Prepared for:
Anne Arundel County Department of
Public Works Bureau of Watershed
Protection and Restoration

Project Name: *Pet Waste Outreach – Bacteria Monitoring*

October 2021 – September 2022

Year 2 Summary Report

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ENVIRONMENTAL CENTER

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Introduction and Scope:

In accordance with the 2014 Anne Arundel County National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit (Permit Number MD0068306) requirements the County has developed a bacterial TMDL restoration plan (AACO, 2017) that includes community education to inform pet owners about the potential fecal contamination contribution of pet waste at local beaches. In the 2017 report, of the four categories of fecal contributors, 46% is estimated to be from dog waste, particularly after storm events. In the 2017 report, public education was cited as an effective tool for decreasing pet waste contribution to the bacterial load.

The Anne Arundel County Bureau of Watershed Protection and Restoration (BWPR) developed a plan to reduce pet waste through a program of community engagement, information and education. One of the goals is to minimize pet waste contribution to the Bay pollutant load, and the BWPR contacted the Anne Arundel Community College Environmental Center (AACC EC) to conduct pre-program enterococcus monitoring for an initial 12- month period at two beach sites- Manhattan Beach in Severna Park and Avalon Shores community pier in Shady Side - beginning October 2020 and continuing through September of 2021. The pet waste reduction outreach campaign was planned to begin in the first half of 2022, so the County requested a second year of data collection to capture more pre-outreach information and several months of data after the pet waste reduction program began working with the two communities.

Throughout the two years of monitoring, sampling occurred twice per month, with the exceptions of December January, and February when sampling was performed once per month. Technicians typically sampled on Wednesday mornings between 8 and 11 a.m. Parameters measured included: total suspended solids, enterococci and physical parameters of clarity, water temperature, dissolved oxygen (DO), salinity, conductivity, and pH. Air temperature, tide, cloud cover, general wind direction, and rainfall within 72 hours prior to sample collection were also recorded. One of the sites was sampled twice each week as a quality control. A map showing the sampling sites and the full data set are included in the appendix.

Method Comments:

The detailed procedures employed are outlined in the '*Pet Waste Outreach Program - Bacteria Monitoring AACC EC Project Plan'* submitted to, and accepted by, the Department of Public Works, as account 4601.7405 on 6 October 2022. Minimal modifications were made as required for environmental conditions.

Specifically, at Manhattan Beach the technician waded into the water to a depth of approximately four feet for data and sample collection. At Shady Side sampling was conducted from a pier that extends out next the beach area. This prevented the need for access at a locked gate.

The water level at the Shady Side location was often less than 0.6 m, making it impossible to reasonably measure surface (0.2m) and bottom YSI readings. In those cases, only surface measurements were recorded.

Data:

General Trends:

Analyses were conducted comparing enterococcal concentrations at the two sampling sites across the entire length of the project, then further comparing the bacterial data to each other before May 2022 and from May 2022 through September 2022, and comparing just the summer months' values. There is an interesting and significant decrease in enterococcus when comparing all values prior to, then from May 2022 on (p=0.015). The calculation was also performed comparing only the summer months of May through September of each year, recognizing seasonal patterns including water temperature, rain and animal activity differences in colder months that aren't in the post-outreach data set. The comparison between pre- and post-outreach does not reach significance (p=0.1). Of note, at the Shady Side location, there were more values over the threshold from October to March than from May through September. The reasons for that finding may be complex and reflect more rain associated with those dates, more animal activity or longer survival of the bacteria in colder water.

