	30	2.2	4.3
6-4	P	30	2.3	5.8
6-5	P	30	2.4	5.0
6-6	P	30	2.2	3.5
6-7	P	30	2.2	4.0
6-8	A	30	2.0	2.4
6-9	A	30	2.1	3.5
6-10	A	30	2.1	2.9
6-11	P	30	2.1	3.7
6-12	A	30	2.2	4.4
6-13	A	30	2.2	3.5
6-14	A	30	1.9	2.0
6-15	P	30	2.3	5.1
6-16	A	30	2.2	4.7
6-17	P	30	2.1	2.8
6-18	P	30	2.1	3.6
6-19	P	30	2.2	4.2
6-20	A	30	2.1	3.6
6-21	A	30	2.0	2.6
6-22	P	30	2.6	6.2
6-23	P	30	2.6	5.8
6-24	P	30	3.1	10.9
6-25	P	30	3.8	16.2
6-26	P	30	6.6	34.0
6-27	P	30	3.0	9.6
6-28	P	30	2.2	3.6

6. Conclusions and Recommendations

The 2020 annual update demonstrated that all monitoring stations in the growing area meet NSSP criteria while in the open status. The 2020 review also documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. Fecal coliform water quality in outer Newport Harbor has shown improvements in recent years, likely in response to upgrades in CSO and stormwater control made by the City of Newport. Continued monitoring will help to establish whether improvements in Newport Harbor water quality will continue to the point of a possible reclassification of outer Newport Harbor from prohibited to conditionally / seasonally approved.

Growing Area 6 (GA6) includes an extensive area that was formerly used by the US Navy as the headquarters for the US Atlantic Fleet Cruiser-Destroyer Force and the Naval Surface Group Four. This large military operation included a 6-mile stretch of shoreline and several thousand acres of facilities adjacent to GA6 extending from Newport to Portsmouth and the Gould Island portion of Jamestown. Naval activity in the area included fuel storage depots, training facilities and a torpedo production and testing facility on Gould Island. The US Navy torpedo production and other industrial facilities were largely decommissioned in 1973-74, but limited US Navy operations remain in the Newport-Middletown area.

RI DEM shellfish closure 6-2 (Naval operations area in Newport and Middletown) and closure 6-4 (Gould Island) are in place to prohibit shellfish harvest in areas that may have nearshore sediments that were contaminated by the past naval-industrial operations. In 2018 and 2019 RI DEM received new data on the levels of metals, PAH and PCB contaminants in the sediments in nearshore waters surrounding the former torpedo production and testing facility at Gould Island. Sediments from the northeast corner of the island (near the former torpedo production facility) and from the west side of the island (former nearshore industrial incinerator ash disposal site) were shown to have metals, PAH and PCB levels that were similar to those found in marine sediments adjacent to industrial sites. Prior to 1980 a closure of waters within 500 feet of the shore of Gould Island was in effect. Limited data on the distribution of sediment metals, PAHs and PCBs and the depth contours around the island indicate that a similar 500-foot closure zone around Gould Island will be protective of public health. Accordingly, a change in classification for the nearshore waters within 500 feet of Gould Island to Prohibited (Closure 6-4) was implemented in May of 2020.

Simultaneous with the change in closure 6-4 (Gould Island), the configuration of closure 6-2 (former Naval operations area in Newport and Middletown) was revised. The northwest boundary of closure 6-2 (formerly the day marker at Halfway Rock) was moved southward to the northern end of the Gould Island torpedo testing pier, connecting with the Gould Island closure (Closure 6-4). This resulted in a reclassification of 559 acres at the northern edge of closure 6-2 from Prohibited to Approved. This southward shift in the northern boundary of closure 6-2 resulted in a contiguous Prohibited zone encompassing the former naval-industrial operation on both the eastern (closure 6-2) and western (Gould Island, closure 6-4) portions of GA6. This reconfiguration and reclassification (Figure 1) was implemented in May 2020 to protect public health and provide easier line demarcation and enforcement.

Growing Area 7: West Passage

2020 Annual Update

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A. Introduction

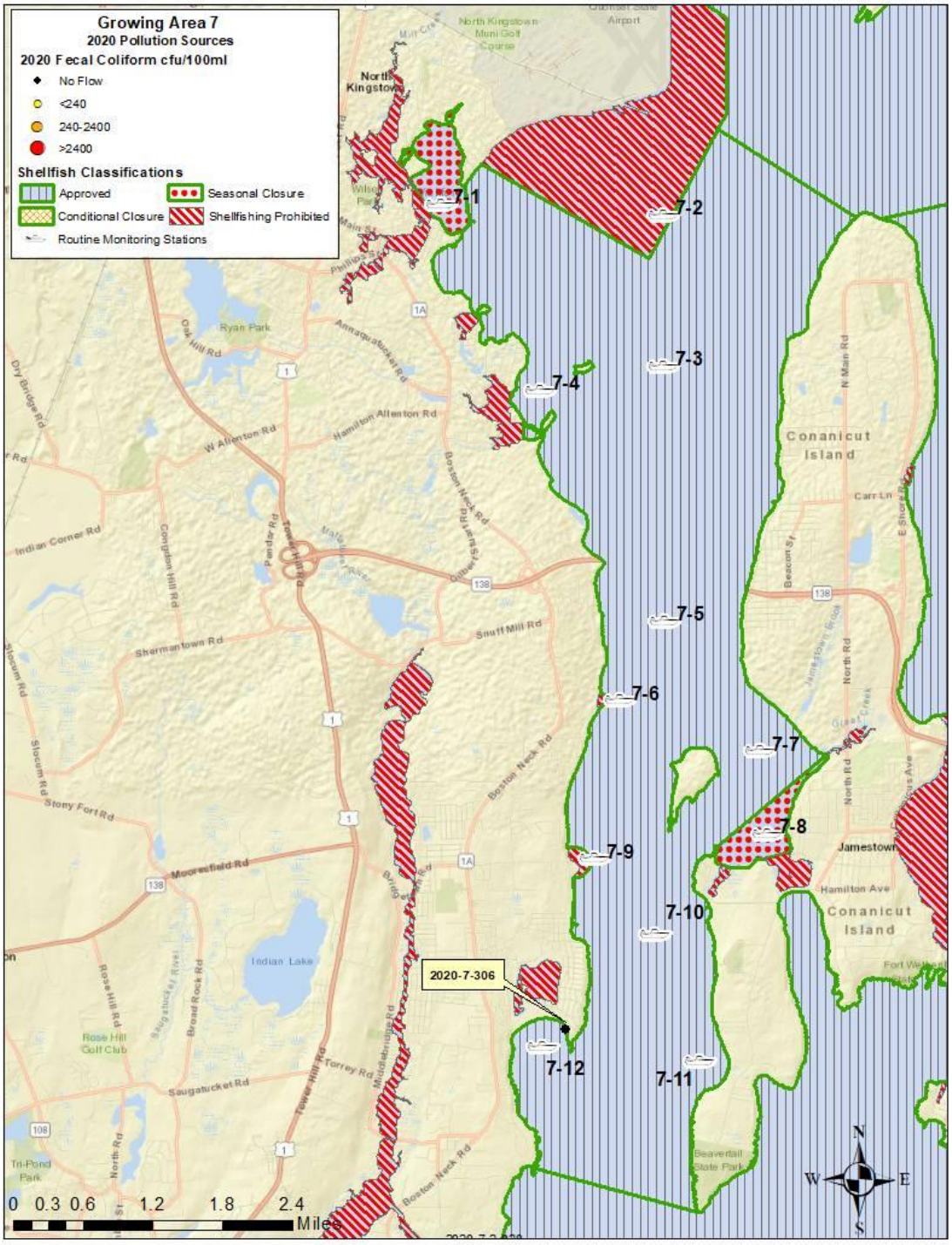
An annual update of the West Passage growing area (GA7) was completed during 2020. The West Passage of Narragansett Bay (Growing Area 7) is presently comprised of sections classified as approved, seasonally approved and prohibited for shellfishing. Six (6) distinct areas of this growing area are prohibited to shellfishing: Wickford Cove (GA7-2), Bissel Cove (GA7-3), a portion of the upper West Passage abutting the Quonset Point area (GA7-1), the area around the docks at the University of Rhode Island's Bay Campus (GA7-4), and Sheffield Cove and Fox Hill Pond (GA7-7 and GA7-8) in Jamestown. In addition, the smaller upland waters landward of the green assessed line are also delineated as prohibited as shown on the GA7 classification map (Figure 1). There are two seasonally closed areas: one in outer Wickford Harbor including Fishing Cove (GA7-6), and the other in the Dutch Harbor- West Ferry (GA7-5) area of Jamestown.

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

B. 2020 Shoreline Survey

During the 2020 annual update one (1) source was investigated. Source 2020-7-306 when sampled in 2016 had a result of 8,000 cfu/100 mL, when visited during the 2020 survey the source had no flow. Due to the Covid-19 pandemic, staff had limited abilities to visit and re-sample all moderately elevated sources. Sources that warranted follow up sampling from the 2019 triennial survey are scheduled to be re-sampled in the 2021 annual update survey.

Figure 1: 2020 Shoreline Survey Sources



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 April 2020.

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 NSSP standards for fecal coliform concentration in Approved waters (see Table 2 for the 2020 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) indicated that there were no fecal coliform violations during 2020. The facility had a reported avg flow of 0.54 MGD, well below their permit of 1.78 MGD. 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, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures, April 2020 update (copy in the Program's permanent file).

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

The West Passage of Narragansett Bay (Growing Area 7) is monitored six times per year following the systematic random sampling schedule indicated by the NSSP for areas not subject to adverse pollution conditions (no point sources). The microbial water quality of GA7 is assessed by monitoring fecal coliform concentration at 13 monitoring stations located in the growing area (Figure 6).

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

HIGHLIGHTS

*** Sampled 6X during the 2020 season.**
*** For approved stations, statistics represent recent 30 samples collected during wet (n = 17) and dry (n = 13) conditions during 12/9/2015 or 5/10/2016 to 9/29/2020.**
*** For seasonally approved stations 7-1 and 7-8, statistics represent recent 15 samples collected 2/23/2016 to 4/16/2020 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 12/2/2020.**

COMMENTARY

The West Passage (Growing Area 7) was sampled six times during 2020 with two wet weather and four dry weather samples collected during 2020. The recent 30 samples used in the 2020 statistical evaluation of approved stations were collected during 12/9/2015 or 5/10.2016 to 9/29/2020 and included samples collected during wet (n=17) and dry (n=13) weather conditions. Statistics for seasonally approved stations 7-1 and 7-8 were calculated based on the recent 15 samples (10 wet weather, 5 dry weather) collected when the station was in the open status.

Results of the 2020 statistical evaluation demonstrated that all approved stations are in program compliance. 2020 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. Station 7-1A in the prohibited area in Mill Cove (inner Wickford Harbor) was added in 2018 to assess water quality changes in response to recent wastewater treatment upgrades in the Wickford area.

RECOMMENDATIONS

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

Table 1: 2020 Statistical Summary for GA 7

RIDEM SHELLFISH GROWING AREA MONITORING: GA7

Recent 30 all weather.
(12/9/2015 or 5/10/2016 to 9/29/2020, all mTEC, 17 wet and 13 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
7-1	SA	30	4.1	15.6
7-1A**	P	15	24.5	178.0
7-2	P	30	1.9	2.0
7-3	A	30	2.3	5.2
7-4	A	30	3.1	9.6
7-5	A	30	2.1	3.4
7-6	A	30	2.0	2.0
7-7	A	30	2.0	2.4
7-8	SA	30	1.9	2.0
7-9	P	30	2.0	2.4
7-10	A	30	2.0	2.6
7-11	A	30	2.0	2.0
7-12	A	30	2.3	5.3

****** new station 7-1A added for Mill Cove, Wickford Harbor in 2018; number of observations is low (n= 15) and insufficient data to calculate representative statistics for compliance.

Recent 15, when OPEN
(2/23/2016 to 4/16/2020, all mTEC, 10 wet and 5 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
7-1	SA	15	2.5	0.0
7-8	SA	15	1.9	0.0

G. Summary and Recommendations

The 2020 annual evaluation of the West Passage (GA7) shellfish growing area demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. In addition, the WWTF in the growing area was shown to be operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform collected while the conditionally approved (seasonal) area was in the open status indicated that all approved and seasonally approved stations met NSSP criteria and are in compliance.

The 2020 annual review demonstrated that the West Passage growing area (GA7) is in program compliance and is properly classified. No classification changes are recommended.

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

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1. Introduction

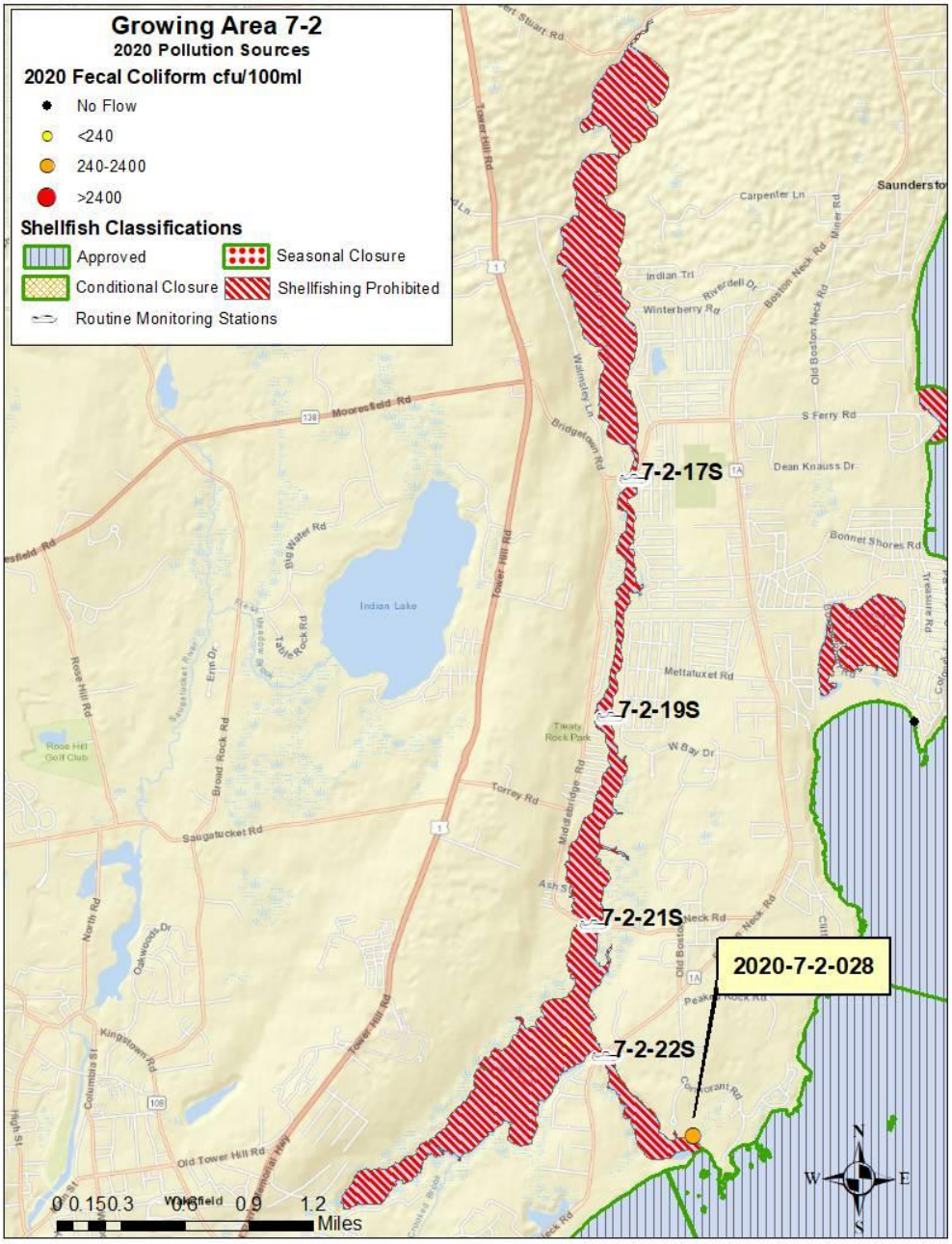
All waters of the Narrow River, Growing Area 7-2 have been classified as prohibited to shellfishing since August 28, 1979 due to elevated fecal coliform concentration. Because the area has been classified as prohibited to shellfishing for decades, a shoreline survey of the growing area has not been completed 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 Rhode Island Sound (GA14). In addition, DEM Shellfish staff regularly sample four stations in the Narrow River to track changes in fecal coliform concentration. Follow up source sampling was completed in July of 2019 and 2020.

2. 2019 and 2020 Shoreline Survey of Lower River

A shoreline survey of the southernmost portion of the Narrow River (GA 7-2) was completed on July 1st, 2019 by DEM Shellfish staff. The area surveyed is approximately 4,500 feet of tidal river length extending from the crossing of Route 1 at Sprague Bridge south to where the Narrow River joins RI Sound (Figure 1). The area surveyed comprises approximately 39 acres of Narrow River tidal waters currently classified as prohibited to shellfish harvest. The area is a popular recreational site visited by small boats (kayaks, skiffs) during the warmer months of the year. The tidal waters are surrounded by a fringing *Spartina*-dominated saltmarsh and upland forest with some residential housing. There are approximately twenty (20) private residences and two (2) beach clubs within 1,500 feet of the surveyed

area of the Narrow River. Based on sampling from 2018-2019, follow up sampling of two sources was warranted in 2020.

Figure 1: Site examined during shoreline survey of the lower Narrow River (GA7-2) during 2020



Twenty-seven (27) potential sources were identified with seven (7) sources found to be dry during the 2018 survey. No large-flow sources were identified, with most potential sources having only a trickle of flow on the survey dates. Nineteen (19) of the twenty (20) sources found to have some flow, had fecal coliform results of less than 240 cfu/100 ml. Source 7-2-028 was the only source resampled in 2019 and in 2020. Source 2020-7-2-306 was revisited in 2020 however there was no flow at the time of the 2020 survey.

Source 7-2-028 is a small seep (approximately 1 foot wide by 1 inch deep) flowing from an upland *Phragmites* spp. stand and across a small beach. In 2019 this source had a fecal coliform concentration of 580 cfu/100 ml, when followed up in 2020, this source had a fecal coliform concentration of 1,000 cfu./100 mL and a flow of 0.077 cfs. The entirety of GA7-2 Narrow River is classified as prohibited and the low flow rate and the strong tidal flushing in the waters that this source discharges to are expected to minimize the impact of this source on the fecal coliform water quality of the growing area.

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

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

Source ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Description and Location	Receiving Waters Classification	Act/ Pot	Dir/ Indir	2019 Results cfu/100mL	2020 Results cfu/100mL	Flow (cfs)
2020-7-2-028	41.44351	-71.441625	GW stream, through phragmites, flows across sand beach into receiving waters	Prohibited	A	D	581	1000	0.077

3. Water Quality Monitoring

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

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures, April 2020 update (copy in the Program's permanent file).

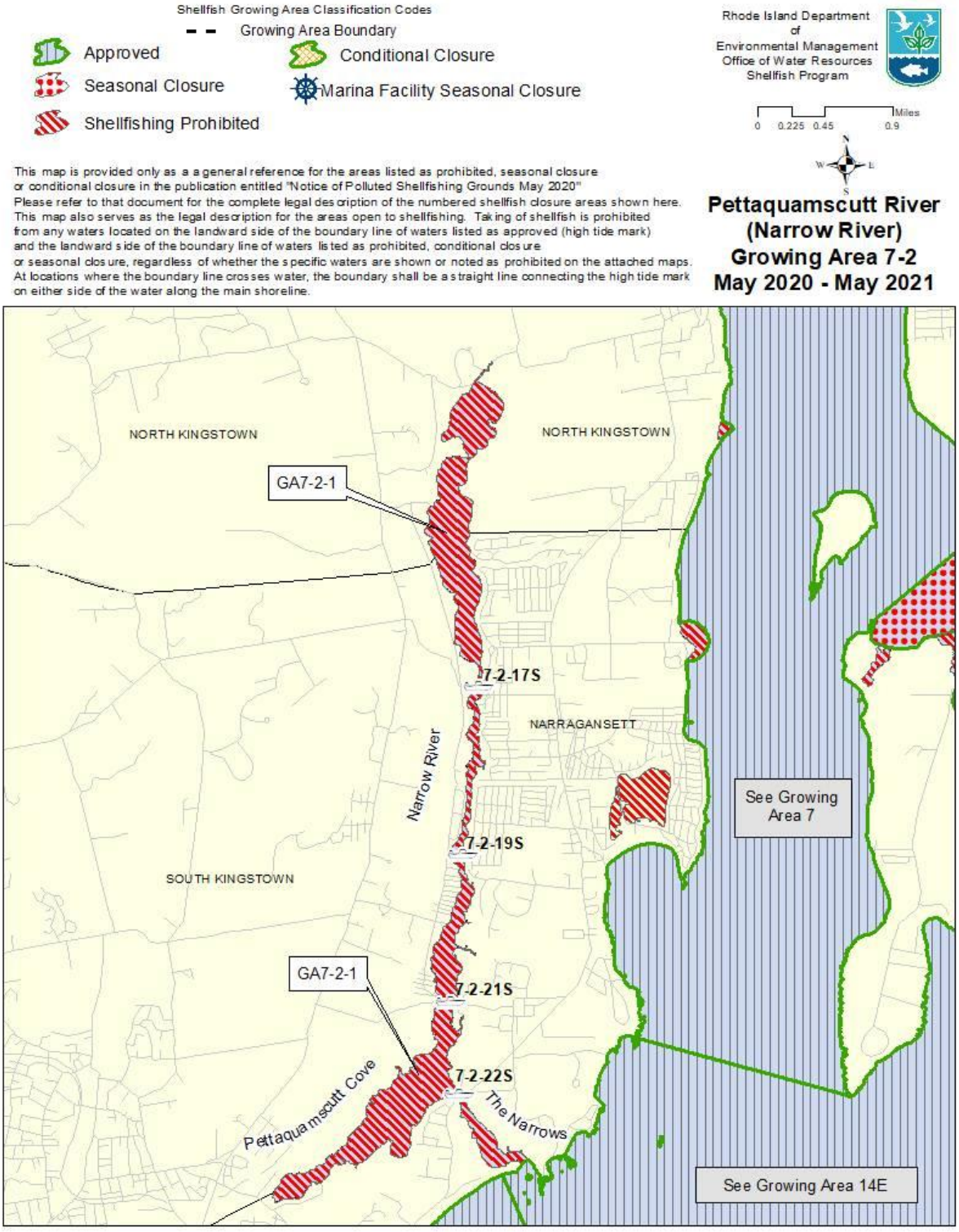
The results of all bacteriological monitoring – whether collected as part of the routine bacteriological monitoring program or sanitary survey program – are evaluated by RIDEM Shellfish staff as they are received from the RIDOH. Any unusual or exceptionally elevated values are immediately evaluated to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

The waters of the Narrow River were sampled seven (7) times during 2020. 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, Figure 3 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 classification scenario. In addition, all of the stations exceeded NSSP criteria for shellfish harvest under a Conditionally Approved scenario of a 0.5", 7-day rain closure. Recent sampling has demonstrated that the waters of GA7-2 regularly exceed NSSP criteria for safe shellfish harvest. DEM Shellfish Program staff will continue to monitor the fecal coliform water quality of the Narrow River growing area to track any potential improvements in water quality.

4. Marinas and Mooring Fields

There are two marinas located within the waters of this growing area. Both marinas have mainly small vessels because the waters of the river are shallow and low bridges limit the size of boats capable of navigating to these marinas. The waters of the entire river are currently classified as prohibited which includes the marina proper and further provide more than ample dilution to be protective of shellfishing in adjacent approved waters at the confluence of the river with open waters of Rhode Island Sound approximately a mile and a half to the southeast. Refer to the report entitled RIDEM "Evaluation of Waters Adjacent to Marinas: Marina Dilution Analysis Background, June 2017" which is located in the program's permanent files for further details and the relative dilution calculations.

Figure 3: 2020-2021 classification map and routine monitoring stations.



