2014 Shellfish Program Classification Report

RI Department of Environmental Management

Upper Narragansett Bay
Growing Area 1
2014 Annual Update

A sanitary survey of the Upper Narragansett Bay Growing Area 1 was conducted in 2009. A triennial update was completed in 2012. There were a total of seventy-seven (77) actual or potential sources identified during this shoreline survey, excluding marinas. 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. In 2012 follow-up sampling was done of 13 sources of actual or potential pollution that were identified in the 2009 shoreline survey report. Each of these sources had results that were equal to or exceeded the recommended follow-up threshold of 240 MPN outlined in the shellfish programs standard operating procedures. All sources in which flow was observed were sampled. As a result of the sampling in 2012, four sources had results greater than 240 MPN and were sampled for the 2013 annual review. Of those four sources none of the results exceeded 2400 cfu/100ml requiring follow-up sampling. However two sources 1-202 and 1-207 originally exhibited elevated bacteria counts in 2009 (above 2400) and were resampled for this annual review.

Source ID	**Description**	**2009 Results MPN** Fc/100ml	**2012 Results mTEC** Cfu/100ml	**Volume**	**2013 Results mTEC** Cfu/100ml	**2014 Results mTEC** Cfu/100ml
1-001	STREAM	430	29	51.0 cfs	NS	NS
1-002	MILL CREEK	930	102	453.3 cfs	NS	NS
1-003	OUTLET FROM UPSTREAM WETLAND	750	610	.04 cfs	NF	NS
1-023	OUTLET MARSH	1100	130	0.34 cfs	NS	NS
1-030	18" RCP	430	933	Trickle	NF	NS
1-040	STREAM	460	754	.02 cfs	258 .007 cfs	NS
1-041	STREAM	930	140	Trickle	NS	NS
1-044	STREAM	1500	NF	NF	NS	NS
1-051A	STREAM FROM UPLANDS	240	NF	NF	NS	NS
1-070	STREAM	460	160 In stream 2 cfu/100ml	Trickle	NS	NS
1-075	36" CMP	460	260	0.04 cfs	1070 Drip	NS
1-202	24" RCP	24001	5800	.25 cfs	NS	3
1-207	GW STREAM	4300	12 In stream 7 cfu/100ml	Drip	NS	NF

HIGHLIGHTS

*** All Areas Open Sampled 12X in 2014**
*** Statistics represent most recent data >10/1/13 (N=15) for Conimicut Triangle stations**
*** Statistics represent most recent data >10/15/13 (N=15) for "Area A" stations**
*** Statistics represent most recent data >03/6/14 (N=15) for "Area B" stations**
*** All conditionally approved stations in compliance when open**
*** mTEC = 15 (<31 cfu/100ml)**
*** *Data run 4/30/14***

COMMENTARY

The Upper Narragansett Bay (Growing Area 1) was sampled fourteen (14) times in 2014. Additional targeted sampling was also completed in 2014 to analyses areas under a variety of rain conditions. All samples in the analysis were collected during dry weather conditions when the areas were "open/approved" for shellfish harvesting. Some samples were also collected in the Conimicut Triangle when it was closed and Area A was open to try to confirm that the Triangle is properly classified. Additional samples were collected at the new stations in area B under wet conditions (>1.5") in an attempt to quantify an upper limit to the rain closure criteria. The statistical evaluation for the Upper Narragansett Bay incorporates the most recent 15 (the minimum number required by NSSP Manual of Operations guidelines for conditionally approved areas) dry weather samples collected for each station in the Conimicut Triangle, Area "A" and "Area" B.

Results of this year's review demonstrate that Station 12, located on the line between the Conimicut Triangle and the Providence River, should still be closed at the 0.5" mark because of the variability in the available samples.

RECOMMENDATIONS

*** All conditionally approved stations are in compliance and conformance**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
Conimicut Triangle when open				
GA1-12	CA	15	2.4	0.00
Area A when open				
GA1-5C	CA	15	2.5	0.00
GA1-6A	CA	15	2.3	0.00
GA1-7	CA	15	2.1	0.00
GA1-8A	CA	15	2.3	0.00
GA1-10	CA	15	2.2	0.00
GA1-11A	CA	15	2.7	0.00
GA1-12	CA	15	2.4	0.00
GA1-1	CA	15	2.4	0.00
GA1-4	CA	15	2.2	0.00
Area B when open				
GA1-2	CA	15	2.6	0.00
GA1-3C	CA	15	2.3	0.00
GA1-6A	CA	15	2.3	0.00
New Stations Area B Stations 13, 14 when open				
GA1-13	CA	13	2.1	0.00
GA1-14	CA	13	2.0	0.00
Conimicut Triangle when closed and Area A open (2011 THRU 2014 all data, >0.5” < 0.8” less than 7 days)				
GA1-12	CA	5	10.6	20.00

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31	90TH PERC
Area B new Stations 13, 14 (<8 days >1.5" Rain)					
GA1-13	**CA**	**4**	**13.2**	**50.00**	
GA1-14	**CA**	**4**	**12.1**	**25.00**	

Currently there are no changes recommended to the closure criteria currently in place for the Conimicut Triangle, sub-area "A" or sub-area "B". No other changes to the current conditionally approved classification are recommended at this time. A triennial update is scheduled for 2015. The following is the current classification map for GA1 with the location of routine monitoring stations.

Shellfish Growing Area Classification Codes

Growing Area Boundary

Upper Narragansett Bay Conditional Area - A

Upper Narragansett Bay Conditional Area - B

Upper Narragnasett Bay Conditional Conimicut Triangle

Approved

Seasonal Closure

Shellfishing Prohibited

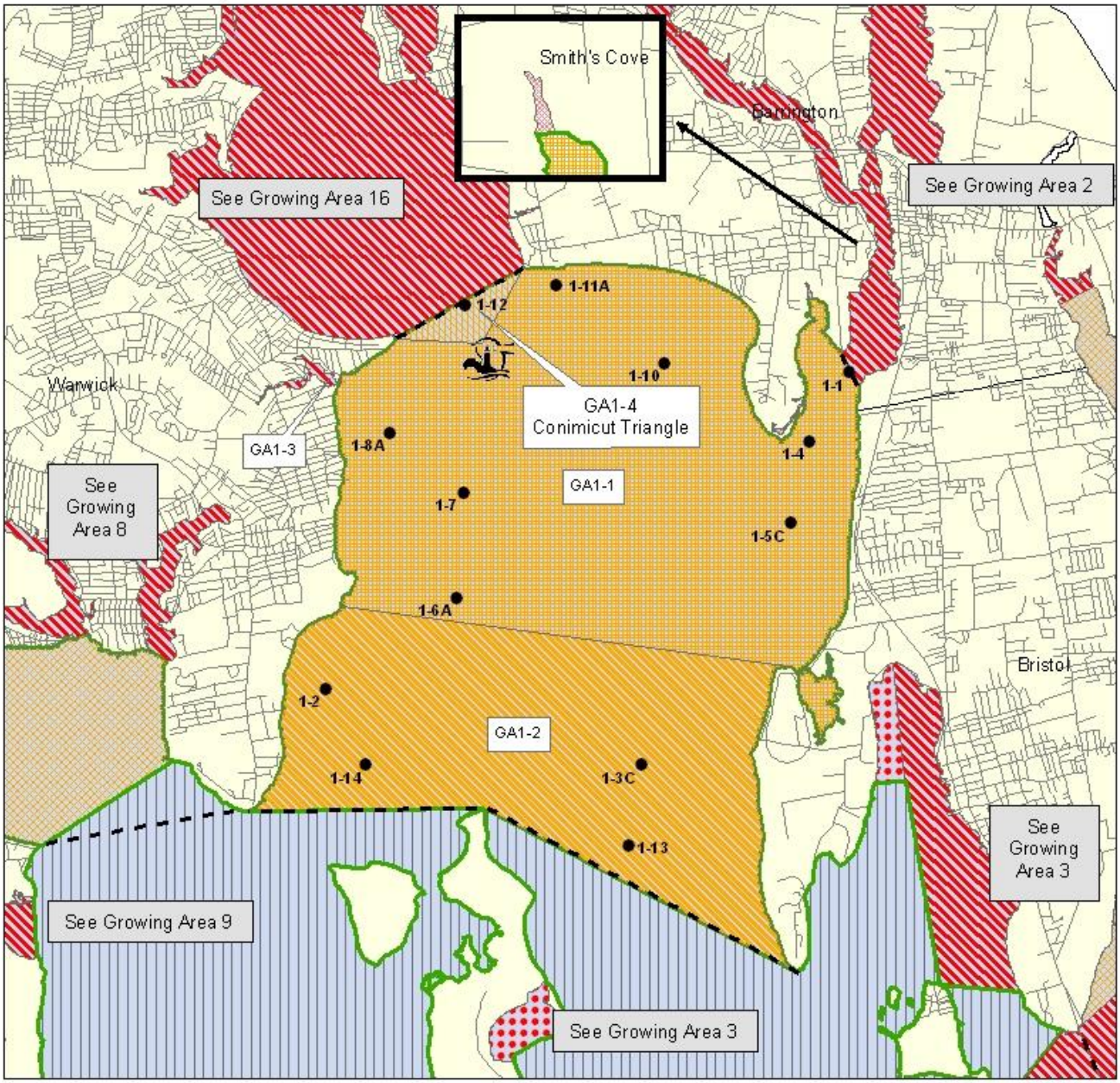
Un-assessed - Shellfishing Prohibited

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

0 0.275 0.55 1.1 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Upper Narragansett Bay Growing Area 1 May 2014 - May 2015



Growing Area 2
Barrington, Palmer and Warren Rivers
2014 Annual Update

All waters of the Barrington, Palmer and Warren Rivers, Growing Area 2 are currently prohibited to shellfishing. The area was sampled twice in 2014 during both during wet weather conditions. Results from existing sampling indicate that the area is out of compliance during wet weather and generally out of compliance during dry weather. The area is therefore correctly classified as prohibited. The monitoring of this area will continue in 2015 as recommended by the TMDL in order to gather a more comprehensive database of water quality under various conditions.

A joint effort by the states of Massachusetts and Rhode Island to identify sources of pollution along with watershed sources to the Palmer River is slated for the summer of 2015.

The results of the routine monitoring stations indicate that this growing area is properly classified and therefore no changes to the classification are recommended at this time.

HIGHLIGHTS

*** Sampled 2x in 2014 (both during wet weather)**
*** Statistics represent combined wet and dry weather data >07/01/10 (N=15)**
*** Statistics represent dry weather only >7/25/05 (N=15) same as last year**
*** Area is presently classified as prohibited**
*** MTEC = 6**
**** Data run 2/10/15***

COMMENTARY

The Barrington, Palmer, and Warren Rivers (Growing Area 2) were sampled two times during the 2014 sampling season. Both runs were conducted during wet weather conditions. The sampling boat could not fit under the bridge due to high tide conditions so only 14 samples for stations 6, 6A, 7 and 7A for one run.

The stations located in the Barrington River (Stations 1 – 5), and the Palmer River (Stations 6 – 8), were downgraded from conditionally approved to prohibited about twelve years ago. The TMDL for the area was completed in 2002 and the recommendations involving the shellfish program call for monitoring the area bimonthly (refer to TMDL).

Results of the limited statistical evaluation for the area, conducted since the completion of the TMDL (>1/1/03), indicate that the area is out of compliance during wet weather and generally out of compliance during dry weather. Additional wet and dry weather data is recommended to better generally characterize the area.
The area is properly classified.

RECOMMENDATIONS

*** Maintain closure of all the Barrington River and Hundred Acre Cove**
*** Maintain closure of all the Palmer River**
*** Even though area is closed, attempt six systematic random samplings to support TMDL recommendations.**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS
Wet/Dry Combined

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31/49	90TH PERC(49)
GA2-1	P	15	37.0	33.33	387.3
GA2-1A	P	15	11.4	20.0	104.1
GA2-2	P	15	7.1	6.67	44.7
GA2-3	P	15	7.4	6.67	34.3
GA2-4	P	15	5.5	6.67	33.2
GA2-5	P	15	5.3	6.67	23.0
GA2-6	P	14	39.2	42.86	348.5
GA2-6A	P	14	167.9	92.86	1053.4
GA2-7	P	14	8.9	7.14	41.9
GA2-7A	P	14	11.0	7.14	47.5
GA2-8	P	15	6.6	6.67	45.2
GA2-9	P	15	5.5	0.00	19.8
GA2-10	P	15	3.6	0.00	11.4
GA2-13	P	15	3.9	0.00	13.3

*values adjusted for mtec

2/10/15

Dry Weather Only most recent 15

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 49	90TH PERC(<49)
GA2-1	P	15	15.0	20.0	132.4
GA2-1A	P	15	10.1	13.33	82.3
GA2-2	P	15	7.5	13.33	47.2
GA2-3	P	15	6.1	13.33	28.9
GA2-4	P	15	6.5	6.67	27.0
GA2-5	P	15	6.5	6.67	31.7
GA2-6	P	15	21.7	20.0	138.7
GA2-6A	P	15	117.6	66.67	899.0
GA2-7	P	15	6.2	0.00	20.3
GA2-7A	P	15	10.8	6.67	60.1
GA2-8	P	15	8.7	0.00	29.0
GA2-9	P	15	6.8	13.33	37.9
GA2-10	P	15	5.3	0.0	23.2
GA2-13	P	15	8.7	13.33	101.1

The following closure map is for the May 2014 – May 2015 season and also depicts the routine monitoring station locations. No changes to existing prohibited classification recommended.

Shellfish Growing Area Classification Codes

Approved

Shellfishing Prohibited

Upper Narragansett Bay Conditional Area - A

Upper Narragansett Bay Conditional Area - Conimicut Triangle

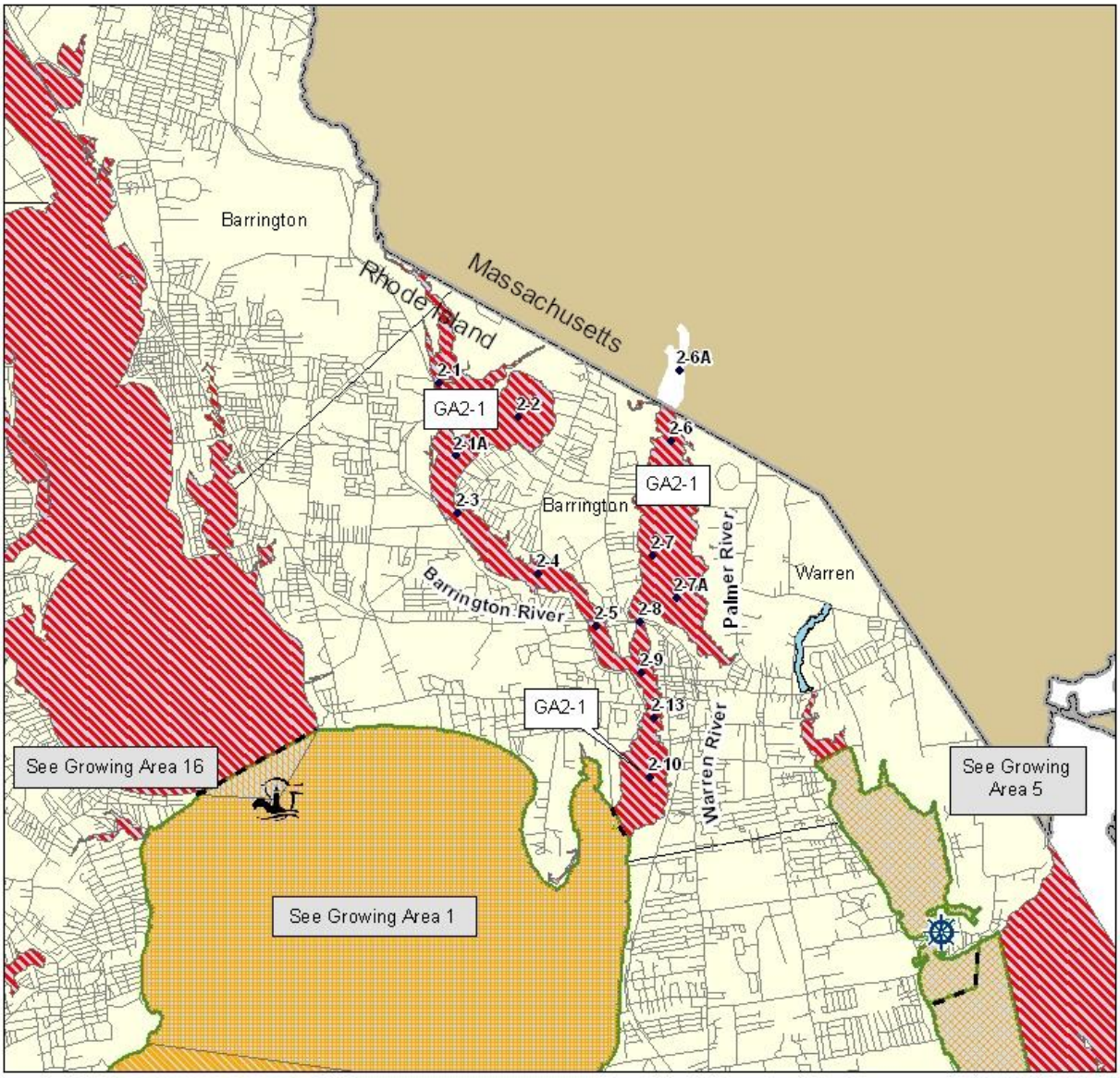
Growing Area Boundary

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

0 0.375 0.75 1.5 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Barrington, Palmer and Warren Rivers Growing Area 2 May 2014 - May 2015



East Middle Bay
Growing Area 3
2014 Annual Update

A 12 year sanitary shoreline survey of the East Middle Bay Growing Area 3 was conducted in 2010. There were a total of sixty-one (61) actual or potential sources identified during this shoreline survey, excluding marinas. A total of forty-five (45) were not actively flowing at the time of the shoreline survey with the remaining sixteen having flows warranting sampling. All sources in which flow was observed were sampled.

Of the forty-five sources exhibiting flows during the 2010 survey only five had bacteria results exceeding the 2400 fc/MPN threshold requiring follow-up sampling for this annual update. Three of the five, 3-201, 3-005 and 3-018 are located in Prohibited areas and were not re-investigated for this update. The other two sources, 3-060 and 3-301 were re-sampled in 2013.

Source 3-060 is a small stream at the southerly end of Hog Island which is the outlet of tidal wetlands. The results of sampling in 2010 were 2400fc/MPN from the initial sampling and >/= 24,000fc/MPN with in stream results of <3fc/MPN. In 2012 results were 23fc/MPN and in 2013 the results were <2 cfu/100ml. Due to the remoteness of this source and the large upland wetlands and the lack of anthropogenic impacts it would appear that this source is not having a negative impact on the classification of the receiving waters.

Source 3-301 is a small stream thru a RCP culvert draining an upland wetland at the southerly end of Prudence Island. The source was sampled twice in 2010 with initial bacteria results of 2400fc/MPN and follow-up sampling results of 23fc/MPN and in stream results of <3 and 4fc/MPN. This was a low priority to re-sample in 2012 due to the remoteness of the source and the lack of anthropogenic impacts. The source was re-sampled in March of 2012 with results of 43fc/MPN from the source and in stream results of <3 fc/MPN both north and south of the source. This source was re-sampled in 2013 with results of <2 cfu/100ml and in 2014 with results of 50 cfu/100ml. It would appear that neither of these sources are having any negative impact on the receiving waters.

In June of 2012 the RIDOH converted to the mTEC method to analyze shellfish water samples. During the transition period and until 30 samples using only the mTEC method have been collected the variability component of the NSSP water standard will be weighted to reflect the number of samples from each method. For GA3 15 sets of samples were analyzed using the mTEC method therefore the 90th percentile variability must be less than 39 CFU. Refer to RIDEM SOP "Transition to Membrane Filtration (mTEC) for Analysis of Fecal Coliform in Seawater and Pollution Source Samples, August 2012".

HIGHLIGHTS

*** Sampled 6x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** Statistics represent combined wet and dry weather, open season data >04/22/10 (N = 15) for conditional/seasonally approved Sta.'s 7 and 12,**
*** All approved and conditional/seasonally approved stations in compliance and conformance**
*** MTEC = 15 (90% = 39cfu/100ml)**
**** Data run 2/3/15***

COMMENTARY

The East Middle Bay (Growing Area 3) was sampled six times in 2014, complying with the minimum systematic random sampling (SRS) monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the East Middle Bay incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Results of the statistical evaluation demonstrate that all approved and conditional/seasonally approved stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

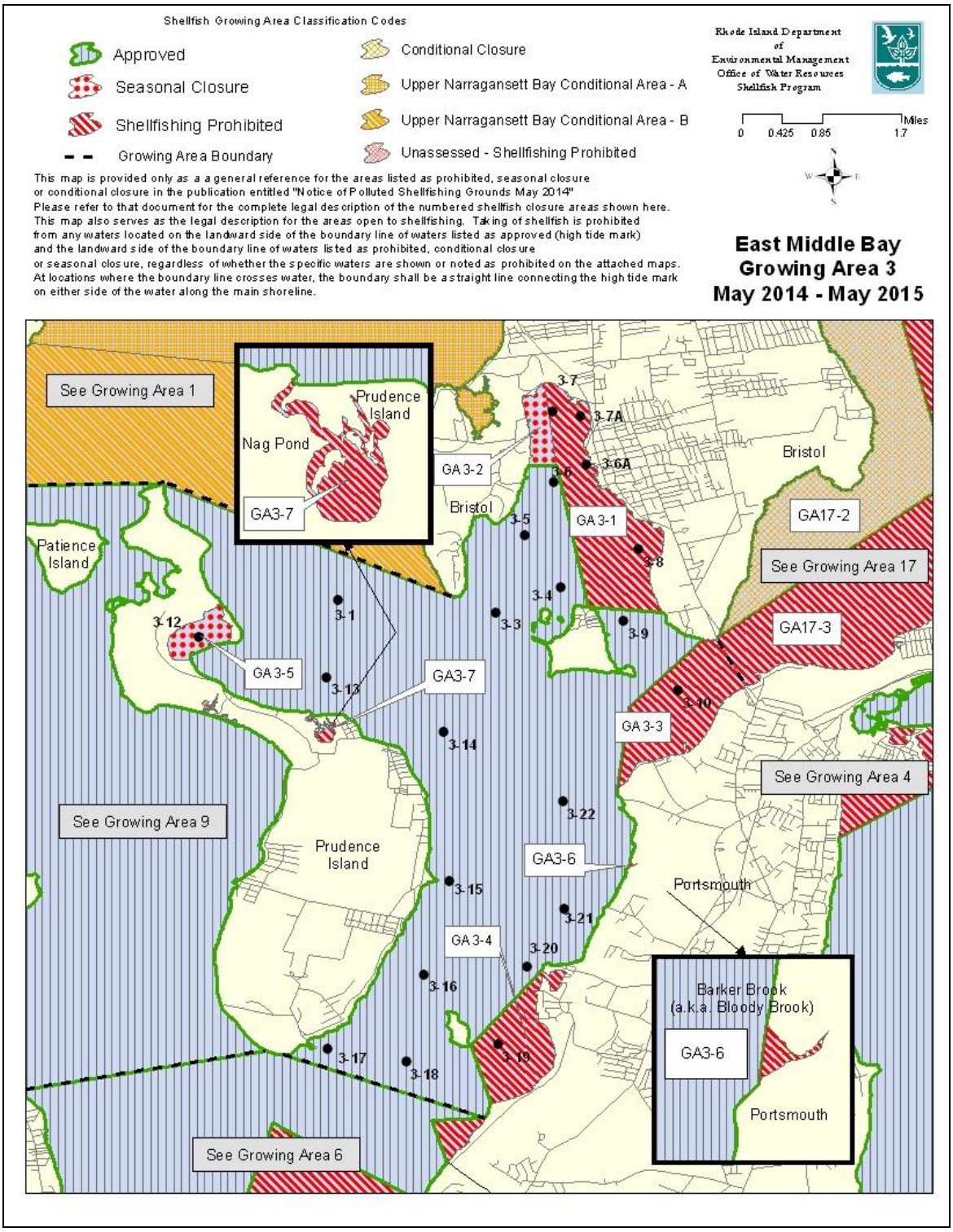
Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<39)
GA3-1	A	30	2.5	7.4
GA3-3	A	30	2.8	10.4
GA3-4	A	30	2.6	5.2
GA3-5	A	30	2.7	9.7
GA3-6	A	30	2.9	8.5
GA3-6A	P	30	5.1	38.2
GA3-7	SA	30	2.9	13.6
GA3-7A	P	30	5.6	39.1
GA3-8	P	30	8.0	66.4
GA3-9	A	30	3.1	10.3
GA3-10	P	30	2.5	4.5
GA3-12	SA	30	2.8	6.0
GA3-13	A	30	2.3	5.0
GA3-14	A	30	2.3	5.2
GA3-15	A	30	2.4	4.0
GA3-16	A	30	2.2	2.9
GA3-17	A	30	2.2	3.1
GA3-18	A	30	2.2	3.0
GA3-19	P	30	2.2	3.0
GA3-20	A	30	2.3	3.9
GA3-21	A	30	2.2	3.4
GA3-22	A	30	2.4	4.1

Most recent seasonal wet/dry combined open season data

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL<31
GA3-7 (OPEN)	**SA**	**15**	**2.5**	**0.00**
GA3-12 (OPEN)	**SA**	**15**	**2.8**	**0.00**

The results of the routine monitoring stations indicate that this growing area is properly classified and therefore no changes to the classification are recommended at this time. The following map is the closure map for the 2014-2015 season.

The next required survey would be a annual update to be completed in 2015.



Sakonnet River
Growing Area 4
2014 Annual Update

A 12 year sanitary shoreline survey was completed in 2013. There were a total of one hundred and sixty-seven (167) actual or potential sources identified during this shoreline survey, excluding marinas. A total of one-hundred and eight of the one hundred and sixty seven sources were not actively flowing at the time of the shoreline survey with the remaining fifty-nine having flows warranting sampling. All sources in which flow was observed were sampled.

In 2013 fourteen sources had sampling results greater than 240 cfu/100ml. Of those fourteen sources five are located in prohibited areas of the growing area and the remaining eight sources did not have bacteria counts that exceeded 2400 cfu/100ml warranting follow-up sampling for this annual review. One source (2014-4-702), a 4" diameter PVC pipe at the top of the embankment into Nannaquaket Pond did have results greater than 2400 (8000 cfu/100ml) during the initial sampling round. However, follow up sampling of this source resulted in bacteria counts of 15 cfu/100ml in 2013. Additional reconnaissance of the area concluded that the source through this overflow pipe is from a small pond to the rear of a large single family home site and as such does not appear to have a negative impact on the growing area receiving waters. In 2014 this overflow pipe was not flowing as water levels in the small pond were below the invert.

Previous surveys of the Sakonnet River had revealed several sources that had elevated bacteria counts and were put on a "watch list" to re-visit. These thirteen sources as depicted on the map below are discussed in the following paragraphs.

Source 4-540 is a stream from Gardiner Pond at Third Beach in Middletown. Bacteria results were 1100fc/MPN in 2011 and 9300 MPN in 2006. The source was revisited in 2014 and as a result of shifting sands and low water elevations no flows were directly reaching the receiving waters and therefore no sample was taken of the stagnant stream.

Source 4-1222 is a small stream that discharges into the southeastern corner of the Island Park cove, or Old Orchard Cove as referred to locally. Previous sampling in 2008 had indicated an elevated bacteria level. Subsequent sampling has this source ranging in bacteria counts between 10 and 2401, with this year's result of 340 cfu/100ml. Flows from this stream have been historically low resulting in no negative impacts to the receiving water. The next triennial survey in 2016 will result in additional sampling of this source.