Precipitation and Enterococci:

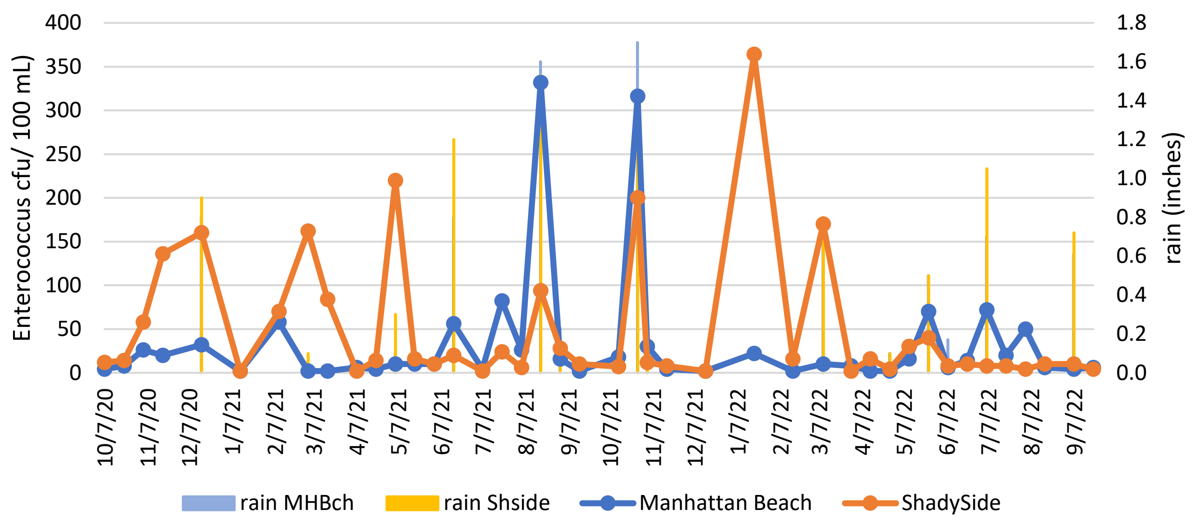
A complete data set is included in the appendix. Rain events, especially rain events of 0.5 inches or more with 48 hours prior to sampling are often correlated with enterococcus spikes. Single values greater than 104 cfu/ 100 mL are considered unsafe for swimming per the Code of Maryland Regulations Sec.26.08.02.03-3 that addresses water quality. Determination of a water body's health over time is more effectively determined by calculating the geometric mean. A site with a geometric mean calculated over at least a 90 day period with at least 5 data points and a value of less than 35 cfu/100 mL, is considered healthy. The geometric means at both sites in the study were well below the threshold throughout the study period and when considered in separate annual calculations (October through the following September of each sampling cycle) (Table 1).

However, rain events, especially events of 0.5 inches or more within 48 hours prior to sampling did frequently result in enterococcus spikes. Of the 42 sampling events, 9 were impacted by rain greater than 0.2 inches (Table 1). After rain events the average enterococcus concentrations at Manhattan Beach and Shady Side increased 6.8 and 3.2- fold over non-rain days, respectively.

Table 1. ENTEROCOCCUS (ENT) expressed as colony-forming units per 100 mL (cfu/100 mL)							
	All samples			<0.2 inches of rain 48 hrs prior		Rain >= 0.2	
	Mean ENT	Geometric Mean ENT	% Dates >104 cfu	Mean ENT	Geometric Mean ENT	# Sample Events	Mean ENT
Manhattan Beach	33.1	11.6	4.8	14.7	8.1	9	100.0
Shady Side	49.5	17.6	16.7	35.0	12.7	9	113.6