5. **Annual Statistical Summary**

GROWING AREA 7-2 - PETTAQUAMSCUTT RIVER (Narrow River)

HIGHLIGHTS

*** Sampled 7X during 2020.**
*** 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= 13) and dry (n= 17) weather 2/16/2017 to 12/8/2020.**
*** Statistics also calculated under dry weather scenario (less than 0.5" rain in prior 7 days) for recent 15 samples collected 4/11/2017 to 9/22/2020.**
*** All samples analyzed by the mTEC method.**
*** Data run 12/15/2020.**

COMMENTARY

The Pettaquamscutt River (Growing Area 7-2) was sampled seven (7) times from shore-access stations during 2020. The area is classified as prohibited to shellfishing so there is no minimum sampling requirement. The 2020 statistical evaluation for the Pettaquamscutt River includes an approved scenario (recent 30 samples collected under all weather conditions) and a conditionally approved scenario (recent 15 samples collected during dry weather). The area has been closed to shellfish harvest for direct human consumption since 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 fecal coliform 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 fecal coliform criteria for approved waters. Evaluating the recent 15 samples under a conditionally approved 0.5" rain closure management scenario of a 7-day closure following >0.5" rain, all stations exceeded NSSP fecal coliform criteria for conditionally approved areas. The 2020 evaluation demonstrated that the Narrow River continues to exceed fecal coliforms that support harvest of molluscan shellfish. The area is properly classified as Prohibited.

RECOMMENDATIONS

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

Table 2: GA7-2 Fecal coliform compliance statistics for 2020.

Approved scenario – for informational purposes only.
Recent 30 all weather
(2/16/2017 to 12/8/2020; all mTEC, 13 wet and 17 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
7-2-17S	P	30	18.1	69.1
7-2-19S	P	30	22.9	94.8
7-2-21S	P	30	12.3	60.8
7-2-22S	P	30	13.8	36.0

Conditionally Approved scenario – for informational purposes only.
Recent 15 dry weather (<0.5" rain in previous 7 days) only.
(4/11/2017 to 9/22/2020; all mTEC, 15 dry weather)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
7-2-17S	P	15	23.8	40.0
7-2-19S	P	15	35.1	60.0
7-2-21S	P	15	18.5	40.0
7-2-22S	P	15	12.2	20.0

6. Summary and Conclusions

The 2020 update demonstrated that water quality in Growing Area 7-2 (Pettaquamscutt or Narrow River) did not meet NSSP criteria under either an Approved or a Conditionally Approved (0.5", 7-day rain closure) scenario. The 2020 update has demonstrated that the area is properly classified as Prohibited. No changes in classification are recommended.

Growing Area 8:
Greenwich Bay

Triennial Re-Evaluation
2020

Warwick Cove

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

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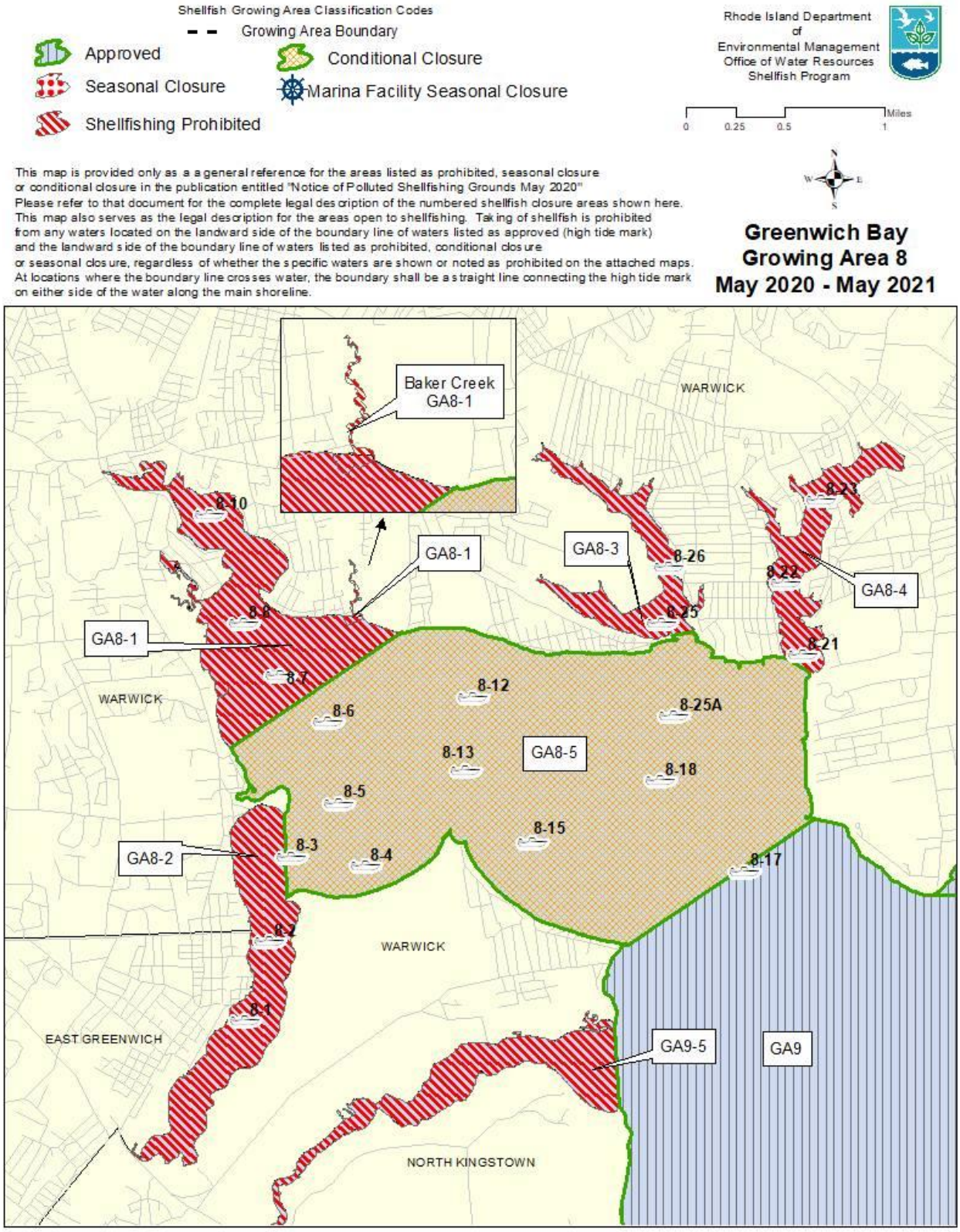
1 Introduction

A triennial update of the Greenwich Bay shellfish growing area (GA8) was completed in 2020. Comprehensive 12-year shoreline surveys of Greenwich Bay were completed in 2005 and 2017 by staff from RIDEM's Office of Water Resources Shellfish Program with assistance from staff of the TMDL program. The 12-year 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 shoreline was divided into seven survey areas with teams assigned to each area. The respective teams surveyed as much of their areas as possible within a two-day sampling effort 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. Triennial surveys of the growing area were completed in 2008, 2011 and 2014. Annual growing area updates were completed in each intervening year.

The primary objective of the shoreline survey was to identify and characterize any new sources of pollution impacting the growing area and to reevaluate point and non-point sources identified during previous surveys.

Figure 1: 2020-2021 Classification Map



2 Description of Growing Area

Greenwich Bay is an estuarine embayment of Narragansett Bay. It has approximately five square miles (1,295 hectares) of water, contains five protected coves and receives drainage from a 26-square mile (6,734 hectares) watershed. Greenwich Bay is relatively shallow, with a mean depth of 7.5 feet (2.3 m) and a maximum depth of approximately 37 feet (11.3 m) at the eastern edge of Greenwich Bay adjacent to Narragansett Bay. Greenwich Bay has provided people with food, shelter, transportation, trade, and recreational opportunities for centuries. The shellfish growing area encompasses all of the shoreline north and west of a line from Sandy Point in Warwick to the southernmost tip of Warwick Point on Warwick Neck (Figure 1). The growing area is bounded by the towns of Warwick and East Greenwich.

The Greenwich Bay watershed includes parts of the City of Warwick and the Towns of East Greenwich and West Warwick in central Rhode Island. The watershed area covers about 26 square miles (6,734 hectares) and can be characterized as urban/residential, with high to medium density residential land-use covering almost one-third of the total land area. Greenwich Bay is home to three licensed bathing beaches: Goddard Park, Oakland Beach, and City Park. There are also numerous marinas and mooring fields along the shorelines.

There are numerous small freshwater brooks and streams that discharge to Greenwich Bay coves. The largest freshwater inputs into Greenwich Bay are Hardig Brook into Apponaug Cove with a daily average flow of 8.6 mgd (million gallons per day), and Maskerchugg River flowing into Greenwich Cove with an average daily flow of 8.02 mgd. These two sources make up approximately 60 percent of the total freshwater input to the bay. There are several other smaller tributaries with a combined flow of 4.3 mgd in addition to groundwater (4.8 mgd) and atmospheric inputs (1.8 mgd) providing fresh water to this estuary (Greenwich Bay Special Area Management Plan (SAMP), 2005).

Growing Area 8 is presently comprised of sections classified as approved, conditionally approved, and prohibited for shellfishing (Figure 1). Four distinct areas of this growing area are classified as prohibited to shellfishing: Apponaug Cove (GA8-1), Greenwich Cove (GA8-2), Buttonwoods and Brushneck Coves (GA8-3), and Warwick Cove (GA8- 4). The conditionally approved waters are managed with a 0.5", 7-day rain closure to protect public health from elevated fecal coliform levels due to stormwater runoff. Details of this are in the Greenwich Bay Conditional Area Management Plan (last updated August 2019) located in the DEO Shellfish Program's permanent files. A seasonal (December) closure of the Greenwich Bay (GA8) growing area was previously warranted due to unacceptable water quality during December. However, recent monitoring has shown that December fecal coliform water quality has improved and the seasonal (December) closure of the Greenwich Bay conditional area (GA8) was ceased after May 2017. There are currently no Seasonally Approved waters in the Greenwich Bay growing area.

In addition to the conditionally approved status, a shellfish harvest management area has been established within Greenwich Bay by RIDEM's Division of Marine Fisheries. This fisheries management plan regulates commercial harvesting of shellfish in the Greenwich Bay conditionally approved areas, and further divides the conditionally approved portion of the growing area into 3 sub-areas with controlled harvest limits in each area. Recreational digging is allowed when the conditional area is in the open status. The water quality closure of the Greenwich Bay conditional area (GA8) supersede all harvest management rules, and no harvest is allowed while the area is in the closed status.

3 Pollution Source Survey

Steve Rogers and Steve Engborg, Marine Biologists for the RIDEM Office of Water Resources shellfish Program coordinated and conducted shoreline reconnaissance of Greenwich Bay with the assistance of other RIDEM Office of Water Resources staff members. They also conducted the review of this triennial survey and all pollution sources. The 2020 survey was conducted on September 14th and September 16th, 2020 during dry weather. Only 0.03" of precipitation was reported at T.F. Green Airport (KPVD) in the five (5) days prior to the 2020 survey.

During the 2017 12 -Year Sanitary Shoreline Survey 206 actual or potential sources were identified, 84 of those sources were found to be flowing at the time of survey. Twenty-six (26) of those sources sampled exceeded the 240 cfu/100 mL threshold warranting follow up sampling. During the 2020 triennial survey twenty-three (23) sources were visited, ten (10) of the twenty-three sources visited in 2020 had no flow, the remaining thirteen (13) were sampled as part of the 2020 triennial survey.

Special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the receiving waters, but may contribute to pollution in the growing area), 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 (or 500 mL if MSB analysis was also required) Nalgene bottles from all sources that were actively flowing at the time of the field study. Samples were stored in a portable cooler and transported to the Rhode Island Department of Health Laboratory at the end of each field day. The mTEC membrane filtration method, as described in Standard Methods for the Examination of Water and Wastewater (APHA, 1999), was used for analysis for both shoreline and routine station (bay run) samples.

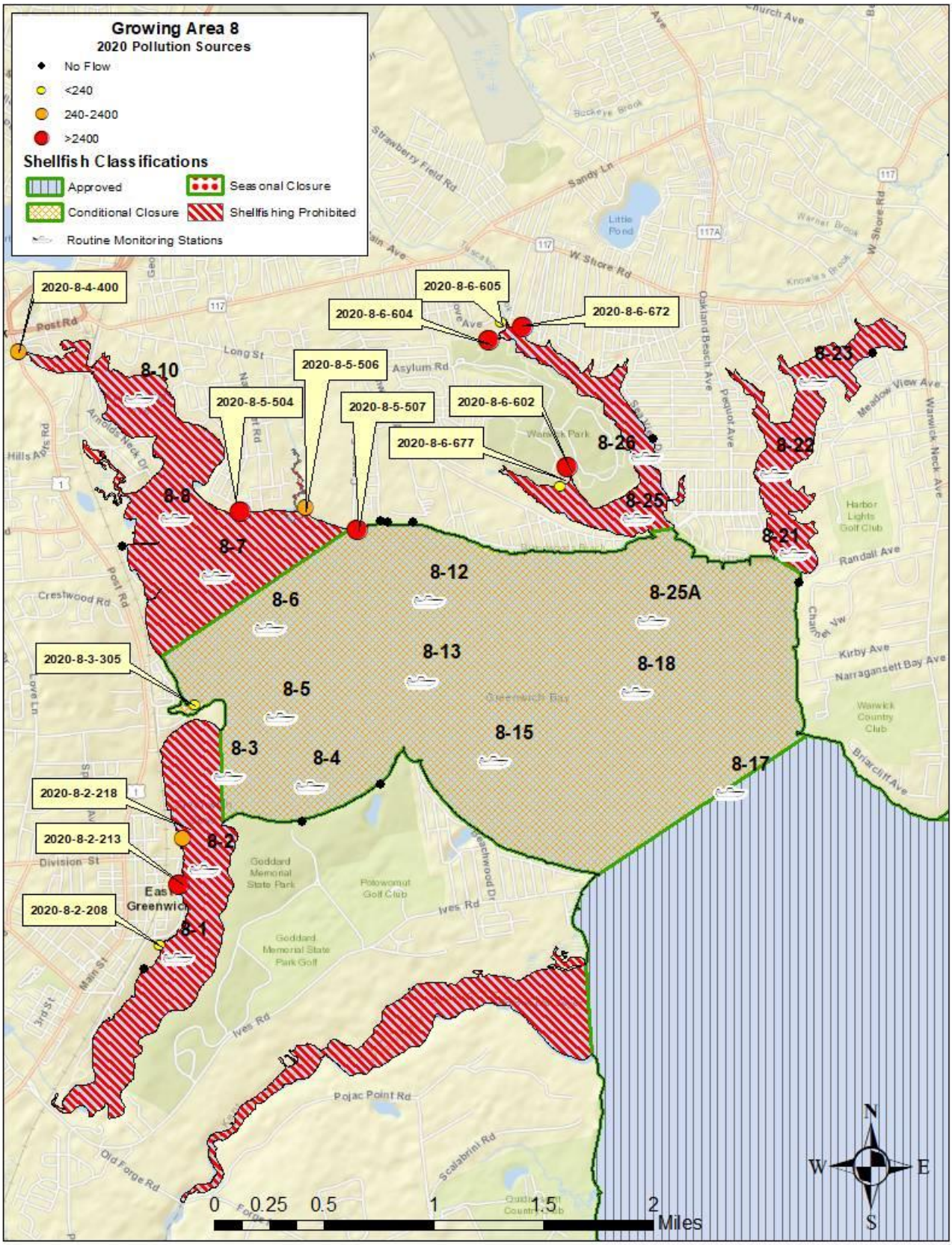


Figure 2: 2020 GA8 Pollution Sources

Source Id	Date visited	Latitude	Longitude	Description	Receiving Waters Classification	Act/Pot	Dir/Ind	2017 Results (cfu/100mL)	2020 Results (cfu/100mL)	Flow (cfs)
2020-8-1-103	9/14/2020	41.66645	-71.43445	Twin 24" concrete pipe in seawall with grates	A	Actual	Direct	1040	NS	NF
2020-8-1-109	9/14/2020	41.6689	-71.4275	Marsh drainage stream	A	Actual	Direct	300	NS	NF
2020-8-2-205	9/14/2020	41.656767	-71.448383	24" concrete pipe north of EG town ramp south of WWTP bottom of access road to ramp	P	Actual	Direct	360	NS	NF
2020-8-2-208	9/14/2020	41.65835	-71.447017	30" concrete pipe at bottom of steps at playground north of WWTP	P	Actual	Direct	1180	< 100	0.004
2020-8-2-213	9/14/2020	41.6623	-71.445267	30" concrete pipe under south end of 20 Water St deck. Visited at low tide	P	Actual	Direct	1200	4,700	trickle

				and water was still up to and slightly flooding pipe.						
2020-8-2-218	9/14/2020	41.665383	-71.444983	30" concrete pipe south side of Norton's Marina at marine railway	P	Actual	Direct	280	1,000	Trickle
2020-8-3-305	9/14/2020	41.6742	-71.443883	Stream at marsh outlet	A	Actual	Direct	305	200	trickle
2020-8-3-311	9/14/2020	41.684683	-71.450283	36" concrete pipe under roadway at end of Masthead Dr	P	Actual	Direct	400	NS	NF
2020-8-4-400	9/14/2020	41.697467	-71.459383	Harding Brook at Rt 1 sum of 408, 409 & 410. Sampled as 8-4-412 in 2017 due to incorrect GPS coordinates	P	Actual	Direct	1200	2,000	
2020-8-5-504	9/16/2020	41.686967	-71.43985	4' wide concrete	P	Actual	Direct	1120	6,800	

				canal draining upstream wetlands						
2020-8-5-506	9/16/2020	41.687233	-71.434133	Bakers Creek	P	Actual	Direct	300	450	15.3
2020-8-5-507	9/16/2020	41.685767	-71.429517	Small creek draining wetland area	A	Actual	Direct	300	6,000	0.141
2020-8-5-508	9/16/2020	41.68625	-71.426867	15" CMP conveying creek draining upstream wetland	A	Potential	Direct	1000	NS	too little to sample
2020-8-5-510	9/16/2020	41.686217	-71.424583	Area of groundwater seepage. No odors.	A	Potential	Direct	99/ IS 700	NS	too little to sample
2020-8-5-527	9/16/2020	41.686295	-71.427483	Small groundwater seep at base of stairs of 360 Claypool Dr. right-of-way	A	Potential	Direct	320	NS	NF
2020-8-6-602	9/16/2020	41.690483	-71.411133	Stream upstream of culvert under bike path at Warwick	P	Actual	Direct	420	6,800	0.155

				City Park						
2020-8-6-604	9/16/2020	41.698217	-71.41915	Stream at head of Brushneck cove	P	Actual	Direct	1100	3,300	
2020-8-6-605	9/16/2020	41.704283	-71.420133	Tuscatucket Brook at Rt. 117 stone culvert	P	Actual	Indirect	1080	100	
2020-8-6-657	9/16/2020	41.69175	-71.4034	Seepage under source #656	P	Potential	Indirect	1180	NS	NF
2020-8-6-672	9/16/2020	41.699117	-71.414933	36" concrete pipe at end of Shand Ave	p	Actual	Direct	1270	15,000	Trickle
2020-8-7-708	9/16/2020	41.6822	-71.390633	wetland drainage	A	Actual	Direct	1180	NS	NF
2020-8-7-711C	9/16/2020	41.697343	-71.384081	8" concrete pipe. Drains catch basin at end of Guild Ave	P	Actual	Direct	700	CNL	

Table 1: 2020 GA8 Pollution Sources

All but one (1) of the sources with elevated (> 240 cfu/100 ml) fecal coliform results in the 2020 survey flow into Prohibited waters of the coves surrounding the main portion of Greenwich Bay. This remaining single source, source 8-5-507, flows into Conditionally Approved waters. Source 8-5-507 (Figure 3) is a small stream that drains a wetland area surrounded by dense residential development in Warwick, RI. This source flows parallel to the receiving waters for approximately 100 ft before crossing a sandy beach and entering the receiving waters. At the time of the 2020 sample this source had a flow of 0.141 cfs and a fecal coliform result of 6,000 cfu/100 ml. Prior surveys have indicated only moderately elevated fecal coliform for this source, with a result of 300 cfu/100 ml recorded in 2017. This source enters the Conditionally Approved waters of the growing area just east of the Apponaug Cove Prohibited zone (Figure 2). An in-stream sample had a result of 800 cfu/100 mL, indicating dilution, but still elevated results during the 2020 survey. Nearby RI DEM Shellfish Program monitoring stations 8-6, 8-7 and 8-12 all had acceptable results during 2020 (Table 2) indicating the source was not impacting the microbial water quality of the nearby growing area. This source will be investigated and resampled as part of the 2021 reevaluation.

Figure 3: Source 8-5-507, a small stream draining a wetland.

Source 2020-8-2-213 is a 30" concrete pipe under a deck on the south end of 20 Water Street in East Greenwich. At the time of the 2020 survey it was low tide and tidal water was still present in the pipe. This source had a 2020 result of 4,700 cfu/100 mL, and a trickle flow. This source flows into the prohibited waters of Greenwich Cove, adjacent to East Greenwich Marina. The extensive Greenwich Cove Prohibited zone provides sufficient dilution between this source and the Conditionally Approved waters of the growing area.

Source 2020-8-5-504 is a 4’ wide concrete canal that drains an upland wetland area that flows through a densely populated area of Warwick, RI. This canal flows between 50 and 58 Melbourne Road and enters the prohibited area of Apponaug Cove. During the time of the 2020 survey the water in the canal was observed to be a stagnant water with a dark color and the source was not flowing. This source had a

2020 fecal coliform result of 680 cfu/100 mL, but there was no flow, so the source was not reaching or impacting the receiving waters.

Source 2020-8-6-672 had the highest results of the 2020 triennial survey with 15,000 cfu/100 mL and a trickle flow. This source is a 36" concrete pipe and the end of Shand Avenue that could potentially flow into the prohibited waters of upper Brush Neck Cove (Figure 4). This source had minimal trickle flow at the time of the 2020 survey and it flows into receiving waters that are classified as prohibited. DEM Shellfish Program monitoring station 8-26 in the prohibited water of Brushneck Cove had fecal coliform results that nearly met NSSP criteria during 2020 (Table 2) indicating that this source had minimal impact on the receiving waters which are classified as Prohibited. This source will be resampled as part of the 2021 annual reevaluation.

Figure 4: Source 8-6-672, a concrete pipe near Brushneck Cove, Warwick, RI.

4 Wastewater Treatment Facilities (WWTF)

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

The facility is permitted to discharge a maximum daily of 1.70 MGD (million gallons/day) of treated effluent. The average flow for 2020 was 0.78 MGD, well within the permit limits. While fecal coliform is not a permit criterion, it is monitored, and monthly geometric mean fecal coliform was generally

around 1 MPN/100 ml during 2020. This review of the East Greenwich WWTF indicated that the facility is well-run and was operating well-below permitted bacteria discharge levels during 2020.

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

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

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

5 Water Quality Studies: RI DEM Shellfish Program monitoring data:

HIGHLIGHTS

* Sampled 11X during 2020.
* Statistics represent recent 15 samples collected between 8/19/2019 and 12/22/2020 for most stations
* Statistics represent recent 15 samples collected between 10/11/2018 and 12/22/2020 for stations 8-25 and 8-26 which are in shallow coves that cannot be sampled at low tide.
* All samples analyzed by the MTEC method.
* All conditionally approved stations are in compliance.
* Data run 12/24/2020.

COMMENTARY

Greenwich Bay (GA8) was sampled eleven times during 2020 with all samples collected while the area was in the open status. Samples were not collected during April 2020 due to the Covid-19 outbreak. The 2020 statistical evaluation showed that all conditionally approved stations in Greenwich Bay were in compliance with NSSP criteria. 'Sentinel stations' located in prohibited areas of Greenwich Cove (station 8-3), Apponaug Cove (station 8-7) and Warwick Cove (station 8-21) adjacent to open areas also met criteria for conditionally approved waters. This indicated that Prohibited areas of Greenwich Bay provide an adequate dilution from potential fecal coliform sources and are protective of public health. The 2020 statistical review demonstrated that the Greenwich Bay Conditionally Approved area (GA8) is in program compliance and is properly classified.

RECOMMENDATIONS

*** Maintain Greenwich Bay as conditionally approved year-round (December seasonal closure ended in May 2017).**

*** Continue to sample prohibited areas in Greenwich, Apponaug, Buttonwood, Brushneck and Warwick Coves to track water quality changes in support of TMDL work in the watershed.**

Table 2: 2020 Statistical evaluation of Growing Area 8 fecal coliform levels.

