

SALEM SOUND COASTWATCH



Leading the Way to a Healthier Sea and Shore.

Salem Sound Clean Beaches and Streams Program Report for June through August 2023

The following report is a summary of results from water quality testing that took place from June through August in Salem Sound Coastwatch's Clean Beaches and Streams Program at coastal outfall pipes and streams. Salem Sound Coastwatch (SSCW) conducts water sampling following a Department of Environmental Protection approved Quality Assurance Project Plan (QAPP). All SSCW volunteer water samplers took the required training as spelled out in this QAPP. Sampling and chain of custody protocols were followed, and a completeness range of 90 to 100 percent of the samples for collection was met.



#213 – Patch Beach, Beverly

US EPA National Water Quality Inventory reports runoff from urbanized areas is the leading source of water quality impairments to surveyed estuaries, harming fish and marine plants and animals, killing native vegetation, and making recreational areas unsafe and unpleasant.

(EPA 841-F-03-003)

Approach and Methods

While municipalities test bathing waters at public beaches, Salem Sound Coastwatch focuses on stormwater outfall pipes and coastal streams, many of which are located at bathing beaches and near boating areas. SSCW's samples are collected at sites of stormwater discharge at low tide, which means that bacterial counts tend to be higher than beach samples taken at high tide in three feet of water where the ocean has diluted the discharge. Testing outfall pipes and streams shows whether bacterial contaminants are making their way into our area waters from the land.

EPA determined that *Enterococcus* is the best indicator organism in marine waters to show a correlation with adverse human health effects. Therefore, all states were mandated to use this standard by April of 2004. Since 2004, all Salem Sound communities and SSCW have used *Enterococcus* as the indicator organism for marine water testing.

The EPA water quality standard for Class A, B, and C is met if the *Enterococcus* level of a single sample is less than 104 CFU/100mL or if the geometric mean of the most recent five (5) *Enterococcus*

levels within the same bathing season does not exceed 35 colonies per 100mL (Massachusetts state sanitary code 105 CMR 445.000). The geometric mean is a statistical averaging method used to even out the average when dealing with a wide range of numbers.

Definition of Dry vs. Wet Conditions

Rain can cause temporary elevated bacterial counts at discharge sites and within nearshore coastal waters. Runoff from impervious surfaces (parking lots, roofs, streets) flushes contaminants through storm drains, bringing pollution onto the beaches and other coastal habitats. Therefore, testing under dry conditions gives a better picture of on-going contamination problems.

SSCW defines “dry” conditions vs. “wet” differently than the municipalities. The municipalities define wet conditions, or a “storm” event, as any occurrence of precipitation during the sampling or within the 24 hours preceding the sampling. **Under SSCW’s definition, dry conditions are less than 0.2" precipitation the day of sampling or less than 0.5" within the three days preceding sampling. Wet conditions are defined as more than 0.2" precipitation 24 hours before sampling or more than 0.5" within three days preceding sampling.** Protocols for wet weather sampling are the same as for dry weather sampling. Graphs 2 through 3 on pages 12-13 show the precipitation for the sampling period. Note, a graph may indicate rain when sampling was listed as “Dry”; this means the rain fell after the sample was taken.

Salem Sound Coastwatch Test Results

Table 12 on pages 11 and 12 shows results for all the samples taken between June 7 and August 17, 2023. Samples were taken every 2 weeks within two hours of low tide and driven to Gloucester where Biomarine tested all water samples. (16 East Main Street, Gloucester MA 01930).

Values that are higher than the EPA standard (EPA-823-R-03-008) are indicated in **bold: *Enterococcus* >104 CFU/100mL**. In addition, geometric means are included for all sites (n = 6) and a geometric mean for only dry sampling (n = 5).

There was one Wet event on July 5. On this date, every site had bacterial counts above the EPA standard: *Enterococcus* >104 CFU/100mL. The Wet weather results ranged from 119 to 12,098 CFU/100mL. Dry weather sampling ranged from <10 to 24,196 CFU/100mL. However, it must be noted that the summer was very rainy.



Results Summary

Wet weather sampling events are removed to determine the bacterial hotspots that are defined by Salem Sound Coastwatch as sites having *Enterococcus* counts greater than 1000 CFU/100mL.