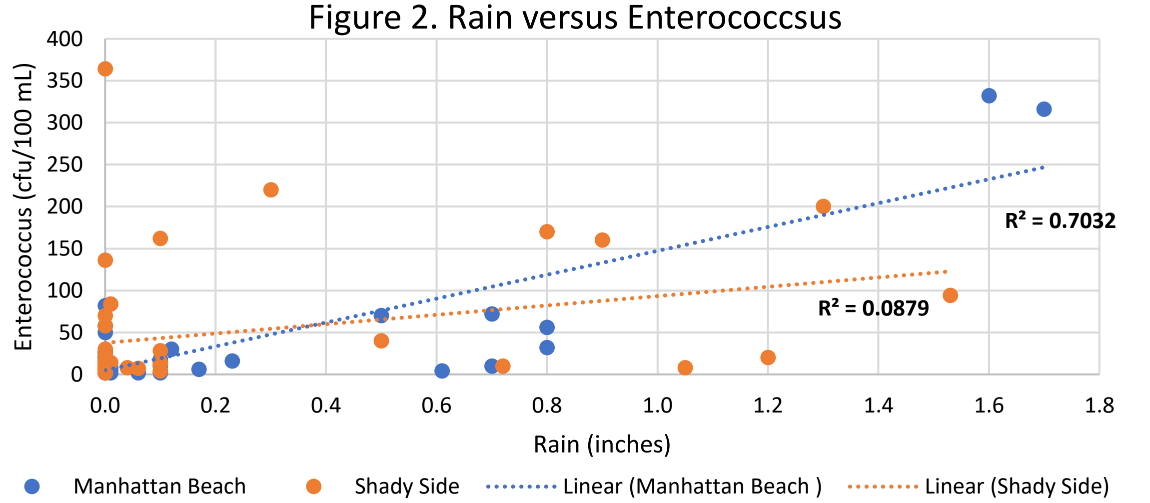
Figure 1 illustrates the general pattern of mostly higher concentrations of bacteria at Shady Side, and the finding that rain was correlated with the high counts on several occasions. However, over 89% of the 84 samples fell below the 104 cfu/ 100 mL threshold.

Figure 1. Enterococcus versus Rain



There is a clear relationship between rain and bacterial concentration at Manhattan Beach (Figure 1) that doesn't appear in the data from Shady Side. The only two dates when the values were above 104 cfu/100 mL at Manhattan Beach were the two dates with the highest rainfall (8/18/21, 1.6 inches rain, 332 cfu/ 100 mL and 10/27/21, 1.7 inches rain, 316 cfu/100 mL). At Shady Side there was no such pattern, and this is further demonstrated in Figure 2, with a high R^2 value when comparing rain to enterococci at Manhattan Beach (0.70), but an insignificant value for Shady Side (0.09).

Figure 2. Rain versus Enterococcsus



Three of the seven values at Shady Side that were above the 104 cfu/100 mL threshold occurred on days with less than 0.2 inches of rain, and the highest value occurred on a day when there had been no rain at all (1/19/22, 364 cfu/100 mL). This suggests input from sources other than runoff due to rainfall.

Of note, the 3 March 2021 data point for Shady Side (142 cfu/100 mL) was collected just over 72 hours following a rain event over 1.0 inch, although only 0.1 inch fell within 48 hours. In addition, the 16 June 2021 samples were both significantly below the threshold although there had been over 1 inch of rain at each site that occurred approximately 48 hours before sampling. There was no rain within 24 hours of testing.

Although anecdotally the enterococcus averages are higher at Shady Side than at Manhattan Beach and the values are higher on dates affected by rain, the differences are not statistically significant in a t-test (assuming unequal variance).

<u>Other Factors' Contribution to Bacterial Concentrations:</u>

While rain is certainly a significant factor in runoff that can lead to increased enterococcus contamination, the variation in concentrations over the course of the study, particularly at the Shady Side location, indicates that other factors play a considerable role. Determining the relative input of each factor is a challenge, and typically requires large data sets collected over a long period of time. As mentioned above, the depth at the Shady Side location was often very shallow, and on three occasions the depth was less than 0.5 m. However, there was not a correlation between depth and enterococcus concentration.

<u>Wind and Tide:</u>
Possible relationships between wind direction, wind speed and tide levels were analyzed. There have been conflicting studies analyzing tide's effect on enterococcus (Boehm and Weisber, 2005; Aslan et al 2018; Ek et al 2021) with some data suggesting that falling tide, regardless of geomorphology, are more likely associated with high bacterial concentrations, and others suggesting the opposite effect. In addition, wind direction has been shown to have a small effect (Ek et al 2021). In the span of this study, there was an even split between high concentrations that occurred during rising and falling tides, and there was no discernible correlation between wind direction and enterococcus values.