RIDEM SHELLFISH GROWING AREA MONITORING: GA8

Recent 15 when area was open (all dry weather).
(8/19/2019 to 12/22/2020; all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
8-1	P	15	8.4	13.3
8-2	P	15	4.0	0.0
8-3	P	15	2.4	0.0
8-4	CA	15	2.9	0.0
8-5	CA	15	4.3	6.7
8-6	CA	15	2.7	0.0
8-7	P	15	3.4	0.0
8-8	P	15	5.1	13.3
8-10	P	15	13.2	26.7
8-12	CA	15	5.2	0.0
8-13	CA	15	3.2	6.7
8-15	CA	15	2.8	6.7
8-17	CA	15	2.5	0.0
8-18	CA	15	3.1	0.0
8-21	P	15	4.7	6.7
8-22	P	15	5.5	0.0
8-23	P	15	9.5	20.0
8-25A	CA	15	2.5	0.0

Recent 15 when area was open (all dry weather).
(10/11/2018 to 12/22/2020; all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
8-25	P	15	6.8	13.3
8-26	P	15	6.6	13.3

6 Conclusions and Recommendations

The 2020 Triennial Re-evaluation of Greenwich Bay (GA8) demonstrated that shoreline sources are not 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 all conditionally approved stations met NSSP criteria and that the Greenwich Bay Growing Area (GA8) is in program compliance and is properly classified.

Growing Area 8 is a conditionally approved growing area, impacted by precipitation events and contains 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) revised in August 2019. The Greenwich Bay (Growing Area 8) CAMP was re-evaluated during this review and the monitoring and management actions were consistent with the management plan (CAMP).

No classification changes are recommended for the Greenwich Bay Conditional Area (GA8) at this time.

GA9
West Middle Bay
2020 Annual Update

Contents

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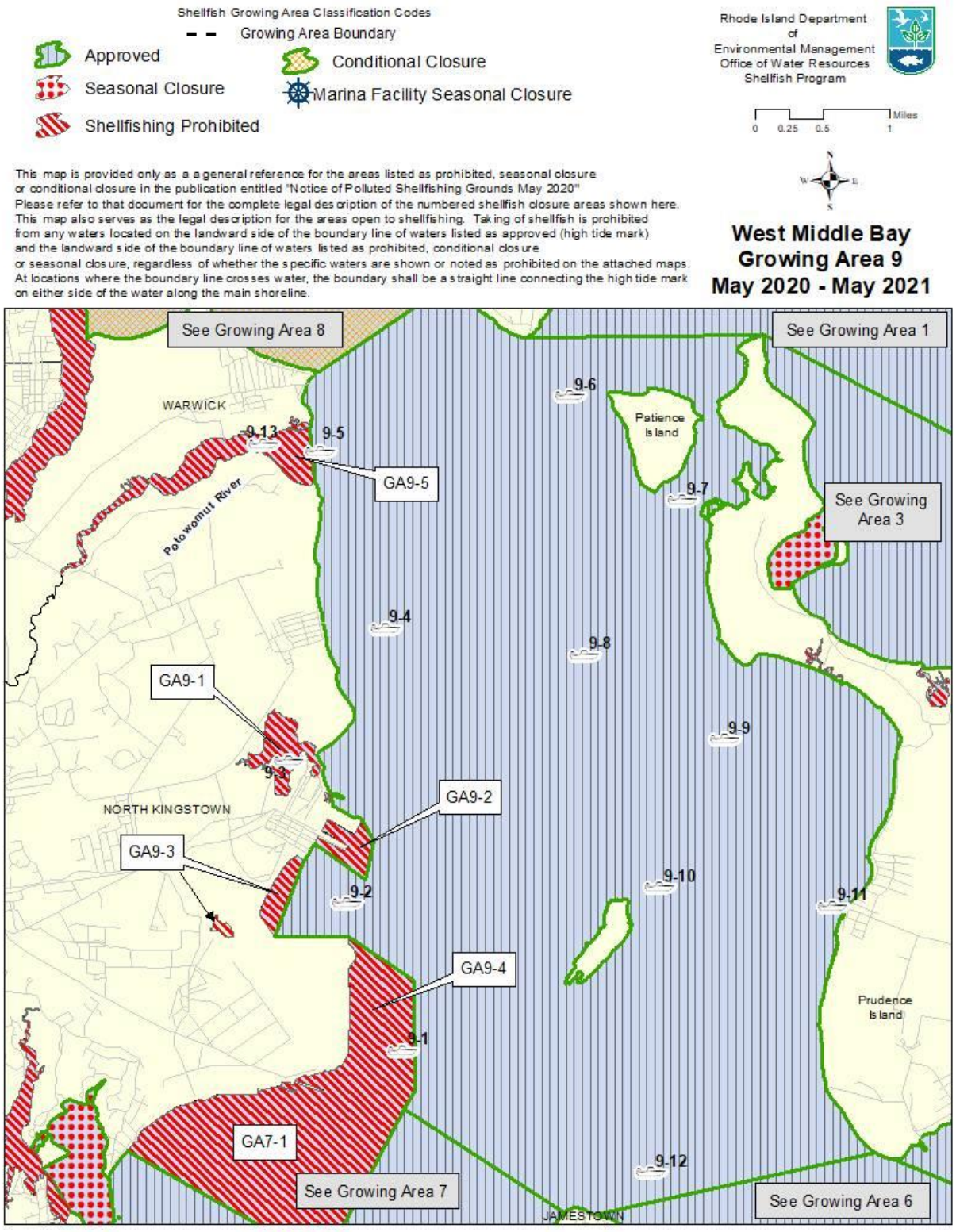
1. Introduction

An annual update shoreline survey of the West Middle Bay was conducted during the summer of 2020 by staff from RIDEM's Office of Water Resources. The survey involved a shoreline reconnaissance of the entire study area to locate and catalog pollution sources and collect bacteria samples from all sources actively flowing into the survey area. Comprehensive 12-year surveys of the growing area were completed in 2007 and 2019. Triennial updates of the area were completed in 2010, 2013, and 2016. Annual updates were completed in each intervening year between triennial and 12-year surveys. The 2020 survey was an annual update.

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

Figure 1. Current (2020-2021) Shellfish Classification Map of GA9 with Routine Monitoring Stations



2. 2020 Shoreline Survey

No sources sampled during the 2019 survey exceeded 2,400 cfu/100 ml, and therefore no sources were sampled during the 2020 annual shoreline survey update.

A. Description of Sources

No Sources sampled during the 2019 survey exceeded 2,400 cfu/100 ml and therefore no sources were resampled as part of the 2020 annual update.

B. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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

C. Marinas

There are five (5) marinas / mooring fields located within the waters of the West Middle Bay growing area (GA9). All are located within the prohibited waters of Allen Harbor in North Kingstown. Details of these marinas can be found in the shellfish program's document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017". Waters of the marina proper and waters adjacent to marinas have either a year-round prohibited area or a seasonal closure to be protective of shellfish waters should an accidental discharge from a vessel occur. All waters in Rhode Island are designated as No Discharge Zones which prohibits the discharge of any sewage from any vessel within any waters of the state. Information regarding the enforcement and inspection procedures for vessels operating in RI waters can be found on our website 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 2020 was 0.54 MGD, well within the permit limits. A review of this WWTF DMR data indicated zero daily maximum *Enterococci* violations during the year of 2020. No fecal coliform or flow violations occurred during 2020. The Quonset Point WWTF services the Quonset Point and Davisville Depot areas and the Quonset Point WWTF discharge is located in the prohibited Quonset Point industrial area safety zone. The closed safety zone (prohibited to shellfish harvest) provides sufficient dilution to be protective of adjacent approved waters. Description and dilution calculations for the Quonset WWTF closed safety zone are located in the program's permanent files. The remaining areas adjacent to the West Middle Bay Growing Area rely on OWTS.

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

3. GA9 Annual Statistical Evaluation

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

Surface water samples are collected by the RIDEM OWR Shellfish Program staff. A description of field conditions is recorded, which includes overall tidal stage, wind direction and speed, number of days since last rain and the rainfall total, the status of conditional areas (open or closed), any important observations such as flocks of birds or algae blooms, and water temperature and collection time at each sampling station. All samples are analyzed by the RIDOH Water Microbiology Laboratory for the presence of fecal coliform bacteria. RIDOH uses the procedures as prescribed by the American Public Health Association in "Standard Methods for the Examination of Water and Wastewater" (APHA, 1999) for the standard fecal coliform membrane filtration method (sm48 mTEC) utilized exclusively since August 2012. The procedure for water sample holding times and temperature control for the SM48 and SM01 methods are described in the RI DEM Shellfish Growing Area Monitoring Program Standard Operating Procedures (updated April 2020; 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 2020.**
*** Statistics represent combined wet (n= 17) and dry (n= 13) weather data collected between 2/23/2016 or 6/30/2016 to 9/29/2020.**
*** All samples analyzed by the MTEC method.**
*** Data run 12/2/2020.**
*** All approved stations in compliance.**

COMMENTARY

The West Middle Bay (Growing Area 9) was sampled six times during 2020, 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. All stations in Approved waters of this growing area met NSSP criteria during 2020.

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 was suitable for approved harvest of shellfish. The 2020 statistical

evaluation indicated that the freshwater end of the Potowomut River (station 9-13) met, but nearly exceeded the 90th percentile variability criteria and that shellfish harvest should remain prohibited for that region. 'Sentinel station' 9-5 at the mouth of the Potowomut River and at the transition from prohibited to approved waters continues to meet criteria for approved waters and should remain approved for shellfish harvest. The 2020 statistical review indicated that all approved stations in the growing area were in program compliance and that the area is properly classified.

RECOMMENDATIONS

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

Table 1: GA9 fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA9

Recent 30 all weather.
(6/17/2015 to 1/7/2020; all mTEC, 17 wet and 13 dry weather sets of samples)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
9-1	P	30	2.1	2.9
9-2	A	30	2.0	2.4
9-3	P	30	2.9	8.0
9-4	A	30	2.7	7.1
9-5	A	30	4.0	18.6
9-6	A	30	2.9	7.0
9-7	A	30	2.2	3.4
9-8	A	30	2.0	2.4
9-9	A	30	2.1	2.8
9-10	A	30	2.1	3.0
9-11	A	30	2.0	2.4
9-12	A	30	2.1	2.9
9-13	P	30	6.1	24.3

4. Summary and Conclusions

The 2020 annual update of the West Middle Bay growing area (GA9) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area. A review of the one (1) WWTF in the growing area has shown that it is operating in an efficient manner that consistently resulted in effluent flow and fecal coliform concentration being well below permitted discharge levels. A statistical review of water column fecal coliform samples collected in the growing area demonstrated that all Approved stations met NSSP criteria and that the West Middle Bay Growing Area (GA9) is in program compliance and is properly classified.

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

Pt. Judith & Potters Pond
Growing Area 10
Triennial Re-Evaluation
2020

Point Judith Pond, Narragansett, RI **Photo courtesy of The Narragansett Bay Estuary Program**

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

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1 Introduction

A triennial reevaluation shoreline survey of Point Judith Pond and Potters Pond was conducted during 2020 to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of shoreline surveys is to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys. Comprehensive 12-year sanitary surveys of Growing Area 10 were completed in 2002 and 2011. Triennial surveys of Growing Area 10 were completed in 2005, 2008, 2014, 2017 and 2020 (this survey report). Annual updates were completed in each intervening year.

The 2020 triennial survey involved follow-up sampling of previously identified sources from the 2017 triennial survey and the 2011 12-year sanitary shoreline survey. All sources with fecal coliform values of greater than 240 cfu / 100 ml were investigated and reevaluated during the 2020 survey.

Portions of Growing Area 10 have experienced increasing fecal coliform levels recently that have required reclassification of portions of the growing area. Due to a pattern of increasing coliform concentration observed during wet weather in 2019, two impacted areas in Pt. Judith Pond were reclassified to conditionally approved shellfish harvest areas in February 2020 (Figure 1). In 2018 a reclassification of the Bluff Hill Cove area of Pt. Judith Pond (the southeast corner, near water quality monitoring station 10-16A in Figure 1) occurred in the form of a downgrade from Approved to Prohibited shellfishing waters. This change was due to elevated fecal coliform bacteria results from multiple shoreline sources and a resultant increasing and variable water column fecal coliform result in that 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 April 2020.

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

2 Description of Growing Area

Growing Area 10 is located on the south coast of Rhode Island just west of Narragansett Bay and includes two coastal salt ponds: Pt Judith Pond to the east and Potter Pond to the west (Figure 1). Both Pt. Judith and Potter Ponds are coastal lagoons, or salt ponds, that formed when the Laurentian ice sheet receded, and glacial deposits formed ridges or moraines that separated the coastal salt ponds from the open ocean of Block Island Sound. Land use in the watershed surrounding Pt. Judith and Potter Ponds is 38% forested, 24% residential, 20% wetlands and water, 9% farmland and 6% commercial/ industrial use (RI DEM, 2008). Approximately 46,500 people resided in the towns of Narragansett and South Kingston surrounding Pt Judith and Potter Ponds in 2010 (US Census, 2010). This is an approximately 18% increase in population during since the 1990 census (US Census, 1990)

Point Judith Pond occupies approximately 1,530-acres and is bounded by the towns of Narragansett and South Kingstown, Rhode Island. Potter Pond occupies approximately 330-acres and is located entirely within the town of South Kingstown (CRMC, 1999). The watershed includes portions of South Kingstown to the west, northwest and northeast, portions of Narragansett to the east and a small portion of North Kingstown to the north (RI DEM, 2008). Both ponds are relatively shallow, but on average Point Judith Pond (2 m average depth) is deeper than Potter Pond (average depth less than 1 m). Point Judith Pond receives fresh water from the Saugatucket River and several small streams while no large freshwater streams enter Potter Pond. Both ponds receive considerable groundwater input with groundwater contributing approximately 40% of freshwater to Pt Judith Pond and 100% of the freshwater to Potter Pond. The southern end of Point Judith Pond consists of a constructed breachway that is protected by the breakwaters of the Harbor of Refuge. The breachway was constructed from 1902-1910 and is the source of tidal marine waters entering both Pt. Judith and Potter Ponds.

Point Judith Pond has approximately 919 acres of Approved shellfishing waters, 213 acres of Conditionally Approved waters and 486 acres of Prohibited waters. Most of the waters classified as Prohibited are either in the far northern end of the Pond near the Saugatucket River, near marinas or near the industrialized port areas at the Port of Galilee (Figure 1). Potter Pond has approximately 334 acres of Approved waters and 14 acres of Prohibited waters in the Succotash Marsh area (Figure 1).

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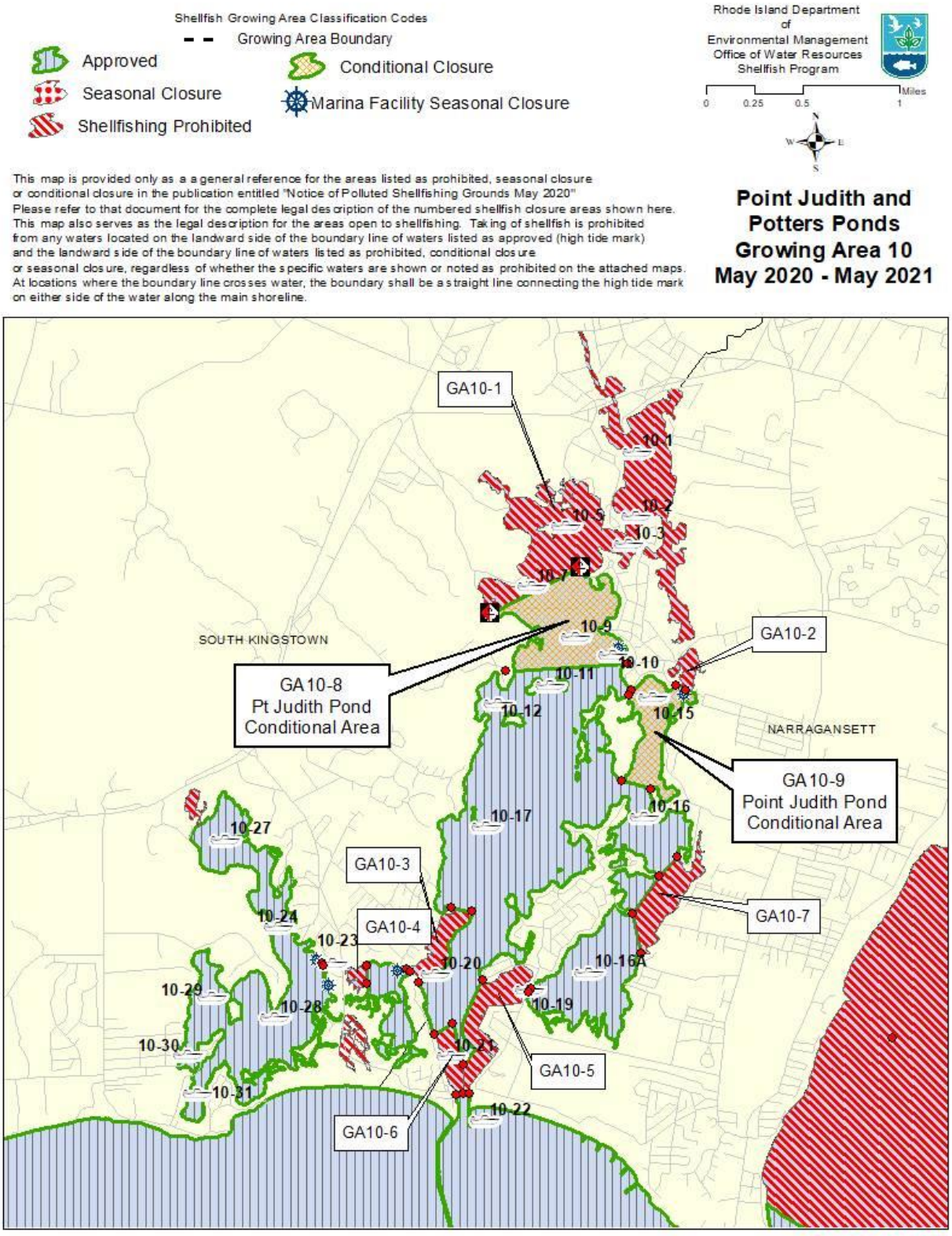
Figure 1: Current (2020-2021) GA10 Shellfish Classification Map with routine monitoring station locations.



3 Pollution Source Survey

The 2020 shoreline survey of Point Judith and Potter Ponds was conducted as a triennial re-evaluation of this growing area. As such, the survey involved review of previous shoreline surveys and sampling of actual pollution sources with bacteriological results greater than 240 cfu / 100 ml as well as identification of any new sources of pollution if applicable (Figure 2). The 2020 survey was conducted on 11/24/2020 during wet weather conditions (one day after 1.54" rain at nearby Westerly Airport, NOAA weather station KWST).

There were thirty (30) sources identified from previous surveys that required follow-up sampling. Ten (10) of the sources were visited during the 2020 triennial survey. Twenty (20) of the sources were not visited because they are adjacent to or flow into Prohibited sections of the growing area. Four (4) sources evaluated in the 2020 survey had elevated (greater than 240 cfu/ 100 ml) bacteria results (Table 1).

During the survey special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the growing area but may contribute to pollution), actual (discharging at the time of the survey), or potential (not actively discharging at the time of the survey but considered a possible source of pollution). Bacteriological samples were collected in sterile, four-ounce (125mL) Nalgene bottles from all sources that were actively flowing at the time of the field study. Samples were stored in a portable cooler and transported to the Rhode Island Department of Health Laboratory at the end of each field day. The mTEC membrane filtration method, as described in Standard Methods for the Examination of Water and Wastewater (APHA, 1999), was used for analysis for both shoreline and routine growing area monitoring samples. Details of sample collection are in the DEM Shellfish Program Standard Operating Procedure document (updated April 2020) in the Program's permanent files.

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 April 2020.

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

A. Survey Personnel

Steven Engborg and Steven Rogers, Biologists in the RIDEM Office of Water Resources, coordinated the shoreline reconnaissance of the Point Judith Pond and Potter Pond with the assistance of other staff members at RIDEM. Sampling was completed in November of 2020.

Figure 2: Map with locations with 2020 pollution sources.

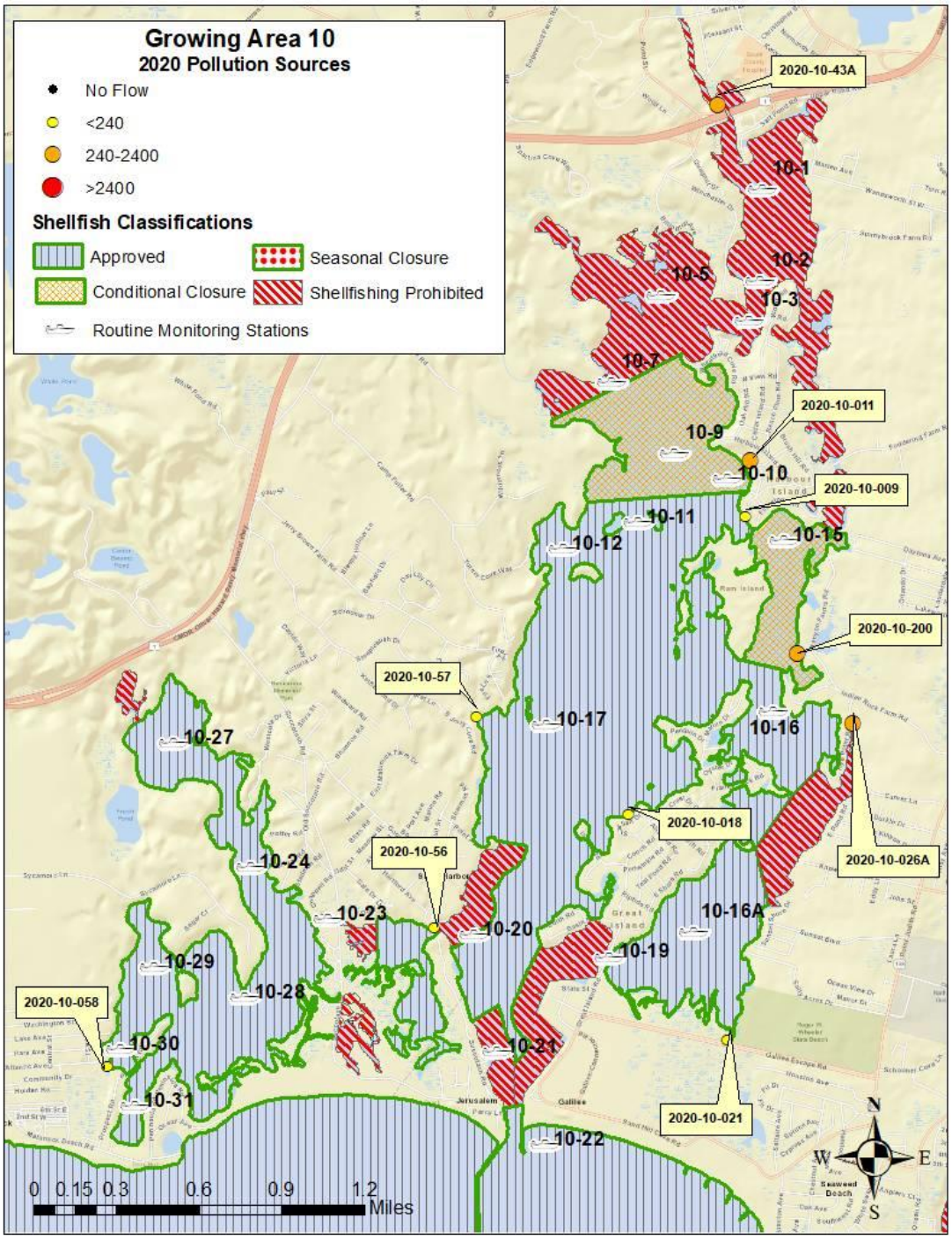


Table 1: 2020 Summary of Pollution Sources in GA10

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2019 Results mTEC cfu/100ml	2020 Results mTEC cfu/100ml	2020 Volumetric Flow (cfs)
2020-10-56	11/24/2020	41.38577	-71.519367	RCP flared end outfall end of Gooseberry Rd. SK	Prohibited	A	D		<2	N/A
2020-10-011	11/24/2020	41.4102	-71.4973	RCP outfall-near Cedar Island Rd, Harbor Island, Narr	Conditionally Approved	P	D	NS	1700	N/A
2020-10-018	11/24/2020	41.3917	-71.5058	Stream draining cove near Starfish Drive-Great Island, Narr	Approved	A	D	NS	<2	Trickle (<.001)
2020-10-57	11/24/2020	41.39683	-71.5164	Stream draining Cove	Approved	A	D		<2	Trickle (<.001)
2020-10-058	11/24/2020	41.37843	-71.542173	Two stormwater swales-Prospect Ave, SK	Approved	A	D		100	N/A
2020-10-009	11/24/2020	41.40732	-71.4977	Cove outlet- west of Isle Pt. Rd, Narr	Approved	A	D		62	N/A
2020-10-021	11/24/2020	41.37877	-71.503	Galilee salt marsh outlet (west), Narr	Approved	A	D		100	N/A

2020-10-43A	11/24/2020	41.429	-71.4996	Saugatucket River	Prohibited	A	D		900	64.6
2020-10-026A	11/24/2020	41.39645	-71.4902	Rye Cove in stream sample	Prohibited	A	D		1100	1.42
2020-10-200	11/24/2020	41.4001	-71.494	Culvert draining pond at kenyon Farm	Conditionally Approved	A	D		1600 (IS 960)	0.094

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

B. Description of shoreline sources

The Saugatucket River (source 10-43A) is the largest source of freshwater to Pt. Judith Pond. In turn, stormwater is a significant source of fecal coliform bacteria to the Saugatucket River, and the river delivers this bacterial loading to Point Judith Pond during wet weather (RIDEM, 2002). Samples from the 2002 12-year survey and the 2005 triennial update both had results of 1,100 MPN / 100 ml. In 2019 both samples of the Saugatucket were taken during dry weather and results were markedly lower at 200 cfu/ 100 ml. A TMDL for the Saugatucket River was completed in 2008 which made numerous recommendations to address the bacteria impairments within this river. The elevated fecal coliform concentration and the relatively large flow rate indicate that the Saugatucket River is the largest source of fecal coliform loading to GA10 during wet weather. The 2020 survey had a result of 900 cfu / 100 ml and a flow estimate of 64.6 cfs for source 10-43A, the Saugatucket River. Currently there are multiple offices within RIDEM that are investigating the elevated wet-weather coliform bacteria levels of the Saugatucket River. The extensive Prohibited zone and recently instituted upper Pt. Judith Pond Conditionally Approve areas (Figure 1) provide a dilution buffer for wet weather bacterial inputs from the Saugatucket River. DEM Shellfish Program monitoring stations 10-1, 2,3,5,7 (Figure 1) located in the upper Pt. Judith Pond Prohibited zone demonstrate the effectiveness of dilution of the Saugatucket River outflow (source 10-43A) prior to reaching the Conditionally Approved and Approved shellfishing waters of Growing Area 10.