HOTSPOTS:

According to SSCW testing results, every town tested had a site considered to be a hot spot in 2023.

Table 1: Hotspots are defined as the Geometric Mean for ONLY DRY weather sampling (n=5) for Enterococcus > 1000 CFU/100mL.

2023 Hot Spots			
Town	Location	Site ID	Geometric Mean (DRY)
Marblehead	Red Steps Beach	735	1,086
Salem	Shetland Park (previously New Salem)	629-SP	2,271
Beverly	West End of Brackenbury Beach (outfall pipe)	213	4,066
Davers	Waters River at Sylvan St	404	1,541
Manchester	Wolf Trap Estuary at bridge	161-E	1,134
Manchester	Wolf Trap Estuary upper marsh	161-WUM	1,025

2023 Monitoring Results	SITE	DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Location	Site ID	6/7	6/21	7/5	7/19	8/3	8/17	Geometric Mean
Marblehead								
Red Steps (MH)	735	4,352	4,352	631	602	316	420	1086
Salem								
Shetland Park (New Salem)	629-SP	24,196	933	5,475	1,576	1,530	1,187	2271
Beverly								
West End Brackenbury Beach (outfall pipe)	222	~	~	3,076	983	14,834	4,611	4066
Danvers								
Waters River at Sylvan St	404	~	~	~	6,893	1,783	298	1541
Manchester								
Wolf Trap Estuary at bridge	161-E	1,223	238	4,611	6,867	2,613	359	1134
Wolf Trap Estuary from upper marsh	161-WUM	~	~	~	1,918	2,310	243	1025

Manchester

As the Wolf Trap Brook flows through the salt marsh #161 E and exits onto Black Beach at Kettle Cove #161, hotspots based on the geometric means greater than 1000 CFU/mL of dry weather sampling continue to show the brook to be a problem area. #161 E is collected in the salt marsh with sampling done from a walking bridge that crosses the brook. Two sites in the marsh upstream of the bridge, 161-EUM and 161-WUM, were added to try to pinpoint the source of contamination. Additional testing is recommended to determine if septic systems are the source.

Sampling and actions taken to reduce bacteria have been ongoing since 2006. For a complete history, see the Manchester-by-the-Sea Clean Beaches and Streams 2023 Report. Failing septic systems in the watershed were considered a possible source of bacterial contamination as well as the presence of wildlife and pet feces being washed into the brooks during rain events. The nonpoint sources in and around the marsh make it difficult to clearly identify the nature of the pathogens. SSCW and the Manchester Coastal Stream Team worked with EPA Region 1 in 2018 to conduct advanced molecular source tracking using PhyloChip Technology and pharmaceutical testing. COVID interrupted sampling for several years.

Table 2: Geometric Mean of Bacterial Counts for Manchester Sampling Sites from 2006 – 2023 (Dry Days Only)

Year / Site #	160D	161	161E
2006	99	2,606	~
2007	165	311	332
2008	252	1,590	920
2009	34	413	303
2010	730	1,411	1,718
2011	200	2,786	1,277
2012	37	837	1,862
2013	33	1,826	2,002
2014	205	478	1,368
2015	131	1,346	2,276
2016	288	2,230	11,822
2017	35	1,058	1,214
2018	28	1,022	2,221
2019	Waiting for test results		
2020	~	~	721
2021	Covid interrupted testing		
2022	for these sites		
2023	~	880	1,134
Geo Mean	105	1,111	1,342



Table 3: 2023 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams

2023 Monitoring Results		DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Salem Sound Coastwatch Sampling Locations	Site #	7-June	21-June	5-July	19-July	3-Aug	17-Aug	Geometric Mean
Manchester								
Black Beach off 127	161	368	246	1,010	5,794	1,081	933	880
Wolf Trap Estuary from bridge	161-E	1,223	238	4,611	6,867	2,613	359	1,134
Wolf Trap Estuary from marsh	161-M	1,935	399	12,098	1,160	823	459	805
Wolf Trap Estuary - West upper marsh	161-WUM	~	~	~	1,918	2,310	243	1,025
Wolf Trap Estuary - East upper marsh	161-EUM	~	~	~	1,572	404	332	595

SSCW and the Manchester Coastal Stream Team met with the Public Health Director for the Manchester Board of Health to review findings, history, and concern about septic system leakage in the area. Following the Covid interruptions, the Board of Health is resuming septic tank testing in areas of concern as identified in the DPW’s comprehensive wastewater treatment plan.