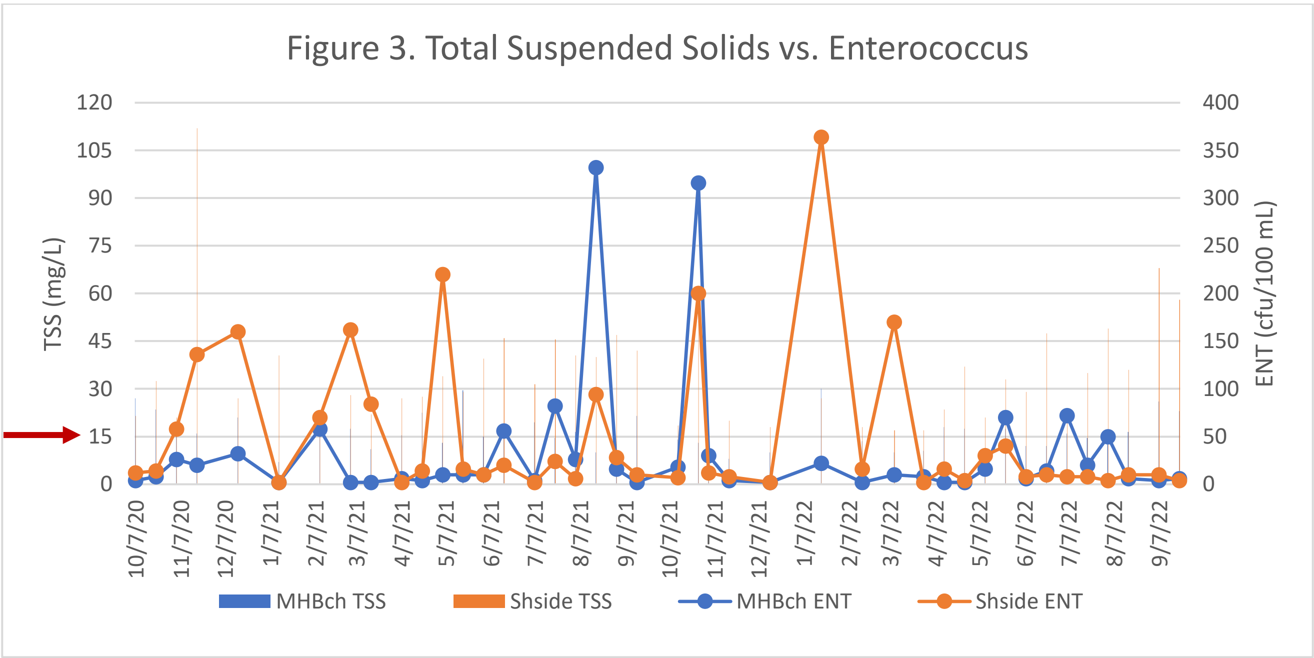
Table 2. Wind direction and tide with Enterococcus values over 104 cfu/100 mL

Date	Site	Wind direction	Tide	ENT (cfu/100 mL)
8/18/21	MHBch	SSW	falling	332
10/27/21	MHBch	WNW	rising	316
11/18/20	Shside	WNW	falling	136
12/16/20	Shside	ENE	falling	160
3/3/21	Shside	W	rising	162
5/5/21	Shside	SSW	rising	220
10/27/21	Shside	NW	rising	200
1/19/22	Shside	N	falling	364
3/10/22	Shside	N	rising	170

In addition, while the Shady Side site was often very shallow, often resulting in data collection only at 0.2 m, there was not a correlation between depth and enterococcus values. In addition, while the tide phase was recorded, additional parameters that may affect depth, such as moon phase and storm surge, were not included in the data set.

Total Suspended Solids:

Total suspended solid (TSS) concentrations were measured at each site. Figure 3 illustrates that there is not a significant correlation between TSS and bacterial concentration spikes at either site (R^2 values at each site were below 0.10). There was a significant difference between TSS values at the two sites, with Shady Side having higher TSS values over the sampling period ($P=6.8 \times 10^{-8}$ in two-tail t-test). In addition, while 45% of the Manhattan Beach TSS values are below the upper limit of 15 mg/L recommended for a healthy habitat for submerged aquatic vegetation (SAV), only 1 measurement at Shady Side (2.4%) did not exceed the threshold (EPA, 2000). Whether the consistently higher TSS concentrations at Shady Side in anyway contribute to the higher frequency of bacterial spikes is unclear, but the pattern during the summer of 2022 did not show a correlation between TSS and enterococcus spikes at the Shady Side site.