Sources 4-013, 4-107 and 4-1600 discharge to waters that are classified as prohibited and although sampling results have been elevated they do not impact the waters beyond the prohibited line.

Source 4-263 was not flowing at the time of sampling in 2014. This pvc pipe had previous bacteria counts of 680 cfu/100ml in 2013 with a trickle flow. It would not appear to be impacting the receiving waters but again will be resampled in 2016 as part of the areas triennial update.

Sources 4-619 and 4-621 also had previously elevated bacteria counts. These two sources are storm drains that discharge street runoff from the adjacent Main Road in Tiverton. Sampling during wet weather is warranted to evaluate any potential impacts.

Source 4-708 had previous high fecal counts but flows are impacted by wet weather and the last few years there was no flow at the time of sampling.

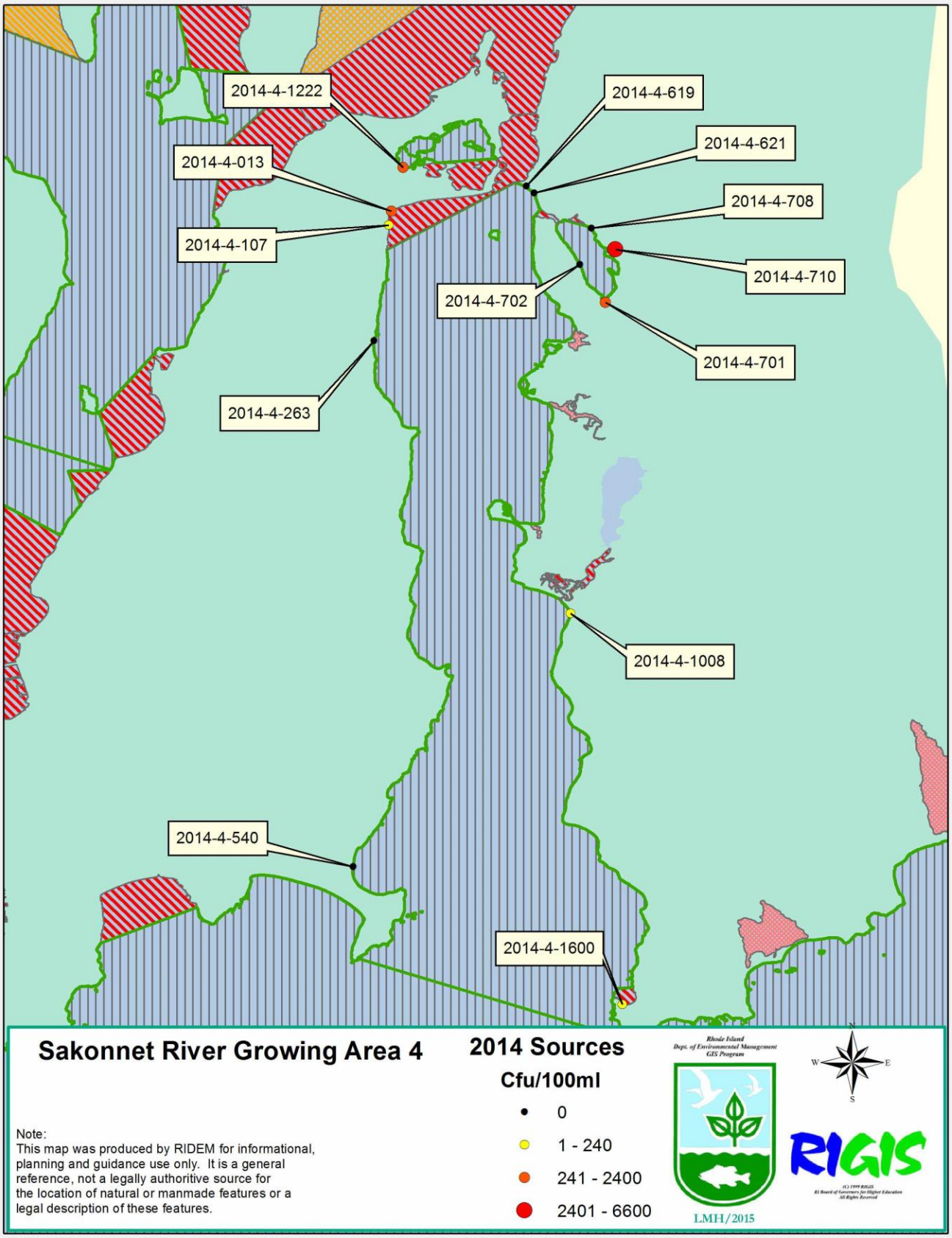
Source 4-710 is White Wine Brook which enters Nannaquaket Pond from the northeast from a substantial wooded wetland. Initial sampling indicated elevated bacteria counts. Subsequent sampling resulted in counts much lower. Sampling of the small cove at the point of confluence with the pond was also done and results were 650 cfu/100ml during high tide and 13.3 cfu/100ml during low tide. This source needs additional sampling in 2015 to ensure compliance with water quality standards. The two routine monitoring stations (GA4-4 and GA4-21) in the pond indicate compliance with the shellfish standard.

Source 4-701 is the headwaters of Nannaquaket Pond as it exits from a wooded swamp to the south. Results from sampling and the routine monitoring station would indicate this source is not negatively impacting the receiving waters.

Source 4-1008 is from a swale that follows along the edge of Town Road in Little Compton. This has intermittent flows and the most recent sampling in which flows were observed resulted in bacteria counts of 45 cfu/100ml which will not have any significant impact on the large volume of receiving waters in this area of the Sakonnet River.

Source 4-1600 is a RCP that discharges into Sakonnet Harbor. This area was reclassified as prohibited several years ago due to unacceptable water quality results from the routine monitoring station GA4-11 located in the center of the harbor during open season. It had previously been classified as seasonally approved and closed during the summer months due to the potential influence of the many commercial and recreational boats moored in the harbor.

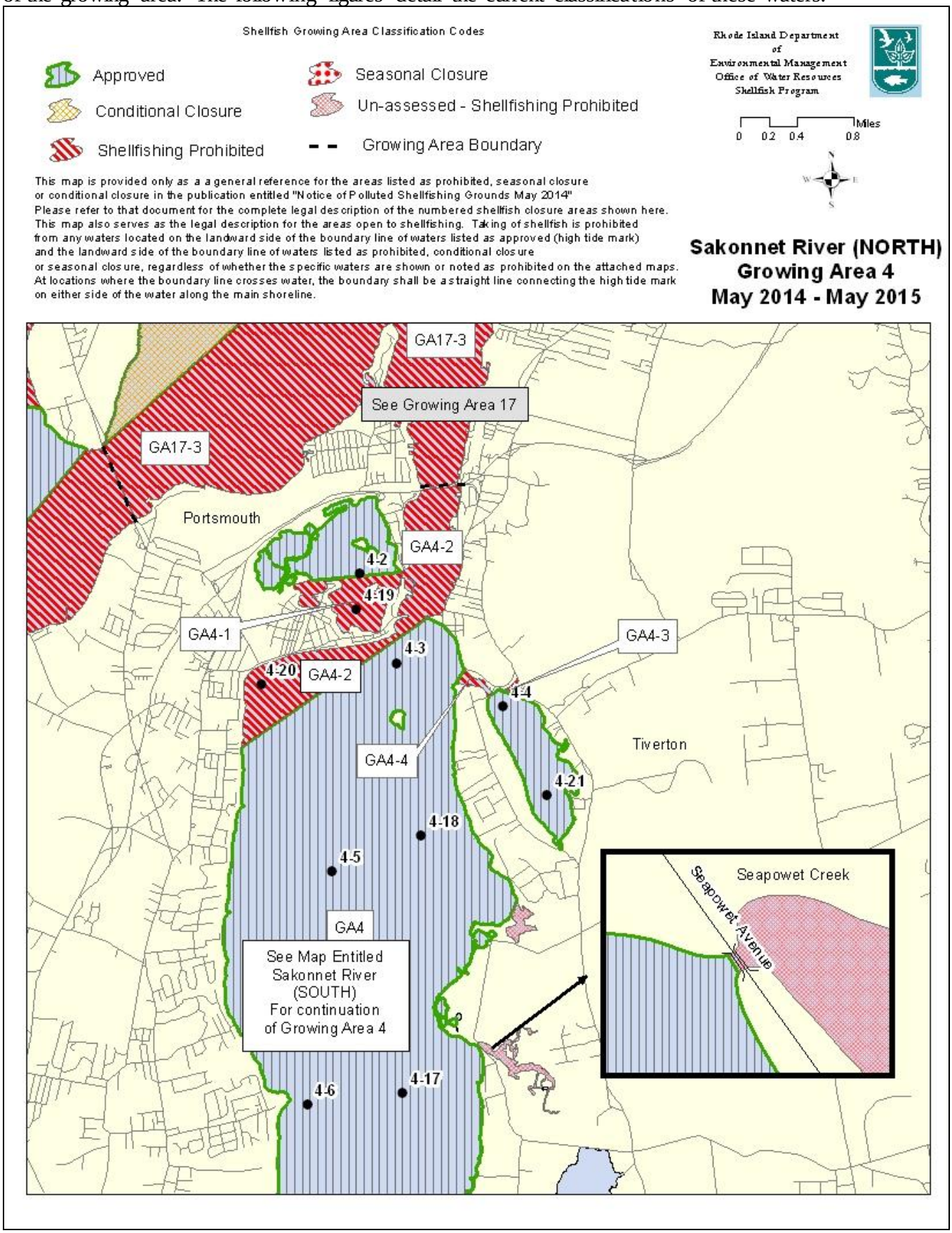
As noted several of these sources warrant follow-ups in either 2015 or 2016 as part of the annual or triennial updates.


2014-4-1222
2014-4-619
2014-4-621
2014-4-013
2014-4-708
2014-4-107
2014-4-710
2014-4-702
2014-4-701
2014-4-263
2014-4-1008
2014-4-540
2014-4-1600
Sakonnet River Growing Area 4
2014 Sources
Cfu/100ml
0
1 - 240
241 - 2400
2401 - 6600
Note:
This map was produced by RIDEM for informational, planning and guidance use only. It is a general reference, not a legally authoritive source for the location of natural or manmade features or a legal description of these features.
Rhode Island
Dept. of Environmental Management
GIS Program
LMH/2015
N
W
E
S
RIGIS

Source ID	Description	Actual	Direct	Previous elevated Results MPN	Other results MPN	2013 Cfu/100ml	2014 Cfu/100ml
2013-4-013	24" Dia RCP at corner Park Ave	A	D			8000	410
2006-4-107	24" dia. RCP at end of ROW corner Atlantic and Tallman	A	D	23000		2220	67
2013-4-263	4" dia black PVC pipe north of Lawrence Lane south of jetty	A	D			680	NF
2013-4-701	Stream at south end of pond at Nannaquaket Road	A	D			400	650
2013-4-710	White Wine Brook at road crossing 24" dia CMP	A	D			1500	6600
	Re-sampled along with in stream in cove						570 / 650 IS
	Re-sampled along with in stream in cove						18.6 / 13.3 IS
2013-4-1600	36" dia flared end draining upland pond	A	D			420	10
2013-4-1008	Small stream along south side of Town Road	A	D	15000		NF	45
2009-4-1222	Stream draining upland marsh	A	D	2401	93	10	340
2009-4-1008	Small stream along south side of Town Road	A	D	15000	230	NF	45
2009-4-540	Stream from uplands wetland	A	D	9300	230	1100 / <3 IS	NF
2009-4-619	12" dia CMP storm drain Grinnell's Beach Tiverton	A	D	4300		NF	NF
2009-4-621	Storm flow from under wall from remains of 18" dia CMP	A	D	43000		NF	NF
2009-4-708	ASSF from road water breaks out at shoreline	A	D	4300		NF	NF

NF-No flow IS-In-stream Prohibited Classification

The Sakonnet River Growing Area 4 classification maps are divided into north and south due to the size of the growing area. The following figures detail the current classifications of these waters.



Shellfish Growing Area Classification Codes

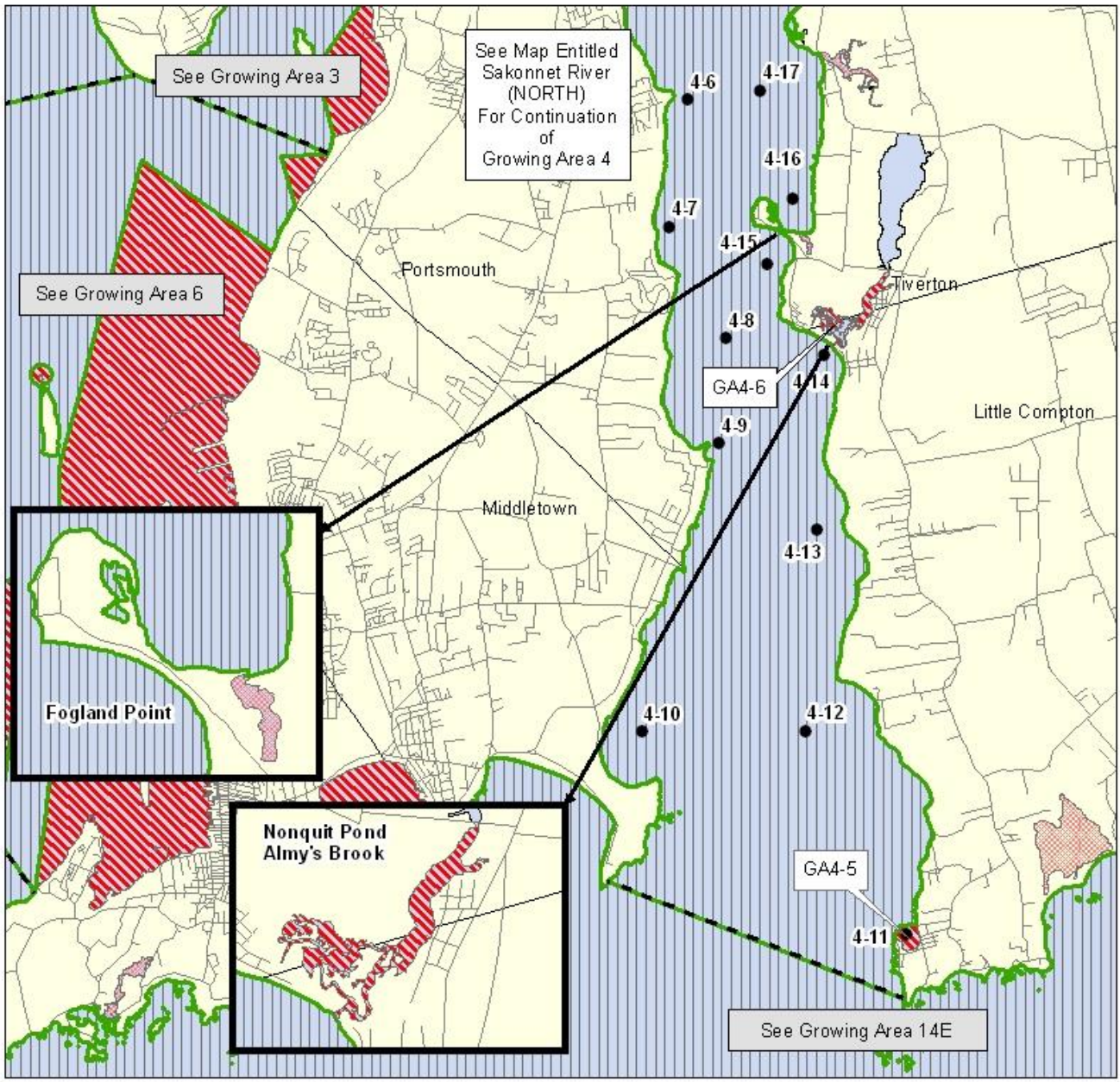
- Approved
- Conditional Closure
- Growing Area Boundary
- Un-assessed - Shellfishing Prohibited
- Seasonal Closure
- Shellfishing Prohibited

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

0 0.45 0.9 1.8 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014"
Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here.
This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps.
At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Sakonnet River (SOUTH) Growing Area 4
May 2014 - May 2015



HIGHLIGHTS

*** Sampled 7x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** All approved stations in compliance and conformance**
*** MTEC = 15 (90% = 39 cfu/100ml)**
**** Data run 2/3/15***

COMMENTARY

The Sakonnet River (Growing Area 4) was sampled seven times during the 2014 sampling season, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the Sakonnet River incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Results of the statistical evaluation demonstrate that all other approved, stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results consider re-opening station 11 Sakonnet Harbor?**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<39)
GA4-1	P	30	2.3	3.8
GA4-2	A	30	2.3	3.4
GA4-3	A	30	2.8	6.2
GA4-4	A	30	4.7	19.1
GA4-5	A	30	3.4	9.2
GA4-6	A	30	2.2	3.3
GA4-7	A	30	2.2	2.8
GA4-8	A	30	2.1	2.8
GA4-9	A	30	2.1	2.7
GA4-10	A	30	2.1	2.6
GA4-11	P	30	2.8	8.2
GA4-12	A	30	2.0	2.0
GA4-13	A	30	2.4	4.7
GA4-14	A	30	2.4	4.7
GA4-15	A	30	2.5	5.2
GA4-16	A	30	2.3	5.6
GA4-17	A	30	2.4	5.3
GA4-18	A	30	2.7	6.3
GA4-19	P	30	3.1	7.3
GA4-20	P	30	2.7	6.3
GA4-21	A	29	2.6	5.3

The next required survey would be an annual update to be completed in 2015.

Kickemuit River

Growing Area 5
Triennial Re-Evaluation
For Calendar Year 2014

Photo Courtesy of Laurel Park Imp. Assoc.

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

Table of Contents

1.0 Introduction 1
2.0 Description of Growing Area 1
3.0 Pollution Source Survey 3
4.0 Mooring Fields and Marinas 3
5.0 Wastewater Treatment Facilities (WWTF) 3
6.0 Water Quality Studies 4
7.0 Conclusions and Recommendations 5

Table of Figures

Figure 1 Kickemuit River GA5 2

List of Tables

Table 1 Summary of Elevated Sources 3
Table 2 RIDEM Shellfish Growing Area Monitoring Results 4

1.0 Introduction

A triennial re-evaluation shoreline survey of the Kickemuit River shellfish growing area was conducted in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline survey is to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys.

The Kickemuit River – Growing Area 5 is presently divided into two sections, shellfishing prohibited and conditionally approved. There is also a seasonally closed area associated with the small neighborhood marina near Touisset Point in Warren. There are 10 routine monitoring stations located throughout the growing area.

A shoreline survey of this growing area was conducted in the spring of 2008. A total of 36 sources were identified during this shoreline survey, excluding marinas. A total of 16 sources were not actively flowing at the time of the shoreline survey with the remaining 20 having flows warranting sampling. All sources in which flow was observed were sampled.

2.0 Description of Growing Area

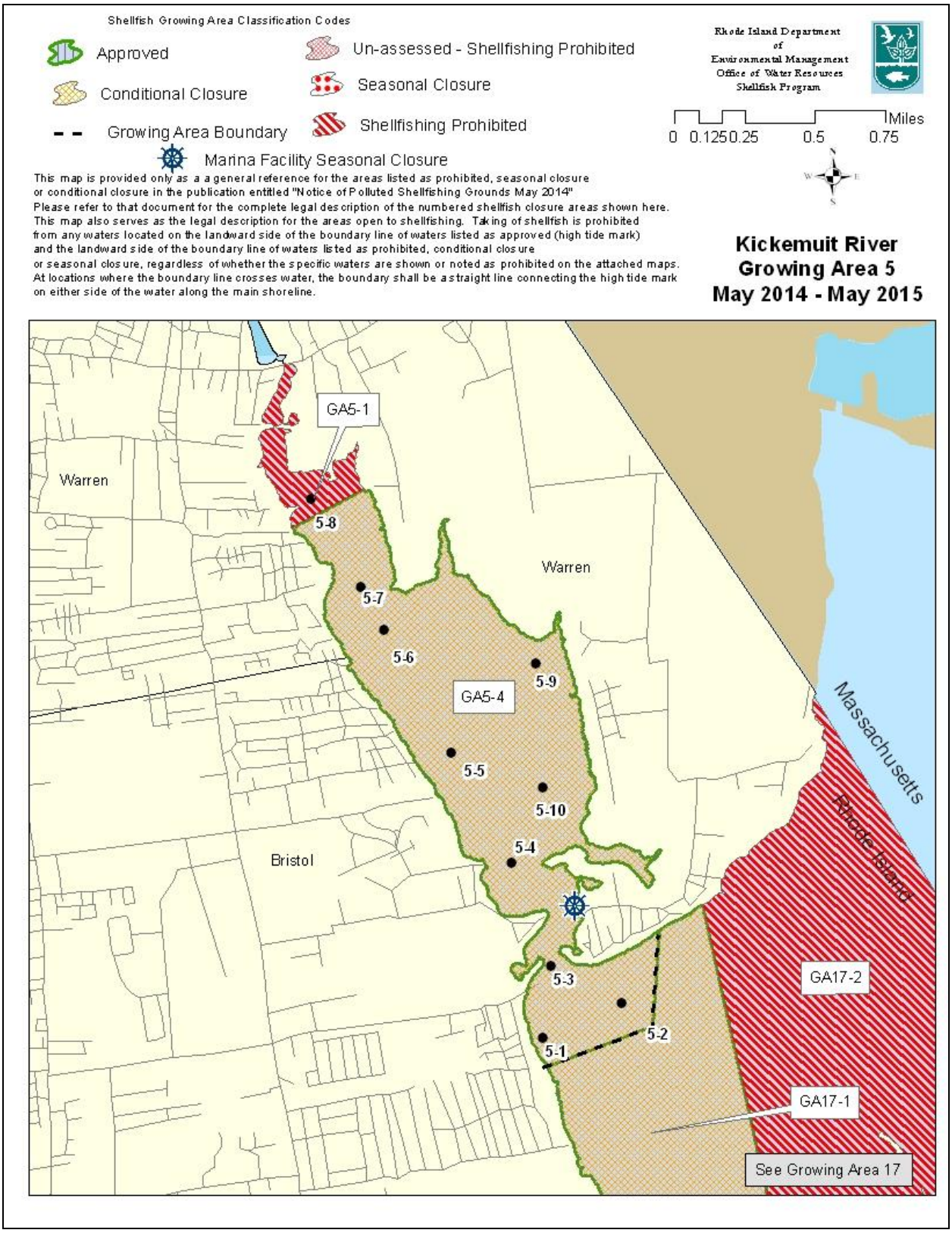
Growing Area 5 consists of approximately 643 acres (RIDEM GIS). The Kickemuit River is bordered by the towns of Bristol and Warren Rhode Island. The Kickemuit River originates in Massachusetts as a freshwater river crossing over the state border and continuing to a retaining dam at Rt. 103, Child Street in Warren. From that point south the river continues as a tidally influenced, brackish inlet, which terminates in Mount Hope Bay. The growing area is that tidally influenced portion of the river and a portion of Mount Hope Bay north of a line from the neighborhood south of routine monitoring station 5-1, east to station 5-2 and then north to the shoreline of Coggeshall Point represented by the black dashed line on Figure 1.

The area is divided into one prohibited shellfishing area encompassing routine monitoring station 5-8 and one marina closure on the Touisset shoreline. The remaining portion of the growing area is operated on a conditionally approved basis, closed for seven (7) days in the event of 0.5 inches of rainfall. The precipitation that initiates these shell-fishing 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.

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

Area of Shellfishing Prohibited Kickemuit River	44.5 acres
Area of Remaining Conditional Areas	512.4 acres
Longest reach	2.8 miles
Widest reach	0.7 miles
Deepest point	16 feet

Figure 1 Kickemuit River GA5



3.0 Pollution Source Survey

Lucinda M. Hannus, Senior Environmental Scientist for the Division of Water Resources conducted the review of previous surveys for this triennial update.

This shoreline survey was conducted as a triennial re-evaluation of this growing area. As such the survey involved review of previous shoreline surveys, bacteriological sampling of actual pollution sources noted in previous surveys that were found to be equal to or greater than 240 fc/100ml and identification of any new sources of pollution if applicable. Source 5-103 was initially sampled in the tidal flats at the confluence of this stream with the Kickemuit River. Subsequent sampling was done at the source a small upland pond with significantly reduced bacteria counts or no flow from the overflow pipe. Source 5-030 is a wet weather source and does not impact the area in the open condition.

Table 1 Summary of Elevated Sources

Source ID	2008 Results MPN	Classification of Receiving waters	Additional sampling results 2009 MPN	2011 Results MPN	2012 Results cfu/100ml	2013 Results cfu/100ml	2014 Results cfu/100ml
5-103	11,000	Conditional	<4 / 39	23	19	NS	NF
5-013	93	Conditional			1670	60	210
5-014	110,000	Conditional	<3	23	56	NF	8000 12 (3 IS)
5-030	430	Conditional		NF	NS	NS	NS

NF – No Flow, NS – No Sample IS – In Stream

4.0 Mooring Fields and Marinas

In 2013 the mooring fields in the Kickemuit River were classified as seasonally approved, closed during summer months. After further analysis it was determined that these areas are not typical of overnight occupation but rather as "parking lots" for adjacent property owners and therefore not posing the risks associated with transient or overnight mooring fields, these areas were reclassified as Conditionally Approved. One area on the shoreline of Touisset however was determined to be a marina under the definition of dockage that is capable of handling ten or more boats. This smaller area at the Narrows now has a seasonal Marina closure associated with it.

5.0 Wastewater Treatment Facilities (WWTF)

There are currently no wastewater treatment facilities that discharge directly to this growing area.

6.0 Water Quality Studies

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

Growing Area 5 is a conditionally approved area, and is monitored on a monthly sampling regime, sampled during "Open" conditions. Sampling runs are conducted during dry weather conditions when the conditionally approved portions of the growing area are open to shellfish harvesting.

All samples are collected at a depth of 1-2 feet below the water's surface using 4-ounce nalgene bottles. The samples are then stored in a portable cooler at a temperature of approximately 4° Celsius. Upon completion of the monitoring run, samples are transported to the RIDOH laboratories in Providence for analysis. The mTEC method as described in Standard Methods for the Examination of Water and Wastewater is used to analyze the samples. The data is compiled and reviewed according to NSSP requirements stating that at least the most recent 15 data sets be used. Table 2 demonstrates the areas ability to conform to NSSP statistical criteria. Refer to Figure 1 for the locations of these monitoring stations within the Kickemuit River Growing Area 5.

Table 2 RIDEM Shellfish Growing Area Monitoring Results

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
GA5-1	CA	15	2.8	0.00
GA5-2	CA	15	2.9	0.00
GA5-3	CA	15	2.5	0.00
GA5-4	CA	15	2.6	0.00
GA5-5	CA/SA	15	2.7	0.00
GA5-6	CA/SA	15	2.8	6.67
GA5-7	CA	15	2.6	0.00
(GA5-8)	(P)	(14)	(4.2)	(7.14)
GA5-8	P	15	5.1	13.33
GA5-9	CA	15	2.3	0.00
GA5-10	CA	15	2.4	0.00

HIGHLIGHTS

*** Sampled 12x in 2014**
*** Statistics represent dry weather, approved data >10/01/13 (N = 15) 1-7, 9, 10**
*** Statistics represent dry weather, approved data >9/1/13 (N = 15) Sta. 8**
*** Station 8 exceeds variability criteria but is located in a prohibited zone**
*** All other conditionally approved stations in compliance and conformance**
*** mTEC=15 (<31 cfu/100ml)**
**** Data run 2/3/15***

COMMENTARY

The Kickemuit River (Growing Area 5) was sampled twelve times for 2014. All samples were collected during dry weather when the area was "open/approved" for shellfish harvesting. The statistical evaluation for the Kickemuit River incorporates the most recent 15 dry weather samples collected for the area, the minimum number required by NSSP Manual of Operations guidelines for conditionally approved areas.