Danvers

Danvers had one hot spot in 2023: Waters River at Sylvan St and Endicott Rd (Site #404). Frost Fish Brook at Poplar St (#400) has been a hot spot in the past and is still relatively high, though below a dry geometric mean of 1000.

Table 4: **2023 Danvers Water Quality Monitoring Results from Outfall Pipes and Streams**

2023 Danvers	Site #	6-7-23	6-21-23	WET 7-5-23	7-19-23	8-3-23	8-17-23	Dry Geo Mean
Frost Fish Brook at Poplar St	400	399	631	882	2,400	913	657	816
Waters River at Sylvan St	404	~	~	~	6,893	1,783	298	1,541
Crane River at Ash St	405	583	373	538	~	~	~	466

Reviewing the sampling results over the past few years indicate that both sites have had elevated levels of bacteria.

Table 5: **2019-2023 Danvers Water Quality Monitoring Results – Annual Geometric Means**

Danvers	Site #	2019	2020	2021	2022	2023	Dry Geo Mean
Frost Fish Brook at Poplar St	400	857	1350	298	1,649	816	858
Waters River at Sylvan St	404	-	924	948	-	1,541	1,105

SSCW met with the Danvers Board of Health (BOH) to review these results and to discuss potential sources of pollution at these sites. The source of pollution at Waters River at Sylvan St (#404) may be due to a nearby pet shop with training and pet care. SSCW will deliver pamphlets to the Board of Health for distribution to the pet shop for client education. They will also suggest the installation of animal waste bags and receptacles. Another factor may be the stagnant, lower water levels behind the pet shop.

Danvers BOH found high levels of bacteria in the swimming water at Sandy Beach, resulting in its closure numerous times this past summer. It is suspected that geese are a source at Frost Fish Brook at Poplar St and Sandy Beach. Geese prefer a clear area for take off so the introduction of taller grasses, shrubs and/or benches may deter them. The BOH will remind the Harbormaster and the Danversport Yacht Club of the pump out requirement for all boaters. Signage to educate boaters may be necessary. Testing along the creek feeding Frost Fish Brook in the Donegal Ln and Colgate St area was suggested to see if this area is contributing to pollution downstream at Frost Fish Brook and at Sandy Beach.

Beverly

Beverly had one hotspot in 2023: Brackenbury Beach (#213), The dry geometric mean for Brackenbury Beach was about two times higher than any other site tested this year (4,066 CFU/100mL). Several of Beverly’s beaches were closed this summer due to high bacterial counts in the swimming water.

Table 6: **2023 Beverly Water Quality Monitoring Results from Outfall Pipes and Streams**

2023 Monitoring Results	SITE	DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Salem Sound Coastwatch Sampling Locations		6-7-23	6-21-23	7-5-23	7-19-23	8-3-23	8-17-23	Geometric Mean
Beverly								
East End Brackenbury Beach (Stream)	213	496	350	383	3,282	504	368	638
West End Brackenbury Beach (outfall pipe)	222	Pipe Blocked with Sand		3,076	983	14,834	4,611	4,066
Rice's Beach	214	449	NS	631	585	583	414	502
Dane St Beach and Lawrence Brook	321	1,234	231	119	723	545	364	528
Dane St Beach Outfall Pipe to East	323	~	~	~	399	NS	134	231
Water St Boat Ramp	321-S	~	~	~	~	~	~	~

When high levels of bacteria were detected at the Patch / Brackenbury Beach (#213) outfall in 2003, SSCW worked with EPA Region 1 to undertake a Sanitary Beach Survey in 2004 and 2005. No direct source was detected, but a relationship with high bacterial counts and full and new moons was seen. The thought was that the marsh was not well flushed so bacteria remained in the marsh heating up until the higher tides could cleanse the area. In addition, SSCW worked with an upstream abutter to reduce the feeding of ducks that wintered over in a pond created by a small dam. The dam was removed and feeding stopped. The counts in 2016 were the lowest of any year since 2003; Massachusetts experienced a record drought in 2016, which may have been a factor in the lower bacterial levels. The 2017 results were slightly higher than 2016 but within normal variability and a continued improvement from years ago when the ducks were being fed. The outfall pipe #222 generally does not flow and is blocked by sand. However, this summer with the increased precipitation, it was flowing in July and August. If bacterial counts continue to be high, the wetland area from which the outfall pipe drains should be investigated.