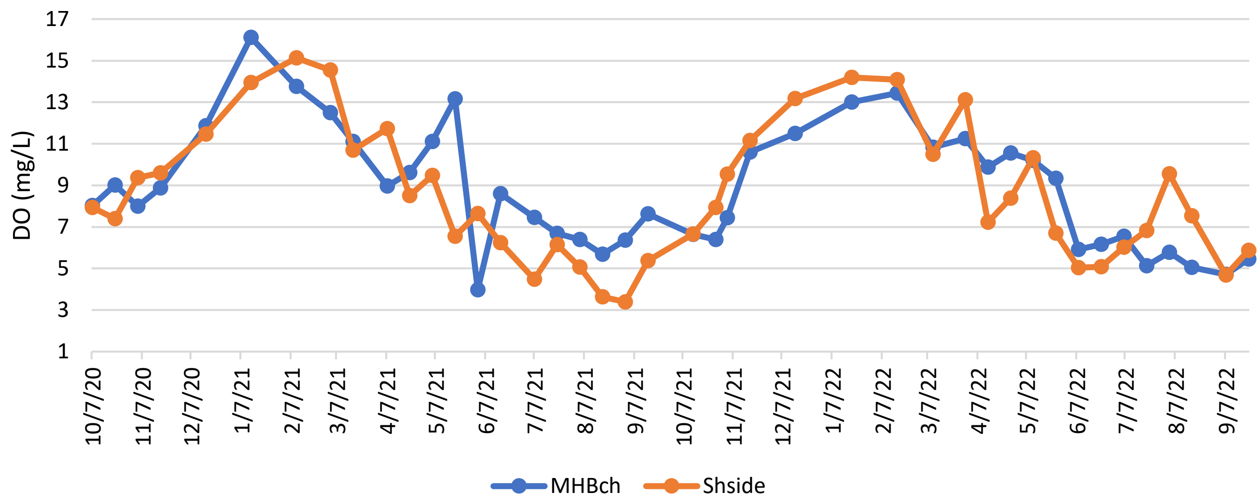
Clarity:

Secchi Depth as a measure of clarity in this study is skewed by the fact that the water was clear to the bottom on most sampling dates from November 2020 through early April 2021. This is not surprising as the cooler temperatures typically result in greater clarity. However, during the summer months clarity at both sites was typically lower than the 100 cm threshold considered necessary to support underwater grasses. The same trend continued in 2022, and there was not a significant relationship between clarity and enterococcus values.

Dissolved Oxygen:

Levels of dissolved oxygen are a key measure of water quality and dissolved oxygen levels 5.0 mg/L or greater are necessary to prevent stress on various marine organisms. During the course of the project 95.2% and 90.5% of surface measurements (0.2 m) were over 5.0 mg/L at Manhattan Beach and Shady Side, respectively. Although the shallowness at Shady Side only allowed bottom readings on about half of the sampling dates (22 of 42 measurements), the dissolved oxygen values were above 5.0 mg/L 90.2% and 90.4% of the time at Manhattan Beach and Shady Side, respectively.

Figure 4. Surface Dissolved Oxygen



Salinity and pH:

While salinity may not have a direct effect on bacterial counts, it is an important measure of water quality, affecting the health of other marine organisms and potentially producing an environment that alters local populations, as some species favor, or require, certain salinity ranges. The salinity measurements during the first year of analysis were lower than average, with the effect even more dramatic at the Manhattan Beach site. This pattern was seen by other groups measuring salinity on the Magothy River (informal communications with the Magothy River Association).

Salinity values were relatively normal during the second year of the project, with the Magothy River site returning to the typical pattern of increasing values through the summer (Figure 5). There were no unusual peaks or dips, which also coincides with the typical rain pattern and totals during 2022.