Source 10-26A is a small stream on the eastern shore of Pt. Judith Pond that drains into Rye Cove (Figure 3). The receiving waters are classified as Prohibited to shellfishing. The 2020 sample collected on 11/24/2020 (one day after 1.54" rain) had an elevated bacterial level of 1,100 CFU/100 ml and a flow rate of 1.42 cfs. This small stream passes through a marsh and there is an approximately 1,800 feet (549 m) distance through a Prohibited zone (closure 10-7; Figure 1) between this source and the Approved waters of Growing Area 10. Acceptable fecal coliform levels observed at nearby monitoring stations 10-16 and 10-16A in Approved waters demonstrate the effectiveness of the Prohibited zone in diluting the fecal coliform loading from source 10-26A.

Figure 3: Source 10-26A, a small stream flowing into Rye Cove.

Source 10-200 (Figure 4) is a culvert draining a pond at Kenyon Farm in Narragansett, RI and discharging into the Conditionally Approved waters of Upper Pt. Judith Pond. The 2020 survey was conducted during wet weather (1 day after 1.54" rain) and the Conditionally Approved receiving waters were in the closed status. During the 2020 survey source 10-200 had a fecal coliform result of 1,600 cfu / 100 ml and a flow rate of only 0.094 cfs. An in-stream bacteria result of 960 cfu / 100 ml indicated some dilution during wet weather. The 2019 observation of this source took place during dry weather and yielded much lower result of 100 cfu / 100 ml, showing the wet-weather impact on this source. Nearby monitoring station 10-15 (Conditionally Approved waters) and 10-16 (Approved waters) had acceptable fecal coliform levels demonstrating that source 10-200 has minimal impact of the fecal coliform levels of the growing area when it is in the Open status.

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

Source 10-011 (Figure 5) is a reinforced concrete pipe draining into the Conditionally Approved area (GA10-8; Figure 1) of upper Pt. Judith Pond. For the 2020 survey, this source was sampled 11/24/2020 on which was a period of wet weather (1 day after 1.54" rain at Westerly Airport). The 2020 result for source 10-011 was 1,700 cfu / 100 ml with a flow rate of 0.22 cfs. The Conditionally Approved receiving waters were in the Closed status at the time of the 2020 survey. Nearby monitoring station 10-10 had fecal coliform levels that met NSSP criteria for Conditionally Approved areas (Table 2), demonstrating that this source has minimal impact on the fecal coliform water quality of the growing area when it is in the Open status.

Figure 5: Source 10-11, a reinforced concrete pipe on Harbor Island, Narragansett, RI.

C. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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

D. Mooring Fields and Marinas

There are numerous recreational boating facilities within the growing area that have the potential to have negative impacts on water quality. An area protective of shellfish waters has been established for marinas proper and the adjacent waters. As of 2017 there were four (4) pump-out facilities servicing Growing Area 10: two (2) in upper Point Judith Pond near Ram Point and two (2) in the Snug Harbor area near the channel connecting Pt. Judith and Potter Ponds. Both ponds are within the states no-discharge zone, making the discharge of marine sanitation devices illegal.

The Port of Galilee in the Town of Narragansett is the major commercial fishing center in Rhode Island. The Port is located on the eastern side of Point Judith Pond immediately north of the breachway. There are also commercial fishing boats harbored in Snug Harbor immediately south of High Point in South Kingstown. The areas immediately surrounding these commercial ports are classified as Prohibited (Figure 1) and are closed to shellfishing. 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 discharges associated with marine vessels. Details of this analysis can be found in the program document entitled "Evaluation of Waters Adjacent to Marinas – Marine Dilution Analysis Background June 2017."

4 Wastewater Treatment Facilities (WWTF)

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

5 Water Quality Studies

The 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 for fecal coliform monitoring are collected at 24 stations throughout the growing area (Figure 1). Station locations were selected to be representative of the range of conditions throughout the growing area. Seventeen (17) monitoring stations are in Pt. Judith Pond (6 in approved waters, 5 in conditionally approved waters and 8 in prohibited waters). Seven (7) monitoring stations are in Potter Pond (6 approved, 1 prohibited). The waters of GA10 are sampled a minimum of six (6) times per year, consistent with NSSP guidance for waters not impacted by point sources of pollution.

Water samples are collected at monitoring stations throughout the growing area (Figure1). Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated April 2020 and available in the Program's permanent files). Briefly, samples are collected 1-2 feet below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored

on ice at 40 C. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2020) annual statistical report is below.

A. 2020 Review and Statistical Summary of Growing Area 10

HIGHLIGHTS

*** Sampled 6X (4 wet weather, 2 dry weather) during 2020 while the area was in the open status.**
*** For Approved stations, statistics represent recent 30 samples collected when the area was open during both wet (n= 16) and dry (n= 14) weather during 6/15/15 or 7/17/2015 to 10/6/2020.**
*** For Conditionally Approved stations, statistics represent recent 15 samples collected when the Conditional area was in the open status during 6/29/2017 to 10/6/2020 (6 wet weather and 9 dry weather).**
*** GA10 management changes were put into effect on 2/1/2020:**
- All stations: emergency rain closure (2.5", 7-day closure)
- Northern Pt. Judith Pond (stations 10-9, 10-10, 10-15): reclassified as Conditionally Approved with 1.4" rain, 7-day closure.
*** All samples analyzed by the MTEC method.**
*** All approved stations in compliance.**
*** Data run 12/3/2020.**

COMMENTARY

Wet weather during 2019 led to degraded water quality in the Pt. Judith and Potter Pond growing area and the need to reclassify portions of Upper Pt. Judith Pond as Conditionally Approved with a 1.4" rain 7-day closure. 2019 rainfall at Westerly Airport (NOAA weather station KWST) totaled 59.1" of precipitation compared to the long-term mean level of 43.2". 2020 marked a return to more typical rainfall in the area with 36.4" of precipitation recorded at Westerly Airport. Pt. Judith and Potter Ponds (GA10) were sampled 6X during 2020, with four of the samples collected during wet weather (greater than 0.5" rain in prior 7 days) and two samples collected during dry weather.

Pt. Judith Pond

2020 fecal coliform statistics were calculated consistent with the new Pt. Judith and Potter Ponds (GA10) conditional area management plan adopted in early 2020. This included the creation of Conditionally Approved area in upper Pt. Judith Pond and a 2.5" excess rain closure for the entire growing area. For Approved stations, the recent 30 samples included 15 dry weather and 15 wet weather samples collected during 6/15/2015 or 7/17/2015 through 10/6/2020. The 2020 statistical review demonstrated that all Approved stations in the growing area met NSSP fecal coliform criteria. However, stations 10PJ-16 located in Bluff Hill Cove had a 90^{th} percentile variability statistics of 28 cfu/100 ml which is approaching the NSSP variability criteria of 31 cfu/100 ml. Investigation of shoreline fecal coliform sources contributing to elevated fecal coliform in Bluff Hill Cove will continue during 2021. The Conditionally Approved station in Pt. Judith Pond (10PJ-9, 10PJ-1-, 10PJ-15) met NSSP criteria when in the open status. Note that these stations did not meet criteria under an Approved classification, demonstrating the continued necessity for the Conditionally Approved classification in Upper Pt. Judith Pond. The 2020 statistical evaluation demonstrated that all Approved and Conditionally Approves area of Pt. Judith Pond meet NSSP criteria and that the area is properly classified.

Potter Pond

The recent statistical evaluation demonstrated that all Approved stations in Potter Pond met NSSP fecal coliform criteria during 2020. However, four of seven Approved stations had 90th percentile variability statistics in the twenties and station 10PP-24 had a 90th percent variability statistic of 28.9 cfu/100 ml which is approaching the NSSP criteria of 31 cfu/100 ml. The elevated 2020 variability statistics were due to increased fecal coliform values observed under both wet weather conditions during 2019 and elevated fecal coliform observed during dry weather on a single 2020 sample date (10/6/2020). Potential fecal coliform sources contributing to the recent increase in fecal coliform variability in Potter Pond will be investigated during 2021.

RECOMMENDATIONS.

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

Table 2: GA10 Pt. Judith Pond fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA10

Pt. Judith Pond
Recent 30 when open (with 2.5" emergency rain closure); 6/15/2015 or 7/17/2015 to 10/6/2020; 16 wet and 14 dry weather); all mTEC analysis.
Conditionally Approved stations shown for informational purposes only, not for compliance.

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
10PJ-1	P	30	53.8	644.2
10PJ-2	P	30	31.7	429.3
10PJ-3	P	30	21.6	227.3
10PJ-5	P	30	11.0	81.4
10PJ-7	P	30	8.1	51.8
10PJ-9	CA	30	6.1	33.5
10PJ-10	CA	30	5.5	31.6
10PJ-11	A	30	4.2	15.2
10PJ-12	A	30	4.0	11.9
10PJ-15	CA	30	6.8	56.8
10PJ-16	A	30	5.0	28.5
10PJ-16A	A	30	5.4	22.8
10PJ-17	A	30	3.3	11.1
10PJ-19	P	30	6.5	29.2
10PJ-20	P	30	4.3	13.1
10PJ-21	P	30	5.0	19.8
10PJ-22	A	30	2.9	7.4

Pt. Judith Pond
Recent 15 when open (1.4" Conditional Approved area rain closure)
(6/29/2017 to 10/6/2020; all mTEC, 6 wet and 9 dry weather)
Conditionally Approved stations only
****** new station added in 2020; number of observations is low (n= 5) and insufficient data to calculate representative statistics for compliance.

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
10PJ-7A	CA	5	9.1	
10PJ-9	CA	15	5.5	6.7
10PJ-10	CA	15	3.8	6.7
10PJ-15	CA	15	4.8	6.7
10PJ-15A	CA	5	3.9	

Table 3: GA10 Potter Pond fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA10

Potter Pond
Recent 30 when open (with 2.5" emergency rain closure)
(6/15/2015 or 7/17/2015 to 10/6/2020; 16 wet and 14 dry weather); all mTEC analysis.

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
10PP-23	P	30	4.8	18.1
10PP-24	A	30	6.5	28.9
10PP-27	A	30	5.0	23.7
10PP-28	A	30	3.8	15.2
10PP-29	A	30	3.4	11.4
10PP-30	A	30	4.4	20.2
10PP-31	A	30	4.7	22.0

6 Conclusions and Recommendations

The 2020 Triennial Re-evaluation of Pt. Judith and Potter Ponds (GA10) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area's Approved waters or the Conditionally Approved waters when they are in the Open status. A statistical review of water column fecal coliform data collected while the area was in the open status indicated that all Approved and Conditionally Approved stations met NSSP criteria and that the Pt. Judith and Potter Pond Growing Area (GA10) is in program compliance and is properly classified.

Growing Area 10 has conditionally approved areas in upper Pt. Judith Pond that are negatively impacted by precipitation and wet weather discharge of the Saugatucket River. Therefore, the RIDEM Shellfish Program monitors Growing Area 10 in accordance with the guidelines set forth in the Greenwich Bay Conditional Area Management Plan (CAMP) revised in January 2020. The Pt. Judith and Potter Pond (Growing Area 10) CAMP was re-evaluated during this review and the monitoring and management actions were consistent with the management plan (CAMP).

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

Growing Area 11 NG
Ninigret and Green Hill Ponds
2020 Annual Update

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1. Introduction

During 2020 an annual update shoreline survey was completed for the Ninigret Pond and Green Hill Pond shellfish growing area (GA11NG; Figure 1). Previous shoreline surveys of this area included comprehensive 12-year surveys completed in 2002 and 2012 and triennial surveys completed during 2005, 2008, 2015 and 2018. The 2020 annual re-evaluation shoreline survey was conducted 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 (Figure 1) presently has two classifications: Prohibited and Approved. The entirety of Green Hill Pond and the easterly section of Ninigret Pond adjoining Green Hill Pond are presently classified as prohibited to shellfishing due to elevated bacteria levels. The remainder of the growing area is in Ninigret Pond and is classified as Approved. There are twenty-three monitoring stations that are routinely sampled to characterize the water quality of the growing area.

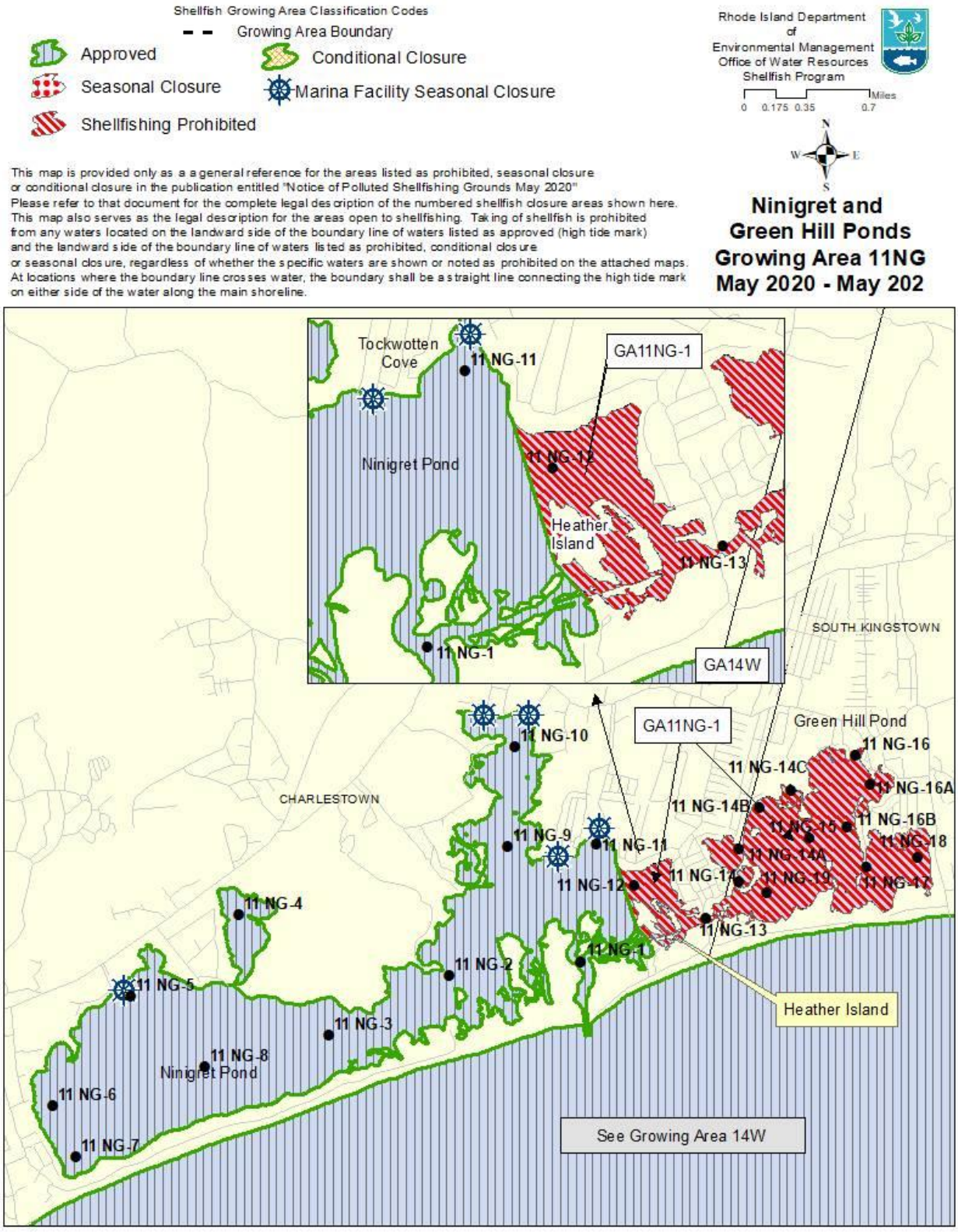
During the 2012 12-year survey a total of ten (10) actual or potential sources were identified, with five (5) sources discharging into each pond. In Green Hill Pond, all five (5) identified sources discharge or potentially discharge into waters that are currently classified as Prohibited. Only two (2) of the sources had greater than 240 cfu/100 ml results in the 2012 survey: source 11GH-01 (Factory Brook) and source 11GH-04 (an RCP outfall flowing into Allen Cove). Both sources discharge into the prohibited area of Green Hill Pond. There is sufficient dilution within the Green Hill Pond and eastern Ninigret Pond prohibited zone so that these sources have no impact on the microbiological water quality of the approved waters of Ninigret Pond.

In Ninigret Pond, five (5) sources were identified during the 2012 survey. One (1) source discharges to prohibited waters and four (4) sources discharge or potentially discharge into approved water of Ninigret Pond. Fecal coliform results from these four (4) sources were less than 240 cfu/100 ml or had low (trickle) flow during the 2018 survey (Table 1). Due to the 2018 survey results no sources were sampled in 2019 or 2020.

2. 2020 Shoreline Survey

In 2020 no shoreline survey sources were sampled because bacteria counts were low in previous years. The 2020 annual update included a review of marinas and mooring areas in the growing area, a review of OWTS complaints in the area and a review of growing area fecal coliform monitoring data.

Figure 1: Current (2020-2021) Shellfish Classification Map of GA 11NG with Routine Monitoring Stations



3. Marinas and Mooring Areas

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 1: 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’

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 1). 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 the RI DEM website: http://www.dem.ri.gov/programs/water/shellfish/marine-pumpouts.php

Dilution calculations supporting the sizing of prohibited safety zones surrounding marinas may be found in the document entitled ‘RIDEM Marina Dilution Analysis – June 2017’ and in the electronic Excel file ‘2017 Marina Calcs VIMS FDA’ located in the program’s permanent files.

4. Wastewater Treatment Facilities / Domestic wastes

There are no wastewater treatment facilities (WWTF), or any permitted RI Pollution Discharge Elimination (RIPDES) discharges that discharge to Growing Area 11NG. The Ninigret and Greenhill Pond watershed consists of mainly residential homes with very little commercial and no industrial land developments. The entire watershed is served by onsite wastewater treatment systems (OWTS). OWTS complaints and filings in the immediate watershed of the growing area were reviewed as part of the 2020 update and no significant violations of OWTS were recorded (Table 2).

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 use 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 revised April 2020.

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

Table 2. GA11NG OWTS Complaints and status in 2020

Address	Town	Date	Complaint	Case	Distance From Shellfish Waters	Case Status
29 FIRST ST	WESTERLY	7/1/2020	Installing a septic system today, draining water from where the existing septic were and going directly into the pond. Water table is high; pumping water out of a hole.	OCI-OWTS-20-46	500 ft from Prohibited Green Hill Pond	Unfounded
POWAGET AVE	CHARLESTOWN	10/5/2020	Sewage discharge into Ninigret Pond	OCI-OWTS-20-77	On Ninigret Pond	Unfounded
280 POND SHORE DR	CHARLESTOWN	12/3/2020	Failing septic at above location	OCI-OWTS-20-92	On Ninigret Pond	Unfounded
GREEN HILL BEACH	SOUTH KINGSTOWN	9/2/2020	Very strong septic odor in the general vicinity of Green Hill Beach in South Kingstown, Rhode Island. It seems to worsen at low tide, but is almost always present regardless of the tide level.	OCI-OWTS-20-74	On Ocean and Green Hill Pond	Unfounded

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

Water samples are collected at twenty-four (24) monitoring stations throughout the growing area. Twelve (12) stations are in Ninigret Pond (11 Approved stations, 1 Prohibited station). Twelve (12) stations are located in the prohibited waters of Green Hill Pond.

Water samples are collected at monitoring stations throughout the growing area (Figure1). Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated April 2020 and available in the Program's permanent files). Briefly, samples are collected 0.5 m (1-2 feet) below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice at 4 C. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2020) annual statistical report and commentary is below.

A. 2020 Review and Statistical Summary of Growing Area 11QW:

HIGHLIGHTS

*** Sampled 6X during 2020 (3 wet weather, 3 dry weather).**
*** Statistics represent recent 30 samples collected under both wet (n= 13) and dry (n= 17) weather conditions during *6/10/2015 or 11/18/2015 to 10/22/2020.***
*** All approved stations in compliance.**
*** All samples analyzed by the mTEC method.**
*** Data run 12/4/2020.**

COMMENTARY

Ninigret Pond and Green Hill Ponds (Growing Area 11NG) were sampled six times (3X dry weather and 3X wet weather) during 2020, consistent with the minimum systematic random sampling monitoring requirements for approved areas. The recent 30 sample results are representative of both wet (n= 13) and dry (n= 17) weather conditions.

The 2020 statistical review demonstrated that all approved stations in Ninigret Pond met criteria for shellfish harvest for direct human consumption. 2019 was a wet year, with elevated rainfall and multiple extreme rain events. In order to ensure shellfish harvest occurs only when the waters of the growing area meet microbiological standards, an emergency rain closure for rainfall of greater than 2.5" in a 24-hour period as measured at Westerly Airport was instituted in early 2020.

2020 had near-average rainfall and 2020 fecal coliform levels were generally lower than those observed during 2019. Stations 11NG-10 located at the northern end of Ninigret Pond east of Marshneck Point and 11NG-4 (located in Foster Cove) had elevated, but still acceptable, fecal coliform variability statistics for 2020. The 'sentinel station' 11NG-12 that marks the transition from approved waters in the western end of NIngret Pond to prohibited waters at the far eastern end of Ninigret Pond and Green Hill Pond exceeded NSSP variability criteria in the 2019 and 2020 evaluations. This is likely reflective of the wet weather experienced during 2019 as 2020 observations were acceptable. Continued monitoring of this station is required to determine if there is westward expansion of reduced water quality from eastern Ninigret and Green Hill Pond.

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. 2020 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 (90^{th} percentile statistic above NSSP threshold) and unpredictable fecal coliform levels. The 2020 statistical evaluation demonstrated that one (1) station (11NG-15) of the twelve (12) stations located in Green Hill Pond met NSSP criteria for harvest of shellfish. Future monitoring will continue in Green Hill Pond to track and support TMDL and other water quality improvement efforts in the watershed.