Lawrence Brook (#321) flows out on to Dane Street Beach in the northeast corner and receives stormwater from its watershed. It is important to monitor because it is adjacent to a heavily used public beach. Rain events increase the level of bacteria carried by the brook onto the beach. It was brought to our attention at the end of July 2017 by the City of Beverly Public Service Department that several catch basins around Kelleher’s Pond had become receptacles for dog waste bags. The catch basins in the Essex St/Pond View lane/Colon St area drain to Beverly’s outfall #510 (SSCW #321) that exits onto the Dane St Beach via the Lawrence Street Brook. The City cleaned the catch basins and SSCW stenciled the area’s catch basins. These actions resulted in August bacterial levels that met the Class A, B and C standards as specified by the EPA (EPA-823-R-03-008): Enterococci > 104 CFU/100mL. This shows the importance of catch basin maintenance and continued public education. This was a hotspot in 2020 and 2022 so SSCW will continue to work with Beverly to reduce sources in the Lawrence Brook watershed.

Table 7: Geometric Mean for West End Brackenbury Beach (#222) and Lawrence Brook (#321), Beverly: Results 2007 – 2023 for Dry Sampling Days Only

Salem Sound Coastwatch Testing Sites	SITE	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Geo Mean
Beverly																			
West End Brackenbury Beach (outfall pipe)	222	340	~	~	~	~	~	~	~	~	~	~	137	512	164	621	761	4,066	497
Dane St Beach and Lawrence Brook	321	701	501	242	426	432	376	494	419	282	64	124	249	154	2,294	575	1,671	528	392

Salem

The improvement the City of Salem made under an EPA Administrative Order (2011) continues to pay off. This is the first year that Salem has not had several outfalls on the Hotspot List. Salem continues to discover illicit connections which are repaired and redirected to the sanitary sewer system. Although it will always be a given that work remains to improve the sewer and stormwater infrastructure, the City of Salem’s thorough evaluations have resulted in cleaner water entering Salem Harbor and the North River.

Table 8: 2023 Salem Water Quality Monitoring Results from Outfall Pipes and Streams

2023 Monitoring Results	SITE	DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Location	Site ID	6-7-23	6-21-23	7-5-23	7-19-23	8-3-23	8-17-23	Geometric Mean
Salem								
Collins Cove	525	190	233	6,488	9,606	759	567	712
North River Franklin & Foster St (outfall pipe)	532	109	41	2,977	1,439	12,033	5,475	842
North River at Furlong Park (underground)	532-W	145	291	~	63	820	216	216
Juniper Beach	620	171	278	474	450	538	1,895	465
Steps Beach	621	~	~	520	298	110	103	150
Shetland Park (New Salem)	629-SP	24,196	933	5,475	1,576	1,530	1,187	2,302

Shetland Park (#629-SP – Formerly known as New Salem) became a hot spot in 2022 and intensified in 2023. This summer the City of Salem conducted work in this area and fixed a leaking sanitary sewer, which lowered the bacterial counts, but levels are still high due to its urban environment and the number of dogs in the area.

Levels at the outfall located at Furlong Park (#532) drastically increased towards the second half of the summer so this will be an area for further investigation.

Steps Beach (#621) was added in July after the beach was closed to swimming due to high bacterial counts. The results indicate that contamination was probably not due to that outfall pipe.