Results of the statistical evaluation demonstrate that all conditionally approved stations are in compliance with NSSP guidelines.

A TMDL study of the area was completed in January 2010.

RECOMMENDATIONS

*** No other action recommended based on ambient monitoring results**

7.0 Conclusions and Recommendations

The triennial update did include follow-up sampling of previously identified sources as indicated previously. This additional sampling and follow-up results do not indicate that these sources are causing adverse effects to the receiving water quality. The separate investigation conducted by the TMDL program indicates that several sources in the northern reaches of the growing area do have the potential to impact water quality during wet weather. Presently these sources are located in the prohibited area in addition to the conditionally approved status of the entire growing area.

East Passage
Growing Area 6
2014 Annual Update

A 12 year sanitary shoreline survey of the East Passage Growing Area 6 was conducted in 2006. A triennial update was completed in 2012. The shoreline survey identified sixty-three (63) actual or potential sources excluding marinas. Thirty two (32) or almost half of the sources were not actively flowing at the time of the shoreline survey with the remaining thirty-one (31) having flows warranting sampling.

A triennial update was completed in 2012 in which all elevated sources identified in 2006 were re-sampled. Thirteen sources had elevated bacteria results in the 12 year survey; four of them were within prohibited areas and were not re-sampled as part of this annual review. In 2012 of the nine remaining sources, six had no flows and the remaining three sources that had flows had bacteria counts of less than 240 CFU/100 ml. The results from this sampling with additional results from 2014 sampling are in the following table. The area where these sources are located had been problematic in the past and so an effort was made to re-sample even though bacteria counts were relatively low in 2012.

The results of the routine monitoring stations indicate that this growing area is properly classified and therefore no changes to the classification are recommended at this time. The 2013 -2014 classification map is included in this report on page three. The next schedule survey would be an triennial update in 2015.

Elevated sources in the East passage

Source ID	Description	Actual/ Potential	Direct/ Indirect	2006 Results	FLOW	January 2007 Results	August 2008 Results	Size	2009 Results	2010 Results	Add'tl. 2011 Results	2011 Follow-up Results	2012 Follow-up Results	2013 Follow-up Results	2014 Results cfu/100 ml
2006-6-001	Stream north of Wright Lane	A	D	460	1.42 cfs	NS	NS	4' wide 3" deep	1500. 85 cfs	230 < 3 in stream		NS	20 trickle flow	<3	435
2006-6-002	Small stream thru woods, actually (2) 6" PVC pipes	A	D	11,000	Trickle	<3	NF	2' wide ¼" deep	930 Trickle	NF		750 IS 3	NF	136	NF
2006-6-003	Stream thru woods, actually (2) 4" PVC pipes	A	D	110,000	.002 cfs	1,100 .027 cfs	39 Trickle	6" wide ½" deep	230 Trickle	Unable to locate		1100 IS 11	NF	NF	NF
2006-6-107	Small stream thru woods, actually 6" PVC pipe	A	D	23,000	Trickle	15 Trickle	75 Drip		4 Steady small stream		93	<3 <3 N 4 S	110 trickle flow	NF	77
2006-6-108	Groundwater/ very small stream from uplands, actually 6" PVC pipe	A	D	12,000	Trickle	23	93,000 Stagnant		230 Steady stream		210	4 <3 N 4 S	NF	NF	5900/ NF
2006-6-210	Stone headwall w/ standing water most likely from retention pond	A	D	11,000	Stagnant	430 .013 cfs			1500 In stream headwall submerged	NF		NF	NF	NS	NF

NF – No Flow NS – No Sample

N – North in stream S- South in stream IS – Instream directly in front of source

Shellfish Growing Area Classification Codes

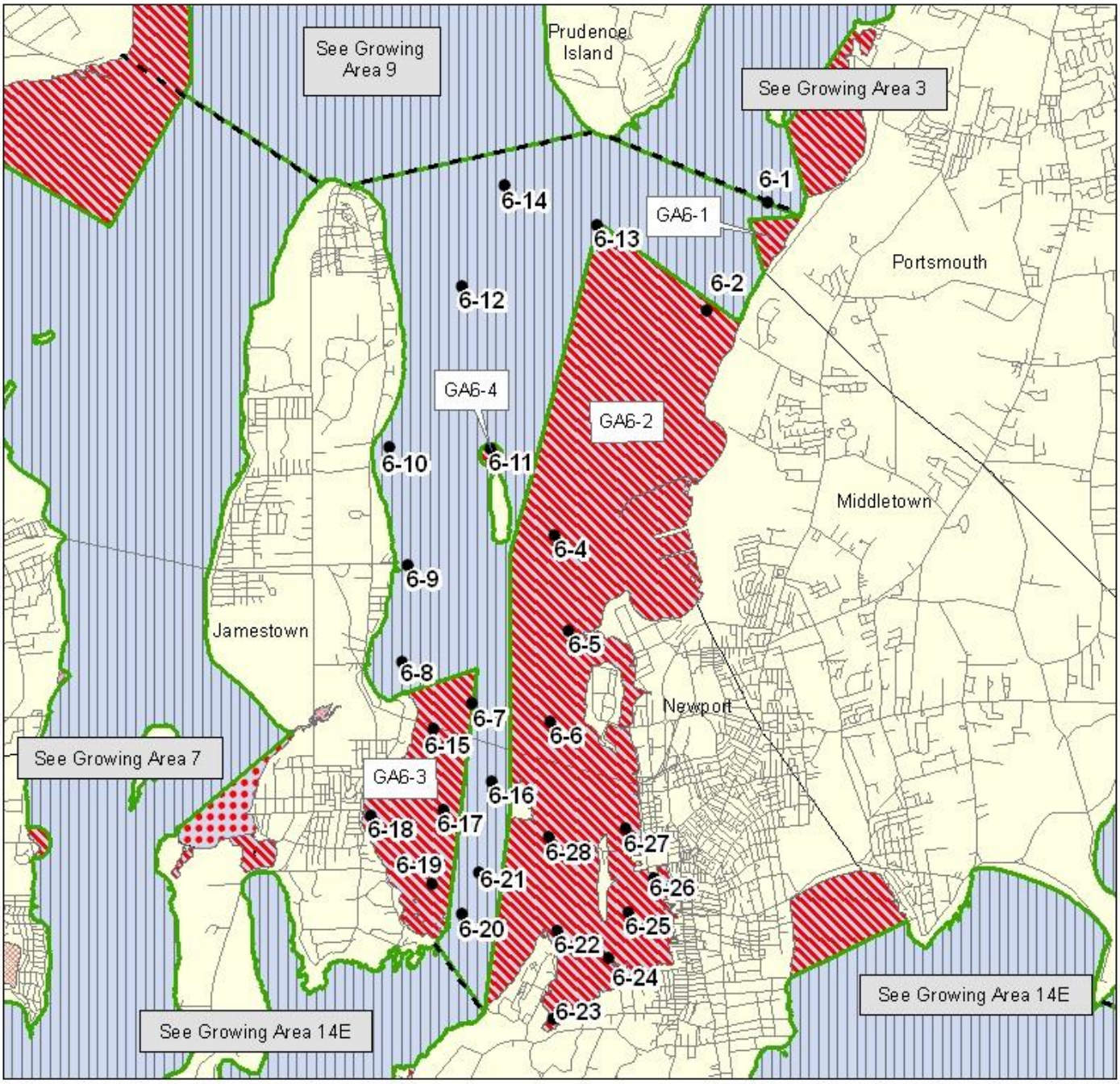
- Growing Area Boundary
- Approved
- Shellfishing Prohibited
- Un-assessed - Shellfishing Prohibited
- Seasonal Closure

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

0 0.45 0.9 1.8 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

East Passage Growing Area 6 May 2014 - May 2015



HIGHLIGHTS

*** Sampled 7x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** All approved stations in compliance and conformance**
*** MTEC =15 (90% = 39 cfu/100ml)**
**** Data run 2/3/15***

COMMENTARY

The East Passage (Growing Area 6) was sampled seven times in 2014, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the East Passage incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Results of the statistical evaluation demonstrate that all approved stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<39)
GA6-1	A	30	2.2	3.3
GA6-2	P	30	2.3	4.3
GA6-4	P	30	2.0	2.4
GA6-5	P	30	2.7	8.7
GA6-6	P	30	2.8	5.8
GA6-7	P	30	2.1	3.0
GA6-8	A	30	2.2	3.3
GA6-9	A	30	2.0	2.0
GA6-10	A	30	2.3	3.6
GA6-11	P	30	2.2	3.1
GA6-12	A	30	2.2	3.4
GA6-13	A	30	2.2	3.5
GA6-14	A	30	2.1	2.7
GA6-15	P	30	2.2	3.1
GA6-16	A	29	2.3	3.5
GA6-17	P	30	2.3	3.4
GA6-18	P	30	2.2	3.3
GA6-19	P	30	2.2	3.2
GA6-20	A	30	2.2	2.9
GA6-21	A	30	2.3	3.3
GA6-22	P	30	2.6	5.4
GA6-23	P	30	2.2	3.3
GA6-24	P	30	3.0	12.5
GA6-25	P	30	5.3	31.1
GA6-26	P	30	7.7	52.9
GA6-27	P	30	3.0	11.6
GA6-28	P	29	2.3	3.7

West Passage

Growing Area 7
Triennial Re-Evaluation
Calendar Year 2011

Jamestown Bridge West Passage Juan Carlos Cruz

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

Table of Contents

1 Introduction 1
2 Description of Growing Area 1
3 Pollution Source Surveys 3
3.1 Survey Procedures 3
3.2 Identification and Evaluation of Pollution Sources 3
3.3 Fox Hill and Sheffield Cove Study 5
4 Mooring Fields and Marinas 5
5 Wastewater Treatment Facilities (WWTF) 5
6 Water Quality Studies 6
6.1 Annual Report of Statistical Evaluations and Comments 7
7 Conclusions and Recommendations 8

Table of Figures

Figure 2-1 West Passage Growing Area 7 2

List of Tables

Table 3-1 Historical results 4

1 Introduction

A triennial re-evaluation shoreline survey of the West Passage was conducted in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline survey is to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys. This triennial update of Area 7 (Figure 2-1) was conducted during the summer and fall of 2014. The survey involved follow-up sampling of previously identified sources that resulted in fecal coliform counts exceeding 240 MPN / 100ml. These sources were evaluated to determine the bacteriological impact into the growing area.

The survey area encompasses all of the shoreline south of a line from Quonset Point in North Kingstown to Bonnet Shores in Narragansett and the western shoreline of Jamestown from Conanicut Point to Beavertail Point.

2 Description of Growing Area

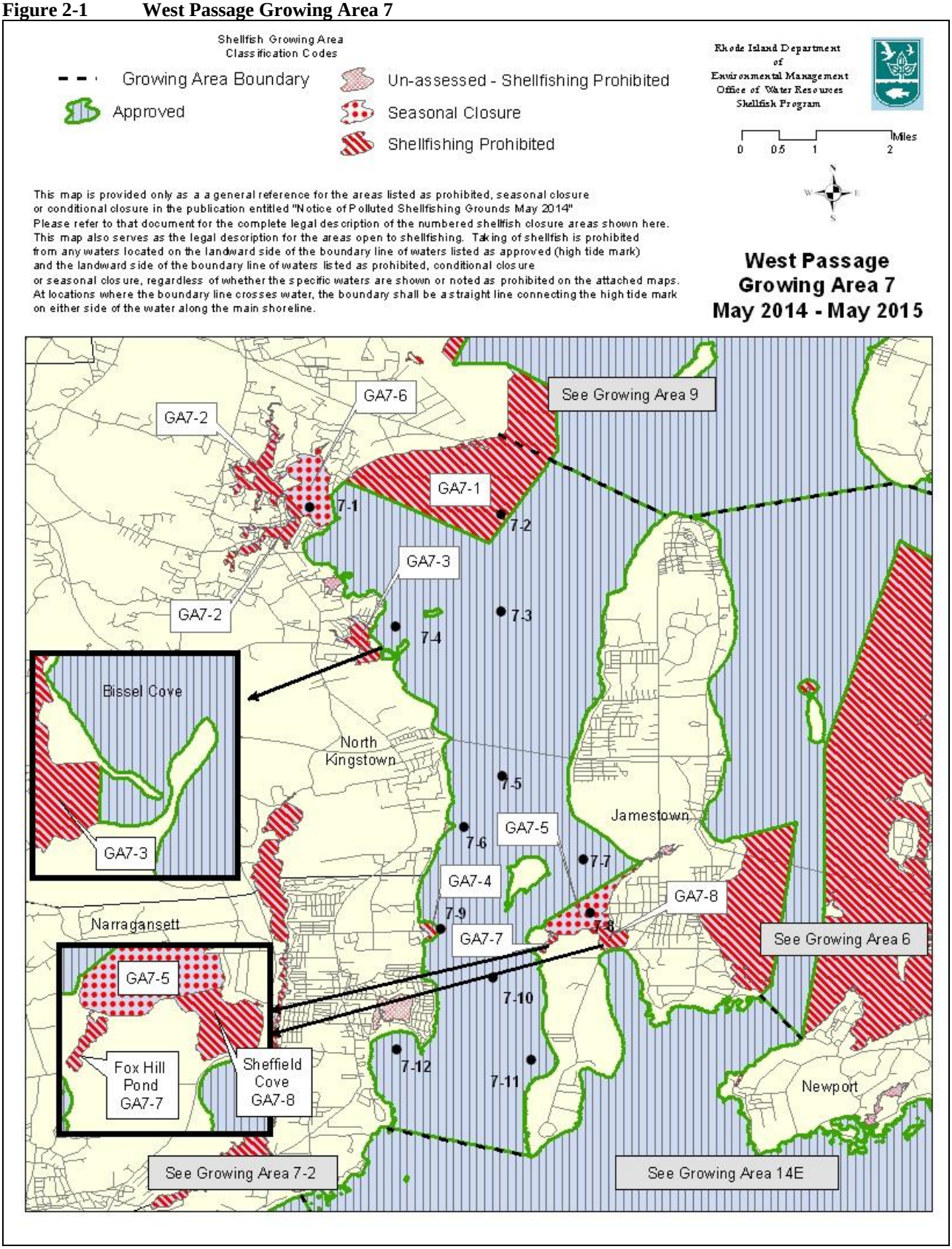
Growing Area 7 is presently comprised of sections classified as approved, seasonal, and prohibited for shellfishing (Figure 2-1). Five distinct areas of this growing area are prohibited to shellfishing. They are Wickford Cove, Bissel Cove, a portion of the upper West Passage abutting the Quonset Point area, Sheffield Cove in Jamestown, and the area around the docks at the University of Rhode Island's Bay Campus. Outer Wickford Harbor in N. Kingstown and Dutch Harbor on Jamestown are operated as seasonal closures in effect between Memorial Day weekend and Columbus Day weekend due to the large number of recreational boat facilities and transient moorings in these two areas during peak summer months.

Hydrographic Characteristics

Total area of the West Passage Growing Area 7	Approximately 12,000 Acres
Widest Reach	Approximately 4.3 miles
Deepest Point	85 feet
Average Depth	30 -50 feet

The West Passage Growing area encompasses approximately 12,000 acres of relatively shallow Narragansett Bay waters. The majority of the shoreline within the West Passage consists of medium to high-density developments with individual septic disposal systems (ISDS). The southern portion of Jamestown and Dutch Island are the only sections of the survey area that could be considered as having large tracts of open space. There are three state parks within this area consisting of Fort Getty State Park (500 acres), Beaver Tail State Park (7.35 acres), and Dutch Island (approx. 100 acres).

Figure 2-1 West Passage Growing Area 7



3 Pollution Source Surveys

3.1 Survey Procedures

Lucinda Hannus, Senior Environmental Scientist from the Department of Environmental Management Division of Water Resources conducted the review for the triennial update of the shoreline of the West Passage.

This review involved follow-up sampling on all previously identified sources in which bacterial results from sampling exceeded the 240 MPN/100 ml threshold established in the shellfish programs standard operating procedures. Sterile 4 ounce nalgene bottles were used to collect samples and then stored in a portable cooler (4° C) during field surveys. At the completion of the field day, samples were transported to the Rhode Island Department of Health Laboratories for analysis. The membrane filtration (mTEC) method as described in Standard Methods for the Examination of Water and Wastewater was used to analyze all samples.

3.2 Identification and Evaluation of Pollution Sources

Follow-up bacteriological samples were taken of all previously identified sources from creeks, streams, pipes/culverts or groundwater seeps that resulted in bacteria counts that exceeded 240 MPN/100ml. In 2014, four sources met the criteria warranting follow-up sampling. They are identified and described in Table 3-1. Figure 3-1 is a map depicting the location of these sources within the growing area.

Table 3-1 Historical results

Source ID	Description	Act /Pot	Dir /Indir	Previous Results	2008 Results	2009 Results	2010 Results	2011 Results	IN STREAM	2012 Results cfu/100ml	2013 Results cfu/100ml	2014 Results cfu/100ml
2008-7-118	2" pvc pipe			24001	2	930	NF	2300	N 23	8000	420 .001 cfs	8000/NF
2005-7-119	Groundwater seep	A	D	240	NF			430	S <3			NS
2005-7-201	Groundwater seep	A	D	930	43			2300				NS
2005-7-305	Stream from upland marsh fades out into beach prior to shore edge	A	I	930	430			430				NS
2005-7-302	24" dia. RCP at #71 Colonel john Gardner Road	A	P	11000	93					NF	NF	NF

Of the twenty sources identified in 2008 as having results greater than 240 MPN, only one re-sampled in 2014 exceeded the 2400 MPN follow-up threshold criteria. Source 7-118 is a 2" diameter pvc pipe located at the base of a seawall in Narragansett. This source has intermittent high bacteria counts along with very low, trickle flows. It is also subject to burial by shifting sand along the shoreline. Subsequent follow-up sampling in September 2014 found no flows from this source. This source should remain on the list for sampling again during the 2015 summer sampling season along with in-stream samples to ensure the source is not impacting the receiving waters.

3.3 Fox Hill and Sheffield Cove Study

Following the May 2007 annual shellfish classification review additional sampling runs were established to further characterize the water quality of numerous smaller coves and estuaries located throughout the state's shellfish growing areas. One of these runs includes Fox Hill and Sheffield Coves located on the western shore of Jamestown just south of Dutch Harbor. It is referred to as the West Bay Land Run. These two coves were classified as conditional / seasonal areas, closed to shellfishing during the months of May through October due to the numerous boats located in the adjacent mooring fields and Dutch Harbor Marina.

Due to the fluctuations and exceedances of the sampling results for Fox Hill Cove and Sheffield Cove the two areas was re-classified as Prohibited in 2009/2010. No additional sampling was completed in 2014 of these two areas due to staffing limitations and the areas remain closed to shellfishing.

4 Mooring Fields and Marinas

There are currently two marina/mooring areas that contain substantial numbers of boats warranting seasonal prohibited closures in addition to the year round prohibited areas of Wickford Harbor and the Quonset Point facility. The first is in the Wickford Harbor area, and the second is in Jamestown in the Dutch Island Harbor area. These two areas are closed to shellfishing from sunrise of the Saturday immediately prior to Memorial Day and ending at sunrise of the Tuesday immediately following Columbus Day.

Rhode Island coastal waters have a Federal designation 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 West Passage growing area. Both marina areas currently have two pump-out facilities each. Three are fixed stations and one is a pump-out boat located at the Dutch Harbor Marina.

5 Wastewater Treatment Facilities (WWTF)

Public sewers service a small portion of the growing area watershed in a portion of the Bonnet Shores neighborhood. All other areas of the watershed are serviced by on-site wastewater treatment systems (OWTSs). There are currently seven RIPDES permits that discharge into the growing area. Four are part of the University of Rhode Island's/ 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 located just outside this closed safety zone and results from the most recent

thirty samples indicate that these waters meet both the geo-mean standard of <14 cfu/100ml and the % not to exceed value of 39 cfu/100ml. Refer to table 6-1 for the actual statistical results.

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 liquid Waste Treatment Plant. The Quonset Point WWTF 2011 performance data report indicates that the average reported effluent fecal coliform concentration for 2011 was 2.86 MPN/100ml with an average flow was 0.427 mgd well below permit levels.

The final permitted discharge is from the Jamestown Water Treatment Facility and is a non-sanitary water release pipe.

6 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 are collected at twelve (12) monitoring stations throughout the growing area (Figure 2-1). Three of these stations are in prohibited areas while the other nine are in the approved portions of the growing area.

Samples are collected 1-2 feet below the water surface (using 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. The membrane filtration mTEC technique is used to analyze the samples. The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. A summary report is written and recommendations regarding the classification of the growing area are made on a yearly basis. The 2014 report is incorporated into this report in the following section. Routine monitoring data is also part of this report and is shown in Table 6-1.

6.1 Annual Report of Statistical Evaluations and Comments

HIGHLIGHTS

*** Sampled 7x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** Statistics represent combined wet and dry weather, open season data >10/01/10 (N=15) for conditional/seasonally approved Sta.'s 1 and 8**
*** All approved and conditional/seasonally approved stations in compliance and conformance**
*** MTEC = 9 (90% = 39 cfu/100ml)**
*** Data run 2/3/15**

COMMENTARY

The West Passage (Growing Area 7) was sampled seven times in 2014, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the West Passage incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Results of the statistical evaluation demonstrate that all approved and conditional/seasonally approved stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<39)
GA7-1	SA	30	4.5	20.1
GA7-2	P	30	2.0	2.4
GA7-3	A	30	2.2	3.4
GA7-4	A	30	3.0	7.6
GA7-5	A	30	2.2	2.9
GA7-6	A	30	2.3	4.9
GA7-7	A	30	2.3	4.0
GA7-8	SA	30	2.5	5.1
GA7-9	P	30	2.0	2.0
GA7-10	A	30	2.0	2.0
GA7-11	A	29	2.2	3.1
GA7-12	A	29	2.4	7.4

Most recent seasonal wet/dry combined open season data

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL<31
GA7-1 (OPEN)	**SA**	**15**	**3.1**	**0.00**
GA7-8 (OPEN)	**SA**	**15**	**2.4**	**0.00**

7 Conclusions and Recommendations

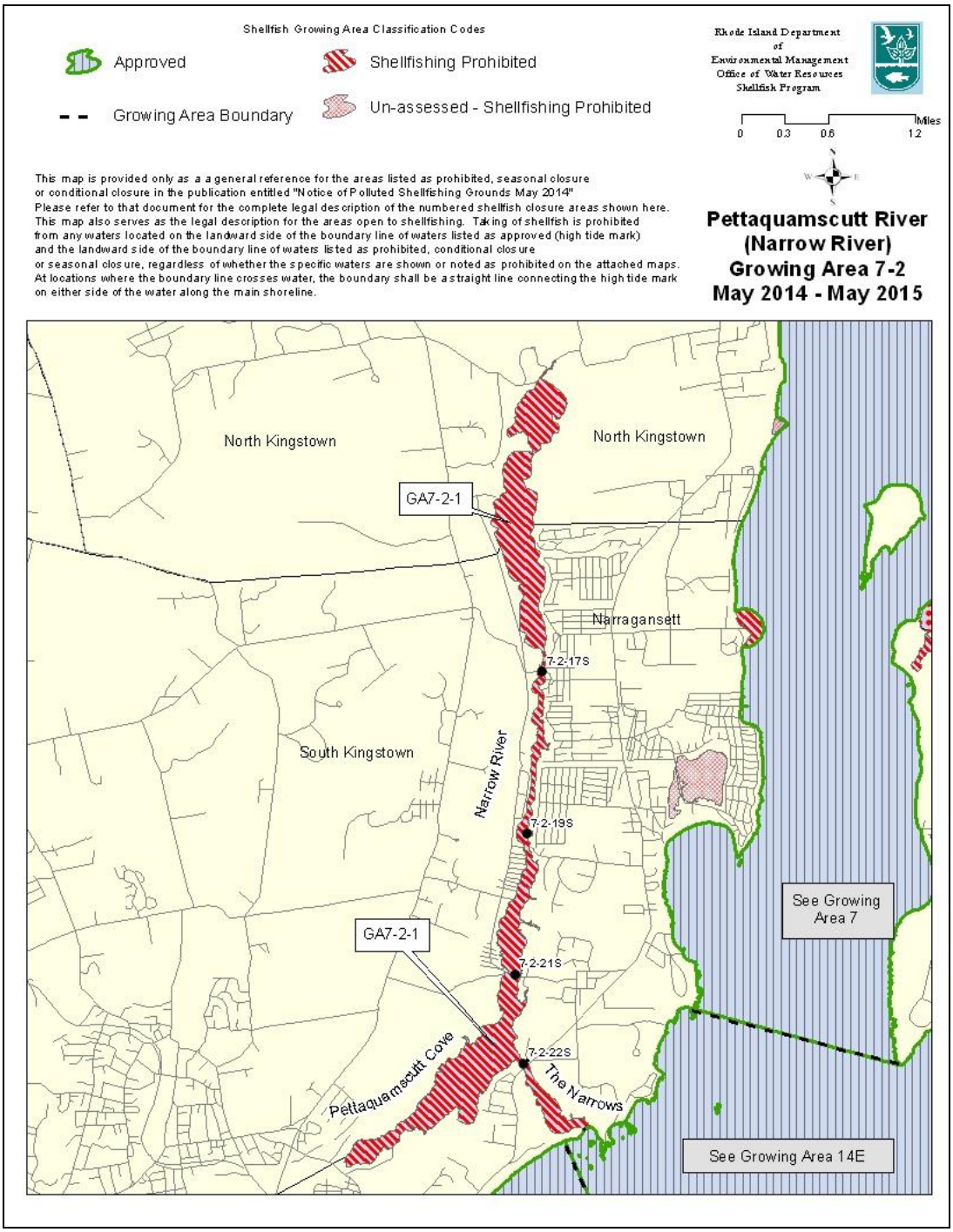
The triennial update of the West Passage (Growing Area 7) reevaluated several point sources in the study area. However, none of the sources appear to have any negative impact on the high quality ambient waters.

Due to the insignificant amount and impact of the sources reevaluated during the triennial update of the West Passage, and the water quality statistical evaluation of the growing area, no changes in growing area classification are recommended. As mentioned previously the classification of Fox Hill Cove and Sheffield Cove has been changed to prohibit shellfishing. The results of this update, combined with previous water quality statistical evaluations of the West Passage, indicate that the survey area conforms to all requirements set forth by the National Shellfish Sanitation Program (NSSP) and is properly classified. No changes for reclassification are recommended at this time.

The next scheduled survey would be an annual update in 2015.

Growing Area 7-2
Narrow (Pettaquamscutt) River
2014 Annual Update

All waters of the Narrow River, Growing Area 7-2 are currently prohibited to shellfishing. The area was sampled two times in 2014. The following map shows the sampling station locations and the current classification of this growing area. Results from the statistical evaluation of all stations exceed the shellfish standard during both wet and dry conditions, therefore the area is properly classified as prohibited as detailed in the following statistical evaluation summary.



HIGHLIGHTS

*** Sampled 2x in 2014**
*** Statistics represent wet and dry weather data >01/01/10 (N = 15) (W=6; D=9)**
*** Dry weather statistics data > 9/1/08 (N = 15)**
*** All stations out of compliance under all conditions**
*** Area is prohibited**
*** mTEC = 8 for wet and dry data**
*** mTEC = 5 for dry only data**
**** Data run 2/10/15***

COMMENTARY

The Pettaquamscutt River (Growing Area 7-2) was sampled two times in 2014. Since the area is classified as prohibited, there is no minimum sampling requirement. The area has been closed to shellfish harvesting for direct human consumption since 1985 due to unpredictable and elevated fecal coliform levels. This area is unique from other growing areas because it is sampled exclusively from shore-accessed stations, mostly from bridges spanning the River. The statistical evaluation for the Pettaquamscutt River incorporates the most recent 15 samples. No NSSP compliance guidelines exist for statistically evaluating prohibited areas. The TMDL for the area was completed in 2002. The recommendations call for additional monitoring to be conducted by NRPA volunteers through the URI Watershed Watch program.