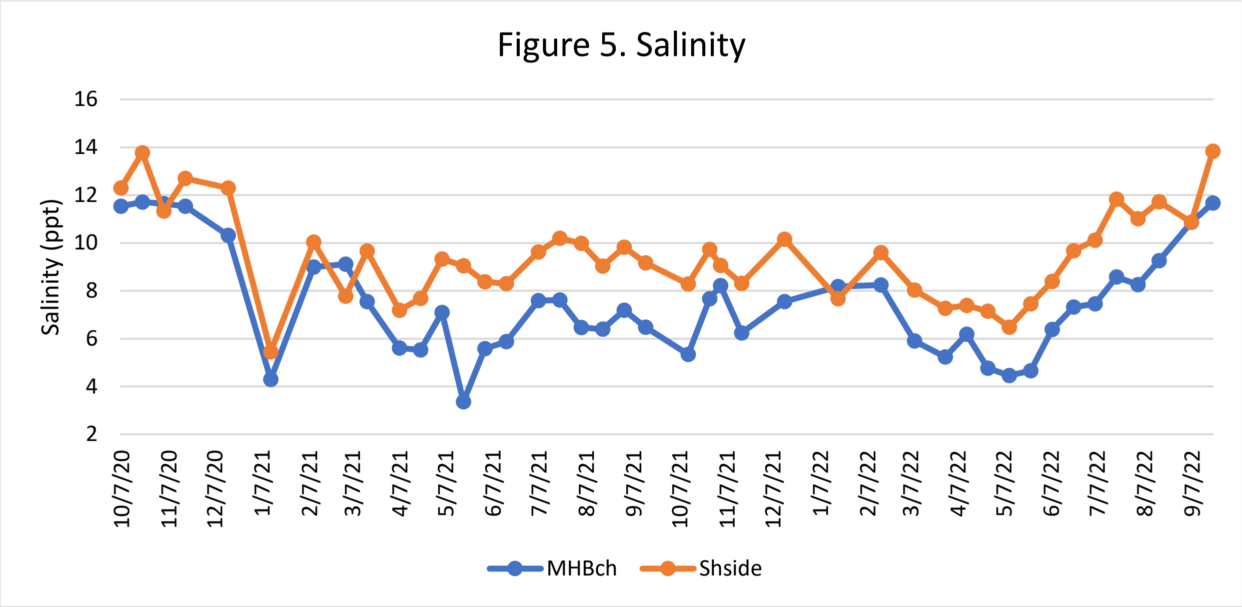


Figure 5. Salinity

Over the course of the project, pH values were relatively stable at both the surface and bottom. Only one value in year 2 sampling was slightly outside of the optimum pH range of 6.5 to 8.5.