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

RECOMMENDATIONS

*** 2.5" rain emergency closure required to maintain compliance with NSSP criteria.**

*** Carefully review future results for stations 11NG-1 (Foster Cove), 11NG-10 (Marshneck Point) and sentinel station 11NG-12. These stations have an increasing fecal coliform variability trend in recent years.**

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

Table 3: GA11NG Ninigret and Green Hill Ponds fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA11NG

Recent 30, all weather Recent 30 all weather (with 2.5" emergency rain closure). (10/17/2014 to 11/6/2019; all mTEC, 11 wet and 19 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
11NG-1	A	30	4.0	19.3
11NG-2	A	30	2.7	7.0
11NG-3	A	30	2.8	8.0
11NG-4	A	30	5.0	21.4
11NG-5	A	30	2.4	4.6
11NG-6	A	30	2.3	4.4
11NG-7	A	30	2.9	8.6
11NG-8	A	29	2.4	4.6
11NG-9	A	30	4.1	18.4
11NG-10	A	30	4.5	26.1
11NG-11	A	30	2.9	7.6
11NG-12	P	30	6.5	52.0
11NG-13	P	30	6.0	40.6
11NG-14	P	30	8.5	76.4
11NG-15	P	30	4.7	28.8
11NG-16	P	30	26.9	277.8
11NG-17	P	30	6.1	52.7
11NG-18	P	30	5.0	31.3
11NG-14A	P	30	10.7	75.3
11NG-14B	P	30	8.4	57.2
11NG-14C	P	30	22.0	181.6
11NG-16A	P	30	9.6	77.9
11NG-16B	P	30	7.4	55.7
11NG-19G**	P	13	6.3	61.2

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

6. Summary and Conclusions

The 2020 annual review of Ninigret and Green Hill Ponds (GA11NG) documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area under normal weather conditions. The 2020 statistical review of growing area monitoring data identified fecal coliform exceedances of NSSP standards during extremely wet weather (>2.5" rain in a 24-hour period). To safeguard public health and emergency 7-day closure of following 2.5" of rain or greater at Westerly Airport in a 24-hour period was added to the management of the growing area in February 2020.

The 2020 annual update demonstrated that all Approved areas of the growing area meet NSSP criteria for safe shellfish harvest while in the open status. The 2020 update has demonstrated that the area is properly classified. No changes in classification are recommended.

Growing Area 11QW
Quonochontaug and Winnapaug Ponds
2020 Annual Update

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1. Introduction

An annual re-evaluation survey of the Quonochontaug Pond and Winnapaug Pond shellfish growing area (GA11QW) was conducted during 2020 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 potentially affecting the area and re-evaluate point and non-point sources previously identified during prior surveys.

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

2. 2020 Survey

Five (5) actual or potential fecal coliform sources were sampled during the 2018 shoreline survey of GA11QW and fecal coliform concentration in flowing sources ranged from 11 to 3,400 cfu/100 ml (Table 1). Only a single (1) source, source 11QW-40 exceeded the 2,400 cfu/100 ml threshold in the 2012 survey (Table 1).

Source 11QW-40 and nearby source 11QW-41 were resampled as part of the 2020 annual update (Table 1). These sources drain a stormwater detention structure on the barrier beach (Misquamicut Beach) separating Winnapaug Pond from the Atlantic Ocean. The detention structure was heavily damaged and partially filled by sediment in 2012 during Hurricane Sandy resulting in reduced capacity of the system. 2020 survey results indicated that fecal coliform in these sources was low (< 100 cfu/100 ml). Companion in-stream samples demonstrated rapid dilution of fecal coliform to < 2 cfu/100 ml within 8 m (25 feet) of the sources. In addition, monitoring station 11QW-36, located approximately 200 meters (656 feet) west of source 11QW-40, has acceptable fecal

coliform levels (Table 3) indicating that this source does not negatively impact the fecal coliform water quality of the growing area.

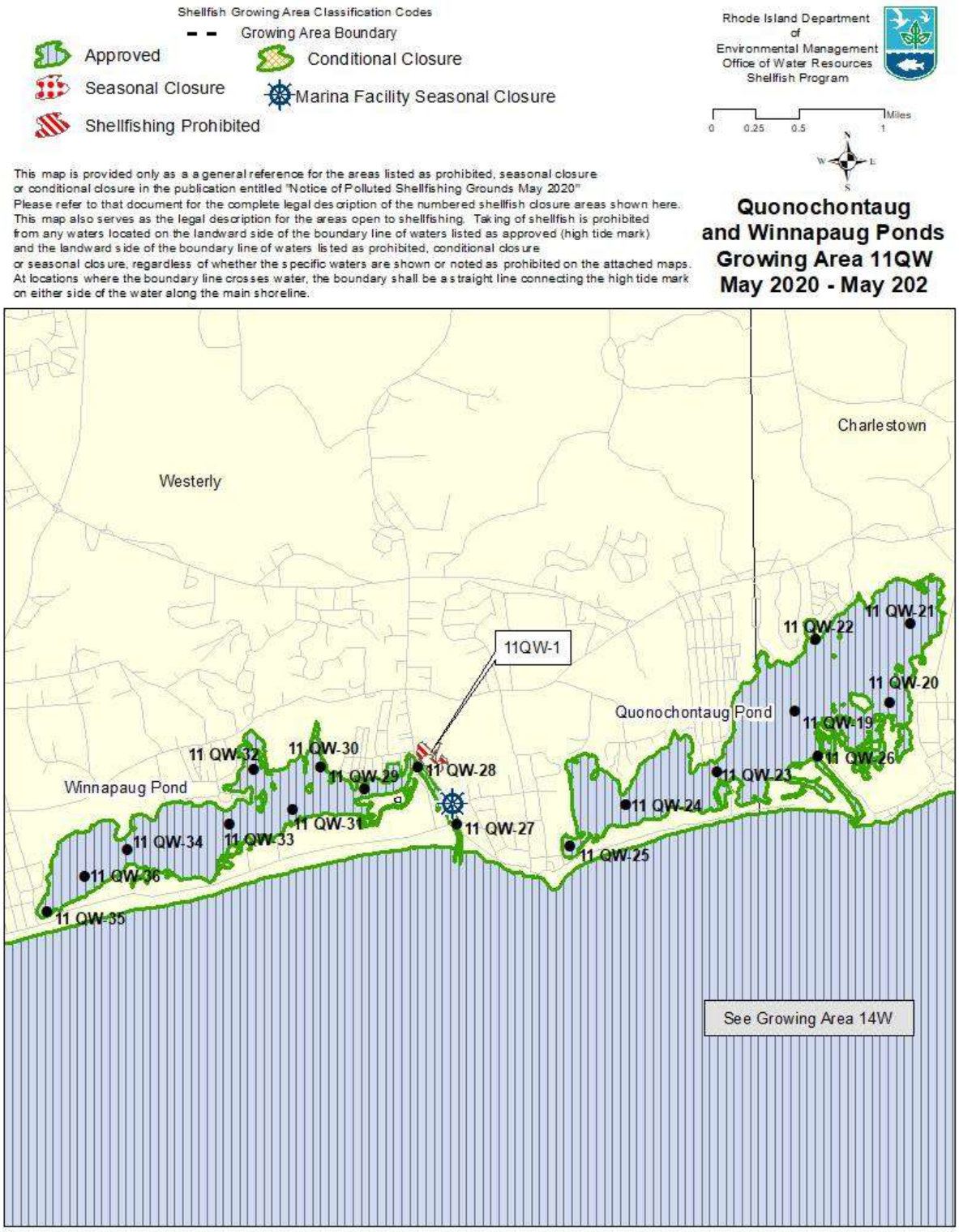
In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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

Table 1: GA11QW Shoreline survey pollution sources and 2020 results

Source ID	Date Visited	Lat.	Long.	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2018 Results mTEC cfu/100ml	2020 results cfu/100 ml	2020 Flow (cfs)
2020-11QW-40	2/24/21	41.3258	71.8022	Stream from swale along detention basin Misquamicut Beach	Approved	A	D	<2	<100	Trickle
2020-16-022	2/24/21	41.3253	71.8027	36" dia RCP	Approved	A	D	100	<100	2.99

Figure 1: Current (2020-2021) Shellfish Classification Map of GA11QW with Routine Monitoring Stations



3. Marina and Mooring Areas

There are two marinas identified in the growing area, one in each pond. The Weekapaug Yacht Club located in a cove on the southwestern corner of Quonochontaug Pond is a small day-sailing school that operates only during the summer months. It has no permanent docks and all boats are either moored or stored on the beach. The facility has a land-based sanitary service and the boats used here do not have MSDs. The Weekapaug Fire District has a series of docks located along the Weekapaug Breachway in Winnapaug Pond. There is a seasonal (summer only) closure associated with these docks. Marina closures are sized so that there is sufficient dilution to be protective during the seasonal operation of marina facilities. The dilution analysis supporting marina closures is in the document entitled "RIDEM Marina Dilution Analysis – June 2017" which is maintained in the program's permanent files.

4. Wastewater Treatment Facilities / Domestic Waste

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 Wastewater Treatment systems (OWTS). There is a mix of types of systems ranging from cesspools, conventional and innovative and advanced systems located in the towns of Charlestown and Westerly (bordering communities). Since 2011 legislation has required that all cesspools located within the critical resource area boundary and within 200 ft of the inland edge of coastal shoreline feature bordering a tidal water area must be replaced and upgraded with a new onsite wastewater treatment system or connected to available municipal sewer lines by January 2014.

Table 2. GA11QW OWTS Complains in 2020

Address	Town	Date	Complaint	Case	Distance From Shellfish Waters	Case Status
15 ROBIN WAY	WESTERLY	7/7/2020	Illegal Septic Repair next to wetlands.	OCI-OWTS-20-50	1 mile from Quonochontaug pond	Unfounded
611 ATLANTIC AVE	WESTERLY	9/3/2020	I have received two complaints this week with respect to a strong, noxious odor of rotten egg / sulfur. The smell of Sulfur is strong and seems to emanate from the waterline area of the beach and although there appears to be a gray discoloration of the sand in that area.	OCI-OWTS-20-72	On ocean and Winnapaug Pond	Unfounded
11 WINONA AVE	WESTERLY	11/4/2020	Site was evaluated for a septic system but there is no record of it ever being installed. Residence continues to be served by a cesspool.	OCI-OWTS-20-91	500 ft from ocean 1400ft from Quonochontaug Pond	Ongoing Investigation - New OWTS permit under review

5. Water Quality Studies

RIDEM Shellfish Program

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

Water samples are collected at eighteen (18) monitoring stations throughout the growing area (Figure 1). Eight (8) stations are located in Quonochontaug Pond and ten (10) stations are located in Winnapaug Pond. All water quality monitoring stations in GA11QW are in Approved waters.

Samples are collected and processed according to the DEM Shellfish Program's standard operating procedure as documented in the Program's permanent files (Shellfish Growing Area Monitoring Program SOP, updated April 2020). Briefly, water samples are collected 0.5 m (1-2 feet) below the water surface using 125 ml (4-ounce) sterile Nalgene bottles which are then stored in a cooler packed with ice. Samples are transported to the Rhode Island Department of Health Laboratories for analysis. Since June 2012, RIDOH has analyzed samples using the mTEC membrane filtration method; all samples used to calculate compliance statistics were analyzed by the mTec method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

A. 2020 Review and Statistical Summary of Growing Area 11QW:

HIGHLIGHTS

*** Sampled 6X when open (5 wet weather, 1 dry weather) during 2020.**

*** Compliance statistics calculated for recent 30 samples when area was in the open status (12/9/2015 to 10/21/2020, 16 wet weather and 14 dry weather samples).**
*** All approved stations meet NSSP criteria.**
*** All samples analyzed by the mTEC method.**

*** Data run 12/4/2020.**

COMMENTARY

Winnapaug and Quonochontaug Ponds (Growing Area 11QW) were sampled six times during 2020; twice during wet weather and 4-times during dry weather (<0.5" in prior 7 days). Extreme rainfall during summer of 2019 led to elevated fecal coliform and an excessive rain closure of the growing area in 2019. Due to this observation of elevated fecal coliform after extreme rain, an extreme rain closure following rain of greater than 2.5" in 24 hours (measured at Westerly Airport) was instituted for this growing area beginning in 2020.

2020 compliance statistics indicated that all Approved stations in the growing area met NSSP fecal coliform water quality criteria. Fecal coliform levels observed during 2020 (a normal rainfall year) were generally lower than those observed during 2019 (a wet year with multiple extreme rain events). Nearly all Approved stations (16 of 18 or 89%) in the growing area had fecal coliform compliance statistics well-below NSSP criteria. Two stations in Quonochontaug Pond (11QW-22 and 11QW-25) met criteria but had 90th percentile variability statistics that approached NSSP criteria of 31 cfu/100 ml. Station 11Q-22 located in Shady Harbor met criteria but had a 90th percentile value of 26 cfu/100 ml. Station 11Q-25 located near Weekapaug Yacht Club had a 90th percentile value of 27 cfu/100 ml. Elevated variability at these stations was primarily due to elevated fecal coliform observed during the wet weather of 2019; 2020 observations were all acceptable at these stations.

The 2020 evaluation demonstrated that the Quonochontaug Pond and Winnapaug Pond growing area (GA11QW) is in program compliance and the area is properly classified.

RECOMMENDATIONS

*** 2.5" excessive rain closure required to maintain compliance with NSSP criteria.**

Table 3: Quonochontaug Pond 2020 fecal coliform compliance statistics

RIDEM SHELLFISH GROWING AREA MONITORING: GA11QW

Quonochontaug Pond

Recent 30 all weather.

(12/9/2015 to 10/21/2020; all mTEC, 16 wet and 14 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
11QW-19	A	30	2.5	6.0
11QW-20	A	30	2.6	5.6
11QW-21	A	30	2.6	5.3
11QW-22	A	30	5.0	26.0
11QW-23	A	30	2.8	7.8
11QW-24	A	30	2.6	5.3
11QW-25	A	30	4.5	27.0
11QW-26	A	30	2.4	5.4

Table 4: Winnapaug Pond 2020 fecal coliform compliance statistics

RIDEM SHELLFISH GROWING AREA MONITORING: GA11QW

Winnapaug Pond

Recent 30 all weather.

(12/9/2015 to 10/21/2020; all mTEC, 16 wet and 14 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
11QW-27	A	30	2.6	5.0
11QW-28	A	30	2.9	6.0
11QW-29	A	30	3.3	7.7
11QW-30	A	30	4.2	13.8
11QW-31	A	30	2.8	6.9
11QW-32	A	30	3.4	10.3
11QW-33	A	30	2.7	6.3
11QW-34	A	30	2.8	8.0
11QW-35	A	30	3.0	8.7
11QW-36	A	30	3.0	9.6

6. Summary and Conclusions

The 2020 annual review of Quonochontaug and Winnapaug Ponds (GA11QW) documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. The 2020 review of fecal coliform water quality data indicated that an excessive rain closure for rain amounts of greater than 2.5" is required for this growing area to maintain compliance with NSSP standards. This 2.5" excessive rain closure was instituted in February 2020. With application of the 2.5" excess rain closure, the 2020 annual update demonstrated that all monitoring stations in the growing area meet NSSP criteria while in the open status.

The 2020 update has demonstrated that the area is properly classified. No changes in classification are recommended.

Growing Area 12:
Little Narragansett Bay and Pawcatuck River
2020 Annual Update

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1. Introduction

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

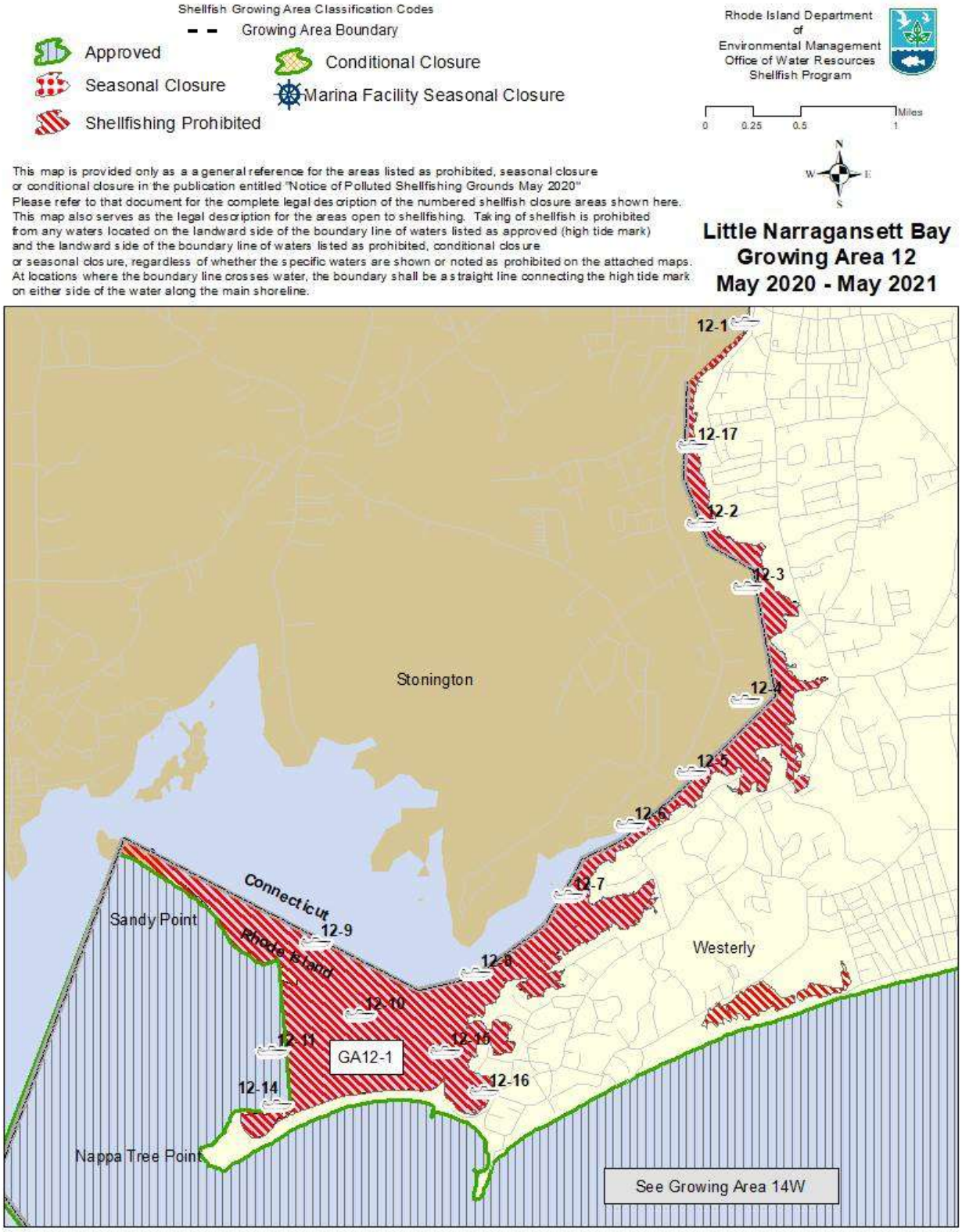
to more sporadic historic sampling that had been done prior to the collaboration with Save the Bay.

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

2. 2020 Survey

The entirety of the Rhode Island portions of Little Narragansett Bay is classified as Prohibited (Figure 1), therefore there has not been a comprehensive shoreline survey of the area by the shellfish program staff. This 2020 update summarizes recent fecal coliform water quality data in the growing area in support of TMDL efforts and to track potential changes in fecal coliform water quality. A TMDL report of fecal coliform was completed in 2010, which included a brief shoreline survey.

Figure 1: Current (2020-2021) Shellfish Classification Map of GA 12 with Routine Monitoring Stations



3. Water Quality Studies

RIDEM Shellfish Program

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

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

Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (Updated April 2020 and available in the Program's permanent files). Briefly, samples are collected 0.5 m(1-2 feet) below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice at <40 C. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2020) annual statistical report and commentary is below.

HIGHLIGHTS

*** Sampled 3X during 2020.**

*** The area is classified as prohibited, with the exception of sentinel station 12-11 which is located on the line between approved and prohibited waters.**

*** For approved station 12-11, statistics represent recent 30 samples collected under both wet (n= 15) and dry (n= 15) weather conditions during 7/30/2015 to 10/20/2020.**

*** Statistics for prohibited stations calculated for information purposes only, not for compliance.**

*** Informational statistics calculated for Approved and 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 12/11/2020.**

COMMENTARY

Little Narragansett Bay (Growing Area 12) was sampled three times during 2020 through a cooperative partnership between DEM Office of Water Resources and Save the Bay. 2020 samples included one collected during wet weather (> 0.5" rain prior 7 days) and two collected during dry weather. The area is classified as Prohibited, so there is no minimum sampling requirement. For more than ~20 years the area has been closed to shellfish harvest for direct human consumption due to elevated and unpredictable fecal coliform levels during wet weather. A TMDL study of the area was completed in 2010, with a focus on improving stormwater and wastewater management and reducing waterfowl impacts in the Pawcatuck River watershed.

The 2020 statistical review indicated that Little Narragansett Bay would not meet NSSP water quality criteria for shellfish harvest under either Approved or Conditionally Approved (with 0.5", 7-day rain closure) management scenarios. Fecal coliform levels remain unpredictable and elevated, especially during wet weather. The sentinel station (12-11) on the line between approved and prohibited waters was in compliance for 2020, demonstrating that the current closure line is appropriate. Under an Approved scenario, only a small area near stations 12-11 and 12-14 located in the western edge of the growing area adjacent to Approved waters, met fecal coliform criteria.

Under a Conditionally Approved management scenario, with a 0.5", 7-day rain closure six stations (12-8, 12-9, 12-10, 12-11, 12-14 and 12-15) in the central to western portion of Little Narragansett Bay would meet NSSP criteria during dry weather. The elevated and unpredictable fecal coliform response to rainfall indicates that the area is currently properly classified as Prohibited for shellfish harvest.

RECOMMENDATIONS

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

*** No other actions recommended.**

Table 1: GA12 Little Narragansett Bay fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA12

GA12 (Little Narragansett Bay and Pawcatuck River) were evaluated under two potential management scenarios (below). The area is classified as Prohibited; statistics shown for informational purposes only, not for compliance.

Approved scenario: Recent 30 all weather.
(7/30/2015 to 10/20/2020; all mTEC, 15 wet and 15 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
12-1	P	30	192.3	764.6
12-2	P	30	174.2	773.3
12-3	P	30	169.0	778.4
12-4	P	30	69.2	455.1
12-5	P	30	47.3	432.5
12-6	P	30	29.3	327.5
12-7	P	30	18.9	157.2
12-8	P	30	11.1	100.7
12-9	P	30	5.7	43.5
12-10	P	30	6.8	38.7
12-11	A	30	4.2	28.1
12-14	P	30	4.9	27.2
12-15	P	30	8.4	48.8
12-16	P	30	19.5	130.2
12-17	P	30	76.4	289.6

Conditionally approved scenario: Recent 15 dry (<0.5" in prior 7 days) weather only. (9/28/2015 to 9/23/2020, all mTEC, all dry weather of <0.5" in prior 7 days)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
12-1	P	15	138.2	100.0
12-2	P	15	94.7	93.3
12-3	P	15	92.4	93.3
12-4	P	15	27.4	46.7
12-5	P	15	17.3	26.7
12-6	P	15	10.9	20.0
12-7	P	15	8.3	13.3
12-8	P	15	3.6	6.7
12-9	P	15	2.3	0.0
12-10	P	15	2.9	0.0
12-11	A	15	2.6	6.7
12-14	P	15	2.9	0.0
12-15	P	15	4.8	6.7
12-16	P	15	13.9	26.7
12-17	P	15	54.8	73.3

4. Summary and Conclusions

The 2020 review of fecal coliform water quality data indicated that fecal coliform water quality in GA12 (Little Narragansett Bay) does not meet NSSP standards under all weather conditions. Fecal coliform concentration in the growing are elevated during wet weather. Analysis of recent data indicated that several stations in the central region of Little Narragansett Bay would meet criteria under a Conditionally Approved scenario, with the area closed for 7-days after 0.5" or greater rain. However, fecal coliform levels in the growing area are variable and continued monitoring under all weather conditions is required to demonstrate that water quality is reliably meeting NSSP criteria prior to possible reclassification. The 2020 update has demonstrated that the area is properly classified as Prohibited. No changes in classification are recommended.