#620 – Juniper Beach, Salem

In 2006, after record-high numbers in 2005 – see Table 8, the Juniper Beach outfall (#620) pipe was cleaned, and a TideFlex “duckbill” tide gate was installed. Bacterial results dropped for several years, but by 2010, bacterial levels had risen to a geometric mean of 7,267 CFU/100mL. The City continued inspections and remediation including the replacement of 100’ of sanitary main line and service laterals. In 2015, an additional 338-foot section of sewer pipe was lined to prevent exfiltration to the drain system and in 2016 approximately 330 feet of sanitary sewer pipe were relined near the Juniper Beach outfall to address indirect discharge. In the Spring of 2023, all the sewer pipes were lined throughout the Willows neighborhood. Sewer manhole covers are scheduled for sealing to prevent contamination next year.

The 2023 geometric mean was 465 CFU/100mL, which removed it from the hotspot list for the eighth year in a row.

Table 9: Juniper Beach Outfall #620 Water Quality Monitoring Results 2004 – 2023

Years	June	June	July	July	Aug	Aug	Geomean (Dry Days)
2004	600	900	17,000	200	9,400	600	1,476
2005	198,630	81,640	8,390	30,760	4,814	14,210	25,672
2006	16,740	173	156	316	3,266	124	622
2007	3,600	20	680	40	290	7,000	358
2008	NS	30	920	70	2,100	120	152
2009	520	1,200	370	680	160	10	94
2010	3,450	24,200	24,000	1,100	24,200	2,760	6,852
2011	24,200	410	2,250	6,490	1,900	3,090	3,076
2012	554	97	520	4,350	110	144	213
2013	24,000	504	173	754	880	295	959
2014	8,660	24,000	842	11,200	24,200	1,990	10,002
2015	9,210	6,130	11,200	13,000	2,480	539	3,966
2016	933	404	471	41	146	450	189
2017	20	10	8,660	602	563	676	93
2018	10	17,300	NS	183	1,630	337	85
2019	368	148	556	272	717	327	353
2020	10	31	30	15,531	3,076	15,531	73
2021	98	341	763	2,064	246	305	398
2022	414	12,997	12,033	298	7,701	97	551
2023	171	278	474	450	538	1,895	465

 Wet Days

Marblehead

Table 10: 2023 Marblehead Water Quality Monitoring Results from Outfall Pipes and Streams

2023 Monitoring Results	SITE	DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Location	Site ID	6-7-23	6-21-23	7-5-23	7-19-23	8-3-23	8-17-23	Geometric Mean
Marblehead								
Grace Oliver	700	187	309	3,255	959	859	416	456
Riverhead Beach	701	~	428	1,160	865	987	857	748
Village St Pier	721	393	52	171	298	165	134	168
Stramski Beach	722	285	135	845	2,613	748	364	487
Red Steps (MH)	735	4,352	4,352	631	602	316	420	1,086

History of Sampling

Table 11: 2007 - 2023 Marblehead Water Quality Monitoring Results Annual Geometric Means

Marblehead	SITE	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Geo Mean
Grace Oliver	700	635	1,212	241	308	542	122	409	720	~	~	~	~	~	~	~	~	456	430
Riverhead Beach (Facing right)	701	~	~	~	~	~	~	~	~	259	122	156	565	194	920	433	1,042	748	381
Village St Pier	721	~	200	~	592	714	259	226	337	1,199	7,340	497	2,377	311	311	2,507	551	168	592
Stramski beach	722	446	2,112	~	667	1,070	458	548	672	1,139	210	640	662	470	989	454	108	487	571
Red Steps	735	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	215	1,086	685

Due to recent beach closures, bacterial sampling was resumed at Grace Oliver # 700 after 8 years. A Sanitary Beach Survey was conducted by EPA New England in 2007 and results indicated that the bacteria are not human related. The high ammonia and bacteria indicate that the source is Steer swamp. In 2023, counts were higher during the wet sampling.

Red Steps #735 sampling began 2022. The outfall drains an urban watershed and the bacterial counts have varied so SSCW will continue to monitor and discuss with Marblehead’s Water & Sewer Department.

In 2015 and 2016, SSCW returned to the Riverhead Beach culvert (#701) which drains much of the downtown area and the neighborhood around the Goldthwait salt marsh after the Marblehead Water and Sewer Commission completed a large stormwater project in the downtown area, 2013 – 2014. Table 11 shows a decrease in bacterial levels during dry weather sampling except for 2022 when it was a hotspot. Due to the large urban watershed and the age of the pipe system, this culvert will continue to be monitored. Additionally, cleaning storm drains is very important.