Results of the statistical evaluation demonstrate that all stations exceed shellfish harvesting criteria during combined wet and dry weather. The dry weather only data also exceeds harvesting criteria. The area is properly classified as prohibited.

RECOMMENDATIONS

*** No action recommended**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

COMBINED WET AND DRY DATA

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 49 (or 31 mtec)
GA72-17S	P	15	32.5	46.67
GA72-19S	P	15	42.4	60.00
GA72-21S	P	15	19.3	40.00
GA72-22S	P	15	16.4	26.67

DRY WEATHER ONLY

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 49 (or 31 mtec)
GA72-17S	P	15	19.9	33.33
GA72-19S	P	15	31.1	40.00
GA72-21S	P	15	10.5	20.00
GA72-22S	P	15	14.9	20.00

Results adjusted for MPN/MTEC blended conversion

HIGHLIGHTS

Greenwich Bay

Growing Area 8
Triennial Re-Evaluation
Calendar Year 2014

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

Table of Contents

1 Introduction 1
2 Description of Growing Area 1
3 Pollution Source Surveys 4
3.1 Identification and Evaluation of Pollution Sources 4
4 Mooring Fields and Marinas 6
5 Wastewater Treatment Facilities (WWTF) 6
6 Water Quality Studies 6
7 Growing Area Monitoring 7
8 Conclusions and Recommendations 11

Table of Figures

Figure 2-1 Growing Area 8 Greenwich Bay 3
Figure 3-2 2014 Sources Greenwich Bay 5

List of Tables

Table 3-1 2014 Sources Greenwich Bay Growing Area 8 4

1 Introduction

A triennial re-evaluation shoreline survey of Greenwich Bay was conducted in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline survey is to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys. This triennial update of Area 8 (Figure 1-1) was conducted in 2014. The survey involved follow-up sampling of previously identified sources from the 2005 12-year sanitary shoreline survey that resulted in fecal coliform counts exceeding 240 MPN / 100ml. These sources were evaluated to determine the bacteriological impact into the growing area.

The survey area encompasses all of the shoreline north and west of a line from Sandy Point in Warwick to the southern most tip of Warwick Point on Warwick Neck. The study area is located within the towns of Warwick and East Greenwich.

2 Description of Growing Area

Growing Area 8 is presently comprised of sections classified as approved, conditional, seasonal, and prohibited for shellfishing (Figure 2-1). Four distinct prohibited areas are in the growing area. They are Greenwich Cove, Apponaug Cove including Bakers Creek and a portion of Greenwich Bay proper, Buttonwoods and Brushneck Coves and Warwick Cove.

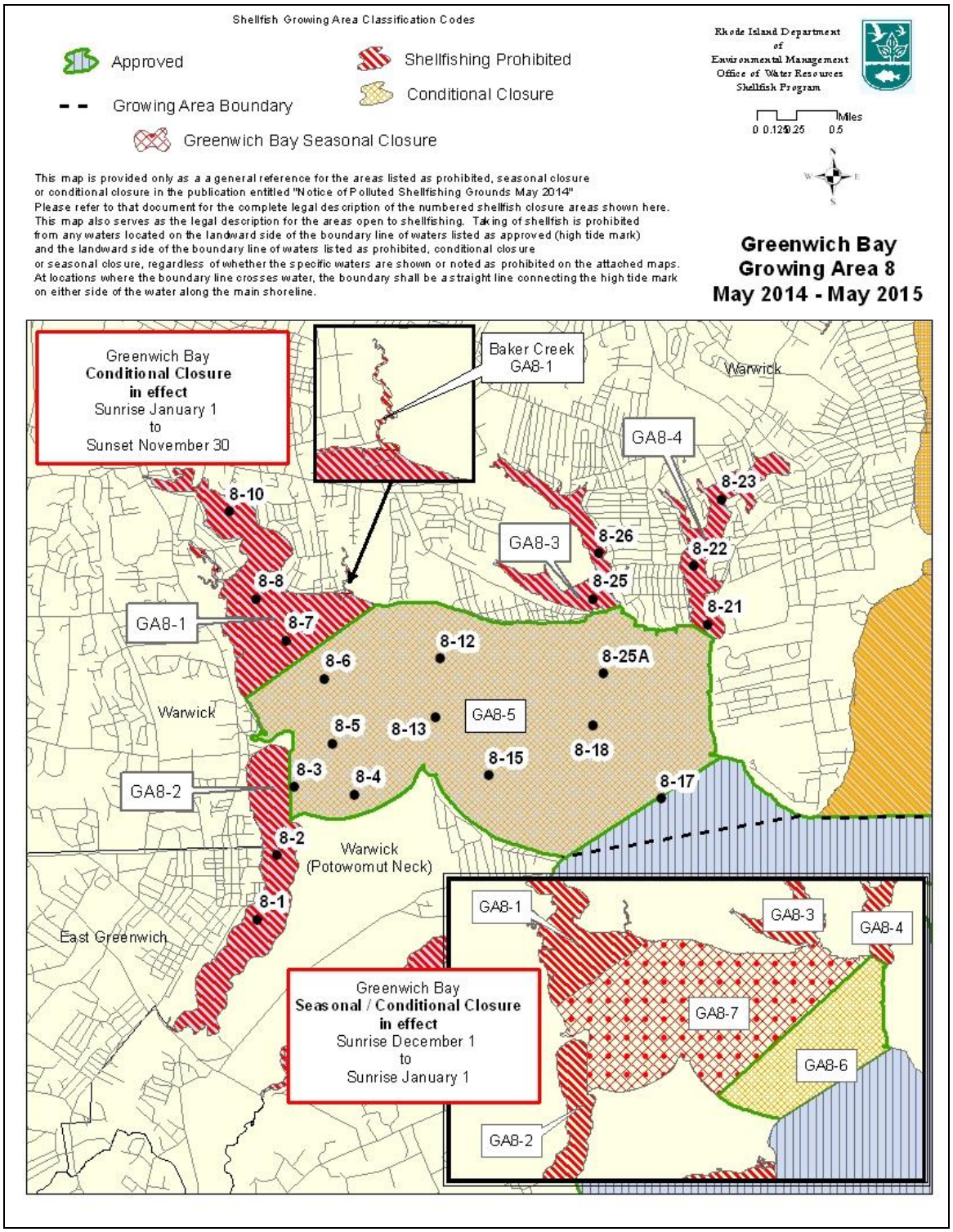
Greenwich Cove is classified as prohibited due to the influences from the East Greenwich Wastewater Treatment Facility and a number of recreational boating facilities. Apponaug Cove is classified as prohibited due to a high concentration of vessels. Warwick Cove is also closed due to the influences of commercial and recreational boating influences. Brushneck Cove was reclassified as prohibited in May of 1990 and Buttonwoods Cove was reclassified as prohibited in May of 2002. These closures were as a result of violations of water quality criteria from indiscrete influences. The coves are very shallow (low tide 1-4 ft) and although the land use directly adjacent to the two coves is undeveloped parkland and open space each cove is most likely influenced by freshwater stream inputs and overland storm water runoff from uplands that are comprised of high to medium-high residential development in over half of the watershed. The majority of the remainder of Greenwich Bay is operated on a conditional basis, closing to shellfishing in the event of 0.5 inches of rainfall as recorded at the TF Green Airport NOAA weather station. Additionally a seasonal closure during the month of December has been in place for several years as the result of as yet undetermined winter water quality issues. The remaining portion of the area at the southeast entrance to the cove (approximately 225 acres) is open to shellfish harvesting. There is also a shellfish management plan that is operated in the area by the Division of Fish and Wildlife that restricts and regulates the commercial harvesting of shellfish.

The majority of the shoreline is typically flat coastal plain with inter-tidal flats prevalent in the coves. Potowomut Neck that encompasses the southern boundary of the growing area contains a state park and two golf courses. The western shoreline of Greenwich Cove and Apponaug Cove is densely developed residential and commercial neighborhoods with numerous marinas and the resultant impacts of a large number of boats. As mentioned previously the Brushneck and Buttonwoods Coves are a mix of open space and developed shoreline with minimal boating influences due to the shallow waters. Warwick Cove also contains several marinas and mooring fields.

Hydrographic Characteristics

Total area of the Greenwich Bay Growing Area	3,200 Acres
Widest Reach	2.8 Miles
Deepest Point (at Warwick Neck)	42 Feet
Average Depth	10-12 Feet

Figure 2-1 Growing Area 8 Greenwich Bay



3 Pollution Source Surveys

Lucinda Hannus, Senior Environmental Scientist and employee of the Department of Environmental Management Division of Water Resources conducted the review for the triennial update of the shoreline of Greenwich Bay.

This review involved follow-up sampling on all previously identified sources in which bacterial results from sampling exceeded the 240 MPN/100 ml thresholds established in the shellfish programs standard operating procedures (SOP). Sterile 4 ounce nalgene bottles were used to collect samples and then stored in a portable cooler (4° C) during field surveys. At the completion of the field day, samples were transported to the Rhode Island Department of Health Laboratories for analysis. The membrane filtration method using mTEC as described in Standard Methods for the Examination of Water and Wastewater was used to analyze all samples.

3.1 Identification and Evaluation of Pollution Sources

Follow-up bacteriological samples were taken of all previously identified sources from creeks, streams, pipes/culverts or groundwater seeps that resulted in bacteria counts that exceeded 240 MPN/100ml. Sixteen sources met the criteria warranting follow-up sampling of which thirteen of which are located in prohibited areas and were not re-sampled as part of this triennial review. Figure 3-2 is a map depicting the location of these sources within the growing area.

The following table 3-1 compares sample results from the sampling events for these sources.

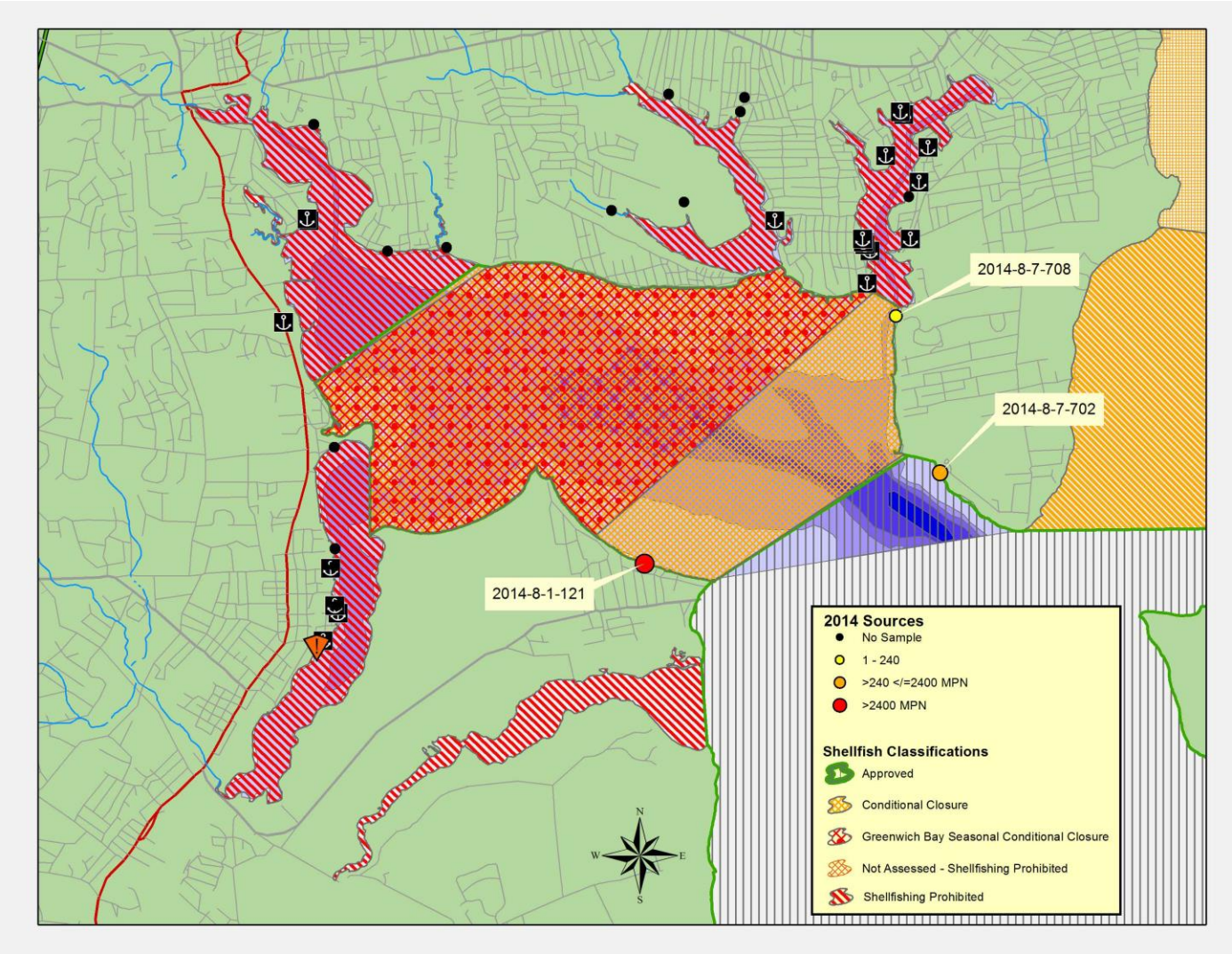
In 2011 these three sources were resampled as part of the triennial update that year. None of the results from that sampling exceeded 2400 cfu/100ml and only one exceeded the 240 cfu/100ml criteria for follow-up sampling for this year's review.

Source 8-1-121 is a drainage pipe that only flows during wet weather. Since it discharges to the conditionally approved are of the bay that closes due to rain events this source would not appear to have impacts on the receiving waters during open conditions. Source 8-7-708 is a small drainage area from an upland wetland which was not re-sampled in 2014 as it again is primarily influenced by wet weather. Source 8-7-702 had results of 43 cfu/100ml and was not re-sampled in 2014. If resources allow these three sources should be re-visited in 2015 to ensure no dry weather impacts.

Table 3-1 2014 Sources Greenwich Bay Growing Area 8

Source ID	Description	2005 Results	2006 Results	2008 Results	2009 Results	2010 Results	2011 Results
2005-8-1-121	18" dia hole in seawall 171 Charlotte Rd and Collins St	1600		4300 1100 IS<3E IS<3W	230 IS 23 E IS 15 W	4300 IS 4600E IS 750W	4 IS E & W NF
2005-8-7-702	24" CMP	2200	11	430			43
2005-8-7-702B	Duplicate	270					
2005-8-7-708	wetland drainage	430	46	93			430

Figure 3-1 2014 Sources Greenwich Bay



4 Mooring Fields and Marinas

As stated in the 12-year sanitary shoreline survey and as depicted on Figure 3-2 there are numerous marinas and mooring areas within the Greenwich Bay growing area. In 2003, Greenwich Bay's 33 marinas, 268 acres of mooring areas, and 67 residential docks accommodated approximately 4,000 boats (Greenwich Bay SAMP, CRMC 2005). As of 2014 there are thirteen pump-out facilities located within the bay to service these boats.

5 Wastewater Treatment Facilities (WWTF)

The Town of East Greenwich operates a sewage treatment facility that discharges to Greenwich Cove at routine monitoring station 8-1. The Greenwich Bay watershed is evolving from a watershed that once relied upon On-site Wastewater Treatment Systems (OWTS) to one in which the majority of sewage is handled by municipal sewers and treatment facilities (Greenwich Bay TMDL, RIDEM 2005). Today, most of the existing residential and commercial occupants in the growing area's watershed have sewers available to them.

The facility is permitted to discharge a maximum daily load of 1.7 mg/d of treated effluent. The average flow for 2014 was 0.85 mgd, within permit limits. The fecal coliform discharge average was 2.38 MPN/100ml well below the permit level of 200 MPN/100ml.

6 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 are collected at twenty (20) monitoring stations throughout the growing area (Figure 2-1). Twelve of these stations are in prohibited areas while the other eight are in the conditionally approved portion of the growing area.

Samples are collected 1-2 feet below the water surface (using 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. The membrane filtration using mTEC agar technique is used to analyze the samples. The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. A summary report is written and recommendations regarding the classification of the growing area are made on a yearly basis. The 2008 report is incorporated into this

report in the following section. Routine monitoring data is also part of this report and is shown in Table 6-1.

7 Growing Area Monitoring

HIGHLIGHTS

*** Sampled 12X in 2014**
*** Statistics represent dry weather, approved January through December data (N = 15) > 4/20/2013**
*** December only data 2000 – 2014 still exceeds criteria for stations west of Sally Rock, as well as station 25A**
*** December only data 2000 – 2014 marginally in compliance for stations east of Sally Rock**
*** All conditionally approved stations in compliance for January – November**
***mTEC = 15**
**** Data run 2/15/15***

COMMENTARY

Greenwich Bay (Growing Area 8) was sampled twelve times in 2014. The statistical evaluations for Greenwich Bay incorporate the most recent 15 dry weather samples collected between January and November for the area when open/approved for shellfish harvesting, which is the minimum number required by NSSP Manual of Operations guidelines for conditionally approved areas.
All the stations in Greenwich Bay have shown show significant elevations in both geometric means and variability criteria in the month of December, enough to knock many conditionally approved stations out of compliance. This year's review, however, has the area in compliance. One of the December sampling dates did have elevated fecals. The November and January data, as well as the warm months of the year, are in compliance. Based on these results, the western portion of Greenwich Bay should remain closed for the month of December as it has for the last three years and until additional data is collected in December. Stations 8-17 and 8-18 are in program compliance and remain conditionally approved during the month of December.

RECOMENDATIONS

*** Maintain existing seasonal closure of western portion of Greenwich Bay during the month of December for another year**
*** Target additional December sampling during dry weather conditions (open status)**
*** No other action recommended**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL(31)
GA8-1	P	14	3.5	0.00
GA8-2	P	15	7.7	6.67
GA8-3	P	15	2.9	0.00
GA8-4	CA	15	2.1	0.00
GA8-5	CA	15	2.3	0.00
GA8-6	P	15	2.3	0.00
GA8-7	P	15	3.6	0.00
GA8-8	P	15	6.3	0.00
GA8-10	P	15	15.2	20.00
GA8-12	CA	15	2.3	0.00
GA8-13	CA	15	2.3	0.00
GA8-15	CA	15	2.5	0.00
GA8-21	P	15	3.3	0.00
GA8-22	P	15	7.0	0.00
GA8-23	P	15	5.5	6.67
GA8-25	P	15	3.3	0.00
GA8-26	P	15	10.7	20.00
GA8-25A	CA	15	2.5	0.00

THIS DATA REPRESENTS THE MOST RECENT N = 15 DRY WEATHER DATA COLLECTED FOR ALL MONTHS EXCLUDING DECEMBER

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL(31/49)
GA8-1	P	11	11.2	9.09
GA8-2	P	12	11.9	25.00
GA8-3	P	13	18.4	15.38
GA8-4	CA	13	16.6	15.38
GA8-5	CA	13	23.0	23.08
GA8-6	P	13	28.3	23.08
GA8-7	P	13	86.2	46.15
GA8-8	P	13	95.2	69.23
GA8-10	P	12	85.7	66.67
GA8-12	CA	13	16.2	23.08
GA8-13	CA	13	27.9	38.46
GA8-15	CA	11	5.6	7.69
GA8-17	CA	13	10.1	7.69
GA8-18	CA	13	12.5	7.69
GA8-21	P	12	15.6	16.67
GA8-22	P	11	23.5	27.27
GA8-23	P	11	16.1	9.09
GA8-25	P	11	14.4	9.09
GA8-26	P	9	47.4	44.44
GA8-25A	CA	9	14.3	11.11

THIS DATA REPRESENT ALL DECEMBER ONLY DATA FROM 2000 THROUGH 2014

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Stations 17 and 18 including December

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL(31)
GA8-1	P	14	3.7	0.00
GA8-2	P	15	6.3	6.67
GA8-3	P	15	3.3	0.00
GA8-4	CA	15	3.2	6.67
GA8-5	CA	15	2.9	0.00
GA8-6	P	15	2.7	0.00
GA8-7	P	15	4.1	0.00
GA8-8	P	15	7.4	0.00
GA8-10	P	15	15.8	13.33
GA8-12	CA	15	2.8	0.00
GA8-13	CA	15	3.0	0.00
GA8-15	CA	15	2.8	0.00
GA8-17	**CA**	**15**	**2.3**	**0.00**
GA8-18	**CA**	**15**	**2.5**	**0.00**
GA8-21	P	15	4.0	6.67
GA8-22	P	15	8.1	6.67
GA8-23	P	15	6.8	6.67
GA8-25	P	14	3.8	0.00
GA8-26	P	13	11.5	23.08
GA8-25A	CA	15	2.8	0.00

THIS DATA REPRESENT MOST RECENT N = 15 ALL MONTHS (10/1/13 – 12/31/14)
ADJUSTED FOR MTEC

8 Conclusions and Recommendations

The triennial update of the Greenwich Bay (Growing Area 8) reevaluated point sources in the study area. However, none of the sources appear to have any impact on the high quality ambient waters during open conditions.

There are numerous point sources identified in previous shoreline surveys that do or have the potential to discharge to Greenwich Bay. The majority of these sources only impact the bay during wet weather thus necessitating the conditional status of the majority of the growing area. Based on the results of this triennial review and the water quality statistical evaluation of the growing area indications are that the survey area conforms to all requirements set forth by the National Shellfish Sanitation Program (NSSP) and is properly classified. It is recommended that the seasonal closure (Dec-Jan) of the middle of the bay be reinstituted this year.

The next survey scheduled is an annual review to be completed in 2015.

West Middle Bay
Growing Area 9
2014 Annual Update

A shoreline survey of the West Middle Bay Growing Area 9 was conducted in 2007 and a triennial update was completed in 2013. There were no sources identified for follow-up sampling as part of this annual report.

The results of the routine monitoring stations indicate that this growing area is properly classified and therefore no changes to the classification are recommended at this time.

The next required survey would therefore be an annual update to be completed in 2015. The following are highlights and evaluations of the annual statistical results for the West Middle Bay growing area.

HIGHLIGHTS

*** Sampled 7x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** Station 13 (Upper Potowomut River), still exceeding variability criteria**
*** All other approved stations in compliance and conformance**
*** MTEC = 15 (90% = 39 cfu/100ml)**
**** Data run 2/10/15***

COMMENTARY

The West Middle Bay (Growing Area 9) was sampled seven times in 2014, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the West Middle Bay incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Station 13 was established in the Upper Potowomut River seven years ago in order to determine whether that portion of the River is suitable for approved shellfish harvesting. Sampling of this station indicated that it was out of compliance and as a result, the line was moved further out towards the approved waters. Results of the 2014 composite sampling (N = 30) Station 13 exceeds the 90th percentile variability criteria. The Upper Potowomut was closed six years ago and should remain closed.

Results of the statistical evaluation demonstrate that all approved stations are in program compliance. The area is properly classified.

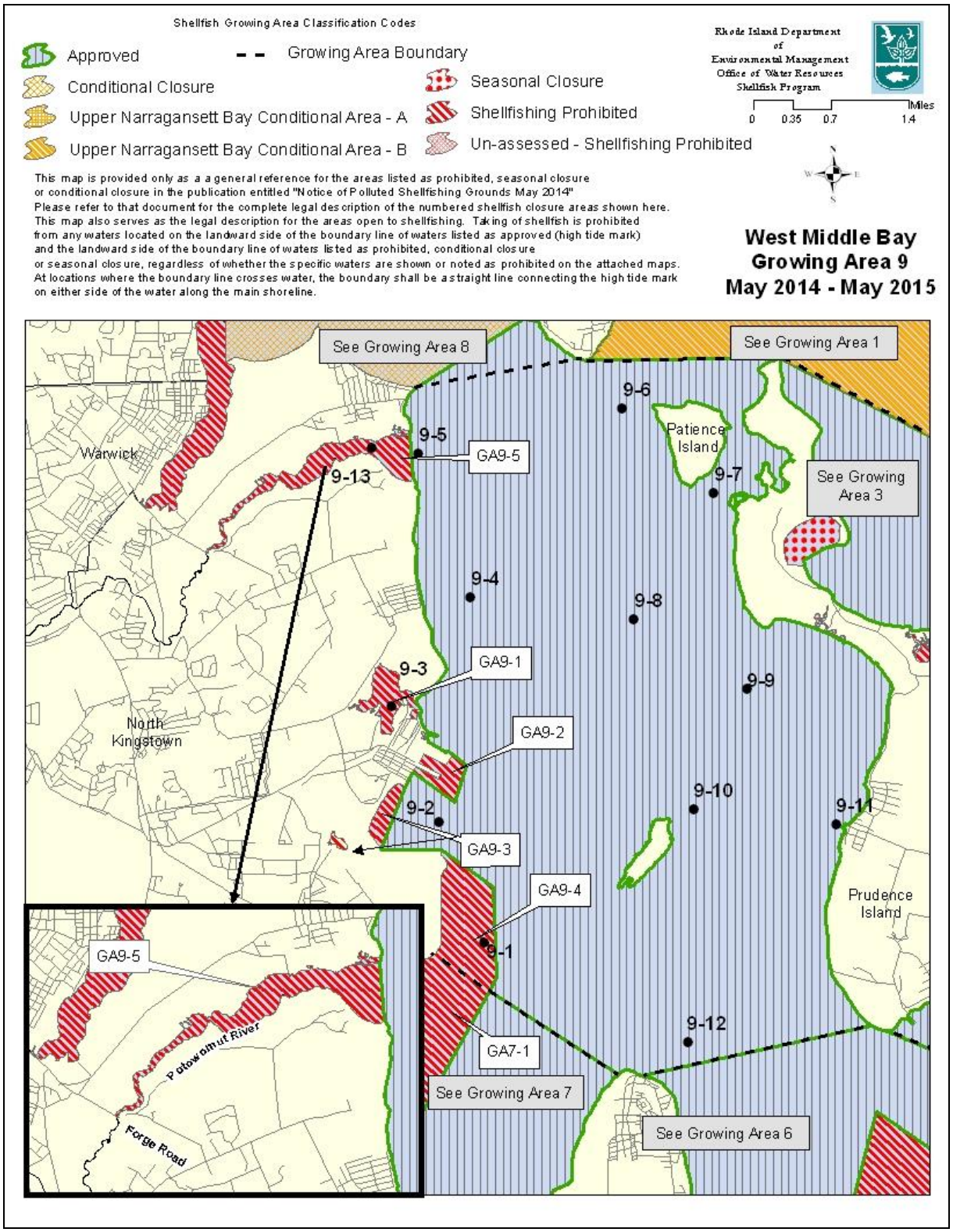
RECOMMENDATIONS

*** Maintain closure of Upper Potowomut River**
*** No other action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<39)
GA9-1	P	30	2.3	4.7
GA9-2	A	30	2.2	3.2
GA9-3	P	29	3.4	11.1
GA9-4	A	30	2.3	3.5
GA9-5	A	30	4.7	15.9
GA9-6	A	30	2.3	3.6
GA9-7	A	30	2.2	3.6
GA9-8	A	30	2.1	2.8
GA9-9	A	30	2.2	3.2
GA9-10	A	30	2.4	4.1
GA9-11	A	30	2.0	2.4
GA9-12	A	30	2.1	2.8
GA9-13	P	30	11.4	117.1

Growing Area 9 West Middle Bay



Pt Judith and Potters Ponds

Growing Area 10
Triennial Re-Evaluation
February 2014

The Providence Journal / John Freida

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

Table of Contents

1.0 Introduction 1
2.0 Description of Growing Area 2
3.0 Pollution Source Surveys 2
4.0 Mooring Fields and Marinas 4
5.0 Wastewater Treatment Facilities (WWTF) 4
6.0 Water Quality Studies 4
7.0 Conclusions and Recommendations 7

Table of Figures

Figure 1-1 Point Judith Pond and Potters Pond 1
Figure 3-1 Sources within the Point Judith and Potters Pond Growing Area 3

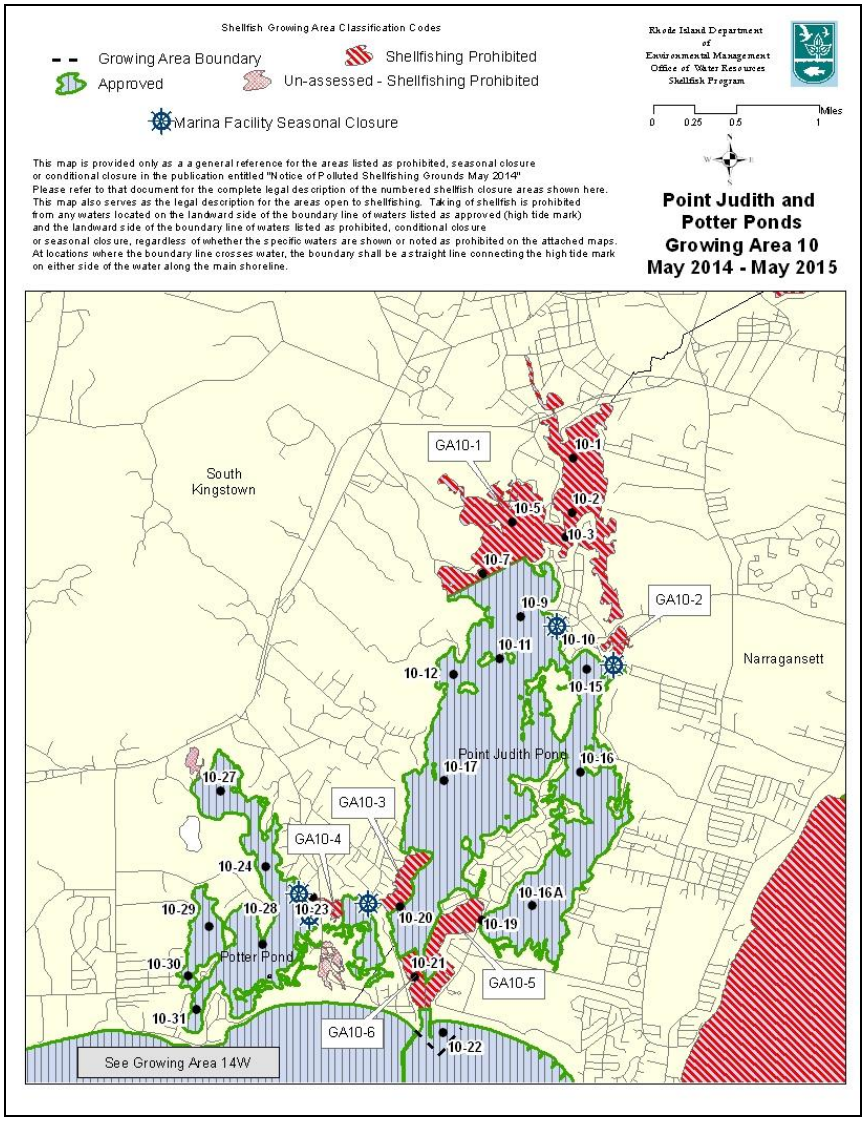
List of Tables

Table 3-1 Sampling Results 2

1.0 Introduction

A triennial re-evaluation shoreline survey of Point Judith Pond and Potters Pond was conducted in order to comply with National Shellfish Sanitation Program (NSSP) requirements for shellfish growing area classification. The primary objective of this shoreline survey is to identify and characterize sources of pollution affecting the area and re-evaluate point and non-point sources previously identified during prior surveys. This triennial update of Area 10 (Figure 1-1) was conducted in 2014. The survey involved follow-up sampling of previously identified sources from the 2011 12-year sanitary shoreline survey that resulted in fecal coliform counts exceeding 240 MPN / 100ml. These sources were evaluated to determine the bacteriological impact into the growing area.