Literature Cited:

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

Growing Area 13

Great Salt Pond at Block Island

2020 Annual Update

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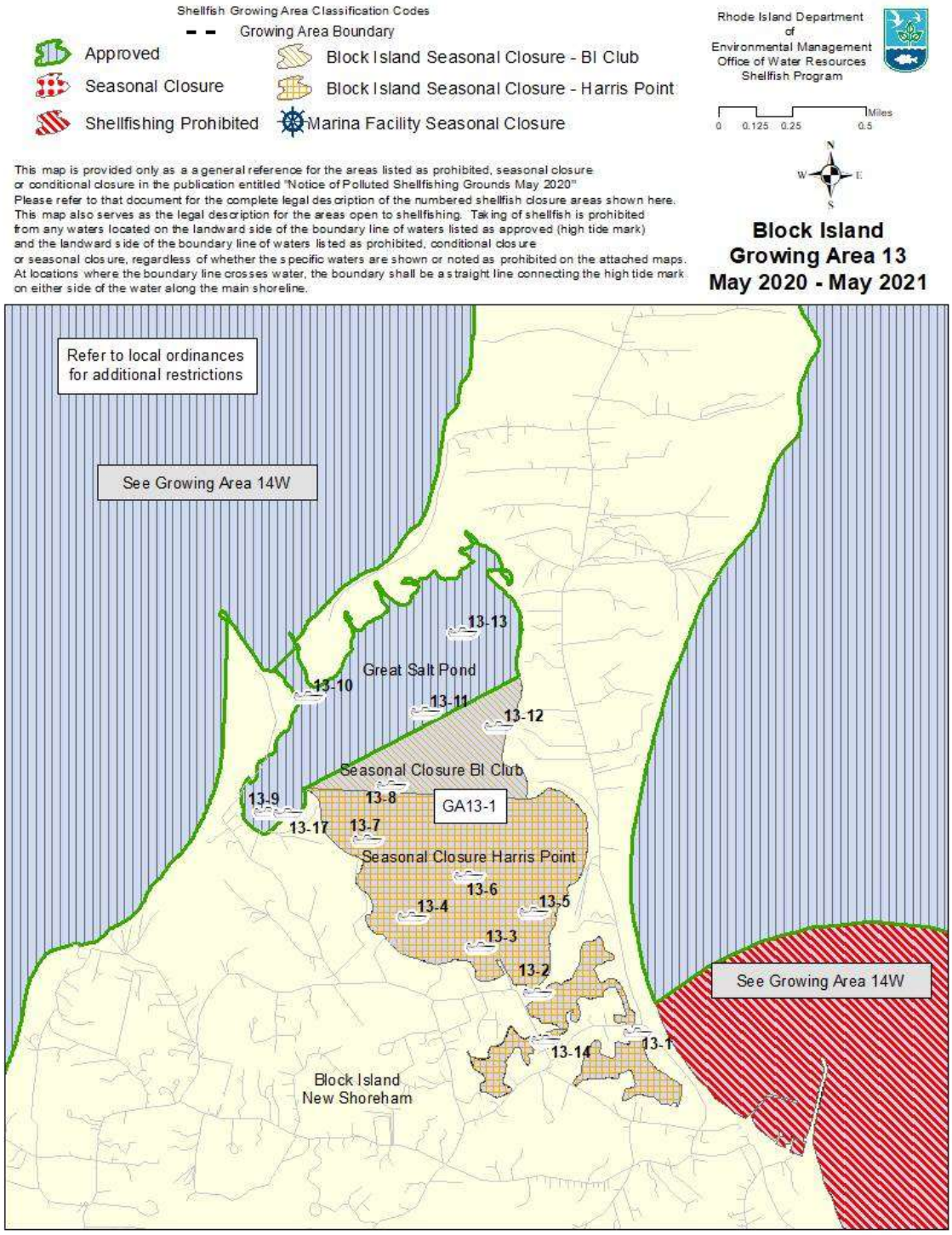
1. Introduction

A comprehensive 12-year sanitary survey of Great Salt Pond, Harbor Pond and Trims Pond on Block Island (Growing Area 13) was last conducted in 2018. The 2018 comprehensive survey involved a shoreline reconnaissance of the growing 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 sources of pollution potentially 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.

Figure 1: Current (2020-2021) Shellfish Classification Map of GA13 with Routine Monitoring Stations



2. 2020 Survey

No sources sampled during the 2018 survey surpassed the 2,400 cfu/100 mL threshold for resampling as part of the 2020 annual update. The 2020 update of GA13 included a review of OWTS complaints adjacent to the growing area and a review of fecal coliform data collected at monitoring stations in the growing area.

During the 2018 comprehensive survey 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. Possible 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 April 2020.

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

3. Marinas and Mooring Areas

Great Salt Pond on Block Island is a destination harbor that sees a dramatic increase in number of visiting boats during the summer months. There are six (6) commercial marinas that have nearly 450 slips and moorings available to the boating public in Great Salt Pond. Two (2) staggered seasonal closures go into effect beginning in May and expanding in June, which encompasses almost three quarters of the pond. These seasonal closures last through the recreational boating

season and end in October. Sampling of the growing area is completed once per month, year-round in a cooperative effort with the Block Island Harbor Master's office. A marina dilution calculation was performed and is detailed in the summary report entitled "Marina Dilution Analysis – June 2017" and also within the electronic excel document 2017 Marina Calcs VIMS FDA on file in the program's permanent files. By calculations there is sufficient dilution within these seasonal closures to be protective of adjacent shellfishing waters. The Town of New Shoreham operates five (5) pump out boats that operate in the Great Salt Pond in addition to a fixed station located in Old Harbor outside of this growing area that service the seasonal increase in docked and moored vessels in Block Island waters.

4. Wastewater Treatment Facilities

New Shoreham has a centralized 0.45 MGD wastewater 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 (GA14). The New Shoreham WWTF discharged a monthly average of 0.10 MGD during 2020, well-below the permitted flow of 0.45 MGD and the New Shoreham WWTF had no permit violations during 2020. 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).

5. Water Quality Studies

RIDEM Shellfish Program

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

Rhode Island is required to conduct bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at fifteen (15) monitoring stations located throughout Growing Area 13 (Figure 1). Four (4) stations have the Approved classification, ten (10) stations are in Conditionally (Seasonal) Approved waters and one (1) station is located in Prohibited waters.

Water samples are collected at monitoring stations throughout the growing area (Figure1). Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (updated April 2020 and available in the Program's permanent files). Briefly, samples are collected 0.5 m (1-2 feet) below the water surface using sterile 125 ml (4 ounce) Nalgene bottles and stored on ice at 4 C. They are transported to the Rhode Island Department of Health Laboratories for analysis via the mTEC method (APHA, 1999). The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. The growing area fecal coliform monitoring data are annually analyzed and evaluated for compliance with NSSP criteria for safe shellfish harvest. The most recent (2020) annual statistical report and commentary is below.

A. 2020 Review and Statistical Summary of Growing Area 13:

HIGHLIGHTS

*** Sampled 11X during 2020.**

*** For approved stations, statistics represent recent 30 samples collected under both wet (n= 11) and dry (n= 19) weather conditions during 4/19/2018 or 5/29/2018 to 12/30/2020.**

*** For seasonally approved stations, statistics represent recent 15 samples when area was open 11/20/2018 or 12/11/2018 to 12/30/2020 during both wet (n= 8) and dry (n= 7) conditions.**

*** All approved stations in compliance.**

*** All seasonally approved stations in compliance.**

*** All samples analyzed by the mTEC method.**

*** Data run 1/5/2021.**

COMMENTARY

Growing Area 13, the Great Salt Pond at Block Island, was sampled eleven (11) times during 2020, exceeding NSSP systematic random sampling requirements. Monitoring of Block Island shellfish growing waters was done through a cooperative agreement between the Town of New Shoreham Harbor Master's Office and DEM 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 11 wet weather and 19 dry weather samples. Similarly, statistics for seasonally approved areas are representative of both wet (n= 8) and dry (n= 7) weather conditions collected when the area was in open status.

The 2020 statistical review demonstrated that all approved and conditionally approved stations in GA13 (Block Island Great Salt Pond) are in compliance. Comparison of results at the conditionally (seasonal) approved stations also demonstrated that seasonal closures are effective in maintaining acceptable water quality during the open season in GA13. The need for a seasonal (summer) closure is especially evident for stations 13-2 and 13-14 located in the area of Great Salt Pond furthest from the breachway. These stations would exceed NSSP criteria if managed as Approved waters that were open to shellfish harvest year-round. The 2020 statistical evaluation demonstrated that all Approved and Seasonally Approved stations in Block Island's Great Salt Pond met NSSP fecal coliform criteria. The area is properly classified.

RECOMMENDATIONS

*** Continue cooperative agreement with Block Island Harbor Master to monitor Block Island shellfish growing areas.**

*** No other actions recommended.**

Table 1: GA13 Block Island Great Salt Pond fecal coliform compliance statistics for 2020.

RIDEM SHELLFISH GROWING AREA MONITORING: GA13

Approved stations, recent 30 all weather.

(4/19/2018 or 5/29/2018 to 12/30/2020; all mTEC, 11 wet and 19 dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
13-9	A	30	3.1	7.9
13-10	A	30	2.4	5.0
13-11	A	30	2.1	3.4
13-13	A	30	2.4	5.2

Results for all observations at seasonally approved and prohibited stations (below) for reference only and not for compliance. Recent 30 all weather (4/19/2018 or 5/29/2018 to 12/30/2020; all mTEC, 11 wet and 19 dry weather).

Station	Classification	N	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
13-1	SA	30	6.6	24.1
13-2	SA	30	6.2	34.4
13-3	SA	30	3.8	14.6
13-4	SA	30	3.5	13.7
13-5	SA	30	2.8	7.9
13-6	SA	30	2.4	6.3
13-7	SA	30	2.5	5.3
13-8	SA	30	2.5	6.4
13-12	SA	30	2.7	6.3
13-14	SA	30	7.0	38.3

Seasonally Approved (closure A & C)

Results for recent 15 samples at seasonally approved stations in seasonal closure areas A & C when station was open. Recent 15 samples (12/18/2017 or 1/24/2018 to 1/14/2020, 6 wet and 9 dry weather, all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
13-1	SA	15	4.0	0.0
13-2	SA	15	3.4	6.7
13-3	SA	15	1.9	0.0
13-4	SA	15	2.1	0.0
13-5	SA	15	1.9	0.0
13-6	SA	15	1.9	0.0
13-7	SA	15	2.0	0.0
13-14	SA	15	2.9	0.0

Seasonally Approved (closure B)

Results for recent 15 samples at seasonally approved stations in seasonal closure area B when station was open. Recent 15 samples (12/18/2017 or 1/24/2018 to 1/14/2020, 6 wet and 9 dry weather, all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
13-8	SA	15	1.9	0.0
13-12	SA	15	2.3	0.0

6. Summary and Conclusions

The 2020 review documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. The review also documented that the single WWTF in the growing area operated well-within its permit limits during 2020. The 2020 review of fecal coliform water quality data indicated that all stations in Growing Area 13 met NSSP criteria while in the open status.

The 2020 update has demonstrated that the area is properly classified. No changes in classification are recommended.

Growing Area 14E and 14W

RI Offshore Waters

2020 Annual Update

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Growing Area 14E and 14W

RI Offshore Waters

2020 Annual Update

1. Introduction

Growing Area 14 is the waters off the southern cost of Rhode Island out to the 3-mile state waters limit including the waters around Block Island. The growing area is broken into an eastern section, GA14E (Figure 1) and a western section (GA14W, Figure 2) which includes the offshore waters around Block Island. Most of the area is far from potential human impacts on microbial water quality and is therefore classified as remote. 12-year sanitary shoreline surveys of the Offshore Growing Area 14E and 14W was conducted in 2006 and 2018. 266 potential sources were located and investigated during the 2018 survey. 155 of the potential sources were not flowing and 111 potential sources were flowing at the time of the 2018 survey. Of these flowing sources, 82 sources had flows too small to measure (trickle or less) or were in locations too hazardous to sample (steep cliffs).

Figure 1: Current (2020-2021) Shellfish Classification Map of GA 14E with routine monitoring stations

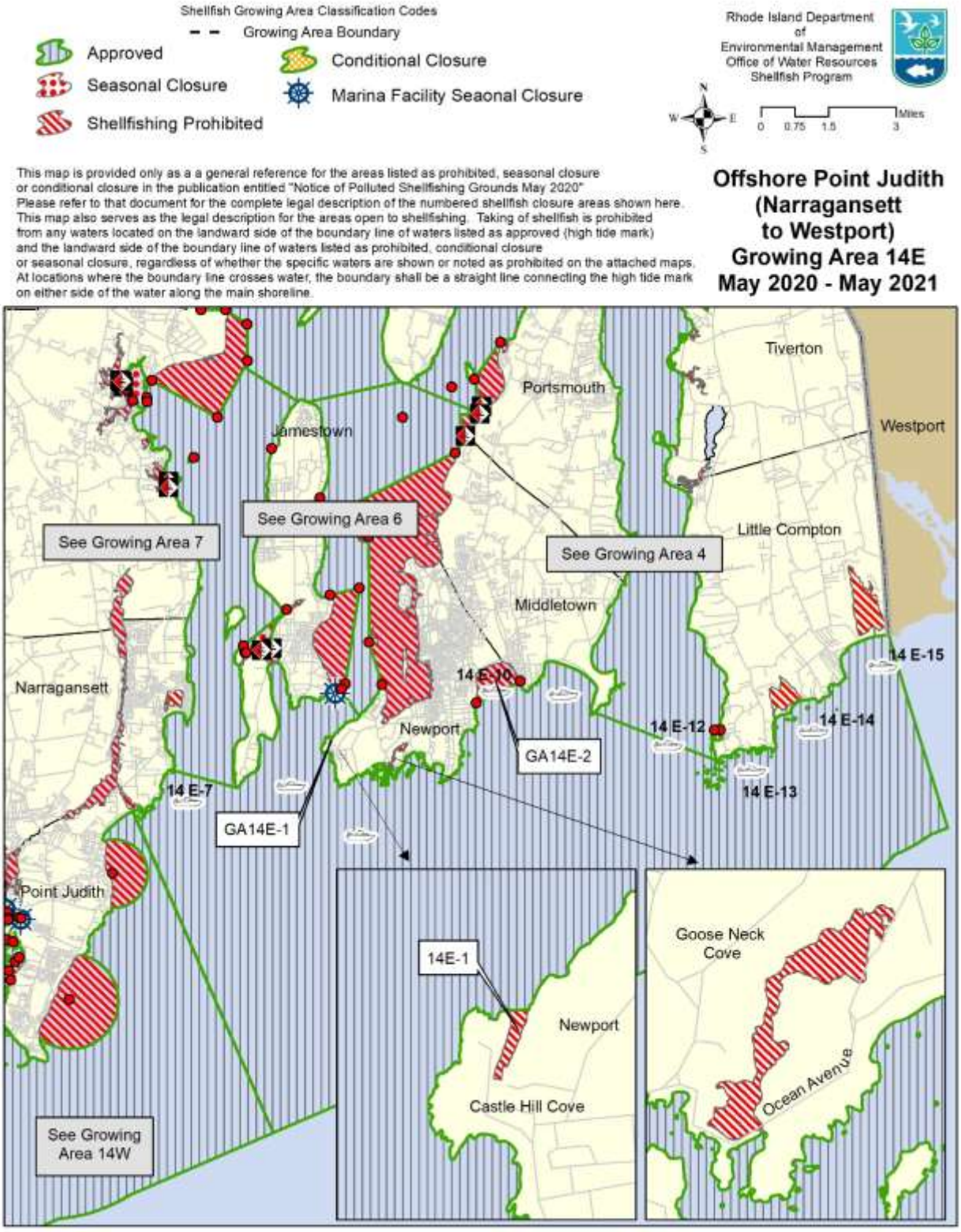
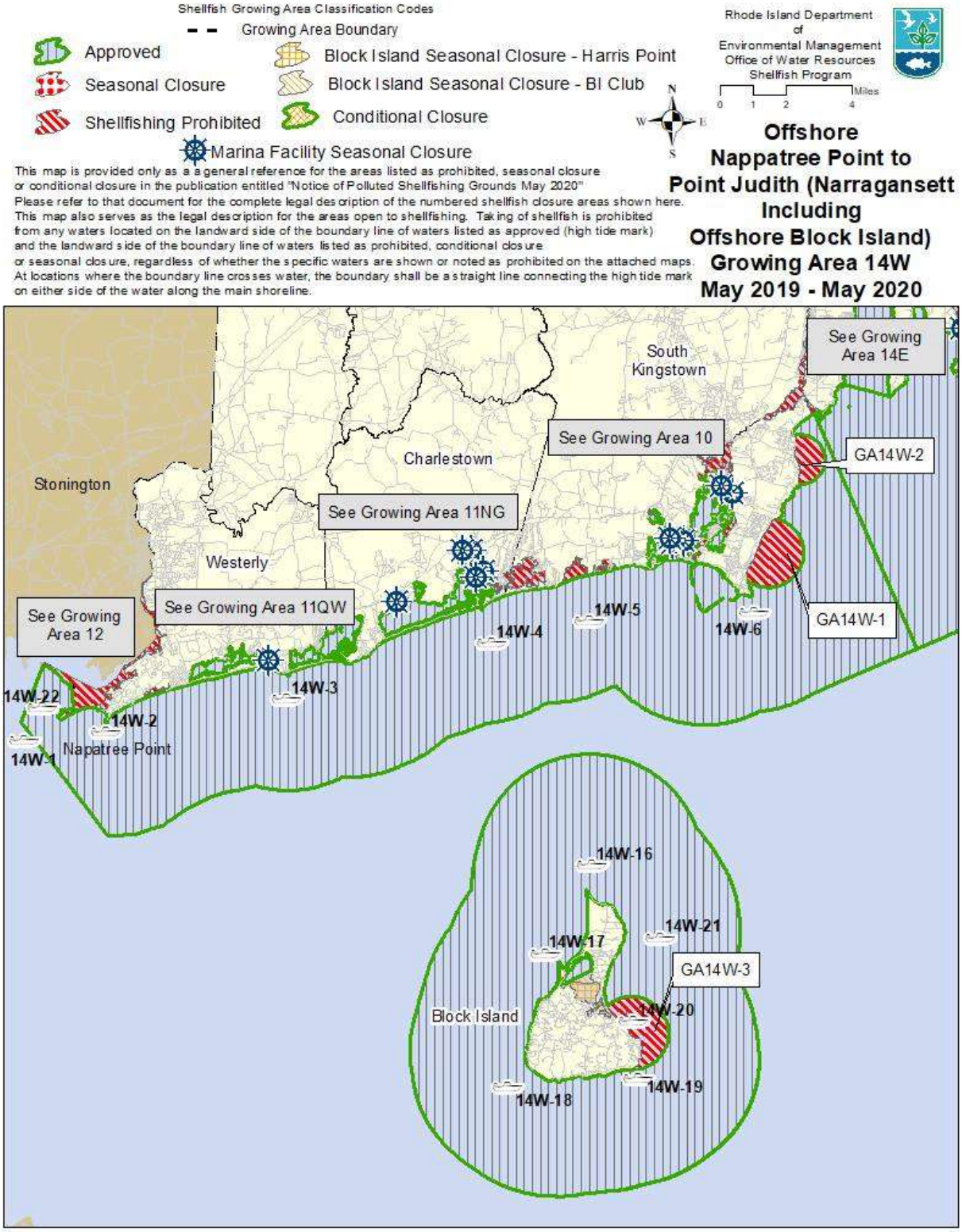


Figure 2: Current (2020-2021) Shellfish Classification Map of GA 14W Offshore with routine monitoring stations.



2. 2020 Survey

Due to the Covid-19 Pandemic, staff had limited abilities to visit and sample the four (4) follow-up sources in 2020. However, the 2019 annual update indicated that these four (4) sources warranting follow-up were either not flowing or had fecal coliform results of less than 240 cfu/100 ml. Details of the 2019 update of these sources is below.

In 2019, source 14E-200B (a groundwater seep) had a trickle flow and a fecal coliform result of <100 cfu/100 ml (Table 1). Source 2019-14E-300A, a small stream that dissipated through the sand before reaching the growing area, had a result of 100 cfu/100 and a trickle flow on 8/15/2019 (Table 1). Source 2019-14W-1302, a seep at Mohegan Bluffs on Block Island, had a trickle flow and a fecal coliform concentration of 180 cfu/100 ml (Table 1). When source 2019-14W-1327 (a small groundwater seep) was visited for the 2019 update it had no flow. The potential sources sampled in the 2019 update were all of low fecal coliform concentration and had low flow. The low flow rate and moderate fecal coliform concentration of these sources (Table 1) indicates that they do not have a significant effect on the microbial water quality of Growing Area14.

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 April 2020.

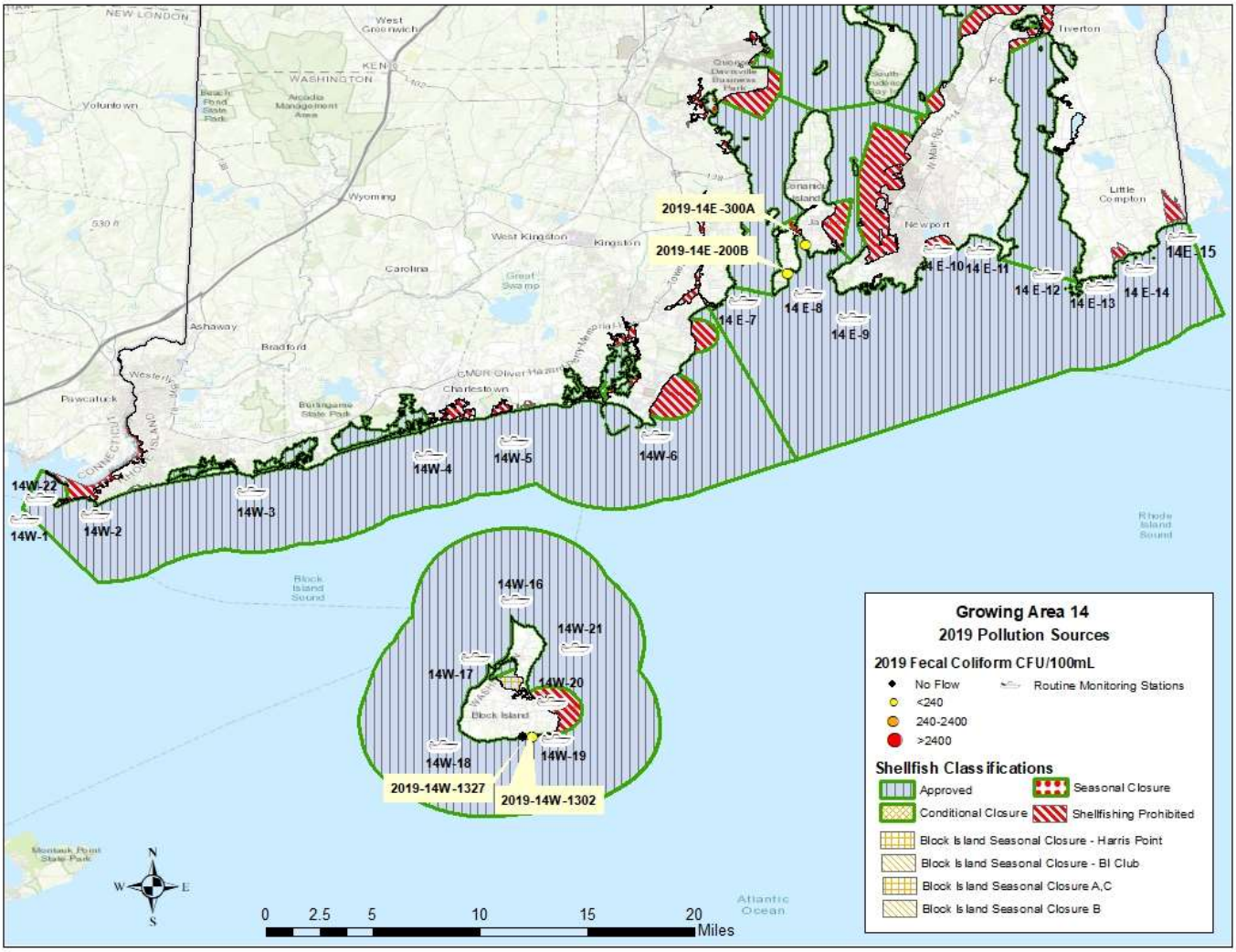
At the time of the shoreline survey, identified sources and immediately adjacent upland areas are visually inspected for any indications of activities having the potential to contribute poisonous or deleterious substances. Further evaluation is conducted during background watershed analysis when developing 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 14E and 14W due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

Table 1: 2019 Summary of Potential Pollution Sources for GA 14 Offshore

Source ID	Date Visited	Latitude	Longitude	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2018 mTEC cfu/100 ml	2019 Results mTEC cfu/100ml	2019 Volumetric Flow (cfs)
2019-14E-200B	8/15/2019	41.46286	-71.38984	GW seep spanning 20' along rock edge next to stairwell	Approved	A	D	2,800	<100	Trickle
2019-14E-300A	8/15/2019	41.48269	-71.37796	stream source. Does reach the water, very low flow	Approved	A	D	80,000	100	Trickle
2019-14W-1302	9/17/2019	41.1502	-71.5631	Flow from bluffs- reaches high tide line, behind 807 Mohegan Trail	Approved	A	D	5,000	180	Trickle
2019-14W-1327	9/17/2019	41.14947	-71.56894	GW stream, between 1082 and 1686 Mohegan Trail. Off bluffs	Approved	P	D	80,000	NF	NF

IS = In stream sample NS = Not sampled NF = No flow DNE = Does not exist

Figure 3: 2019 Pollution sources sampled during 2019 update.