The stream flowing onto Stramski Beach (#722) has been a trouble spot for many years. From 2003 to 2011, the beach was closed due to contamination fifteen times; with 53% (8 times) of the closures associated with rain events. In 2007, working with SSCW, the Marblehead Water and Sewer Department inspected the stormwater infrastructure in this watershed. Storm drains were cleaned and sampled. It was concluded at that time that the presence of raccoons and the low flow, which creates stagnant conditions, may be contributing factors to this persistent watershed problem. Despite the wet summer, Stramski Beach was not closed in 2023.

Village Road culvert (#721) was added to the Marblehead outfalls being monitored in 2014. Over the years, a bacterial spike (> 24,000 CFU/100 mL - not wet weather) has been noticed in August. When Marblehead Water & Sewer investigated the high exceedances, they found raccoons living in the upstream catch basin. Once they were removed and the basin cleaned, counts dropped. Dog waste bags in the catch basins has been another neighborhood problem. SSCW continues to work with Marblehead to provide public education and monitoring.

For Additional Information about SSCW's Clean Beaches & Streams Program, including information on how one can become a volunteer in this important, environmental monitoring program, please call Salem Sound Coastwatch at 978-741-7900 or email barbara.warren@salemsound.org.

Table 12: Salem Sound Coastwatch Water Quality Monitoring Results June through August 2023 from Outfall Pipes and Streams (All Towns)

Full Moon – June 3, July 3, August 1, August 30

New Moon – June 18, July 17, August 16

Note: ~ designates site not sampled.

Wet Days

2023 Monitoring Results	SITE	DRY	DRY	WET	DRY	DRY	DRY	ALL Days	Dry Days
Location	Site ID	6-7-23	6-21-23	7-5-23	7-19-23	8-3-23	8-17-23	Geometric Mean	Geometric Mean
Marblehead									
Grace Oliver	700	187	309	3,255	959	859	416	633	456
Riverhead Beach	701	~	428	1,160	865	987	857	817	748
Village St Pier	721	393	52	171	298	165	134	169	168
Stramski Beach	722	285	135	845	2,613	748	364	534	487
Red Steps (MH)	735	4,352	4,352	631	602	316	420	992	1,086
Salem									
Collins Cove	525	190	233	6,488	9,606	759	567	1,029	712
North River Franklin & Foster St (outfall pipe)	532	109	41	2,977	1,439	12,033	5,475	1,039	842
North River at Furlong Park (underground)	532-W	145	291	~	63	820	216	216	216
Juniper Beach	620	171	278	474	450	538	1,895	467	465
Steps Beach	621	~	~	520	298	110	103	205	150
Shetland Park (New Salem)	629-SP	24,196	933	5,475	1,576	1,530	1,187	2,630	2,271
Beverly									
East End Brackenbury Beach (Stream)	213	496	350	383	3,282	504	368	586	638
West End Brackenbury Beach (outfall pipe)	222	~	~	3,076	983	14,834	4,611	3792	4066
Rice's Beach	214	449	~	631	585	583	414	525	502
Dane St Beach and Lawrence Brook	321	1,234	231	119	723	545	364	412	528
Dane St Beach Outfall Pipe to East	323	~	~	~	399	~	134	231	231
Water St Boat Ramp	321-S	~	~	~	~	~	~	~	~

Danvers									
Frost Fish Brook at Poplar St	400	399	631	882	2,400	913	657	827	816
Waters River at Sylvan St	404	~	~	~	6,893	1,783	298	1,541	1,541
Crane River at Ash St	405	583	373	538	~	~	~	489	466
Magnolia									
Gray Beach 63 Shore Dr 12" pipe	001	<10	<10	~	~	~	~	~	~
Gray Beach 63 Shore Dr 4" pipe	002	<10	<10	~	~	~	~	~	~
Manchester									
Black Beach off 127	161	368	246	1,010	5,794	1,081	933	901	880
Wolf Trap Estuary at bridge	161-E	1,223	238	4,611	6,867	2,613	359	1,433	1,134
Wolf Trap Estuary from marsh	161-M	1,935	399	12,098	1,160	823	459	1,265	805
Wolf Trap Estuary from West upper marsh	161-WUM	~	~	~	1,918	2,310	243	1,025	1,025
Wolf Trap Estuary from East upper marsh	161-EUM	~	~	~	1,572	404	332	595	595