Figure 1-1 Point Judith Pond and Potters Pond



2.0 Description of Growing Area

Growing area 10 is located within the Salt Pond Region, which is located on the southern coast of Rhode Island and consists of shallow coastal lagoons that are productive marine embayments separated from the ocean (Figure 1-1). Point Judith and Potter Ponds are the easternmost waterbodies in Rhode Island's Salt Pond Region, respectively, and are located just west of Narragansett Bay and immediately north of Block Island Sound.

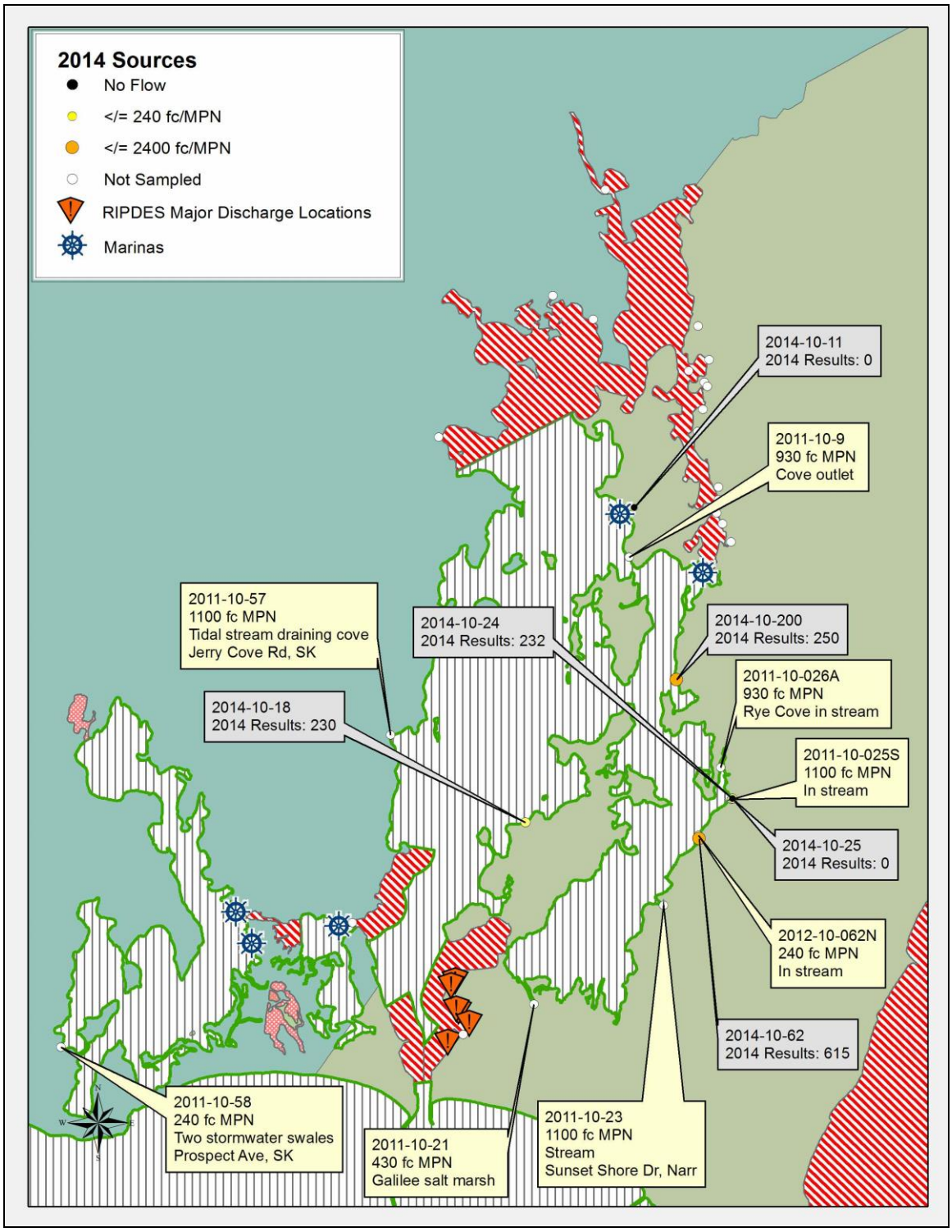
3.0 Pollution Source Surveys

A total of one hundred and two (102) sources or potential sources were identified during the 2011 shoreline survey, excluding marinas. A total of forty-seven of the ninety sources were not actively flowing at the time of the shoreline survey. All sources in which flow was observed were sampled. Of the fifty five sources flowing at the time of the survey, thirty three (33) sources exceeded the 240 MPN threshold. Eighteen of these sources are located in areas of the ponds in which shellfishing is prohibited and were not re-sampled for the triennial update. In addition to those sources located in prohibited areas, in stream samples and other sources in approved waters were not re-sampled for this triennial survey. The following figure (3-1) is a map depicting the location of these sources within the growing area. Table 3-1 contains the descriptions of these sources and the results of sampling. Sources not re-sampled in 2014 that have previously exhibited elevated bacteria levels shall be re-sampled in 2015.

Table 3-1 Sampling Results

Sample ID	Description	Previous Results	2011 Results fc /MPN	2014 Results cfu/100ml
2014-10-11	RCP outfall (wet weather source)		4300	NF
2014-10-200	Culvert draining Kenyon Farm pond		4600	250
2014-10-24	RCP outfall	9	430	232
2014-10-25	Two 2 ½ " pvc pipes buried at rear of yard	9	24000 NF	NF
2014-10-62	RCP flared end outfall Pond View Ave (wet weather source)	43	46000 24000	615
2014-10-18	12: RCP in concrete headwall (wet weather source)	NF	43000 430	230

Figure 3-1 Sources within the Point Judith and Potters Pond Growing Area



4.0 Mooring Fields and Marinas

There are numerous recreational boating facilities within the growing area that have had negative impacts upon water quality, and have resulted in the closure of several areas within Point Judith Pond and a portion of the Potter Pond connector channel. There are two pumpout facilities servicing the numerous marinas, one at the head of Point Judith Pond at Ram Point and the other at the connector channel between the two ponds. Both ponds are within the states no-discharge zone, making the discharge of marine sanitation devices illegal.

The Port of Galilee in the Town of Narragansett is the major commercial fishing center in Rhode Island. The Port is located on the eastern side of Point Judith Pond immediately north of the breachway. There is also commercial fishing boats harbored in Snug Harbor immediately south of High Point in South Kingstown. The areas immediately surrounding these ports are closed to shellfishing.

5.0 Wastewater Treatment Facilities (WWTF)

There are no wastewater treatment facilities that discharge into either Point Judith Pond or Potters Pond. There are five RIPDES permitted discharges (Figure 3-1) into the harbor area in Galilee. They are all water release pipes associated with fish processing and distribution plants.

6.0 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 are collected at monitoring stations throughout the growing area (Figure 1-1). Samples are collected 1-2 feet below the water surface (using 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. The membrane filtration technique using mTEC agar is used to analyze the samples. The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. A summary report is written and recommendations regarding the classification of the growing area are made on a yearly basis. The 2014 report is incorporated into this report in the following sections.

7.0 Shellfish Program Routine Monitoring Program

HIGHLIGHTS

*** Sampled 6x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10(N = 30)**
*** All approved stations in compliance and conformance**
*** MTEC = 16 (90% = 38 cfu/100ml)**
*** Data run 2/12/15**

COMMENTARY

Pt. Judith Pond and Potter Pond (Growing Area 10) were sampled six times in 2014, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for Pt. Judith Pond and Potter Pond incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Results of the statistical evaluation demonstrate that all approved stations are in program compliance. A review of the shellfish data in past years had demonstrated that Station 7 and the stations located north of it in the Upper Pond (presently classified as prohibited) are adversely influenced by wet weather. A TMDL study of the area was completed in June 2008.

All approved stations are in program compliance.

RECOMMENDATIONS

*** No other action recommended based on ambient monitoring results**

Table 7-1 Monitoring Results

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<38)
GA10-1	P	30	57.7	582.0
GA10-2	P	30	43.2	401.2
GA10-3	P	30	27.0	207.8
GA10-5	P	30	13.3	83.7
GA10-7	P	30	8.0	40.0
GA10-9	A	30	5.6	30.2
GA10-10	A	30	3.7	16.6
GA10-11	A	30	4.6	18.4
GA10-12	A	30	3.9	12.3
GA10-15	A	30	4.2	14.8
GA10-16	A	29	3.1	7.9
GA10-16A	A	30	6.2	29.2
GA10-17	A	30	3.6	11.3
GA10-19	P	30	7.6	37.2
GA10-20	P	30	4.2	13.5
GA10-21	P	30	4.4	13.7
GA10-22	A	29	2.7	5.5
GA10-23	P	30	3.4	8.5
GA10-24	A	30	5.7	22.2
GA10-27	A	30	2.8	5.3
GA10-28	A	30	2.7	5.6
GA10-29	A	30	2.9	5.9
GA10-30	A	30	3.8	14.1
GA10-31	A	30	2.6	5.1

8.0 Conclusions and Recommendations

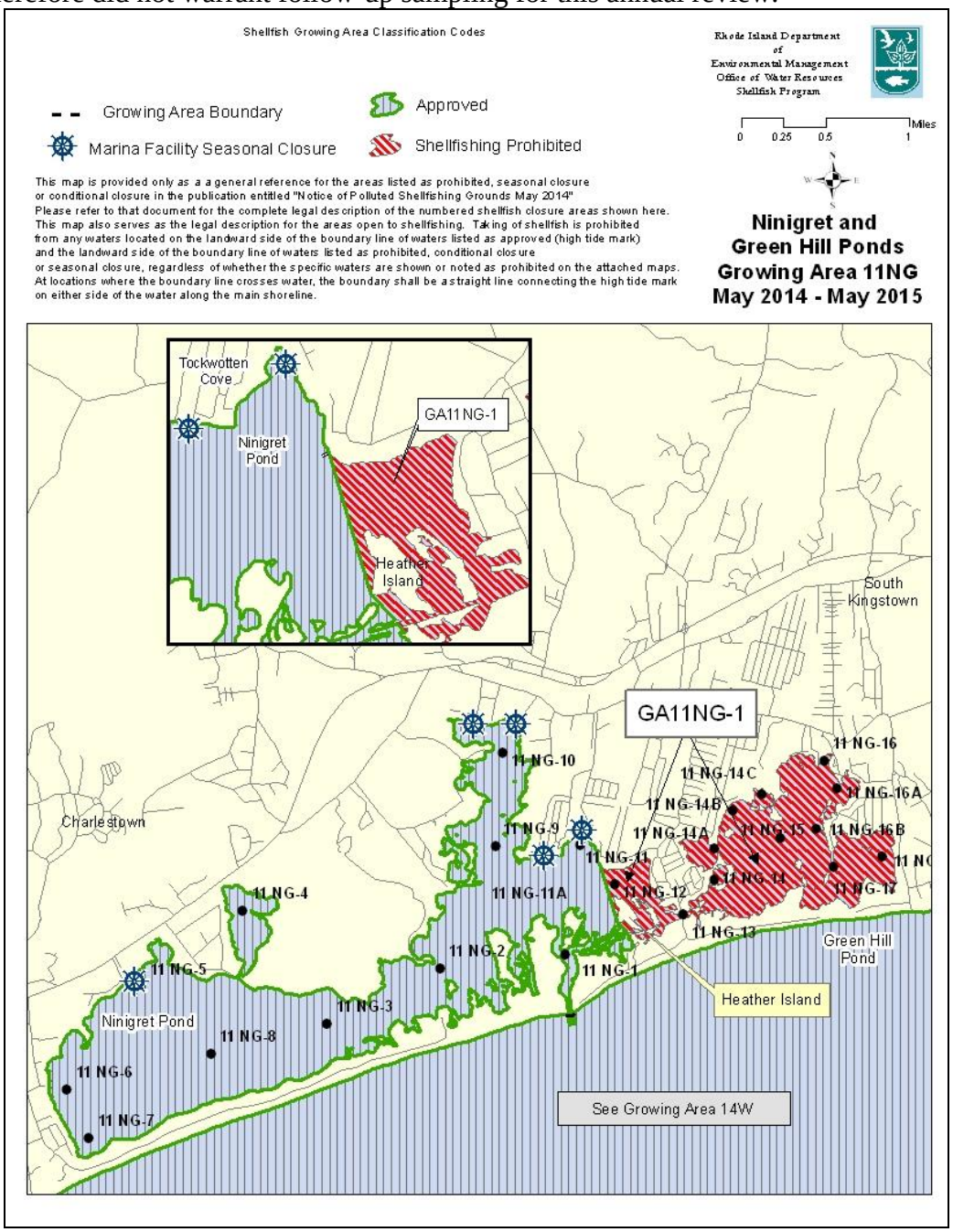
Due to the insignificant amount and impact of the sources identified in previous surveys, or their location in prohibited waters and the water quality statistical evaluation of the growing area no changes in growing area classification are recommended at this time.

The results of this review, combined with previous water quality statistical evaluations of the routine monitoring results, indicate that the survey area conforms to all requirements set forth by the NSSP and is appropriately classified. No changes for reclassification are recommended at this time.

The next scheduled review is an annual review in 2016.

Ninigret and Green Hill Ponds
Growing Area 11 NG
2014 Annual Update

A shoreline survey of the Ninigret and Green Hill Ponds Growing Area 11 NG was conducted in 2012. The shoreline survey identified a total of ten (10) actual or potential sources, five (5) in each pond excluding marinas. Of those five sources located in Green Hill Pond discharge or potentially discharge into waters that are currently classified as Prohibited. Of the five sources discharging or potentially discharging into Ninigret Pond, four of them do so into waters that are approved for shellfishing, the fifth source discharges into the prohibited waters of the pond. All sources in which flow was observed were sampled with no sources within the open areas exceeded the 2400 MPN fecal coliform standard threshold for follow-up sampling. The two major sources identified in the Office of Water Resource's TMDL report; Teal Brook and Factory Pond Brook discharge into the prohibited portion of Green Hill Pond and therefore did not warrant follow-up sampling for this annual review.



The following are the highlights and results of the annual statistical evaluations with recommendations on classifications made prior to the annual review.

HIGHLIGHTS

*** Sampled 6x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** All approved stations in compliance and conformance**
*** MTEC = 16 (90% = 38 cfu/100ml)**
**** Data run 2/12/15***

COMMENTARY

Ninigret Pond and Green Hill Pond (Growing Area 11NG) were sampled six times in 2014 (Growing Area 11NG), complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for Ninigret Pond and Green Hill Pond incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

The TMDL for Green Hill Pond and the eastern portion of Ninigret Pond was approved in February 2006. All approved stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<38)
GA11NG-1	A	30	2.7	6.3
GA11NG-2	A	30	2.8	7.4
GA11NG-3	A	30	2.8	6.8
GA11NG-4	A	30	5.4	24.8
GA11NG-5	A	30	2.6	5.9
GA11NG-6	A	30	3.0	7.4
GA11NG-7	A	30	2.8	7.6
GA11NG-8	A	30	2.6	5.1
GA11NG-9	A	31	4.3	15.9
GA11NG-10	A	31	4.3	15.9
GA11NG-11	A	31	4.8	22.7
GA11NG-12	P	30	8.3	50.7
GA11NG-13	P	30	7.4	46.0
GA11NG-14	P	29	11.6	135.8
GA11NG-14A	P	29	8.5	44.3
GA11NG-14B	P	29	6.3	49.7
GA11NG-15	P	29	6.3	40.5
GA11NG-16	P	29	11.9	143.8
GA11NG-16A	P	29	10.9	106.9
GA11NG-16B	P	29	6.6	38.5
GA11NG-17	P	29	7.6	53.7
GA11NG-18	P	29	4.3	18.4
GA11NG-14C	P	30	21.1	252.1

The next schedule survey would be a triennial update scheduled for 2015.

Quonochontaug and Winnapaug Ponds
Growing Area 11 QW
2014 Annual Update

A shoreline survey of Quonochontaug and Winnapaug Ponds Growing Area 11QW was conducted in 2012. This shoreline survey identified a total of twenty-six (26) actual or potential sources, seventeen in Quonochontaug Pond and nine in Winnapaug Pond excluding marinas.

Of the 26 identified sources from 2012, ten (10) either had no flows or surveyors were unable to locate the source that had been identified in previous surveys. Sixteen (16) sources had flows of which only one had elevated bacteria counts greater than 2400 CFU/100ml requiring follow-up sampling for this annual review.

Source W40 is a small stream that originates from a swale that is adjacent to a stormwater detention basin opposite Misquamicut State Beach. Results were 3400 CFUs/100ml in 2012. This source was reinvestigated in 2013. At numerous times the basin was inspected and clean up work had not been completed. It is still unknown what the status of this basin and drainage system is.

A new in pond station 11QW-36 has been established just off shore of these outfalls and has been sampled 15 times since September 2012. The geo-mean for these samples is 2.3 and the 90th % is 3.9. The new station located offshore of the discharge will continue to be monitored and wet weather sampling of the basin will also begin once confirmation is received that it is back to full operational condition per their water quality certificate.

In 2008 the western end of Quonochontaug Pond in the vicinity of station 25 was out of program compliance and a small closure was incorporated. The most recent data shows this station is back in program compliance.

Shellfish Growing Area Classification Codes

Growing Area Boundary | Approved | Shellfishing Prohibited

Marina Facility Seasonal Closure

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

0 0.25 0.5 1 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014"
Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here.
This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps.
At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Quonochontaug and Winnapaug Ponds Growing Area 11QW May 2014 - May 2015

The following highlights and results of the statistical evaluation of the routine monitoring stations indicate that the rest of this growing area is properly classified and therefore no additional changes are recommended at this time.

HIGHLIGHTS

*** Sampled 6x in 2014**
*** Statistics represent combined wet and dry weather data >01/01/10 (N = 30)**
*** All approved stations in compliance and conformance**
*** MTEC = 16 (90% = 38 cfu/100ml**
***Station 25 in compliance again**
**** Data run 2/12/15***

COMMENTARY

Quonochontaug Pond and Winnapaug Pond (Growing Area 11) were sampled six times in 2014, complying with the minimum SRS monitoring requirement for approved areas. Sample results are representative of wet and dry weather conditions. The statistical evaluation for Quonochontaug Pond and Winnapaug Pond incorporates the most recent 30 samples collected for the area, the minimum number required for analysis according to SRS guidelines.

Station 25, located at the western end of Quonochontaug Pond, is in compliance for the second year running. It had shown a slight exceedance in the variability criteria for several years prior to that.

The results of the statistical evaluation demonstrate that all approved stations are in program compliance.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**
*** Recommend opening Station 25 west end Quonochontaug Pond**

The decision was made to upgrade Station 25 to Approved status based on the shoreline survey and monitoring results. Effective sunrise of the Saturday prior to Memorial Day weekend.

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<38)
GA11QW-19	A	29	2.6	5.2
GA11QW-20	A	30	2.4	4.7
GA11QW-21	A	30	2.7	5.7
GA11QW-22	A	30	3.3	9.5
GA11QW-23	A	30	3.0	7.4
GA11QW-24	A	30	2.6	5.1
GA11QW-25	p	30	5.5	26.7
GA11QW-26	A	30	2.3	3.7
GA11QW-27	A	30	3.3	8.8
GA11QW-28	A	30	3.8	11.7
GA11QW-29	A	30	2.6	5.7
GA11QW-30	A	30	5.7	21.1
GA11QW-31	A	30	3.5	10.5
GA11QW-32	A	30	4.4	11.6
GA11QW-33	A	30	3.3	11.7
GA11QW-34	A	30	2.8	6.9
GA11QW-35	A	30	4.4	16.7
GA11QW-36	A	15	2.3	3.9

A triennial up-date is scheduled for 2015.

Growing Area 12
Little Narragansett Bay
2014 Annual Update

All waters of the Little Narragansett Bay, Growing Area 12 are currently prohibited to shellfishing. The area was sampled five times in 2014. A TMDL study of Little Narragansett Bay was approved by EPA in December of 2010. The recommended implementation activities for the study area focus on stormwater, wastewater, and waterfowl management. The area is properly classified as prohibited.

HIGHLIGHTS

*** Sampled 5x in 2014**
*** Statistics represent combined wet and dry weather data >10/01/11 (N=15)**
*** Area is prohibited**
*** MTEC = 14**
**** Data run 2/12/15***

COMMENTARY

Little Narragansett Bay (Growing Area 12) was sampled five times in 2014. Since the area is classified as prohibited, there is no minimum sampling requirement. The area has been closed to shellfish harvesting for direct human consumption for the last 19 years due to unpredictable and elevated fecal coliform levels. A TMDL study of Little Narragansett Bay was completed on December 1, 2010.

At the present time the area is properly classified as prohibited.

RECOMMENDATIONS

*** Continue monitoring area**
*** No action recommended**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	<10% > 49/MPN 31/mTEC
GA12-1	P	15	148.7	93.33
GA12-2	P	15	81.7	80.00
GA12-3	P	15	106.5	86.67
GA12-4	P	15	32.0	40.00
GA12-5	P	15	38.8	60.00
GA12-6	P	15	19.3	53.33
GA12-7	P	15	12.4	33.33
GA12-8	P	15	10.0	20.00
GA12-9	P	15	2.8	0.00
GA12-10	P	15	4.7	13.33
GA12-11	P	15	3.8	6.67
GA12-14	P	15	3.2	6.67
GA12-15	P	15	4.7	6.67
GA12-16	P	15	8.9	26.67
GA12-17	P	15	61.9	73.33

2014 – 2015 Classification Map

Shellfish Growing Area Classification Codes

Growing Area Boundary

Shellfishing Prohibited

Approved

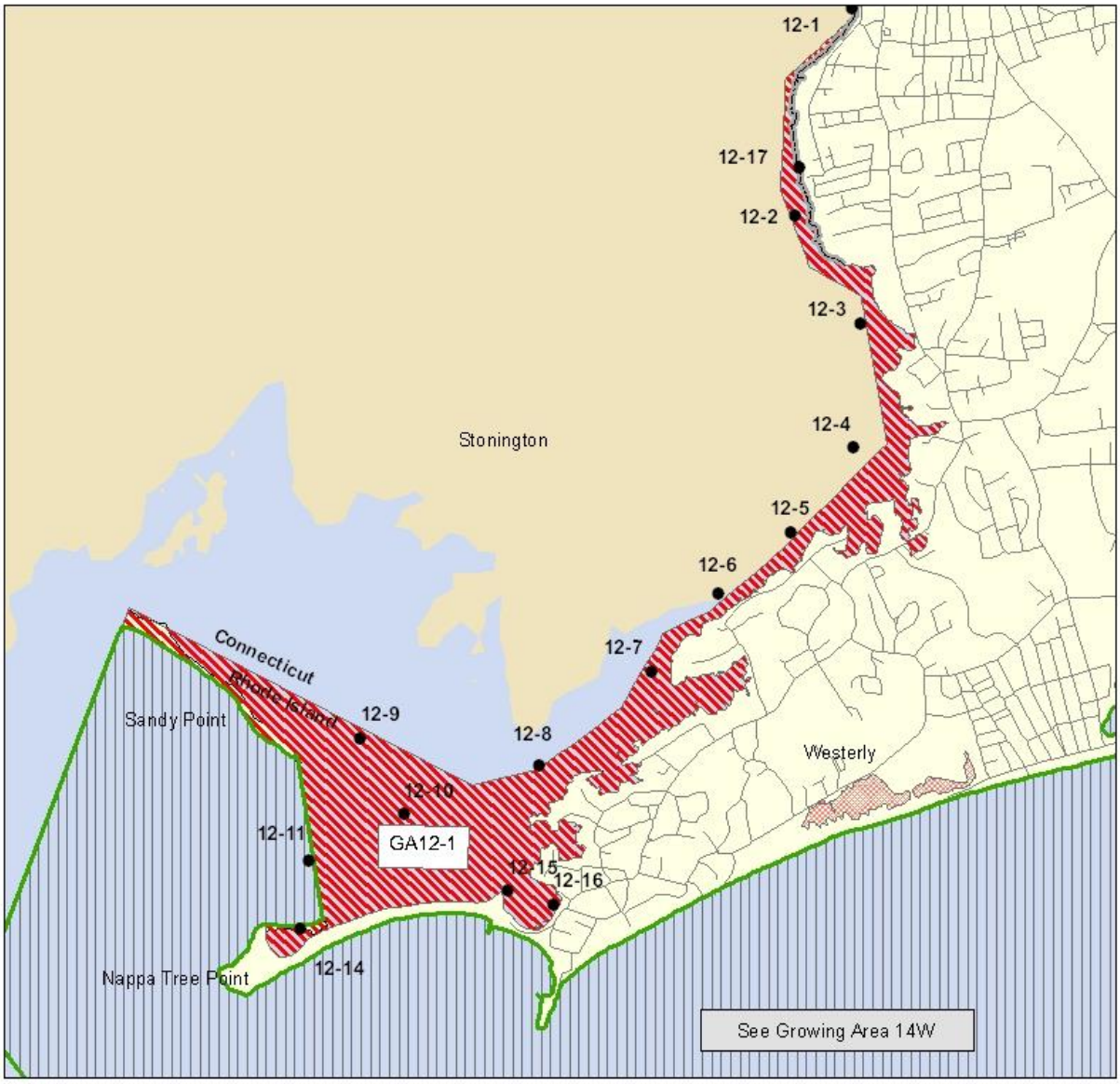
Un-assessed - Shellfishing Prohibited

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

0 0.225 0.45 0.9 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Little Narragansett Bay Growing Area 12 May 2014 - May 2015



Block Island
Growing Area 13
2014 Annual Update

A complete sanitary shoreline survey of the Block Island Growing Area 13 was conducted in 2006. A triennial update was completed in 2012. In 2014 four sources were re-sampled as part of this annual update.

