Salem Sound Clean Beaches and Streams Program Report for Manchester-by-the-Sea 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) that was last revised in 2020. 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 has concluded 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 1 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"; the rain fell after the sample was taken.

Salem Sound Coastwatch Test Results

Test results for Manchester's sampling are included in Table 7 for June 7 through 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).

Those values that are higher than 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 = 3).

There was one Wet event on July 5, 2023. 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

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:

Table 1: **Hotspots are defined as the Geometric Mean for ONLY DRY weather sampling (n=5) for Enterococcus > 1000 CFU/100mL. Wet dates were not included and are shaded blue.**

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

Table 1: **2023 Hotspot Results from Outfall Pipes and Streams across Salem Sound**

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	**2271**
Beverly	West End of Brackenbury Beach (outfall pipe)	213	**2,271**
Davers	Waters River at Sylvan St	404	**4,066**
Manchester	Wolf Trap Estuary at bridge	161-E	**1,134**
Manchester	Wolf Trap Estuary at west 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 West upper marsh	161-WUM	~	~	~	**1,918**	**2,310**	**243**	**1025**

Map 1: **2023 Monitoring Sites in Mancheser-by-the-Sea and Magnolia**

Manchester

As the Wolf Trap Brook flows through the salt marsh #161 E and exits onto Black Beach at Kettle Cove #161, hotspots, having dry sampling geometric means greater than 1000 CFU/mL, continue to be a problem area. #161 E is a collection location in the salt marsh from a walking bridge that crosses the brook. Two sites, 161-

EUM and 161-WUM were added to try to pinpoint the source of contamination upstream of the bridge. Additional testing is recommended to determine where septic systems may be a problem.

History of Sampling

Sampling of the Wolf Trap Brook estuary outflow onto Black Beach (#161) began in 2006 and the number of sites monitored was expanded in 2007 to the Wolf Trap watershed because of the high bacterial counts at #161.

Table 2: **2006 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

Salem Sound Coastwatch--2006 Water Monitoring Results	SITE	DRY	DRY	DRY	DRY	DRY	DRY	*Geomean*
Manchester		**6/14**	**6/28**	**7/11**	**7/26**	**8/8**	**8/23**	
Coolidge Point - Black Beach	151	87	**118**	**839**	**307**	**5,040**	49	***268***
Black Beach - Wolf Trap estuary	161	**806**	**1,045**	**5,654**	**1,462**	**30,760**	**1,462**	***2606***
Wolf Trap upstream	160	21	30	96	**104**	**1302**	**117**	*99*

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. Because the Wolf Trap estuary has 68 septic systems in its immediate watershed and Title V only requires testing of septic systems on sale of property, in spring of 2009, Town Meeting passed the following action:

ARTICLE 19. To see if the Town will request the Board of Health to develop a plan of regular Title V testing of the Town's septic systems that are five years of age or older, with priority given to those systems in areas of environmental vulnerability. And that said Board shall present its plan and an estimation of the cost to the next year's Town meeting.

Two brooks flow into the salt marsh, a small stream on the westerly side (#161W) and the Wolf Trap Brook (#161E) on the easterly side; both were sampled through 2010. When it became apparent that the higher bacterial counts were predominantly on the east side of the marsh (#161E), focus shifted to concentrate on better understanding the sources of bacteria in the eastern section. Since 2011, sampling has continued at 3 locations: upstream of the marsh in Wolf Trap brook (#160D), from the tidal stream at the foot bridge in the marsh (#161E) and where the tidal stream flows onto Black Beach (#161). Starting in 2012, the water sampled at the footbridge in the middle of the marsh (#161E) had higher geometric means than upstream before the marsh (#160D) or downstream at the ocean (#161).

As of 2018, the required septic systems in the area had been tested and replaced if they failed the Title V testing. However, the 2016 bacterial counts did not decrease as much as was expected. Both the Wolf Trap estuary outflow onto Black Beach (#161) and the tidal stream at the foot bridge in the marsh (#161E) remained hotspots in 2016, 2017 and 2018. (Table 3).

Table 3: **2016 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

2016 Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	DRY
Salem Sound Coastwatch Sampling Locations		9-Jun	23-Jun	7-Jul	21-Jul	4-Aug	18-Aug	***Geometeric Mean***
Manchester								
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	**402**	**2,490**	**1,050**	**1,260**	**1,080**	**17,300**	***1,707***
Wolf Trap Estuary - East side form Wooden Bridge in marsh	161 E	**1,790**	**3,080**	**10,500**	**6,920**	**11,200**	**24,000**	***6,897***
Wolf Trap Brook - Downstream of rt. 127	160 D	74	**41**	**288**	NS	NS	NS	***96***

Note: #160D was visited each sampling day, but because there was no flow, it was not sampled (NS).