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 April 2020.

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

3. Marina and Mooring Areas

The growing area has five (5) marinas, two (2) in the offshore waters of Block Island and three (3) in GA14E. The waters surrounding these marinas are classified as prohibited or have seasonal (summer) closures with sufficient dilution waters to be protective of adjacent shellfishing waters. Details of the marina dilution calculations can be found in the report entitled "Marina Dilution Analysis June 2017" and in the electronic excel file 2017 Marina Calcs VIMC FDA located in the program's permanent files.

4. Wastewater Treatment Facilities

The watershed adjacent to the offshore growing area is a mix of undeveloped beaches, rocky cliffs, small seasonal communities and other residential uses. There are no industrial or large commercial areas adjacent to approved offshore waters.

The Rhode Island Pollution Discharge Elimination System Program (RIPDES) is responsible for permitting all industrial and municipal waste discharges to waterbodies of the state. The RIPDES Program has documented and permitted three (3) wastewater treatment facilities that discharge into GA14. All WWTF have prohibited safety zones established around their outfalls. The size of these prohibited safety zones was developed to be protective of adjacent shellfish waters using the EPA PLUMES dilution and dispersion model program. The three (3) WWTF discharging to GA14 are:

Facility	Location	Permit Flow	2020 Avg. Flow
Scarborough WWTF	Narragansett	1.4 MGD	0.63 MGD
South Kingstown WWTF	S. Kingstown	5.0 MGD	2.36 MGD
New Shoreham WWTF	New Shoreham	0.45 MGD	0.10 MGD

In 2020 the Scarborough WWTF had an average flow of 0.63 MGD of the permitted flow of 1.4 MGD. A review of EPA ECHO DMR data indicated that the Scarborough WWTF had no flow or fecal coliform concentration permit violations during 2020. The South Kingstown WWTF reported an average flow of 2.36 MGD versus a permitted flow of 5 MGD and had no flow or fecal coliform violations during 2020. The New Shoreham (Block Island) WWTF had an average flow of 0.10 MGD during 2020. The New Shoreham WWTF had no flow or fecal coliform violations during 2020. The 2020 review of GA14 WWTF indicated that these facilities are well-run and are discharging treated effluent within the permitted flow and fecal coliform limits.

5. Water Quality Studies

RIDEM Shellfish Program

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

Water samples are collected at twenty-one (21) monitoring stations throughout the growing area. There are nine (9) monitoring stations in GA14E of which eight (8) are Approved and one is classified as Prohibited (Figure 4). There are thirteen (13) monitoring stations located in GA14W

of which twelve (12) are classified as Approved and one (1) is classified as Prohibited (Figure 5).

Water samples are collected at monitoring stations throughout the growing area (Figure1). Water samples are collected and handled according to the DEM Shellfish Programs Standard Operating Procedure (updated April 2020 and available in the Program's permanent files). Briefly, samples are collected 0.5 m (1-2 feet) below the water surface using 125 ml (4-ounce) sterile Nalgene bottles 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. Since June 2012, RIDOH has analyzed samples using the mTEC membrane filtration method; all samples used to calculate compliance statistics were analyzed by the mTec method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

A. 2020 Review and Statistical Summary of Growing Area 14:

HIGHLIGHTS

*** Sampled 2X during 2020.**

*** Area is remote in status.**

*** Statistics represent all data collected 7/29/2013 to 10/19/2020 (GA14-E); 7/12/2013 to 10/22/2020 (GA14-W) and 10/17/2013 to 10/28/2020 (GA14-BI).**

*** All samples analyzed by the mTEC method.**

*** All stations in program compliance.**

*** Data run 12/11/20120**

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 2020 in a collaborative effort

between DEM Water Resources and DEM Division of Law Enforcement. Waters around Block Island (stations 14-16 to 14-21) were monitored twice during 2020 in collaboration with the Town of New Shoreham Harbor Master's Office.

The statistical evaluation included the most recent 15 samples dating back to 2013. All recent samples in the analysis set (n=15) were analyzed by the mTEC method. Fecal coliform concentration in the offshore waters is consistently low (2 cfu/100 ml or less), with only six (6) of the 330 observations (1.8%) in the recent data set exceeding the 2 cfu/100 ml detection limit.

The 2020 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 efforts to monitor GA14 offshore remote waters.**

*** No other actions recommended based on ambient monitoring results.**

Table 2: GA13 Block Island Great Salt Pond fecal coliform compliance statistics for 2020

RIDEM SHELLFISH GROWING AREA MONITORING: GA14

GA14E, Recent 15 all weather.

(7/29/2013 to 10/19/2020; all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
14E-7	A	15	2.0	0.0
14E-8	A	15	2.2	0.0
14E-9	A	15	2.0	0.0
14E-10	A	15	2.0	0.0
14E-11	A	15	2.0	0.0
14E-12	A	15	2.0	0.0
14E-13	A	15	2.0	0.0
14E-14	A	15	2.0	0.0
14E-15	A	15	2.0	0.0

GA14W, Recent 15 all weather.

(7/12/2013 to 10/22/2020; all mTEC)

Station	Classification	N	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
14W-1	A	15	2.0	0.0
14W-2	A	15	2.0	0.0
14W-3	A	15	2.0	0.0
14W-4	A	15	2.0	0.0
14W-5	A	15	2.2	0.0
14W-6	A	15	2.0	0.0
14W-22	A	15	2.1	0.0

GA14BI, Recent 15 all weather.

(10/17/2013 to 10/28/2020; all mTEC)

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

6. Summary and Conclusions

The 2020 review of Growing Area 14 (Offshore) documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. The review also documented that the three (3) municipal WWTFs discharging to the growing area operated well-within permit limits during 2020. The 2020 review of fecal coliform water quality data indicated that all stations in Growing Area 14 met NSSP criteria while in the open status.

The 2020 update has demonstrated that the area is properly classified. No changes in classification are recommended.

Growing Area 15
Seekonk River
2020 Annual Update

All waters of the Seekonk River, Growing Area 15, are currently prohibited to shellfishing. The area was not sampled in 2020. 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.

HIGHLIGHTS

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

COMMENTARY

The Seekonk River (Growing Area 15) was not sampled during 2020. 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 low priority for the Shellfish Program because of its prohibited status and proximity to stormwater fecal coliform sources in the greater Providence area.

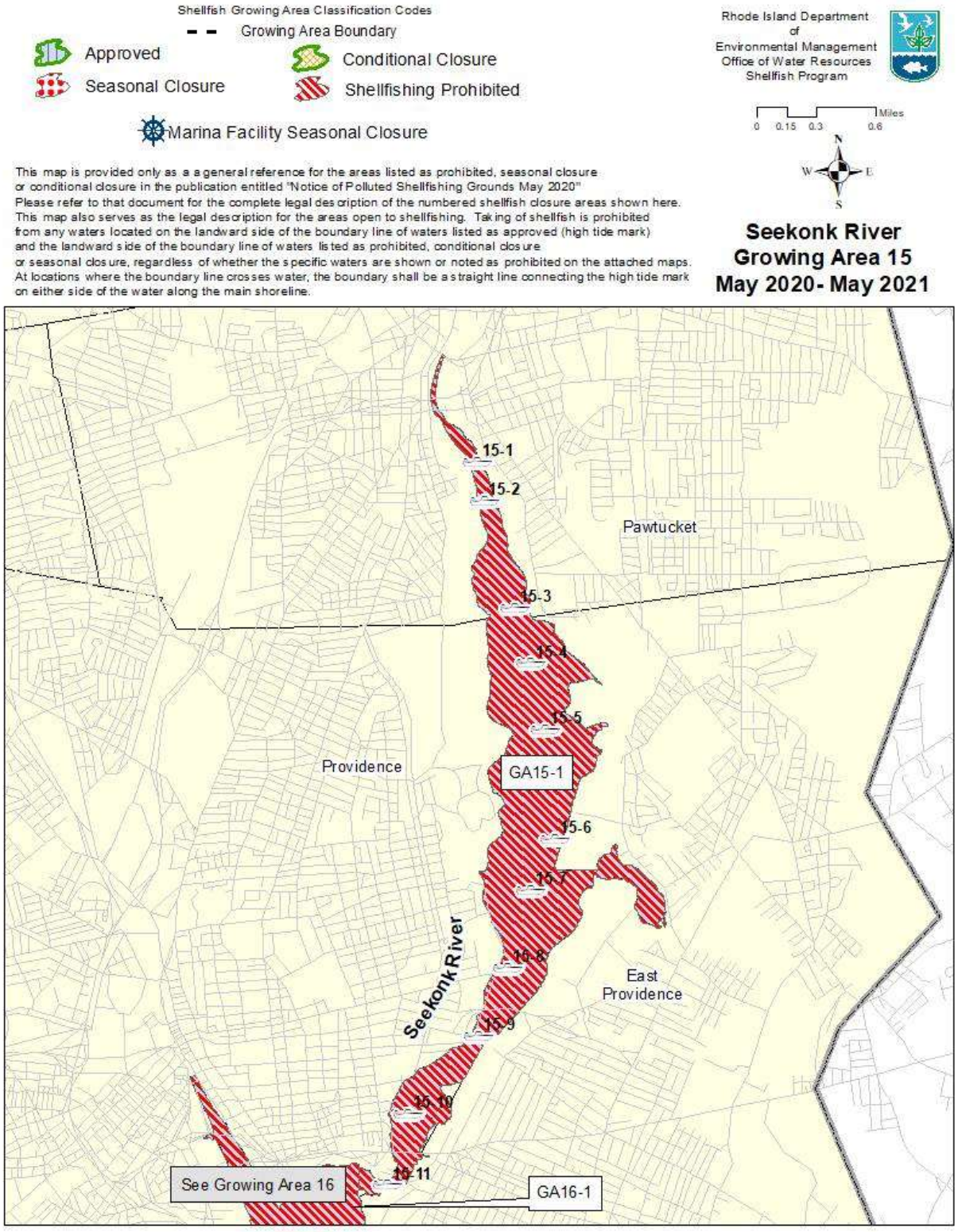
RECOMMENDATIONS

* 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 (2020-2021) Shellfish Classification Map GA15 with routine monitoring stations.



Growing Area 16
Lower Providence River
2020 Annual Update

Contents

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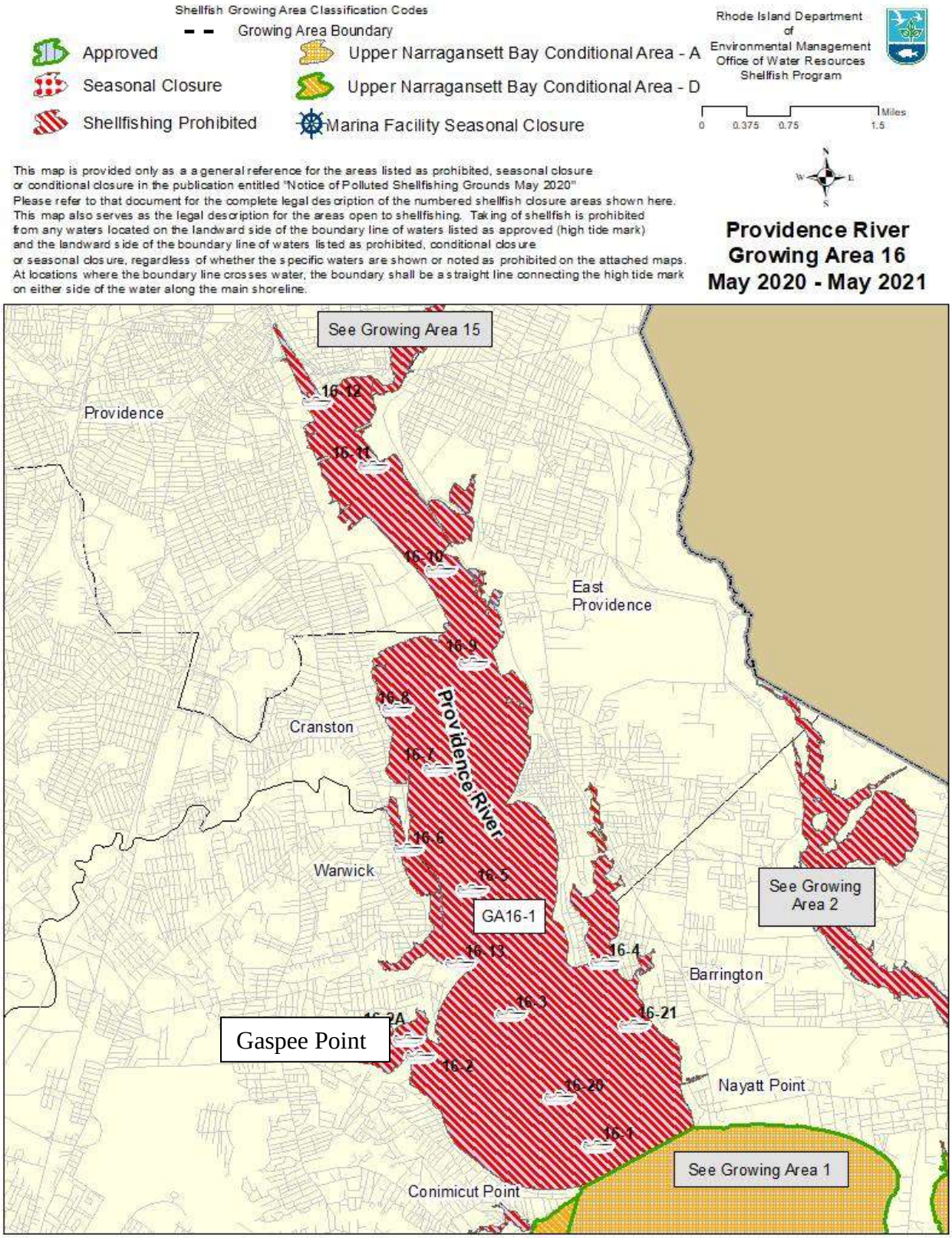
A. Introduction

Growing Area 16 is comprised of the waters of the lower Providence River. ***The entire growing area has historically been and is currently classified as Prohibited. The area south of Gaspee Point is planned to be upgraded to Conditionally Approved with a 7-day, 0.5" rain closure in May 2021.*** While the area has been classified as Prohibited, DEM Shellfish Program staff have regularly monitored the southern portion of the growing area (from Gaspee Point south to Conimicut Point) since 2015 in an effort to track water quality changes following upgrades in stormwater treatment capacity at the major WWTF in the area. 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 of this area was completed in 2017. Three (3) sources exceeded the 240 cfu / 100 ml threshold during the 2017 survey. The 2020 survey involved follow-up sampling the previously identified elevated sources.

Figure 1: Current (2020-2021) Growing Area 16 Classification Map with routine monitoring station locations.



B. 2020 Shoreline Survey

Three (3) sources identified during the 2017 triennial survey warranted follow-up sampling during 2020. Due to the Covid-19 pandemic staff had limited abilities to visit and sample all necessary sources in 2020 so only the two (2) sources having greater than trickle flow were resampled as part of the 2020 annual evaluation (Table 1). These follow-up samples were collected on February 25, 2021.

Source 16-001 had a 2020 result of < 100 cfu/100 ml and companion in-stream samples collected approximately 8 meters (25 feet) from the source indicated rapid dilution with results of 28 to 52 cfu/100 ml in the receiving waters. Similarly, source 16-022 had a fecal coliform level of < 100 cfu/100 ml during the 2020 survey and companion in-stream samples collected approximately 8 meters (25 feet) from the source indicated rapid dilution with results of 2 cfu/100 ml and 1.9 cfu/100 ml in the receiving waters. These sources (16-001 and 16-022) had acceptable fecal coliform levels on 2/25/2021 which was three (3) days after 0.49" rain at nearby TF Green Airport (NOA KPVD weather station). The 2020 results indicate that sources 16-001 and 16-022 have little negative impact on the microbial water quality of the growing area.

Table 1: Summary of sources evaluated during 2020 survey

Source ID	Date Visited	Lat. Long.	Description	Receiving waters classification	Actual / Potential	Direct / Indirect	2018 Results mTEC cfu/100ml	2019 Results mTEC cfu/100ml	2020 results cfu/100ml	2020 Volumetric Flow (cfs)
2020-16-001	2/25/21	41.71857 -71.3708	24" RCP Half filled with sediment	Prohibited	A	D	880	99	< 100	0.212
2020-16-022	2/25/21	41.72835 -71.3817	Stream that drains into marshy beach, upstream is covered in vegetation, address end of Rock Ave.	Prohibited	A	D	1000	6700	< 100	0.255

C. Marinas

The Providence River leads to New England's second largest deep-water port, with many vessels traveling through these waters transporting goods to and from Rhode Island. In addition, hundreds of recreational vessels of various sizes use these waters for recreational enjoyment. There is 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 and all marinas are located north of Gaspee Point. ***No marinas are located in waters south of Gaspee Point which is the area of GA16 under evaluation for reclassification***.

Details of the 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. Wastewater 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 6 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 2020 data indicated that the major WWTFs in the Providence area had no significant violations of their NPDES discharge permits. The East Providence WPCF (RI0100048) reported one permitted discharge violation during 2020, a daily max *Enterococci* level of 2,420 CFU/100ML reported on 11/30/20, although the monthly average was an acceptable 4 CFU/100 ml. Average 2020 flow at the East Providence facility was 5.79 MGD of a permitted flow of 14.2 MGD. The Narragansett Bay Commission Bucklin Point WWTF (RI0100072) reported an average flow rate of 17.7 MGD during 2020 compared to a permitted flow of 31 MGD. This plant reported one violation of elevated *Enterococci* on 10/31/20 of 525.5 MPN/100 ml, exceeding the permitted 276MPN/100 ml limit. The Narragansett Bay Commission Field's Point WWTF (RI0100315) reported no flow or fecal coliform violations during 2020. Average monthly flow through the Field's Point WWTF was 38.95 MGD during 2020 versus a permitted flow of 65 MGD. The 2020 review of GA16 WWTF 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 2: Location of major and minor dischargers within the Providence River watershed.

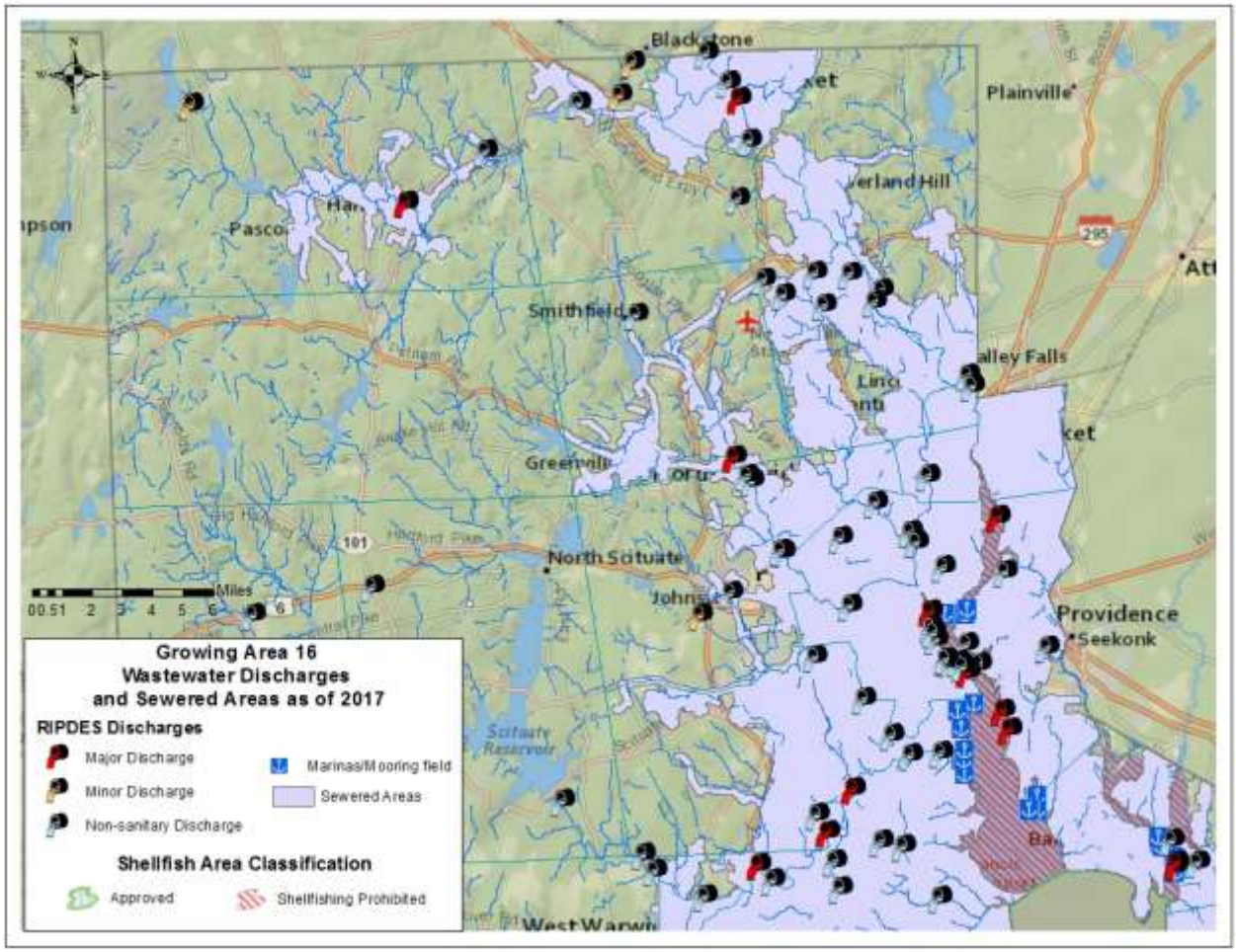


Table 2: Permitted Dischargers within the Providence River watershed

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. Water Quality Studies / Annual Statistical Summary

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

Water samples are routinely collected at six (6) monitoring stations in the southern portion (south of Gaspee Point) of Growing area 16 (stations 16-2, 16-2A, 16-3, 16-4, 16-20, 16-21). The entirety of GA16 is currently classified as Prohibited, so all of these stations are located in Prohibited waters.

Samples are collected and processed according to the DEM Shellfish Program's standard operating procedure as documented in the Program's permanent files (Shellfish Growing Area Monitoring Program SOP, updated April 2020). Briefly, water samples are collected 0.5 m (1-2 feet) below the water surface using 125 ml (4-ounce) sterile Nalgene bottles 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. Since the summer of 2012, RIDOH has analyzed samples using the mTEC membrane filtration method; all samples used to calculate compliance statistics were analyzed by the mTEC method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

GROWING AREA 16 – PROVIDENCE RIVER

HIGHLIGHTS

*** Stations in the lower Providence River were sampled twelve (12) times during 2020 under both wet (n= 4) and dry (n= 8) weather conditions.**
*** The area is classified as Prohibited; shellfish harvest is prohibited in the Providence River (GA 16).**
*** Statistics calculated for informational purposes only, not for compliance.**
*** Recent 30 samples collected 5/23/2018 or 8/27/2018 to 12/16/2020.**
*** Recent 15 dry weather samples collected 8/27/2018 or 2/5/2019 to 11/17/20.**
*** All samples analyzed by mTEC method.**
*** Data run 1/5/2021.**

COMMENTARY

The southern portion of the Providence River (stations 16-2, 16-3, 16-4, 16-20, 16-21 and 16-2A in Growing Area 16) was sampled 12 times during 2020 under a variety of wet (n= 4) and dry (n= 8) weather conditions. While this area is currently 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 tunnel) upgrades. Summary statistics for this shellfishing prohibited area were calculated under two possible management scenarios for informational purposes.