Times with ** were taken outside the two-hour window of sampling at low tide

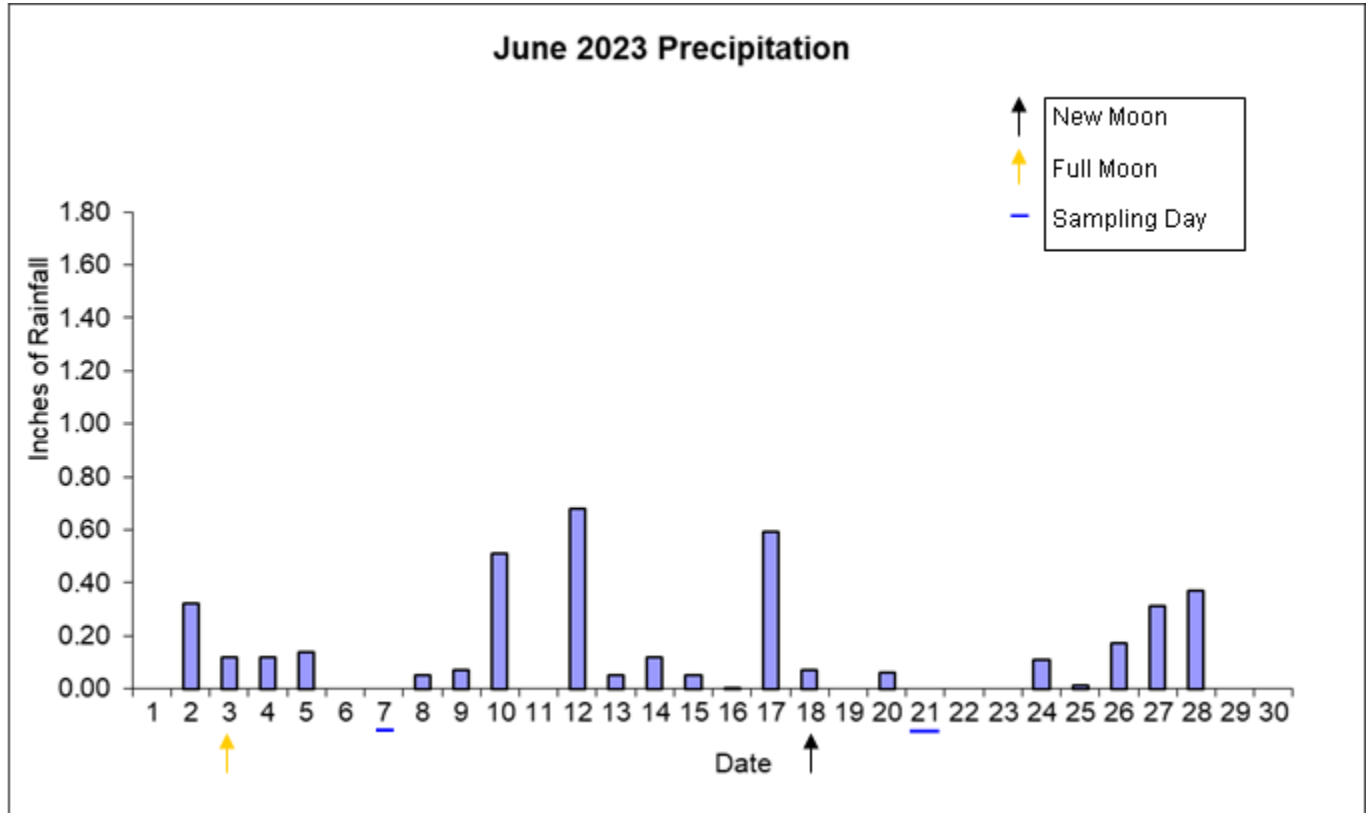
Numbers in bold exceed Class A, B, and C Standards as specified by EPA (823-R-03-008): Enterococci >104 100 CFL/mL