Source ID	Description	2006 Results	2009 Results	2010 Results	2011 Results	2012 Results	2013 Results	2014 Results
2006-13-001	Tributary Upper Harbor Pond	430	1,100 Low flow	23 fc/MPN .31 cfs*	NS	525	8000 25.5 cfs*	NF
2014-13-009	Great Salt Pond							23 cfu/100ml
2006-13-008	Great Salt Pond Andy's Way seep. Green growth.	2100	460 Low flow	9 fc/MPN 1.27 cfs*	NS	NF	NS	No sample
2006-13-011	West of harbor master shack. Drains Wetland	1500	1,100 Low flow	2100 fc/MPN 2.12 cfs*	7	818	654 0.70 cfs*	245 cfu/100ml
2006-13-007	Trim Pond Tributary	1100	NF	NS	NS	8000	8000 0.32 cfs*	NF

* Indicates that flow measurements were taken by non-shellfish program personnel and seem suspect in their dimensions. Previously observed flow from these sources were noted as seeps, trickles and low flows, the dimensions provided by the sampler indicated streams 5 ft wide by up to 2 ft deep which is significantly bigger than a "seep or a trickle".

The area currently closed in Cormorant Cove was sampled twelve times in 2014 and more than thirty times since sampling began along with the routine monitoring station runs. The following are the results from that sampling.

Now labeled Station GA13-17

Station ID	Sampling Period	Geo-Mean all samples Fc/MPN
15 at outfall	Oct 2013 - Dec 2014	**3.2** n=30 3.33 % of results > 31
16 outside buoys	Oct 2013 - Dec 2014	**2.5** n=30 0 % of results >31
17 inside buoys (Formally sta. 15A)	Oct 2012 - Dec 2013	**3.0** n=30 3.33 % of results >31

(mTEC N=18)

Currently there does not appear to be a significant influence to the cove from this upland wetland and it appears that all stations are now in program compliance. It is recommended that we continue sampling and leave this small closure in effect. Station 16 outside the closure area is in compliance.

The results of the routine monitoring stations indicate that this growing area is properly classified and therefore no changes to the classification are recommended at this time. See the attached Block Island Growing Area 13 classification map and the 2013 RI Shellfish Program Routine Monitoring report.

The next required survey would be a triennial update to be completed in 2015.

HIGHLIGHTS

*** Sampled 12x in 2014**
*** Statistics represent all combined wet and dry weather data >10/01/13 (N=30) for approved Sta.'s 9, 10, 11, 13 and 16**
*** Statistics represent combined wet and dry weather, open season data >01/09/13 (N=15) for conditional/seasonally approved Sta.'s 1-7 and 14**
*** Statistics represent combined wet and dry weather, open season data >03/01/13 (N=15) for conditional/seasonally approved Sta.'s 8 and 12**
*** All approved and seasonally approved stations in compliance and conformance**
*** MTEC = 15 (90% = 31cfu/100ml)**
**** Data run 2/25/15***

COMMENTARY

Block Island's Great Salt Pond (Growing Area 13) was sampled twelve times in 2014, complying with the monthly minimum monitoring requirement for conditional/seasonally approved areas. The Town of New Shoreham, Harbormaster's Office, collected all samples through cooperative agreement with this office. Sample results are representative of wet and dry weather conditions. The statistical evaluation for the Great Salt Pond incorporates the most recent 15 combined wet and dry weather, open season samples collected for the area, the minimum number required by NSSP Manual of Operations guidelines for conditional/seasonally approved areas. The statistical evaluation for the four permanently approved stations incorporate the most recent 15 and 30 combined wet and dry weather samples collected for the area.

All approved and conditional/seasonally approved stations are in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	90TH PERC(<31)
GA13-9	A	30	3.5	12.1
GA13-10	A	30	2.5	4.7
GA13-11	A	30	2.4	4.0
GA13-13	A	30	2.2	3.4
GA13-16	A	28	2.5	4.3

N = 30 ALL SEASONS DATA STA 9, 10, 11, 13, 16 7/1/12–12/31/14 MTEC=30

The following stations are conditional/seasonally approved or prohibited and results are for reference only and not for compliance

GA13-1	SA	30	5.7	30.9
GA13-2	SA	30	4.2	15.2
GA13-3	SA	30	3.5	22.7
GA13-4	SA	30	3.0	8.8
GA13-5	SA	30	2.8	7.0
GA13-6	SA	30	2.4	3.9
GA13-7	SA	30	3.1	11.1
GA13-8	SA	30	2.3	4.0
GA13-12	SA	30	2.4	4.1
GA13-14	SA	30	5.9	18.3
GA13-17	P	28	3.0	8.8

Open season data >01/09/13 (N=15) for conditional/seasonally approved Sta.'s 1-7 and 14

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
GA13-1	SA	15	3.7	0.00
GA13-2	SA	15	2.4	0.00
GA13-3	SA	15	2.2	0.00
GA13-4	SA	15	2.3	0.00
GA13-5	SA	15	2.2	0.00
GA13-6	SA	15	2.0	0.00
GA13-7	SA	15	2.0	0.00
GA13-14	SA	15	4.2	0.00

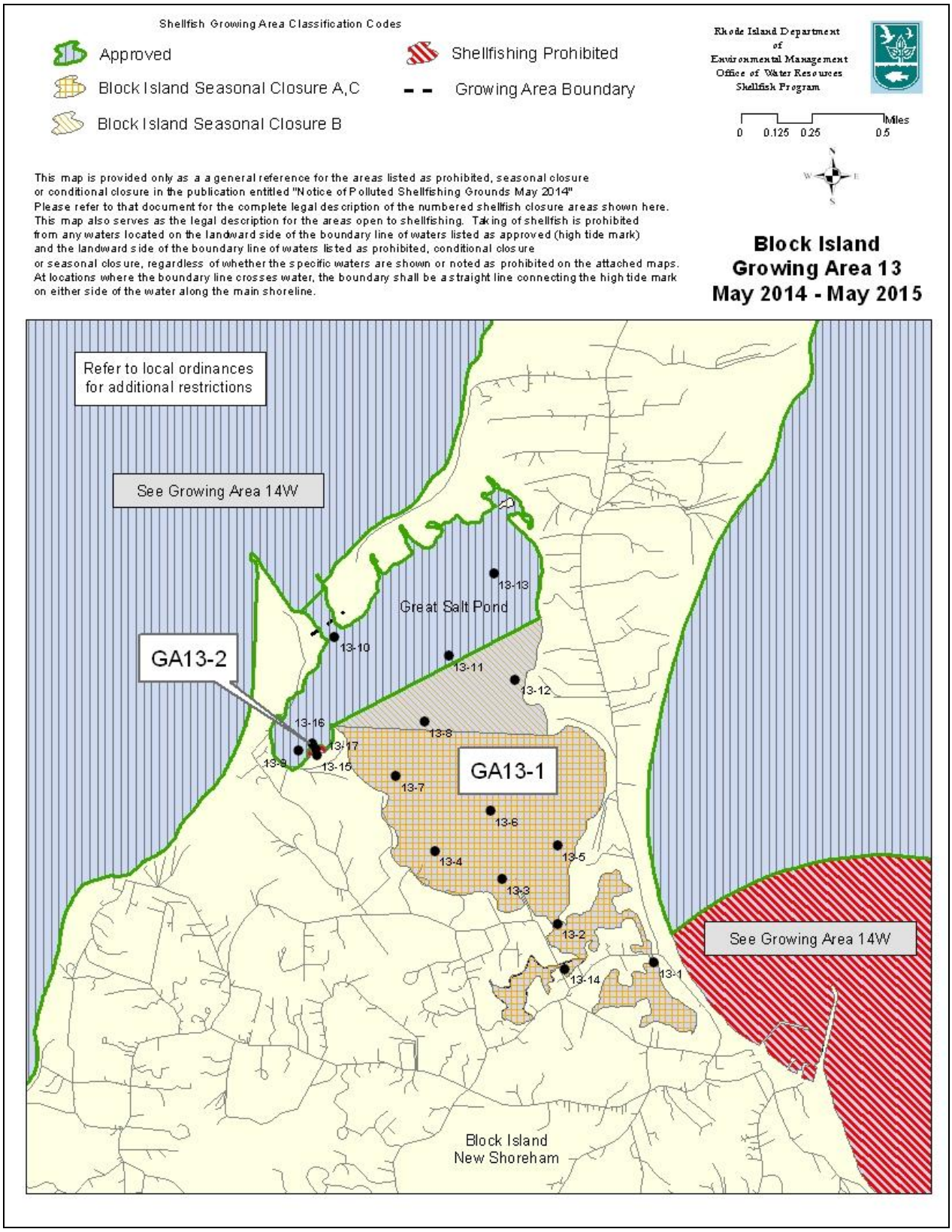
Open season data >03/01/13 (N=15) for conditional/seasonally approved Sta.'s 8 and 12

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
GA13-8	SA	15	2.2	0.00
GA13-12	SA	15	2.1	0.00

Open season data >03/01/13 (N=15) for conditional/seasonally approved Sta.'s 8 and 12

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
GA13-8	SA	15	2.2	0.00
GA13-12	SA	15	2.1	0.00

Current Classification Map



Offshore including Offshore Block Island
Growing Area 14E and 14W
2014 Annual Update

A shoreline survey of the Offshore Growing Area 14E and 14W was conducted in 2006. There were one hundred and sixty-three (163) actual or potential sources identified during this shoreline survey, excluding marinas. A total of ninety of the one hundred and sixty-three sources were not actively flowing at the time of the shoreline survey with the remaining seventy-three having flows warranting sampling. All sources in which flow was observed were sampled. A triennial update of the growing area was completed in 2012. Of the seventy-three flowing sources sampled, thirty-four had results greater than 240 MPN. Thirteen of those were located in prohibited waters within the growing area and were not re-sampled as part of the 2012 triennial update.

Referring back to previous shoreline survey seven sources had results greater than 2400 cfu/100ml for bacteria and these sources were re-visited for this annual update. The following table illustrates the sampling results for these seven sources.

Source ID	Description	Actual	Direct	Previous FC/MPN	2012 Results FC/MPN	2013 Results	2014 Results
2006-14E-102	6" dia CI pipe next to # 101 Camp Varnum	A	D	4300	NF	NF	NF
2006-14E-412	Stream	A	D	460	4900	NS	5600 trickle flow
2006-14E-717	5' wide x 3' tall oval concrete pipe	A	D	4600	9300	2300	NF
2006-14W-001	Weekapaug Breachway	A	D	2401	3	NF	<2
2006-14W-1301	Groundwater flow from bluff	A	D	11000	623	NF	22
2006-14W-300	Stream from upland pond north of Green Hill beach club	A	D	4300	NF	NF	8000 1.06 cfs
2006-14W-301	24" dia RCP flared	A	D	4300	NF	0NF	

HIGHLIGHTS

*** Sampled 2X for 2013 season**
*** Statistical evaluation represents some limited data**
*** Area considered remote**
*** MTEC = 3 (90% = 47cfu/100ml)**
**** Data run 2/24/14***

COMMENTARY

In order to comply with NSSP Manual of Operations requirements regarding approved areas, a semi-annual sampling schedule was initiated in 1994 to monitor the offshore waters that are permanently open to shellfish harvesting. These offshore stations (Growing Area 14) are considered "remote". They have been determined to be physically distant enough from land to not be adversely influenced by any land based point and/or non-point sources. According to

NSSP Manual of Operations guidelines, remote areas are required to be sampled only twice a year. Stations 1 – 15 and 22, located along the south shore from the Connecticut border to the Massachusetts border, were sampled 2x for 2013 by DEM staff, complying with Manual of Operations guidelines for remote areas. Stations 16 – 21, located around the perimeter of Block Island, were sampled 2x in 2013 by the Town of New Shoreham Harbor Masters Office. The statistical evaluation for Growing Area 14 represents all data collected for the area, but is presently incomplete and requires more data to comply with statistical requirements.

Station 22, located due west of Napatree Point, was established six years ago at the location of the former Little Narragansett Bay station 13.

Results of the statistical evaluation, albeit incomplete for Block Island offshore, demonstrate that the area is in program compliance. The area is properly classified.

RECOMMENDATIONS

*** No action recommended based on ambient monitoring results**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	*Status*	*N*	*FECAL-GEO MEAN*	*90TH PERC(<47)*
GA14-1	A	30	2.1	2.5
GA14-2	A	30	2.4	4.9
GA14-3	A	30	2.0	2.4
GA14-4	A	30	2.1	2.6
GA14-5	A	30	2.0	2.4
GA14-6	A	30	2.3	4.4
GA14-7	A	29	2.6	6.8
GA14-8	A	30	2.4	4.5
GA14-9	A	30	2.1	3.0
GA14-10	P	30	3.1	10.5
GA14-11	A	30	2.2	3.2
GA14-12	A	30	2.0	2.4
GA14-13	A	30	2.4	5.8
GA14-14	A	30	2.1	3.0
GA14-15	A	30	2.2	3.2
GA14-16	A	29	2.0	2.0
GA14-17	A	29	2.0	2.4
GA14-18	A	29	2.0	2.0
GA14-19	A	29	2.3	4.0
GA14-22	A	14	2.9	5.4
GA14-20	P	29	2.4	4.0
GA14-21	A	29	2.0	2.0

Shellfish Growing Area Classification Codes

Approved

Shellfishing Prohibited

Growing Area Boundary

Seasonal Closure

Un-assessed - Shellfishing Prohibited

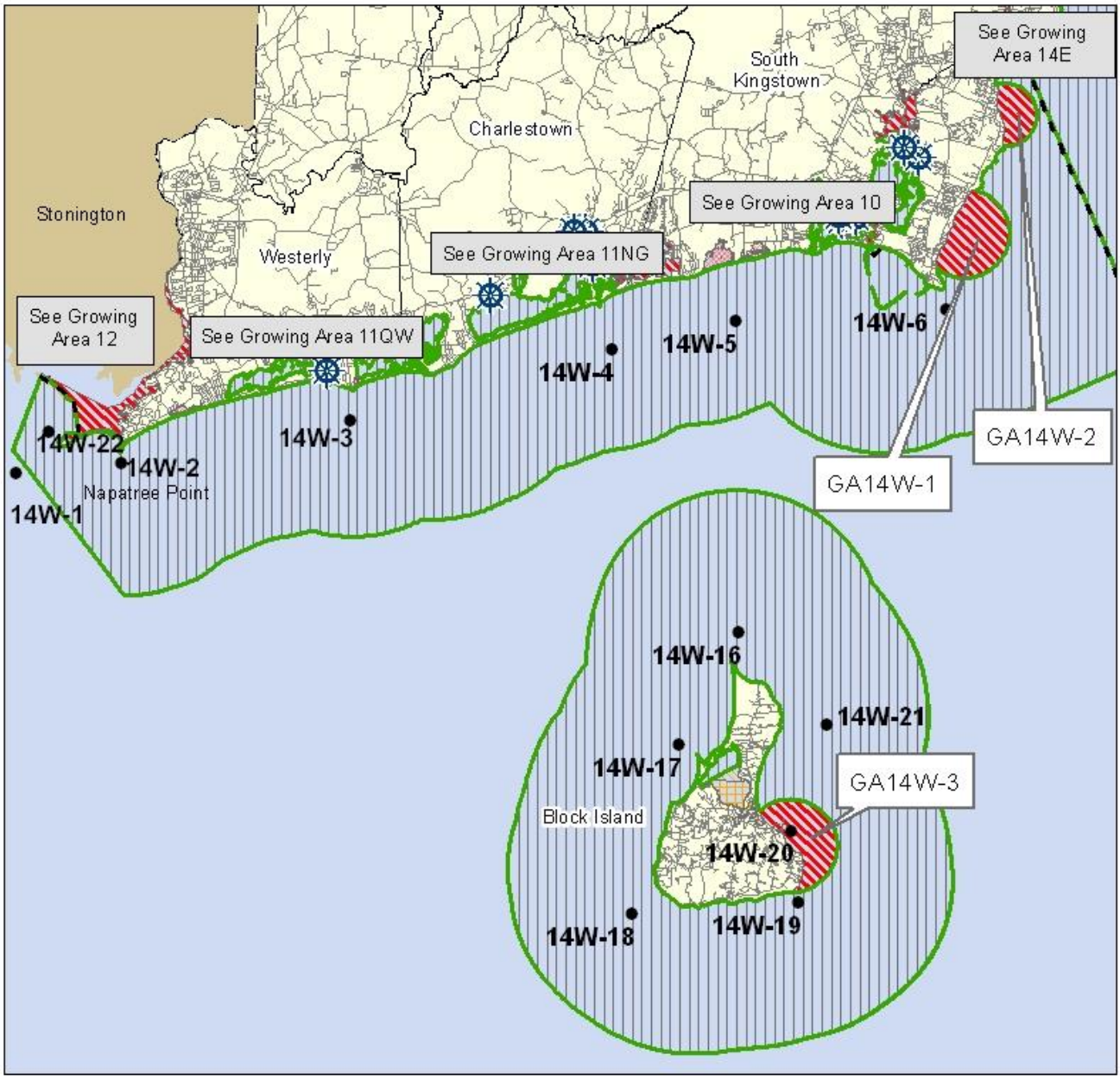
Marina Facility Seasonal Closure

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

0 1.25 2.5 5 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2013" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Offshore Nappatree Point to Point Judith (Narragansett) Including Offshore Block Island Growing Area 14W May 2013 - May 2014



Shellfish Growing Area Classification Codes

Approved

Growing Area Boundary

Marina Facility Seasonal Closure

Shellfishing Prohibited

Un-assessed - Shellfishing Prohibited

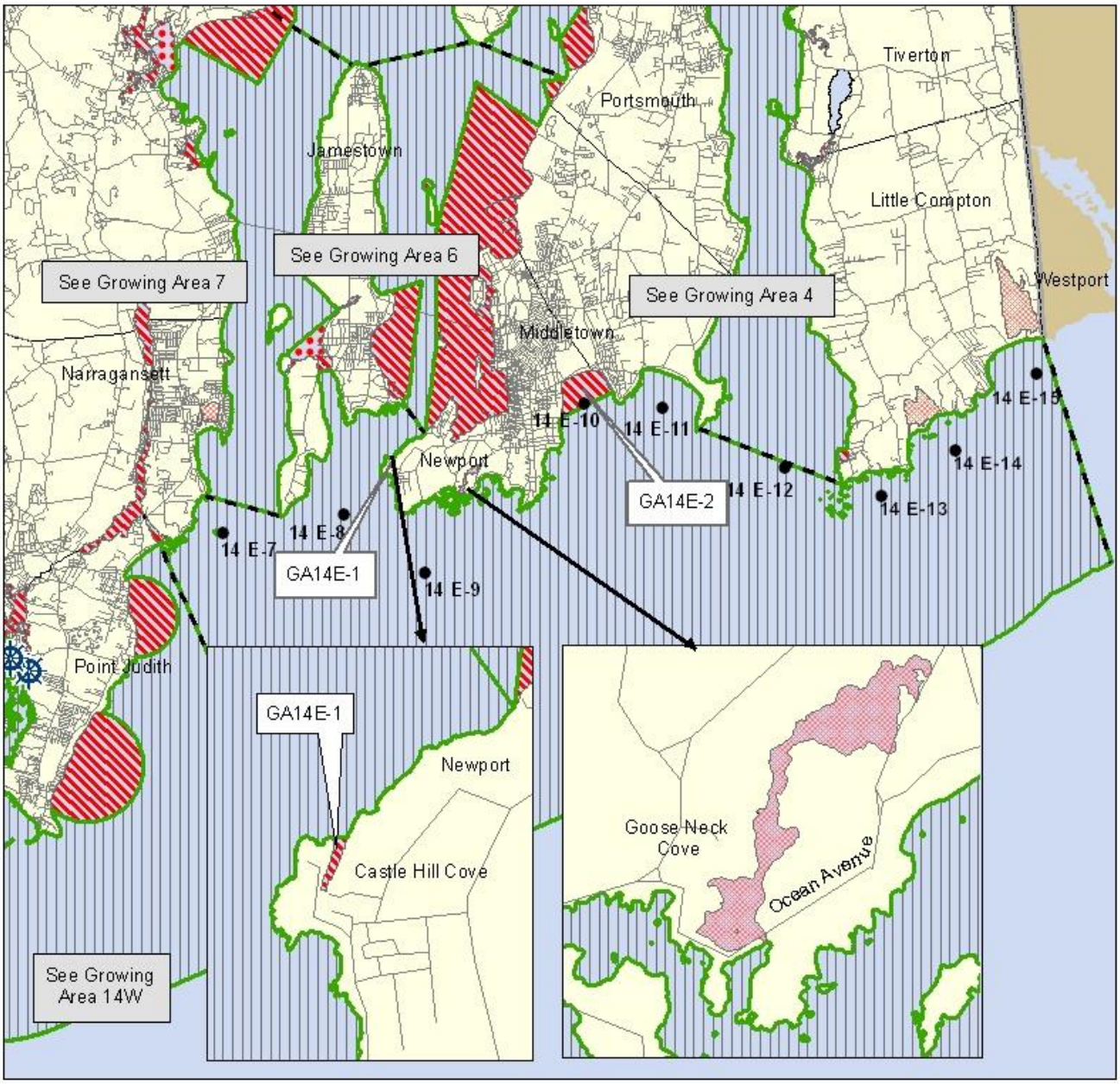
Seasonal Closure

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

0 1 2 4 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2013"
Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here.
This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps.
At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Offshore Point Judith (Narragansett) to Westport Growing Area 14E May 2013 - May 2014



Growing Area 15
Seekonk River
2014 Annual Update

All waters of the Seekonk River, Growing Area 15 are currently prohibited to shellfishing. The area was not sampled in 2014. The area has always been closed to shellfish harvesting because of consistently elevated bacteriological levels, and the area's juxtaposition to a large urban environment. The area is properly classified as prohibited.

HIGHLIGHTS

*** Sampled 0x in 2014**
*** Area is prohibited**

COMMENTARY

The Shellfish Program was not able to sample the Seekonk River (Growing Area 15) in 2014. Since the area is classified as prohibited, there is no minimum sampling requirement. The area has always been closed to shellfish harvesting because of consistently elevated bacteriological levels, and the area's juxtaposition to a large urban environment. The Seekonk River is considered a lower priority growing area, because of its prohibited status presently, to be sampled only as extra time and resources (i.e. staff) allow.

The area is properly classified as prohibited.

RECOMMENDATIONS

*** No action recommended**

Shellfish Growing Area Classification Codes

Shellfishing Prohibited

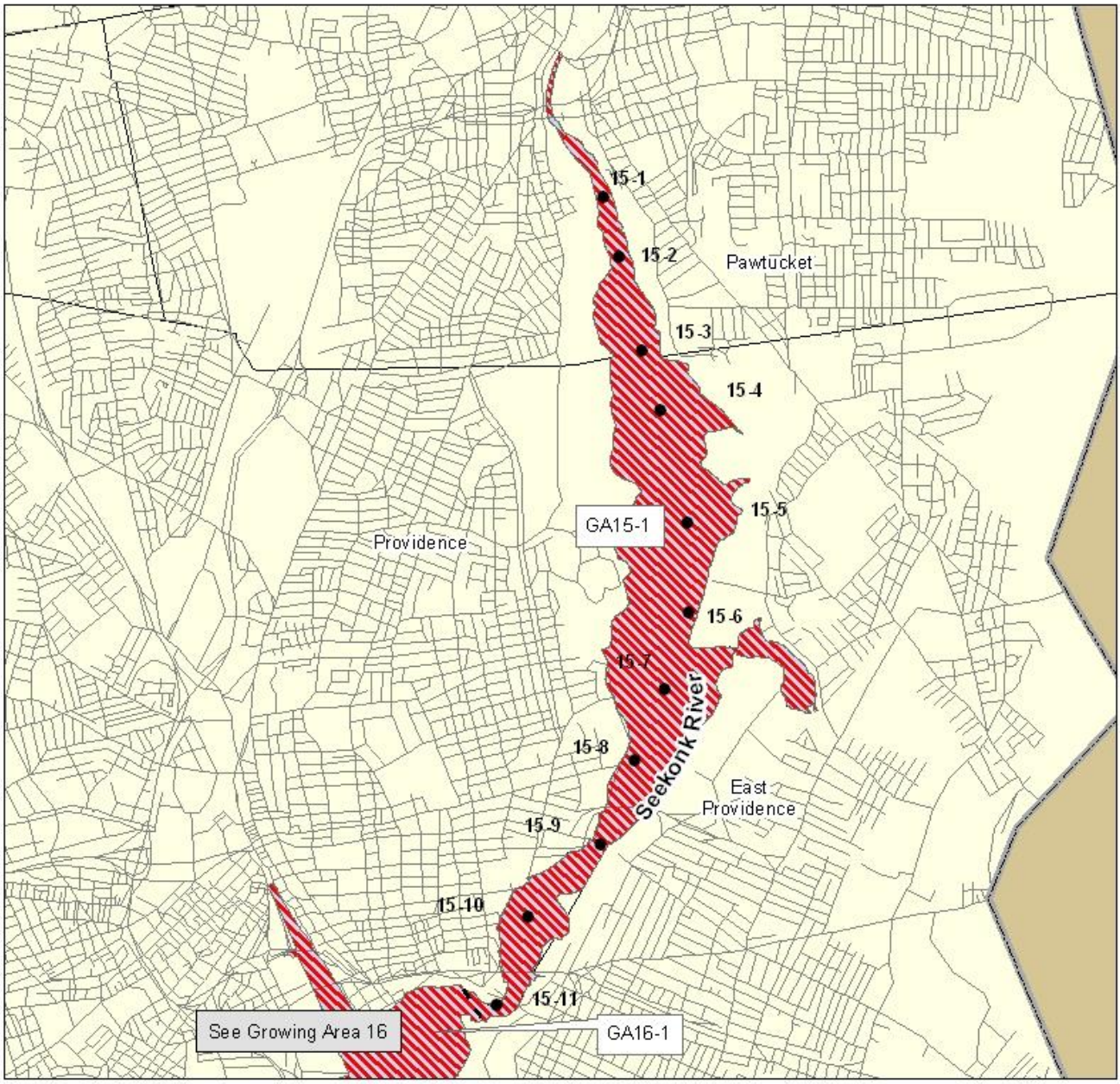
Growing Area Boundary

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

0 0.2 0.4 0.8 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014"
Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here.
This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps.
At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Seekonk River Growing Area 15 May 2014 - May 2015



Growing Area 16
Providence River
2014 Annual Update

All waters of the Providence River, Growing Area 16 are currently prohibited to shellfishing. The area has always been closed to shellfish harvesting because of consistently elevated bacteriological levels, and the area's juxtaposition to a large urban environment. Two major wastewater treatment facilities discharge directly to the Providence River along with flows from upstream tributaries that are impacted by either additional wastewater treatment facilities or combined sewer overflows. Currently the entire area is properly classified as prohibited. The Providence River and its tributaries have a direct impact on the conditionally operated Upper Narragansett Bay Growing Area 1.