Approved management scenario

The 2020 statistical update indicated that one station (16-21, located on the eastern shore of the area) met NSSP criteria for the Approved classification under all weather conditions. The remaining five stations did not meet criteria demonstrating that an Approved classification is not appropriate for the lower Providence River growing area.

Conditionally Approved management scenario

The 2020 statistical update indicated that the central portion of the growing area supported a Conditionally Approved management scenario with a 0.5", 7-day rain closure. Five of six monitoring stations met NSSP criteria for Conditionally Approved stations during 2020. Station 16-4, located in the narrows at the entrance to Bullock Cove, did not meet criteria. 2020 marks the fifth consecutive year (2016 to 2020) that the central portion of the lower Providence River (GA16) met NSSP criteria for Conditionally Approved areas using a 0.5", 7-day rain closure criteria.

The area is properly classified as prohibited to shellfish harvest. However, recent fecal coliform data support reclassification of the central region of the growing area as Conditionally Approved with a 0.5", 7-day rain closure.

RECOMMENDATIONS

*** Continue to monitor lower Providence River under all weather conditions to evaluate potential reclassification.**
*** Data support potential reclassification of portions of the lower Providence River as conditionally approved with a 0.5" rain closure threshold and a 7-day closure duration.**
*** No other actions recommended based on ambient monitoring results.**

Table 3: GA16 Lower Providence River fecal coliform compliance statistics for 2020

RIDEM SHELLFISH GROWING AREA MONITORING: GA16

Six stations in GA16 (Providence River) were evaluated under two potential management scenarios (below). The area is currently classified as prohibited. Statistics shown for informational purposes only, not for compliance.

Approved scenario
Recent 30 all weather.
(5/23/2018 or 6/27/2018 to 12/16/2020; 15 wet and 15 dry, all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	90th percentile (cfu/100 ml)
16-2	P	30	7.6	48.4
16-2A	P	30	6.1	32.9
16-3	P	30	8.4	50.3
16-4	P	30	7.9	37.4
16-20	P	30	5.5	31.0
16-21	P	30	4.0	17.8

Conditionally Approved scenario (0.5", 7-day rain closure)
Recent 15 dry weather only (<0.5" rain in previous 7 days) only.
(8/27/2018 or 2/5/2019 to 11/17/2020, all mTEC)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
16-2	P	15	5.7	6.7
16-2A	P	15	4.9	6.7
16-3	P	15	3.8	0.0
16-4	P	15	6.5	13.3
16-20	P	15	3.0	0.0
16-21	P	15	2.6	0.0

F. Summary and Conclusions

The 2020 annual review documented that there are no shoreline pollution sources that are negatively impacting the fecal coliform water quality of the growing area. The WWTF discharging treated effluent into waters adjacent (up-stream) to the growing area were in compliance with permitted fecal coliform loading during 2020. The 2020 review of fecal coliform water quality data indicated that all monitoring stations in the growing area with the exception of Bullocks Cove (station 16-4) meet NSSP criteria for safe shellfish harvest during dry weather conditions (<0.5" rain in prior 7 days).

The 2020 update has demonstrated that the central portion of the growing area south of Gaspee Point and north of Conimicut Point could support a classification change to Conditionally Approved with a 0.5", 7-day duration rain closure.

G. 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
Triennial Re-Evaluation
2020

Photo courtesy of the Town of Bristol, RI

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

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1. Introduction

The Mt. Hope Bay 2020 shoreline survey was conducted as a triennial re-evaluation of the growing area. As such, the survey included a review of previous shoreline surveys including bacteriological sampling of actual pollution sources noted in previous surveys that had greater than 240 cfu/100 ml fecal coliform concentration. These previously identified pollution sources were re-evaluated to determine their bacteriological impacts on Mount Hope Bay. In addition, the growing area was reviewed for any new potential pollution sources.

A 12-year shoreline survey of Mount Hope Bay was last conducted during August of 2014 by staff from RIDEM's Office of Water Resources Shellfish 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 last triennial survey of the area was completed in 2017 and annual updates were completed in each year between triennial and 12-year surveys.

The Mount Hope Bay growing area (GA17) is managed as a conditionally approved area that has both Conditionally Approved and Prohibited waters (Figure 1). Mt. Hope Bay contains both Rhode Island and Massachusetts state waters. There are 16 routine monitoring stations located throughout the Rhode Island portion of the growing area. Management of the Mt. Hope Bay (GA17) shellfish growing area runs concurrently with the conditionally approved Kickemuit River growing area (GA5) that is contiguous with Mt. Hope Bay (Figure 1).

2. Description of Growing Area

Mt. Hope Bay forms the northeast corner of Narragansett Bay, lying within both Rhode Island to the south, west, southeast and Massachusetts to the north and east. The southwest limit of the growing area is bounded to the southwest by a line from Bristol Point to the Hog Island Shoal light, to the

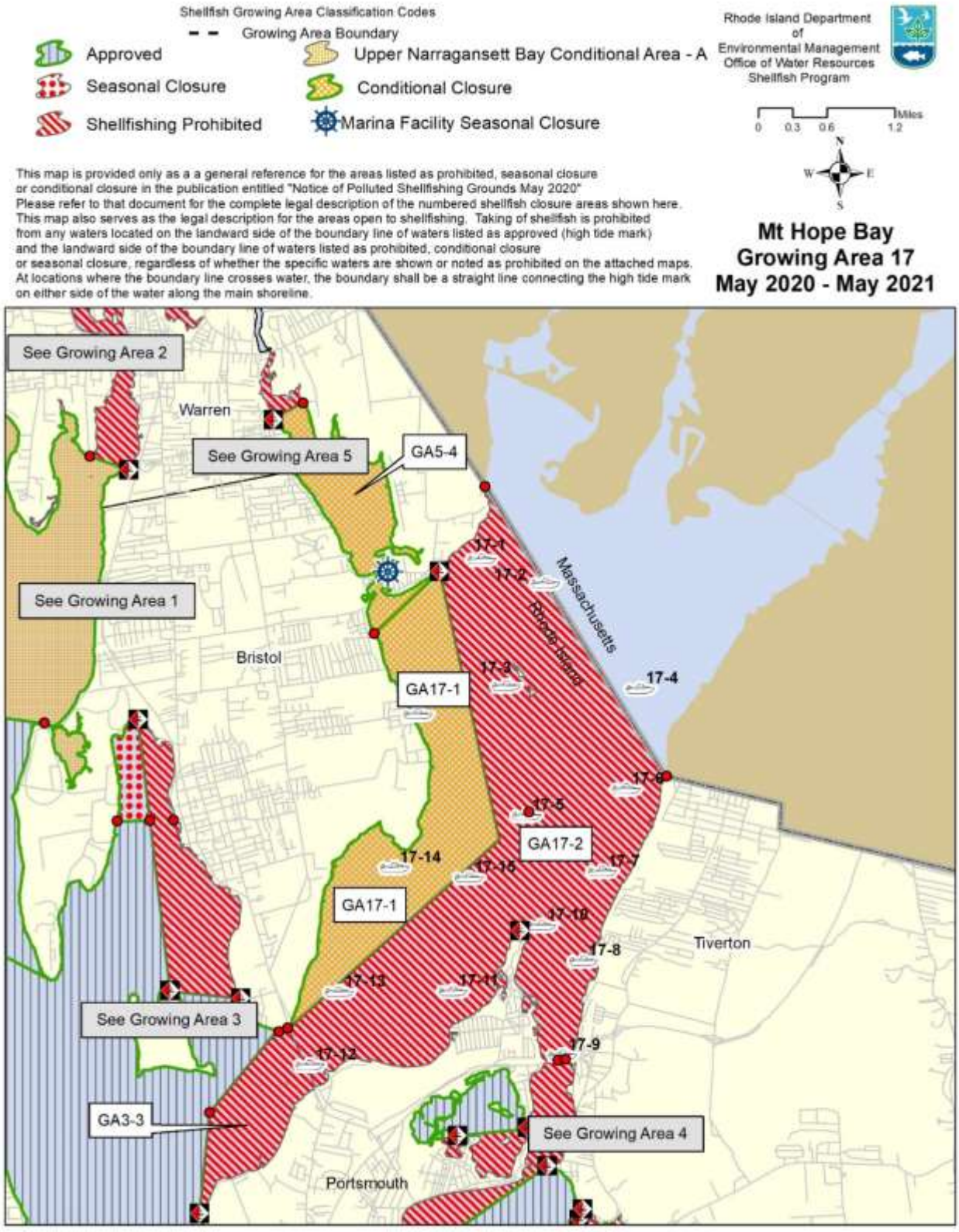
southwestern extremity of Arnold Point in Portsmouth. The southeast limit is the Sakonnet River Bridge. The northwest limit abuts the Kickemuit River Growing Area (GA5) at the mouth of the river, and the northeast limit is the Rhode Island – Massachusetts state line (Figure 1). Mount Hope Bay adjoins the East Passage of Narragansett Bay where the Mt. Hope Bridge crosses between Bristol and Portsmouth. There are five major freshwater inputs to the Bay with the Taunton River being the largest freshwater source.

Growing Area 17 is presently comprised of sections classified as either prohibited or conditionally approved for shellfishing (Figure 1). This divide in classification has the conditionally approved area along the western shoreline and the prohibited zone along the eastern half of the Bay established as a closed safety zone adjacent to the Fall River WWTF outfall. The Mt. Hope Bay (GA17) conditional 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 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) as recorded at the NOAA Taunton weather station (NOAA KTAN).

The following information describes the physical geography of this growing area:

Area of RI Prohibited waters	4,247 acres (1,719 hectares)
Area of RI Conditionally Approved waters	1,508 acres (610 hectares)
Longest reach	5.0 miles (8.0 km)
Widest reach	2.6 miles (4.2 km)
Deepest point	75 feet (23 meters)

Figure 1: Current (2020-2021) Shellfish Classification Map GA17



3. Pollution Source Survey

Steven Rogers and Steven Engborg, Biologists from the Department of Environmental Management Division of Water Resources conducted the review for the triennial update of the shoreline of Mt. Hope Bay (GA17). This review involved follow-up sampling on all previously identified sources in which previous results exceeded the 240 CFU/100 ml threshold established in the shellfish programs standard operating procedures. In 2020, three (3) sources warranted follow-up sampling. Recent results for these sources are in Table 1 and a map of the source locations is in Figure 2. Follow-up sampling for the 2020 update was conducted on 7/16/2020 during a period of dry weather (11 days after 0.11" rain at the NOAA KTAN weather station).

Two sources, source17-2 (a stream flowing from a detention basin on the western shore of the area) and source 17-413 (a 48" concrete pipe on the eastern shore of the growing area), were dry and not flowing at the time of the 2020 follow-up sampling.

Source 17-101, a small stream that originates in a drainage swale and terminates on a sandy shore under the eastern end of the Mt. Hope Bridge in Bristol, RI had a low flow rate of 059 cfs and a fecal coliform result of 100 cfu/100 ml on 7/16/2020. Companion instream samples collected in the receiving waters approximately 8 m (25 feet) east and west of this source had results of 2 cfu/100 ml demonstrating rapid dilution of this source in the receiving waters. In addition, source 17-101 flows into Prohibited waters that provide an added dilution zone between the source and the conditionally approved waters of Mt. Hope Bay (GA17). The 2020 triennial evaluation has demonstrated that shoreline sources are not negatively impacting the fecal coliform water quality of the growing area.

Figure 2: Source 17-101 a small stream draining a swale near the eastern end of the Mt. Hope Bridge.

Figure 3: 2020 Pollution Sources in GA17

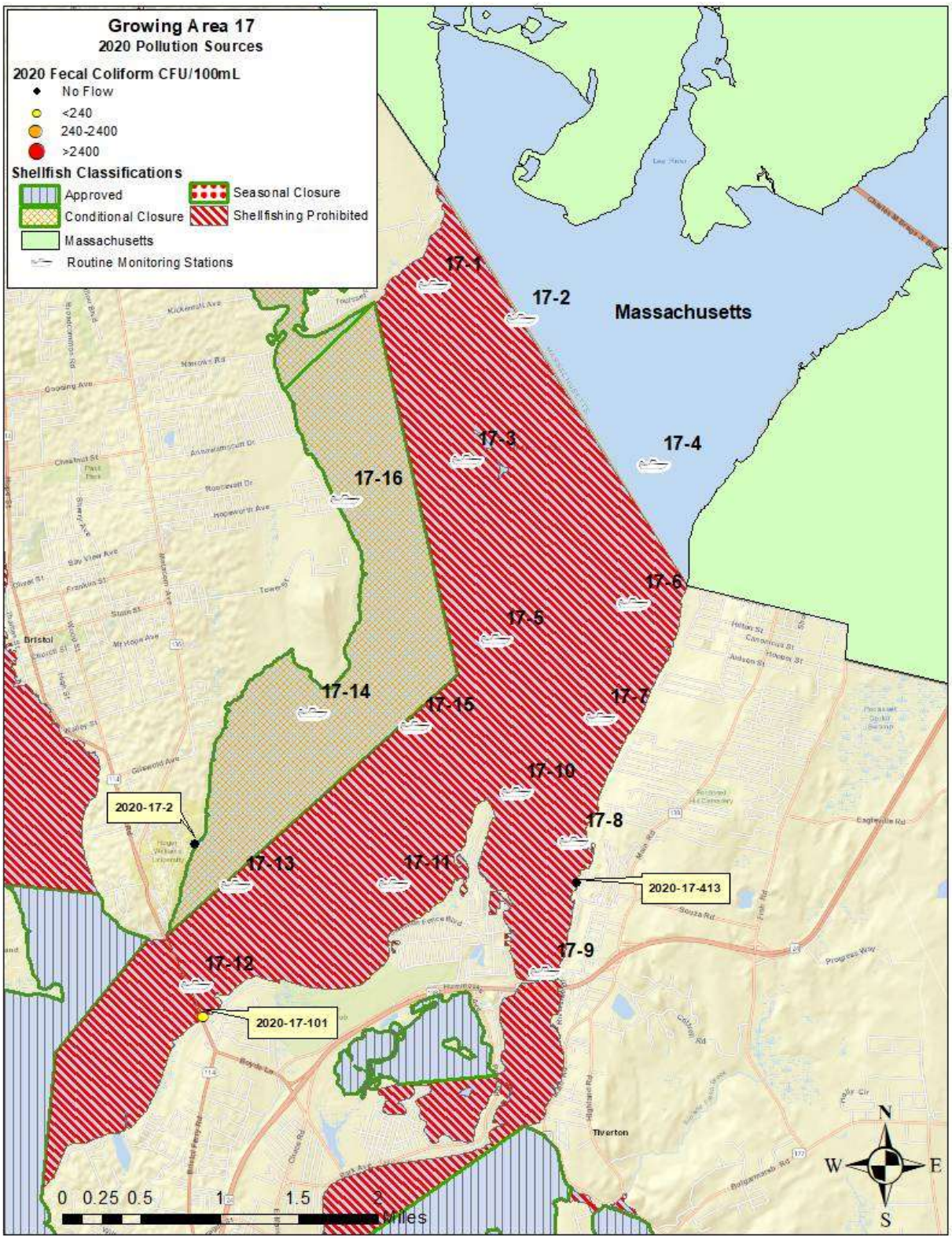


Table 1: 2020 Summary of Pollution Sources in GA17

Source ID	Date	Lat	Long	Description	Classification	Actual / Potential	Direct / Indirect	2018 Results cfu/100ml	2020 Results cfu/100 ml	2020 Flow (cfs)
2020-17-2	7/16/2020	41.65152	-71.25602	Stream from detention basin through apt. complex	CA				NF	N/A
2020-17-101	41.6357	41.6357	-71.2551	Drainage along property ROW. In 2017, could not find/no longer exists.	Prohibited	A	D	340	100	0.059
2020-17-413		41.6478	-71.2092	48" dia outfall at condo complex	Prohibited				NF	N/A

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

4. Poisonous and Deleterious Substances

In addition to identifying fecal coliform sources, all actual and potential pollution sources discharging or having the potential to discharge to shellfish waters were evaluated for the likelihood of poisonous or deleterious substances that may adversely affect a growing area. Growing Areas with the potential to be impacted by poisonous and deleterious sources from existing and legacy sources have been established and classified as Prohibited. The likely sources of these substances are industrial discharges, seepage from waste disposal sites, or agricultural lands. Prohibited areas were established based on land uses within the watershed, consultation with DEM's Office of Waste Management, in situ water column, sediment and shellfish testing. Natural toxins such as those produced by phytoplankton are addressed through routine harmful algae monitoring according to the program's HAB Monitoring and Contingency Plan, RIDEM April 2020.

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 Growing Area 17 due to poisonous or deleterious substances at harmful levels that would be of concern and cause a public health risk.

5. Mooring Fields and Marinas

There are two marinas located along the northeastern shore of Portsmouth within a 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. The two marinas are also located within the prohibited area and there is a sufficient dilution zone to mitigate and potential impact from boater pollution. 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".

All RI waters are designated as a "No Discharge Zone". 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

6. Wastewater Treatment Facilities (WWTF)

There are several sanitary discharges from wastewater treatment plants in the Massachusetts portion of the watershed of Mt. Hope Bay. The plants closest to the growing area are the Somerset Sewer Treatment Plant and the Fall River Wastewater Treatment Plant. These sources have the potential to have a significant impact on the status of the growing area should failure in treatment occur at any of these facilities and the required closed safety zones 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, primarily along the eastern and southern sides of the bay, was determined to be a necessary closure in the case of a WWTF failure after the completion of hydrographic time of travel dye studies in completed in 1987 (Rippey and Watkins, 1987) and 2013 (FDA, 2017; FDA, 2018). The western side of the growing area is sufficiently distant from the Fall River

WWTF to have sufficient dilution in the event of WWTF failure (Rippey and Watkins, 1987; FDA, 2017; FDA, 2018).

This western portion of the growing area (Figure 1) is operated as a conditionally approved area, with closures dependent upon rainfall or snowmelt events of 0.5" or greater in 24-hours, necessitating a temporary closure of these waters for a minimum of seven days. This precipitation closure procedure is outlined in more detail in the Mt. Hope Bay (GA17) Conditional Area Management Plan on file in the Shellfish Program's permanent files. Recent FDA analyses (FDA 2017, 2018) also recommended a 6 MG Fall River WWTF bypass closure to enhance public health protection in GA17. This additional closure criterion is to protect public health in the rare event of a 6 MG or larger bypass under rainfall of less than 0.5" in 24-hours (GA17 is managed with a 0.5" in 24-hour rain closure criteria). This added closure criterion was incorporated into the Mt. Hope Bay (GA17) Conditional Area Management Plan 2019 update (available in the Program's permanent files).

7. Water Quality Studies

RIDEM Shellfish Program

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

Water samples are collected at sixteen (16) monitoring stations throughout the growing area. Two (2) of the stations are in Conditionally Approved waters and the remaining 14 stations are in Prohibited waters.

Samples are collected and processed according to the DEM Shellfish Program's standard operating procedure as documented in the Program's permanent files (Shellfish Growing Area Monitoring Program SOP, updated April 2020). Briefly, water samples are collected 0.5 m (1-2 feet) below the water surface using 125 ml sterile Nalgene bottles. Samples are then stored in a cooler packed with ice for transport to the Rhode Island Department of Health Laboratories for analysis. Since June 2012, RIDOH has analyzed samples using the mTEC membrane filtration method; all samples used to calculate compliance statistics for GA4 were analyzed by the mTEC method. Fecal coliform results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. Shellfish growing area fecal coliform data are analyzed and compliance statistics are calculated annually. A summary of these statistics and related commentary is below.

2020 Review and Statistical Summary of Growing Area 17

HIGHLIGHTS

*** Mt. Hope Bay (Growing Area 17) was sampled nine times during 2020.**
*** For conditionally approved stations, statistics represent recent 15 samples when area was open during 8/20/2019 to 4/12/2021.**
*** 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 4/19/2021.**

COMMENTARY

The conditionally approved Mt. Hope Bay Growing Area (GA17) was sampled nine times during 2020; a deviation from the usual 12 samples per year. Monitoring was limited during spring 2020 due to Covid-19. In addition, October 2020 was a wet month in the area, with 5.9" of rain compared to an October long-term mean level of 4.3"at the Taunton Airport (KTAN) weather station. The wet October 2020 weather resulted in the area being closed 18.5 of 31 days in the month. Of these, there were only five business days on which growing area was in the open status and the laboratory was available to analyze samples. The area was also sampled 9 times during 2019 mainly due to wet weather. This resulted in a moderately reduced number of samples (9 vs. the usual 12) collected during both 2020 and 2019. Note that samples were not collected in six of last 15 months (wet in Oct-Dec 2019, Covid preventing sampling for April 2020, July 2020, wet Oct 2020). Because of this, the sampling window for calculation of 2020 compliance statistics was extended through April 2021.

The Mt. Hope Bay growing area (GA17) was sampled 15 times during 8/20/2019 through 4/12/2021. All samples were collected during dry weather (<0.5" rain in prior 7 days) when the area was in the open status. Sixteen (16) stations are sampled in Mt, Hope Bay, with two stations classified as conditionally approved and the remainder classified as prohibited. The 2020 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 2020 statistical review also demonstrated that all (14 of 14) stations in the growing area that are classified as prohibited also met criteria. These stations are classified as prohibited due to time of travel of a potential bypass or upset at the Fall River wastewater treatment facility.

The 2020 review demonstrated that the conditionally approved stations (17-14 and 17-16) in the Mt. Hope Bay (Growing Area 17) meet NSSP criteria and are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No other actions recommended based on ambient monitoring results.**

Table 2: Growing Area 17 fecal coliform compliance statistics

RIDEM SHELLFISH GROWING AREA MONITORING: GA17
Recent 15 when open.
(8/20/2019 to 4/12/2021, all mTEC, all dry weather)

Station	Classification	n	Geometric mean (cfu/ 100 ml)	% greater than 31 cfu/100 ml
17-1	P	15	3.0	0.0
17-2	P	15	3.1	0.0
17-3	P	15	5.2	6.7
17-4	P	15	2.7	0.0
17-5	P	15	3.2	0.0
17-6	P	15	3.0	0.0
17-7	P	15	3.0	0.0
17-8	P	15	2.6	0.0
17-9	P	15	2.6	0.0
17-10	P	15	3.4	6.7
17-11	P	15	2.8	6.7
17-12	P	15	2.6	0.0
17-13	P	15	3.0	0.0
17-14	CA	15	2.7	0.0
17-15	P	15	2.7	0.0
17-16	CA	15	4.0	6.7

8. Conclusions and Recommendations

The 2020 Triennial Re-evaluation of Mt. Hope Bay (GA17) demonstrated that shoreline sources are not negatively impacting the microbiological water quality of the growing area when this conditionally approved area is in the open status for shellfish harvest. A statistical review of water column fecal coliform levels while the conditionally approved area was in the open status indicated that all conditionally approved stations met NSSP criteria and that the Mt. Hope Bay Growing Area (GA17) is in program compliance and is properly classified.

Growing Area 17 is a conditionally approved growing area, impacted by precipitation events and potentially impacted by discharge from the Fall River sewage treatment facility. Therefore, the RIDEM Shellfish Program monitors Growing Area 17 in accordance with the guidelines set forth in the Mt. Hope Bay Conditional Area Management Plan (CAMP) revised in August 2019. The Mt. Hope Bay (Growing Area 17) CAMP was re-evaluated during this review and the monitoring and management actions were consistent with the management plan (CAMP).

The 2020 triennial update has demonstrated that the area meets NSSP criteria and is properly classified. No changes in classification are recommended.

9. Literature Cited

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.

Rippey, SR and Watkins, WD. 1987. Mt. Hope Bay Sanitary Survey – Microbiological 1986-1987 Final Report. US Public Health Service, Food and Drug Administration, Northeast Technical Services Unit, Davisville, RI 02852. 64 pages.