Table 4: **2017 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

2017 Monitoring Results	SITE	DRY	DRY	**WET**	**WET**	DRY	DRY	DRY
Salem Sound Coastwatch Sampling Locations		**13-Jun**	**27-Jun**	**11-Jul**	**25-Jul**	**8-Aug**	**22-Aug**	***Geometeric Mean***
Manchester								
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	**1,320**	**315**	**1,150**	**2,990**	**1,630**	**1,850**	***1,058***
Wolf Trap Estuary - East side from Wooden Bridge in marsh	161 E	**682**	**1,500**	**1,620**	**4,880**	**1,140**	**1,860**	***1,214***
Wolf Trap Brook - Downstream of RT. 127	160 D	52	5	**570**	**368**	**108**	52	*35*

Table 5: **2018 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

2018 Monitoring Results		DRY	**WET**	**WET**	DRY	**WET**	DRY	Dry Days
Salem Sound Coastwatch Sampling Locations	**Site #**	**14-Jun**	**28-Jun**	**17-Jul**	**31-Jul**	**14-Aug**	**28-Aug**	**Geometric Mean**
Manchester								
Wolf Trap Estuary - Downstream of Ocean St. Black Beach	161	**3,080**	**8,160**	**373**	**299**	**719**	**1,160**	***1,022***
Wolf Trap Estuary - East side, Wooden Bridge in marsh	161 E	**19,900**	**3,260**	**1,110**	**408**	**1,900**	**1,350**	***2,221***
Wolf Trap Brook - Downstream of RT. 127	160 D	10	**816**	**134**	30	**284**	74	*28*

The nonpoint sources in and around the marsh make it difficult to clearly identify the nature of the pathogens. However, in 2018 additional testing was done to identify the bacterial sources more accurately. Salem Sound Coastwatch and the Manchester Coastal Stream Team worked with EPA Region 1 to conduct advanced molecular source tracking using PhyloChip Technology. COVID interrupted sampling for several years. This year testing resumed in Manchester and additional sites were added to the east and west above the bridge (161E) to try to pinpoint the source of pollution. (161-WUM and 161-EUM)

Table 6: **2020 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

2020 Monitoring Results		DRY	DRY	WET	DRY	WET	DRY	WET	Dry Days
Salem Sound Coastwatch Sampling Locations	**Site #**	**8-June**	**22-June**	**30-June**	**09-July**	**23-July**	**6-Aug**	**25-Aug**	**Geometric Mean**
Manchester									
Wolf Trap Estuary Outlet	**161**	**1014**	**910**	-	**288**	**12,987**	**1019**	**1378**	**1301**

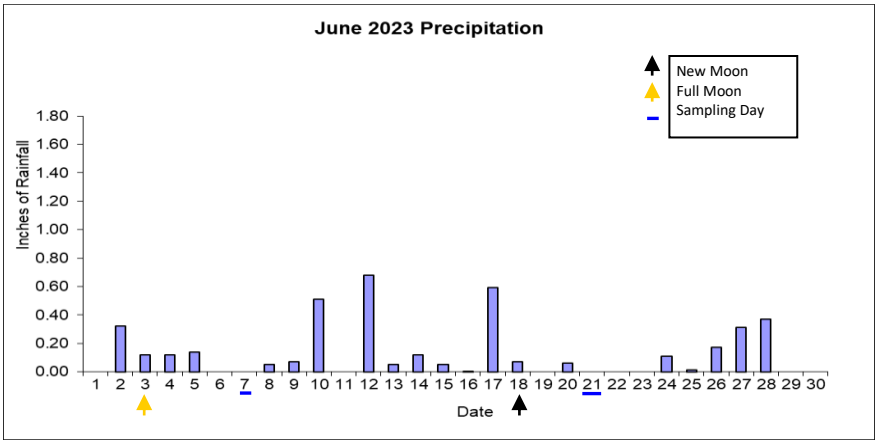
Table 7: **2023 Manchester Water Quality Monitoring Results from Outfall Pipes and Streams**