In order to assess the area for use as a relay area a shoreline survey of the lower reaches of the Providence River south of Gaspee and Bullocks Points was completed in 2009. Of the total thirty-two sources identified in the 2009 survey none of the sources exceeded the 2400 fc/MPN criteria which would normally determine the need for follow-up sampling. Only five sources were equal to or exceeded the 240 fc/MPN criteria and following further investigation it was determined that they do not have a negative impact on the area for its limited use as a relay area by the department's Division of Fish and Wildlife under the current restrictions and standard operating procedures for relaying and depuration.

Currently in a cooperative effort between RIDEM, the Narragansett Bay Commission, the shellfish industry and the RIDOH, shellfish prior to being harvested from this limited relay area are sampled to establish baseline contamination levels. The shellstock is then harvested and transplanted to the previously established approved spawning/management areas in which they are unavailable for re-harvest for a minimum of six – twelve months. Prior to the opening of these management areas to the harvest of the relayed stock, they are re-sampled to insure the depuration period has been sufficient to decrease previous contamination levels to acceptable standards. The program has successfully replenished depleted areas of the bay and provides a bountiful winter harvest.

Extensive wet weather sampling of the Providence River was completed in 2010 to assist in the analysis of its impacts to the water quality of the Upper Narragansett Bay Growing Area 1. A detailed report entitled "Upper Bay GA1 Closure Criteria Analysis" is available for review in the programs permanent files.

HIGHLIGHTS

*** Station GA16-3 collected along with Upper Bay samples**
*** Sampled 11x in 2014**
*** Stations 2, 4, and 20 added to the run**
*** Sampled 6x in 2014**
*** Statistics represent dry weather only data >8/01/13 (N=15)**
*** Area is prohibited**
*** mTEC = 15 (<31 cfu/100ml)**
**** Data run 3/16/15***

COMMENTARY

The Shellfish Program sampled selected stations in the lower portion of the Providence River (Growing Area 16) various times in 2014. The area has undergone an intensive monitoring effort by both this office and the Narragansett Bay Commission in order to evaluate the Providence River and Upper Narragansett Bay water quality as a

result of the operation of the NBC Wet Weather Tunnel. The results for that monitoring effort are stored separately from the strictly Shellfish database because of the need to segregate the data for various reasons. (See documentation for Providence River post-storm supplemental monitoring and targeted wet weather event monitoring).

It was decided to add Stations 2, 4, and 20 to Station 3 in the Providence River to the Upper Bay monthly monitoring runs to see what sort of bacteriological background we are seeing in the lower portion of the Providence River north of Conimicut Point should the area ever be considered for shellfish management purposes. For the 2014 season the available results demonstrate these stations meet the SA standard under dry weather conditions. The area clearly is impacted by wet weather, surface water run-off, and WWTF effects, and needs to be monitored further.
The area is properly classified as prohibited.

RECOMMENDATIONS

*** Continue monitoring at Station 2, 3, 4, 20**
*** No action recommended**

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

FECAL-GEO

Station Name	Status	N	MEAN	%>CRITICAL 31
GA16-2	P	6	4.9	0.00
GA16-3	P	15	3.2	0.00
GA16-4	P	6	5.4	0.00
GA16-20	P	6	6.0	0.00

Shellfish Growing Area Classification Codes

Growing Area Boundary

Conditional Closure

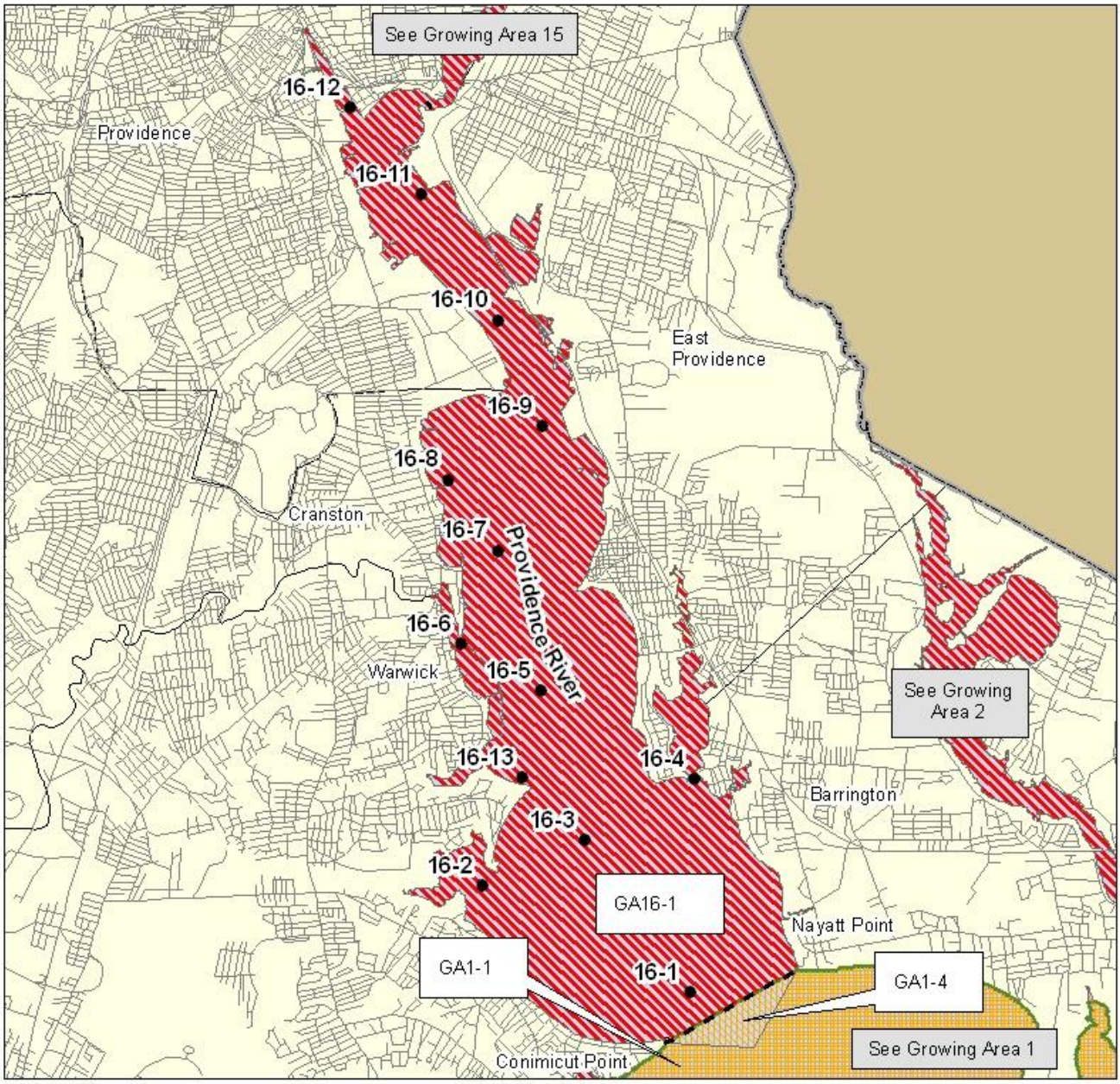
Shellfishing Prohibited

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

0 0.35 0.7 1.4 Miles

This map is provided only as a a general reference for the areas listed as prohibited, seasonal closure or conditional closure in the publication entitled "Notice of Polluted Shellfishing Grounds May 2014" Please refer to that document for the complete legal description of the numbered shellfish closure areas shown here. This map also serves as the legal description for the areas open to shellfishing. Taking of shellfish is prohibited from any waters located on the landward side of the boundary line of waters listed as approved (high tide mark) and the landward side of the boundary line of waters listed as prohibited, conditional closure or seasonal closure, regardless of whether the specific waters are shown or noted as prohibited on the attached maps. At locations where the boundary line crosses water, the boundary shall be a straight line connecting the high tide mark on either side of the water along the main shoreline.

Providence River Growing Area 16 May 2014 - May 2015



Mount Hope Bay
Growing Area 17
12 Year Sanitary Shoreline Survey
Calendar Year 2014

Source: Flickr Doug Kerr

Rhode Island
Department of Environmental Management
Office of Water Resources

Shellfish Program

Table of Contents

1.0 Introduction 1
2.0 Description of the Growing Area 1
2.1 Location 1
2.2 Description of the Area 1
2.2.1 Physical Description 1
2.2.2 Latest Survey 2
2.2.3 Previous Classification Maps 2
2.2.4 Current Classification Map 4
3.0 Pollution Source Survey 5
3.1 Personnel 5
3.2 Survey procedures 5
3.3 Summary of Sources and Locations 6
3.3.1 Locations of Major Sources 6
3.3.2 Pollution Source Table 8
3.4 Identification and Evaluation of Pollution Sources 11
3.4.1 Domestic Wastes 11
3.4.2 Stormwater 11
3.4.3 Marinas 12
3.4.4 Agricultural Waste 13
3.4.5 Wildlife 13
3.4.6 Industrial Wastes 13
4.0 Hydrographic and Meteorological Characteristics 13
4.1 Tides 13
4.2 Rainfall 13
4.1 Winds/Climate 14
4.2 River Discharges 16
5.0 Water Quality Studies 16
5.1 RIDEM Shellfish Program Monitoring 16
5.2 RIDEM TMDL Studies 18
6.0 Interpretation of Data 18
6.1 Effects of Meteorological and Hydrographic Conditions 18
6.1 Recommendations 19

6.1.1 Monitoring Schedule 19
6.1.2 Comments 19
6.1.3 Legal Description 19
7.0 References 19

Table of Figures

Figure 2-1 Mt Hope Bay Area 2
Figure 2-2 2003 Classification Map 3
Figure 2-3 2014 -2015 GA 17 Classification Map 4
Figure 3-1 2014 Source locations 7

List of Tables

Table 3-1 Monthly Breakdown of Closure Days 12
Table 4-1 Rainfall August 2014 Taunton NOAA Station 15
Table 5-1 Routine Data Analysis 18

Acronyms and Terms

CAMP: Conditional Area Management Plan

CRMC: RI Coastal Resource Management Council

EPA: US Environmental Protection Agency

FDA: U.S. Food and Drug Administration

ISSC: Interstate Shellfish Sanitation Conference

MADMF: Massachusetts Department of Marine Fisheries

MPN: Most Probable Number

mTEC:Membrane Filtration method with mTEC agar

NOAA: National Oceanographic and Atmospheric Administration

NSSP: National Shellfish Sanitation Program

OWTS: On-site Waste Water Treatment Systems

RIDEM: Rhode Island Department of Environmental Management

SGAM: Shellfish Growing Area Monitoring

SSCA: State Shellfish Control Authority

1.0 Introduction

A shoreline survey of Mount Hope Bay was conducted during the summer and fall 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 primary objective of the shoreline survey was to identify and characterize any new sources of pollution impacting the growing area, to reevaluate point and non-point sources identified during previous surveys, and to update information regarding the sampling of previously identified sources.

2.0 Description of the Growing Area

2.1 Location

Mt. Hope Bay is found in the northeastern portion of Narragansett Bay. The bay proper extends from the Taunton River and includes the Cole and Lees River in Massachusetts to the Mt. Hope and Sakonnet River Bridges at its southern end. The state line between Rhode Island and Massachusetts bisects the upper portion of the bay with approximately 2985 acres, including the estuarine portion of the Cole and Lees Rivers in Massachusetts with the remaining 5775 acres south of the border in Rhode Island. The Rhode Island towns that border Mt. Hope Bay are Bristol, Warren, Tiverton, and Portsmouth.

As mentioned previously the major rivers that discharge into Mt. Hope Bay consist of the Taunton, Cole, and Lees rivers in Massachusetts and the Kickemuit River in Rhode Island. All four of these rivers originate in Massachusetts with the Kickemuit being the only one that crosses the border and terminates in Rhode Island.

2.2 Description of the Area

2.2.1 Physical Description

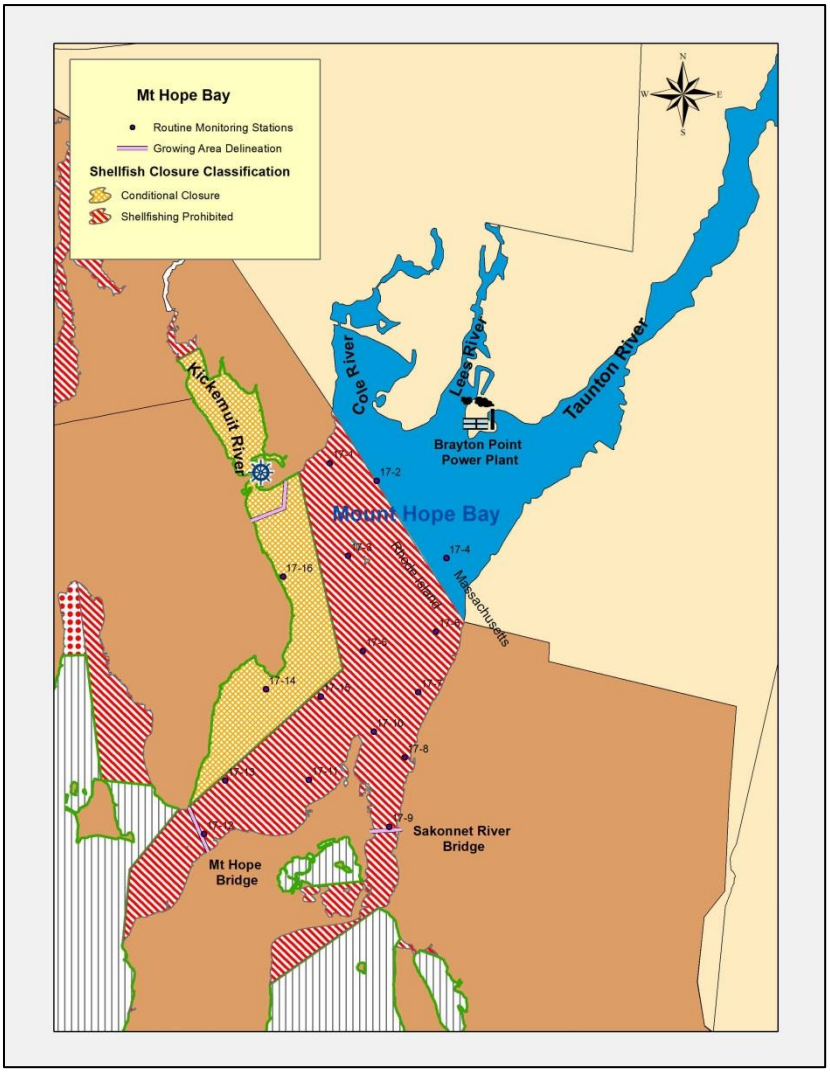
Mount Hope Bay forms the northeast corner of the Narragansett Bay estuary. Although over 70% of Mt. Hope Bay is located in Rhode Island, over 90% of its drainage basin is located in Massachusetts. The drainage area covers more than 395,000 acres. The Bay is 6.95 miles in length along its north-south axis. Mt. Hope Bay empties into the East Passage of Narragansett Bay and the Sakonnet River. Approximately 70% of the Bay has a mean low water depth of 18 feet or less, while the mean tide range is approximately 4.6 feet (Chinman et al. 1985). The average currents are approximately 0.4 and 0.5 knots on the flood and ebb tides, respectively (ASA 1990). Wind direction strongly influences the Bay water's mixing patterns, with the greatest mixing provided by southerly winds (ASA 1990).

The Taunton River is by far the largest source of freshwater to Mt Hope Bay and has the second largest watershed in the state. It also receives discharges from 6 facilities permitted through the NPDES program, four municipal majors, one industrial major and two minor NPDES permits. In addition to these facilities the Fall River WWTP also discharges directly into Mt Hope Bay just north of the state line.

Growing Area 17 is presently comprised of sections classified as either prohibited or conditionally approved for shellfishing (Figure 2-1). This divide in classification runs generally north to south with the conditionally

approved area being along the western shoreline. The prohibited area has been established as a closed safety zone due to the WWTF discharges, while the conditional area is managed as a rainfall triggered closure with 0.5" of rain in less than 24 hours requiring a minimum 7 day closure. This area is managed along with the Kickemuit River, Growing Area 5.

Figure 2-1 Mt Hope Bay Area



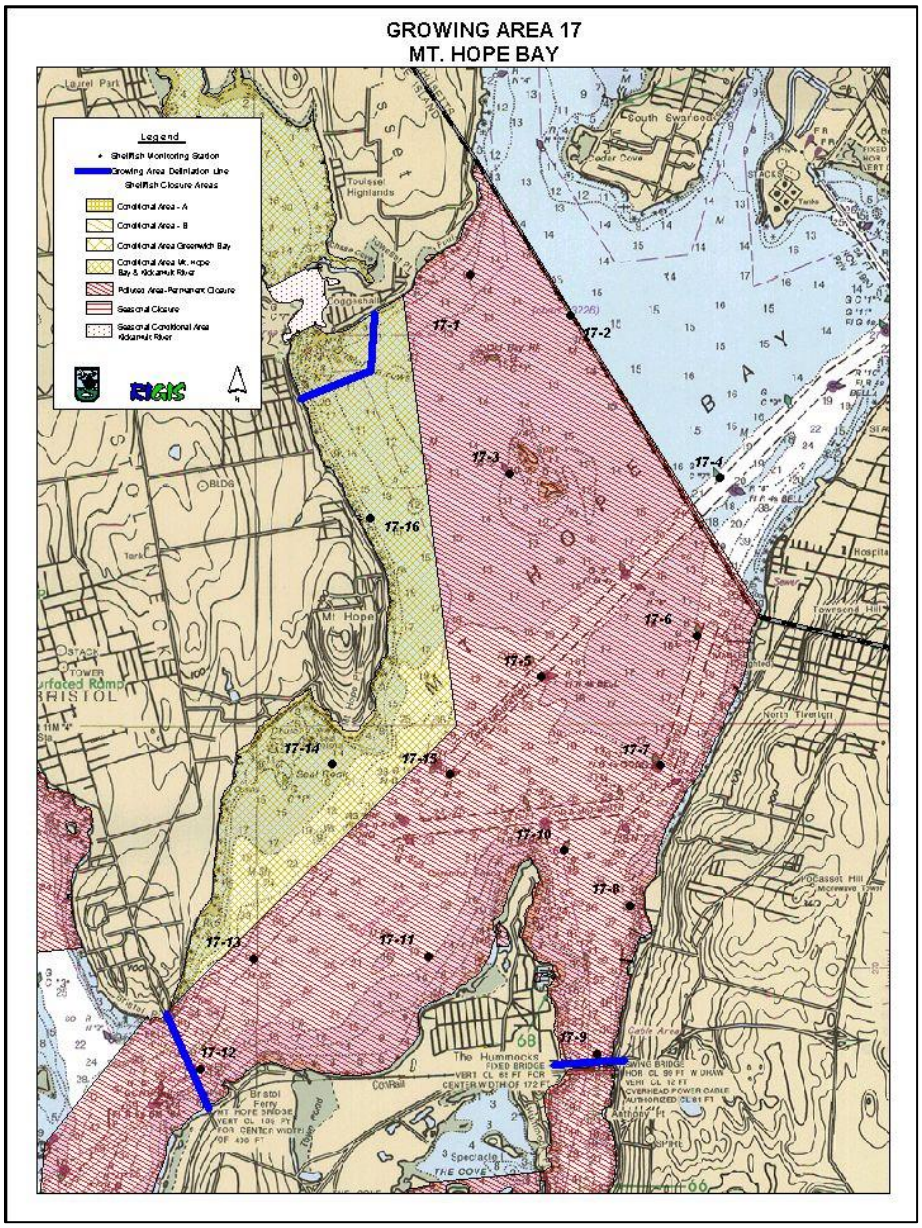
2.2.2 Latest Survey

RIDEM's Office of Water Resources personnel conducted a shoreline survey in 2002 to assess the relative importance of pollution sources impacting the growing area water quality. All areas including prohibited areas were included in the survey.

2.2.3 Previous Classification Maps

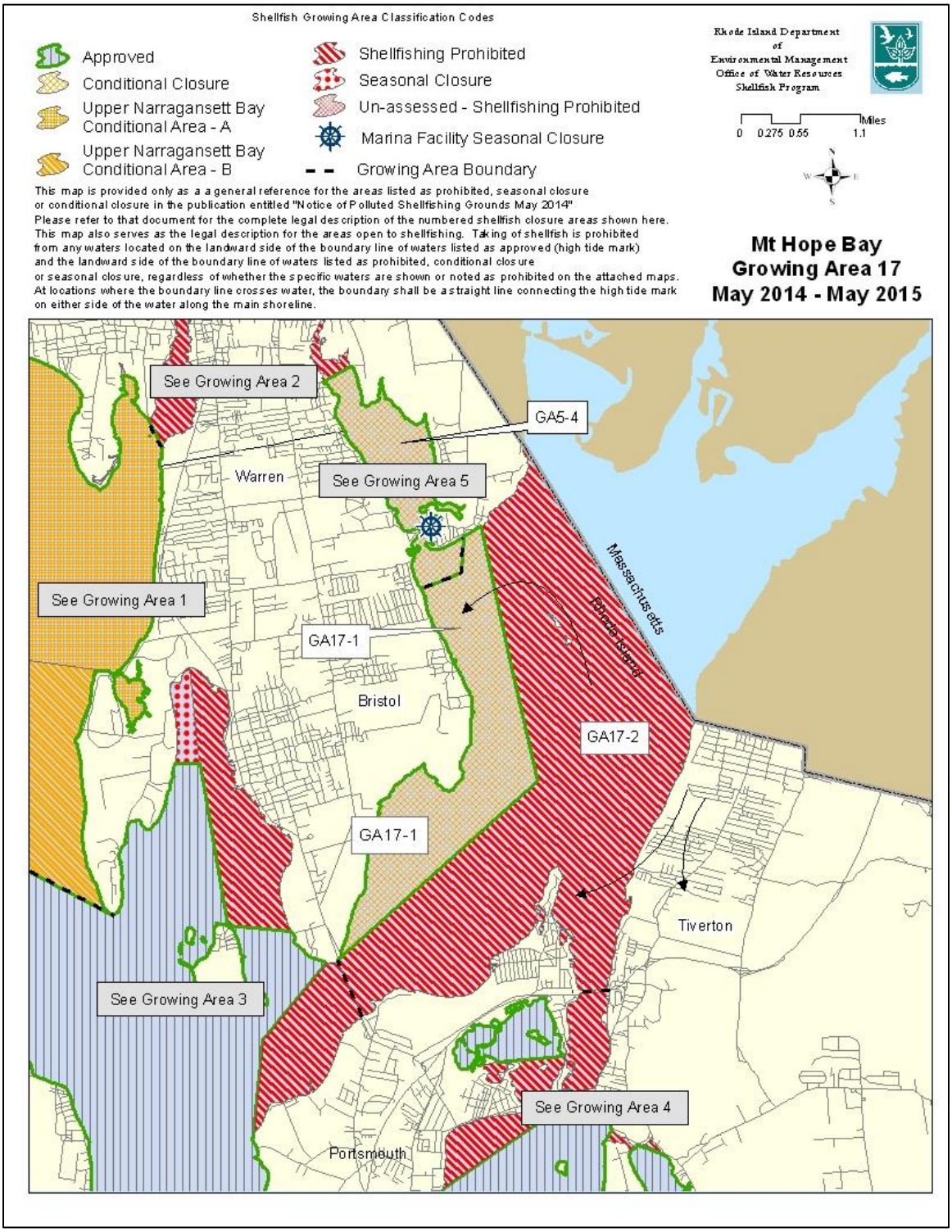
The 2003 -2004 classification map does not vary from the current map and is shown as figure 2-2. The 2014-15 classification map is shown in Figure 2-3.

Figure 2-2 2003 Classification Map



2.2.4 Current Classification Map

Figure 2-3 **2014 -2015 GA 17 Classification Map**



The most recent (May 2014-May 2015 revised annually) RIDEM document entitled Shellfish Closure Areas documents the prohibited shellfish area in Mt Hope Bay. The Conditional Area Management Plan (CAMP) outlines the operating conditions applicable to Mt Hope Bay. The legal description of these closure areas are described below, and shown in the above figure. There are no seasonal or marina closures within the Mt Hope Bay growing area.

Growing Area 17 – Mt. Hope Bay

Shellfishing Prohibited

GA17-2 Mount Hope Bay and vicinity south and west of the Rhode Island-Massachusetts state line to a line from the Rhode Island Department of Environmental Management range marker located on the shoreline of Touisset Point to the Rhode Island Department of Environmental Management range marker on Common Fence point that intersects with a line from Bristol Point to the Buoy R4 channel marker located on the southerly side of the Mount Hope Bay channel, including the waters north and east of a line from Bristol Point to the Hog Island Shoal Light, to the southwestern extremity of Arnold Point in Portsmouth, where a Rhode Island Department of Environmental Management range marker has been established, and north of a line in the Sakonnet River at the centerline of the Sakonnet Bridge in Portsmouth and Tiverton.

Conditionally Approved

GA17-1 All waters of the Kickemuit River and the Mount Hope Bay south of a line from the 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 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 to the Rhode Island Department of Environmental Management range marker located on Common Fence Point in Portsmouth.

(See also 5-4 for that portion of the conditional closure included in the GA5 Kickemuit River Growing Area.)

3.0 Pollution Source Survey

3.1 Personnel

Lucinda Hannus, Senior Environmental Scientist, of the RIDEM Office of Water Resources coordinated and conducted a shoreline reconnaissance of Mt Hope Bay with the assistance of other staff members at RIDEM within the Office of Water Resources.

3.2 Survey procedures

Special attention was given to all types of pipes, drainage ditches, culverts, and streams in order to classify them as a direct (discharges directly to the growing area), indirect (does not discharge directly to the growing area but may contribute to pollution), actual (discharging at the time of the survey), or potential (not actively discharging at the time of the survey but considered a possible source of pollution). Bacteriological samples were collected in sterile, four ounce (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 membrane filter (mTEC) method, as described in Standard Methods of Water and Wastewater, was used for analysis.