Weather Ratings:

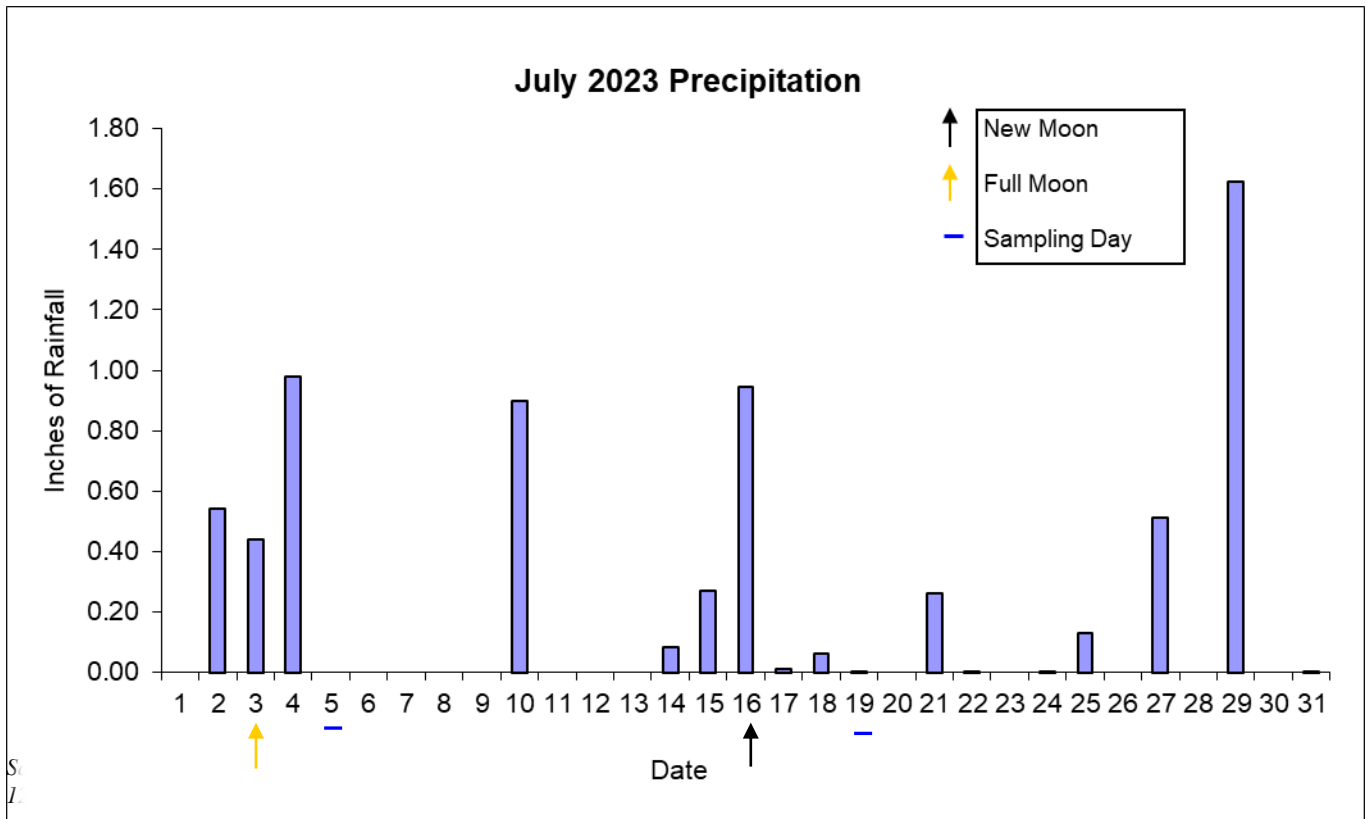
Dry less than 0.2" the day of sampling or less than 0.5" within 3 days preceding sampling

Wet greater than 0.2" the day of sampling or less than 0.5" within 3 days preceding sampling

Graph 1: Precipitation recorded in Salem for June 2023



Graph 2: Precipitation recorded at the Beverly Airport for July 2023



Graph 3: Precipitation recorded at the Beverly Airport for August 2023