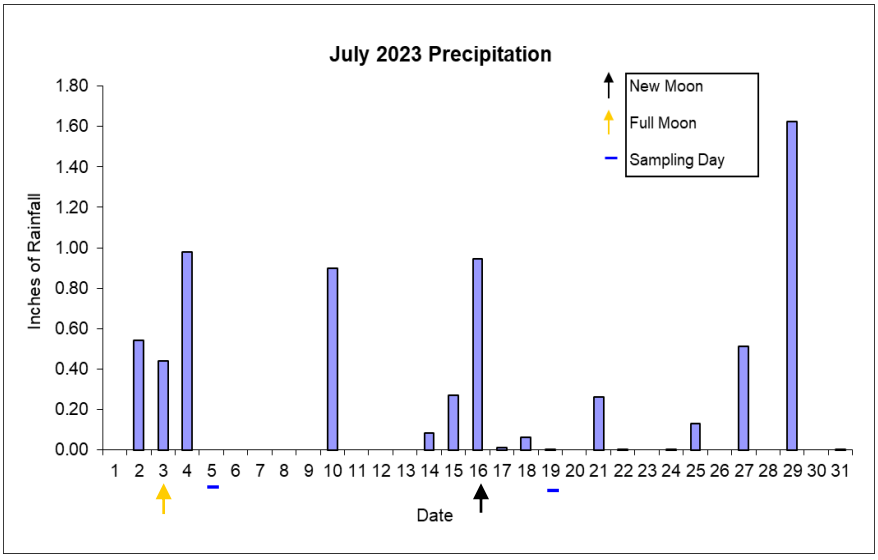
2023 Monitoring Results		DRY	DRY	WET	DRY	DRY	DRY	Dry Days
Salem Sound Coastwatch Sampling Locations	**Site #**	**7-June**	**21-June**	**5-July**	**19-July**	**3-Aug**	**17-Aug**	**Geometric Mean**
Manchester								
Black Beach off 127	161	**368**	**246**	**1,010**	**5,794**	**1,081**	**933**	**880**
Wolf Trap Estuary from bridge	161-E	**1,223**	**238**	**4,611**	**6,867**	**2,613**	**359**	**1134**
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**	**1025**
Wolf Trap Estuary - East upper marsh	161-EUM	~	~	~	**1,572**	**404**	**332**	**595**

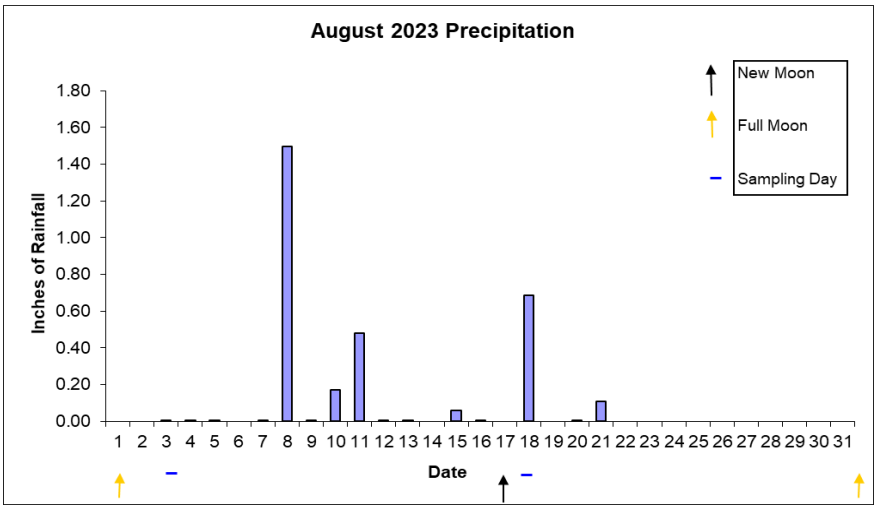
Table 8. **Geometric Mean of *Enterococcus* Counts for Manchester Sampling Sites for 2006 – 2023 (Dry Days Only)**

Year / Site #	**160D**	**161**	**161E**
2006	99	**2606**	~
2007	**165**	**311**	**332**
2008	**252**	**1590**	**920**
2009	34	**413**	**303**
2010	**730**	**1411**	**1718**
2011	**200**	**2786**	**1277**
2012	37	**837**	**1862**
2013	33	**1826**	**2002**
2014	**205**	**478**	**1368**
2015	**131**	**1346**	**2276**
2016	**288**	**2230**	**11822**
2017	35	**1058**	**1214**
2018	28	**1022**	**2221**
2019	Waiting for test results		
2020	~	~	**721**
2021	Covid interrupted testing for these sites		
2022			
2023	~	**880**	**1134**
Geo Mean	105	**1111**	**1342**

Graph 1: **2023 Precipitation Recorded for June, July and August in Salem (Manchester Similar)**







Precipitation run-off behaves differently in an estuary environment than an urban environment; therefore, the same assumptions about the impact of rain preceding testing may not hold true.

Figure 1: **Map of Kettle Cove Septic Systems January 2015 from the Board of Health**