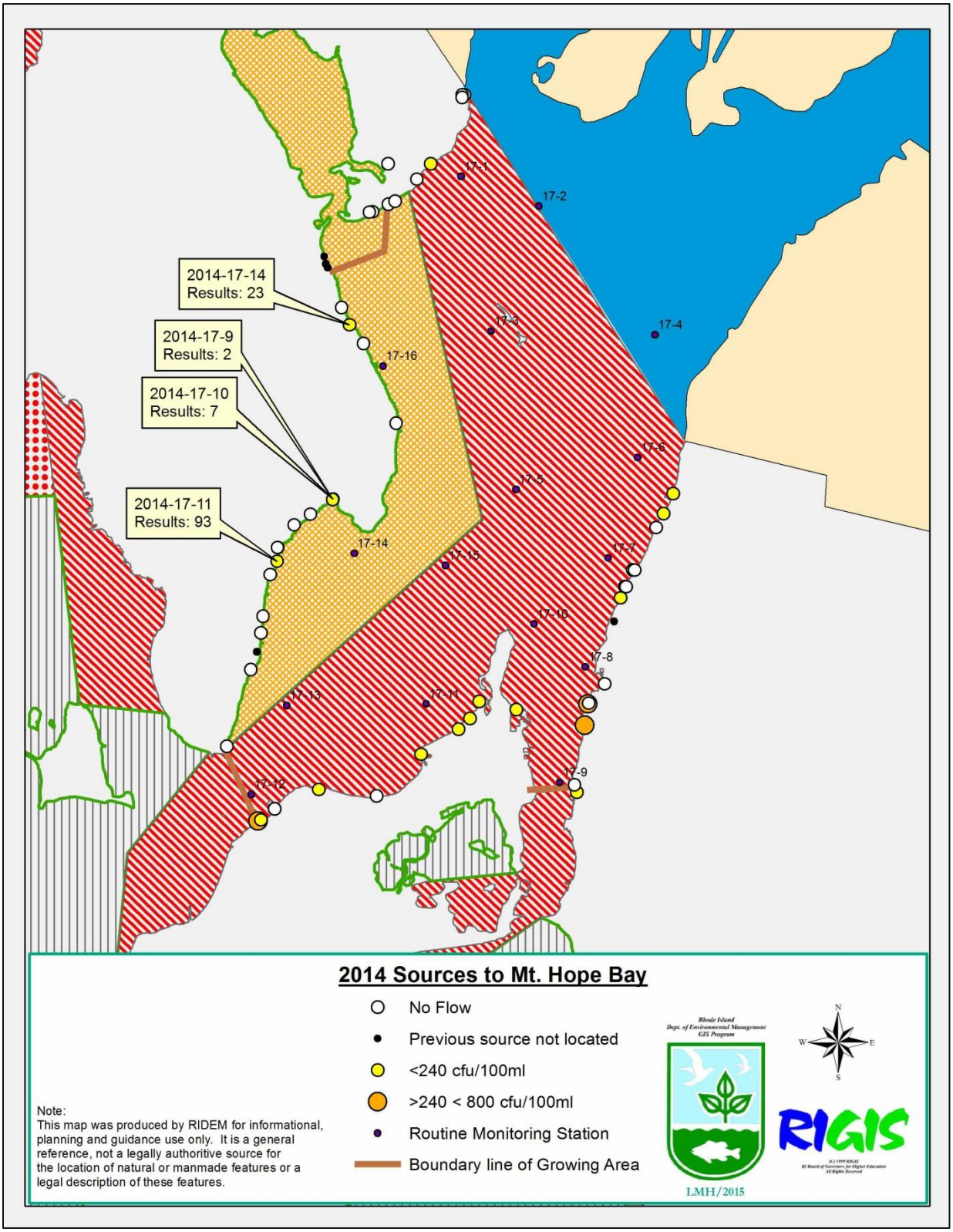
3.3 Summary of Sources and Locations

There were a total of fifty-six (56) actual or potential sources identified during this shoreline survey. A total of thirty-four (34) sources were not actively flowing at the time of the shoreline survey with the remaining twenty-two (22) having flows warranting sampling. All sources in which flow was observed were sampled. Six of the sources identified are located in the Kickemuit growing area just to the north west of Mt Hope Bay as they may have had an impact on the bay due to their location and the dividing line between the two growing areas technically is within Mt Hope Bay proper (ref to figure 2-1). Twenty of the sources that discharge or have the potential to discharge into the conditionally approved areas and the remaining thirty identifies sources are located adjacent to the prohibited waters of Mt Hope Bay. As illustrated in Figure 3-1 all potential or actual sources of pollution that discharge to Mt Hope Bay River are located on the map. Table 3-1 is a listing detailing the source type and sampling results.

3.3.1 Locations of Major Sources

Of the twenty sources that have the potential to impact the conditionally approved area none of the results from sampling exceeding 240 cfu/100ml. The highest result was 93 cfu/100ml with the majority of results in the single digit category. There were three (3) sources where sampling results were greater than 240 cfu/100ml but they are all located in the prohibited area and are not of enough of an impact to affect the conditionally approved area either due to distance of separation or displaying low volumes of flow or relatively low (</= 800 cfu/100ml) bacteria concentrations. There are no major sources of concern located during the 2014 shoreline survey that adversely impact the classification of this growing area.

Figure 3-1 2014 Source locations



3.3.2 Pollution Source Table

2014 Source Id	Description of source	Actual / Potential	Direct/ Indirect	Comments	2014 Fc Results cfu/100ml	LATITUDE	LONGITUDE
2014-17-1	12" iron pipe at end of Ferry Rd.	P	D	Not found	1	41.6435	-71.2594
2014-17-2	stream from wetland approx. 100' from	A	D	Not found	1	41.6515	-71.2560
2014-17-3	twin 6" PVC pipes 50' above shore	P	D	Not found	1	41.6534	-71.2552
2014-17-4	several freshwater seeps over 50' area	P	D	Not found	1	41.6553	-71.2546
2014-17-5	stream coming through rock culvert	A	D	Dry	0	41.6571	-71.2543
2014-17-5A	10" Corrugated PVC pipe	P	D	Dry	0	41.6614	-71.2533
2014-17-6	Stream	A	D	Trickle	98	41.6642	-71.2522
2014-17-7	stream approx. 1000' east of condos	A	D	No flow	0	41.6666	-71.2499
2014-17-8	6" copper-colored pipe	P	D	No flow	0	41.6677	-71.2477
2014-17-9	outlet of open waterbody	A	D	Trickle	6	41.6692	-71.2446
2014-17-10	stream at apex of cove; western branch	A	D	Trickle	12	41.6693	-71.2445
2014-17-11	stream at apex of cove; eastern branch	A	D	Trickle	2	41.6628	-71.2523
2014-17-12	small stream	A	D	Not found	1	41.6772	-71.2357
2014-17-13	12" CMP	P	D	Not found	1	41.6855	-71.2402
2014-17-14	stream south of public boat ramp	A	D	Trickle	73	41.6874	-71.2422
2014-17-15	36" RCP at end of Anawamscut Dr.	A	D	No flow	0	41.6642	-71.2523
2014-17-16	36" RCP at end of Sunrise Av.	A	D	No flow	0	41.6893	-71.2433
	Dual 4" PVC pipes	P	D	Kickemuit GA		41.6934	-71.2452
	10" metal pipe	P	D	Kickemuit GA		41.6938	-71.2454
	24" RCP	P	D	Kickemuit GA		41.6946	-71.2457
	12" corrugated plastic pipe	P	D	Not found		41.7042	-71.2368
	rubber hose from cliff attached to met	P	D	Not found		41.6992	-71.2389

2014 Source Id	Description of source	Actual / Potential	Direct/ Indirect	Comments	2014 Fc Results cfu/100ml	LATITUDE	LONGITUDE
	stream	A	D	Not found		41.6992	-71.2393
	30" RCP	A	D	Not found		41.6600	-71.2039
2014-17-24	stream	A	D	Stream	32	41.6697	-71.1973
2014-17-25	stream	A	D	Groundwater seep	5	41.6677	-71.1986
2014-17-26	stream	A	D	Stream	0	41.6662	-71.1997
2014-17-27	stream	A	D	Stream	77	41.6618	-71.2029
2014-17-28	stream from hill	A	D	Stream	127	41.6601	-71.2040
2014-17-29	stream from hill	A	D	Not found	1	41.6564	-71.2055
2014-17-30	stream from hill; disperses through rocks	A	I	Stream	127	41.6589	-71.2046
2014-17-31	stream, abundant Fe bacteria and VOC smell	A	D	No flow	0	41.6499	-71.2069
	stream from discharging concrete structure	A	D	Not found		41.6479	-71.2091
	36" pipe along rocks	A	D	Not found		41.7026	-71.2328
	cove with outlet stream	A	D	Not found		41.6617	-71.2026
2014-17-35	cove with outlet stream; drains wetland	A	D		17	41.6452	-71.2272
2014-17-36	cove with outlet stream	A	D	Trickle	3	41.6426	-71.2324
2014-17-37	12" iron pipe below high tide line	P	D	bagged	0	41.6383	-71.2386
2014-17-38	Outlet from Boyd's marsh	A	D		3	41.6390	-71.2467
2014-17-39	18" RCP	A	D	No flow	0	41.6370	-71.2528
2014-17-101	Drainage swale along property ROW	A	D	Stream	350	41.6357	-71.2551
2014-17-100	Groundwater or pipe?	A	D		3	41.6358	-71.2547
2014-17-110	GW seep	A	D	Trickle	3	41.6489	-71.2327
2014-17-107	GW seep	A	D	Trickle	2	41.6172	-71.2250
2014-17-108	Stream	A	D		8	41.6172	-71.2300
2014-17-200	10" dia. CMP	P	D	No flow	0	41.7000	-71.2367
2014-17-201	8" PVC	P	D	No flow	0	41.7000	-71.2367

2014 Source Id	Description of source	Actual / Potential	Direct/ Indirect	Comments	2014 Fc Results cfu/100ml	LATITUDE	LONGITUDE
2014-17-202	4" dia. PVC	P	D	No flow	0	41.7003	-71.2358
2014-17-203	Seep in wall	A	D	Trickle	0	41.7114	-71.2261
2014-17-204	8" dia. metal pipe	P	D	No flow	0	41.7114	-71.2264
2014-17-205	Seep in wall	A	D	Trickle	0	41.7111	-71.2264
2014-17-206	Stream	A	D	Trickle	142	41.7042	-71.2308
2014-17-410	drainage swale 229 Riverside Dr	P	D	No flow	0	41.6394	-71.2111
2014-17-411	Drainage swale from wetland	A	D	.005 cfs	430	41.6456	-71.2097
2014-17-412	Outfall north of old bridge	A	D	0.01	3	41.6386	-71.2108
2014-17-413	48" dia. outfall at condo complex	A	D	.1 cfs	800	41.6478	-71.2092

Red highlighted sources located in Prohibited area.

3.4 Identification and Evaluation of Pollution Sources

3.4.1 Domestic Wastes

The Mt Hope Bay watershed has portions that are sewered, areas that have combined storm and sewer overflows and areas that are un-sewered and rely upon on-site waste water treatment systems (OWTS) to handle sanitary and domestic waste. There are no WWTFs located within the Rhode Island side of the bay, with all towns either having sewers that discharge to other waterbodies or properties that rely solely on OWTSs. Fall River is entirely reliant upon public sewers and actually collects sewage from select northern sections of Tiverton. The northern tip of the town of Portsmouth at the southern end of the growing area is also entirely dependent upon OWTSs for treatment of sanitary waste.

Historically the combined sewage overflows within the Fall River collection system were a major source of bacterial pollution to the bay. Fall River has since built and repaired their collection system infrastructure to capture this waste water and provide treatment prior to discharging to the bay. Currently it is uncertain as to what percentage of the total annual CSO volume previously being discharged to the bay is now being collected and treated (RIDEM, TMDL Mt Hope Bay and Kickemuit River, Jan. 2010). The city of Taunton has an aged collection system which is subject to inflow and infiltration and at times is inundated beyond capacity causing overflows into the Taunton River upstream of the bay. It is unknown what the impacts to water quality are in the Bay as this source is approximately 56 miles north of MA/RI border. The town of Somerset also has a treatment facility that discharges to the Taunton River upstream of Mt Hope Bay. This is a relatively small plant (4.2 mgd) compared to Fall River (30.9 mgd) and reports of CSOs or overflows have not historically been an issue. The Massachusetts WWTFs are permitted by EPA Region I through their NPDES permitting process.

In the fall of 2013 FDA with support from RIDEM, Massachusetts Marine Fisheries, EPA, and CRMC a hydrologic dye study was conducted of the area of Mt Hope Bay impacted by effluent from the Fall River Treatment plant. Although the final report is not yet available FDA has advised both RI and Massachusetts that under routine operations the classifications as prohibited adjacent to the treatment plant as currently delineated is sufficient to provide the recommended 1000:1 dilution. In the fall of 2014 a similar study was conducted of the Somerset treatment plant with the preliminary determination that it has no impact to the Rhode Island side of Mt Hope Bay under normal operating conditions. Both plants however would pose a risk under increased flows due to wet weather but since the area is managed on a conditionally approved status with a minimum 7 day closure at the relatively low rain amount of 0.5" this should provide the additional dilution area needed to protect the harvest area. As is standard operating procedure any abnormal operations or flows or failures in disinfection would be addressed as they occur and any necessary emergency closure would be initiated immediately. The existing closed safety zone provides adequate protection for the estimated time of travel as long as notification of the failure is received within a reasonable time.

3.4.2 Stormwater

Stormwater has been documented to be a significant source of bacterial contamination especially in highly developed urban areas such as the watershed to Mount Hope Bay. Approximately half of Rhode Island's side of the Mt. Hope Bay growing area is managed with a conditionally approved classification where rainfall events exceeding 0.5" within a 24 hour time period necessitating a closure of these waters to shellfishing for a minimum period of seven days. In 2014 Mt Hope Bay conditionally approved areas were closed to shellfishing 51.2% of the time for a total of 187 days (see Table 3-1).

Stormwater is attributable to degradation of water quality of the Mt Hope Bay directly from non-point overland runoff and storm drainage systems. There are also an unknown quantity of Combined Sewer Outlets (CSOs) located throughout the drainage area on the Massachusetts shoreline that impact the water quality of the Bay during significant rain events.

Table 3-1 Monthly Breakdown of Closure Days

2014 Month	Days in month	**Kickemuit River/ Mt Hope Bay** Duration	**Kickemuit River/ Mt Hope Bay** % of Year
January	31	25	80.6
February	28	13.5	65.3
March	31	8.5	52.2
April	30	27.5	62.1
May	31	14	58.6
June	30	14	56.6
July	31	14.5	55.2
August	31	0	48.1
September	30	7	45.4
October	31	21.5	47.9
November	30	21.5	50.0
December	31	20	51.2
Yearly Total	365	**187**	51.2

3.4.3 Marinas

There are currently numerous marina and port facilities located along the western shoreline of Mt Hope Bay particularly in the Massachusetts boundaries of Fall River and Taunton. There are also two marinas located in the town of Portsmouth on the Sakonnet River side of the Bay. All of these commercial and recreational port facilities are located in prohibited waters. The western Rhode Island shoreline, along Mt Hope Point which is conditionally approved is rather undeveloped with the most significant dockage area associated with the piers for URI's Coastal Institute's research vessels located at Roger Williams University. To the north of the point and along the Touisset shoreline you have residential neighborhoods with their associated private docks.

Brewer-Sakonnet Marina is the only recreational boat marina having pump-out facilities located in the vicinity of Mount Hope Bay and the Kickemuit River. In addition, the Bristol Pump-out Boat operates as a mobile pump-out facility and serves the Kickemuit River and Bristol Harbor. It does not service boats moored in Mount Hope Bay.

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 Mt Hope Bay growing area.

3.4.4 Agricultural Waste

The Mt Hope Bay watershed is an urban developed watershed comprised of primarily residential, commercial and industrial development. At this time there is no indication that agriculture activities within this watershed are a significant source of bacterial contamination to the Upper Bay.

3.4.5 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 Mt Hope Bay, may contribute pathogens through stormwater runoff or direct deposition. No accurate information as to the magnitude and geographic dispersion of the waste source is available.

Marine birds and mammals are also present in Mt Hope Bay. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of waterfowl it is very difficult to assess their impact on water quality.

3.4.6 Industrial Wastes

The Rhode Island Pollution Discharge Elimination System Program (RIPDES) is responsible for permitting any and all industrial and municipal waste discharges to waterbodies of the state. The RIPDES Program has numerous permitted discharges that may contribute to the degrading of the water quality of Mt Hope Bay. Additionally those activities are also permitted in Massachusetts under EPA's NPDES program. There are no permitted dischargers to the conditionally approved portion of the growing area. All permitted discharges are within prohibited waters.

4.0 Hydrographic and Meteorological Characteristics

4.1 Tides

Tides in Rhode Island are semi-diurnal. This means that the tides have a period or cycle of approximately one-half of a tidal day (12.84 hrs.), characterized by two similar high waters and two similar low waters each tidal day. The tidal current is said to be semi-diurnal when there are two flood and two ebb periods each day. A semi diurnal constituent has two maxima and two minima each constituent day.

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

4.2 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 more than 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 close proximity of impervious surfaces to stream channels. This allows for the rapid and efficient transport of runoff of pollutants including fecal coliform bacteria to river and stream channels that ultimately drain to the growing area.

The shoreline survey dates for the Sakonnet River growing area was over a three day period, Aug 19th through 21st during the summer of 2014. The following rainfall data was observed at the NOAA weather station at Taunton, MA (except as noted*) just north of the growing area. Yellow highlighted days are shoreline survey dates.

4.1 Winds/Climate

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

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

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

Precipitation is evenly distributed throughout the year, with annual averages of 42 to 46 inches with the southeastern bay area's tending to be more like 40 inches. Average yearly snowfall along the shoreline is about 20 inches and the region is known to have years in which snowfall totals can be significantly less than average because of milder winters. Total precipitation however averages around 3 to 3.5 inches per month regardless of season with the lesser amounts in the period between May and July. The Mt Hope Bay watershed in August 2014 received approximately 50 -75% of the normal precipitation according to the Northeast Regional Climate Center.

Table 4-1 Rainfall August 2014 Taunton NOAA Station

Day	Max Temp	Min Temp	Avg. Temp	Precipitation Inches
1	83	58	71	0
2	71	62	67	0.45
3	72	62	67	0.01
4	84	66	75	0
5	88	62	75	0
6	83	57	70	0.16
7	81	51	66	T
8	84	50	67	0
9	84	52	68	0
10	87	52	70	0
11	83	54	69	0
12	82	54	68	0
13	73	65	69	0.38
14	77	50	64	0
15	76	50	63	0
16	78	50	64	0
17	81	53	67	T
18	80	49	65	0
19	81	44	63	0
20	82	49	66	0
21*	80	59	70	0
22	76	59	68	0.11
23	75	49	62	0
24	80	48	64	0
25*	90	59	75	0
26	88	52	70	0
27	87	57	72	0
28	84	54	69	0
29	77	45	61	0
30	77	44	61	0
31	85	63	74	0.14
Max/Min/Avg/Total	**88**	**44**	**67.4**	**1.25**

Based on the NOAA data, the survey dates in August were considered dry weather conditions since it was at least five days following a greater than .5" rain storm.

4.2 River Discharges

As mentioned previously there are two major rivers, the Kickemuit in Rhode Island and the Taunton River in Massachusetts that terminate in the northern end of Mt Hope Bay. The Kickemuit River is a saltwater estuary with a freshwater supply flowing into it over a dam at its northern end approximately 2.5 miles from its confluence with Mount Hope Bay. The Taunton River joins the Massachusetts portion of Mt Hope Bay approximately 2 miles north of the state line. Two lesser rivers the Cole and the Lees River also join Mt Hope Bay on the Massachusetts side.

In 2006 RIDEM TMDL staff conducted targeted wet weather surveys along with MADMF. The sanitary quality of the bay under these conditions appears to be primarily dominated by sources within the Fall River area (combined sewer overflows and stormwater runoff), as well as upstream sources in the Taunton River. Smaller sources exist within Rhode Island and have a notable, although localized impact on water quality during wet weather events, particularly in the Kickemuit River. The final data report (RIDEM, 2008) is available on –line at: http://www.RIDEM.ri.gov/programs/benviron/water/quality/rest/pdfs/mthopeby.pdf and provides a complete synthesis of the study objectives, methods, and analytical and field standard operating procedures. The data presented in the Mt Hope Bay TMDL indicate that all but station 17-1 (Prohibited classification) meet the fecal coliform bacteria standard during dry weather.

The following text has been excerpted from the TMDL regarding Taunton River flows:

"The United States Geological Survey (USGS) maintains a single stream flow site along the Taunton River at Bridgewater, MA. This station (01108000) is located approximately 35 miles (56 km) upstream of the RI-MA border in Mount Hope Bay. Since the Taunton River is by far the largest contributor of freshwater to Mount Hope Bay it follows that the sanitary quality in the bay is due, in part, to inputs from the Taunton River. For the critical condition analysis, mean daily flow, as recorded at USGS station 01108000 was regressed against available data for stations nearest its influence (GA17-4 and GA17-2).

This analysis showed no relationship between discharge and bacteria concentrations in the upper portions of the bay. Additional analysis of this variable included regressing only bacteria data collected under low and ebb tide conditions against river flow. While this resulted in an observable trend in bacteria concentration with respect to discharge, the correlation coefficient (r2 -value) was poor (0.1). The results of this particular analysis should not be used to conclude that bacteria loadings from the Taunton River have minimal effect on the sanitary quality of Mount Hope Bay. The data limitations make it difficult to determine if a critical condition can be defined as being singularly caused by changes in flow in the Taunton River.

5.0 Water Quality Studies

5.1 RIDEM Shellfish Program Monitoring

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

As part of this agreement, the state of Rhode Island is required to conduct continuous bacteriological monitoring of shellfish harvesting waters for direct human consumption in order to maintain certification.

Water samples are collected at sixteen (16) monitoring stations throughout the growing area (Figure 2-1). Two of these stations are in the conditionally approved area while the remaining fourteen (14) are in the prohibited of the growing area.

Samples are collected 1-2 feet below the water surface (using 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. Beginning in June of 2012 the membrane filtration technique, also known as mTEC is used to analyze the samples. The results are sent to the RIDEM Shellfish Program at which time they are reviewed and incorporated into a database. A summary report is written and recommendations regarding the classification of the growing area are made on a yearly basis. The 2014 report is incorporated into this report in the following section. Routine monitoring data is also part of this report and is shown in Table 5-1. As a conditionally approved area, the most recent fifteen data points are used in the analysis of the geo-mean and the variability component of <10% of the results must be less than 31 cfu/100ml.

HIGHLIGHTS

*** Sampled 12x in 2014**
*** Statistics represent dry weather, approved data >10/01/13 (N = 15)**
*** All conditionally approved stations are in compliance and conformance**
*** mTEC=15 (<31 cfu/100ml)**
**** Data run 2/10/15***

COMMENTARY

Mt. Hope Bay (Growing Area 17) was sampled nine times for 2014. All samples were collected during dry weather conditions when the area was "open/approved" for shellfish harvesting. The statistical evaluation for Mt. Hope Bay incorporates the most recent 15 dry weather samples collected for the area, the minimum number required by NSSP Manual of Operations guidelines for conditionally approved areas.

Results of the statistical evaluation demonstrate that all conditionally approved stations may or may not be in compliance with NSSP guidelines.

RECOMMENDATIONS

***All conditionally approved stations in compliance in spite of above**

Table 5-1 Routine Data Analysis

RIDEM SHELLFISH GROWING AREA MONITORING RESULTS

Station Name	Status	N	FECAL-GEO MEAN	%>CRITICAL 31
GA17-1	P	15	2.6	0.00
GA17-2	P	15	3.0	0.00
GA17-3	P	15	4.9	6.67
GA17-4	P	15	2.6	0.00
GA17-5	P	15	2.6	0.00
GA17-6	P	15	2.1	0.00
GA17-7	P	15	2.3	0.00
GA17-8	P	15	2.0	0.00
GA17-9	P	15	2.1	0.00
GA17-10	P	15	2.1	0.00
GA17-11	P	15	2.0	0.00
GA17-12	P	15	2.0	0.00
GA17-13	P	15	2.8	0.00
GA17-14	CA	15	2.6	0.00
GA17-15	P	15	2.8	0.00
GA17-16	CA	15	2.6	0.00

5.2 RIDEM TMDL Studies

As mentioned in previous paragraphs a TMDL of Mt Hope Bay and the estuarine portion of the Kickemuit River was completed in January 2010. The entire document may be found on-line at this address:

http://www.dem.ri.gov/programs/benviron/water/quality/rest/pdfs/mthope.pdf

6.0 Interpretation of Data

6.1 Effects of Meteorological and Hydrographic Conditions

A more extensive investigation would be required to link meteorological and hydrographic conditions to bacterial loading. Based on the statistical results from routine monitoring under all weather and hydrographic

conditions there does not appear to be a direct link between an increase in bacteria loadings and meteorological events within this growing area in areas other than those currently closed to shellfishing.

6.1 Recommendations

6.1.1 Monitoring Schedule

The current monitoring schedule is adequate for maintaining correct classification.

6.1.2 Comments

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

6.1.3 Legal Description

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

Conditionally approved shellfish closure area is described below:

GA17-1 All waters of the Kickemuit River and the Mount 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 to the Rhode Island Department of Environmental Management range marker located on Common Fence Point in Portsmouth.

Prohibited shellfish closure area is described below:

GA17-2 Mount Hope Bay and vicinity south and west of the Rhode Island-Massachusetts state line to a line from the Rhode Island Department of Environmental Management range marker located on the shoreline of Touisset Point to the Rhode Island Department of Environmental Management range marker on Common Fence point that intersects with a line from the east side of the Mt Hope Bridge abutment at Bristol Point to the Buoy R4 channel marker located on the southerly side of the Mount Hope Bay channel, including the waters north and east of a line from the landward end of the rock jetty at Bristol Point to the Hog Island Shoal Light, to the southwestern extremity of Arnold Point in Portsmouth, where a Rhode Island Department of Environmental Management range marker has been established, and north of a line in the Sakonnet River at the centerline of the Sakonnet Bridge in Portsmouth and Tiverton.

7.0 References

Chinman, R.A., and S.W. Nixon. 1985. Depth-area-volume relationships in Narragansett Bay. NOAA/Sea Grant Marine Technical Report 87. Graduate School of Oceanography, University of Rhode Island. 64 pp.

Applied Science Associates (ASA), Inc., 1990. Draft Report, City of Fall River, Combined Sewer Overflow Facilities Plan: Receiving Water Impacts Field Measurement Program (Unpublished).

6.1 Recommendations

6.1.1 Monitoring Schedule

The current monitoring schedule is adequate for maintaining correct classification.

6.1.2 Comments

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

6.1.3 Legal Description

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

Conditionally approved shellfish closure area is described below:

GA17-1 All waters of the Kickemuit River and the Mount 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 to the Rhode Island Department of Environmental Management range marker located on Common Fence Point in Portsmouth.

Prohibited shellfish closure area is described below:

GA17-2 Mount Hope Bay and vicinity south and west of the Rhode Island-Massachusetts state line to a line from the Rhode Island Department of Environmental Management range marker located on the shoreline of Touisset Point to the Rhode Island Department of Environmental Management range marker on Common Fence point that intersects with a line from the east side of the Mt Hope Bridge abutment at Bristol Point to the Buoy R4 channel marker located on the southerly side of the Mount Hope Bay channel, including the waters north and east of a line from the landward end of the rock jetty at Bristol Point to the Hog Island Shoal Light, to the southwestern extremity of Arnold Point in Portsmouth, where a Rhode Island Department of Environmental Management range marker has been established, and north of a line in the Sakonnet River at the centerline of the Sakonnet Bridge in Portsmouth and Tiverton.

7.0 References

Chinman, R.A., and S.W. Nixon. 1985. Depth-area-volume relationships in Narragansett Bay. NOAA/Sea Grant Marine Technical Report 87. Graduate School of Oceanography, University of Rhode Island. 64 pp.

Applied Science Associates (ASA), Inc., 1990. Draft Report, City of Fall River, Combined Sewer Overflow Facilities Plan: Receiving Water Impacts Field Measurement Program (Unpublished).