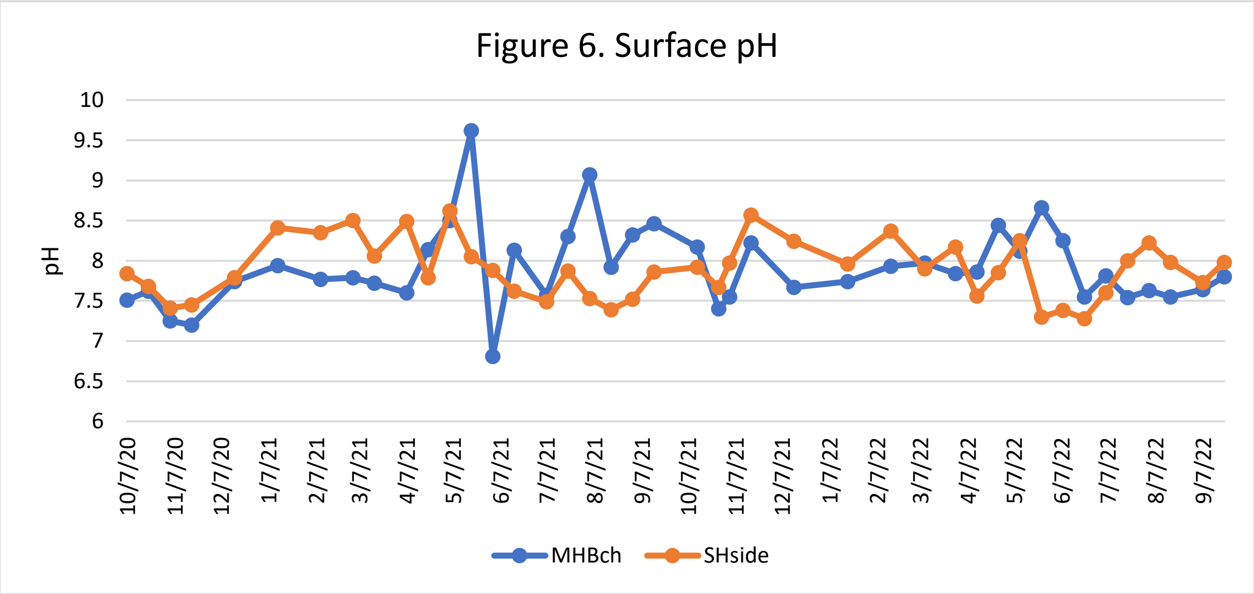
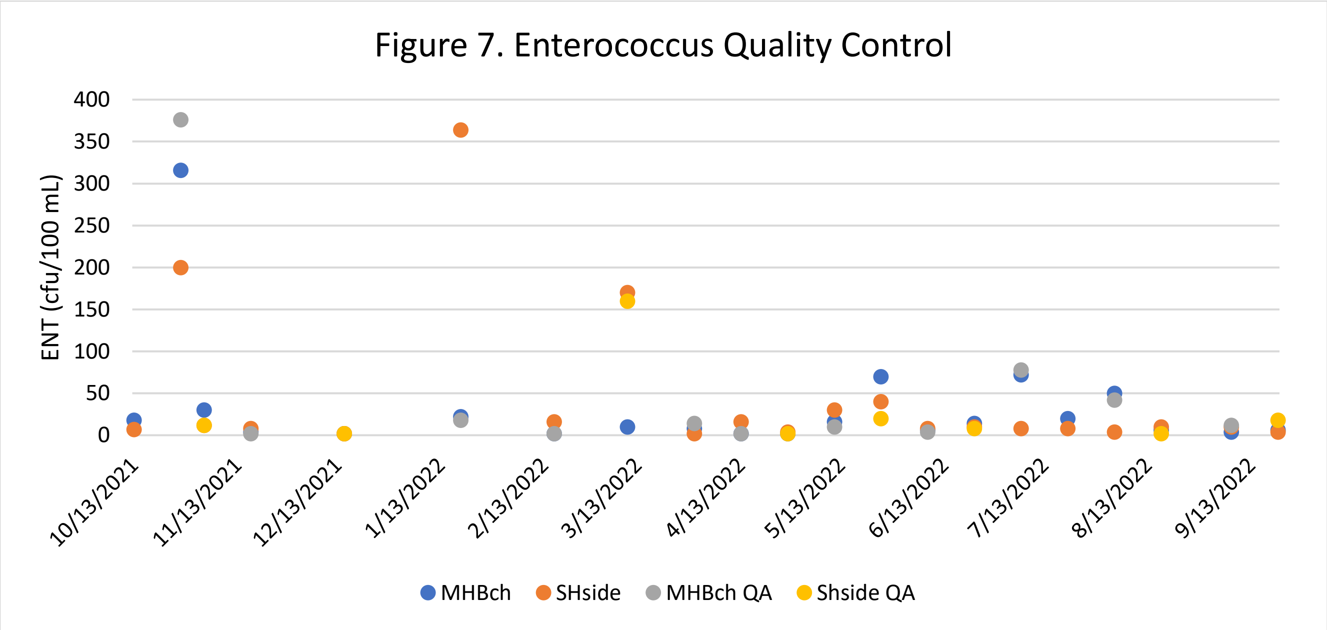


Figure 6. Surface pH

Quality Control:

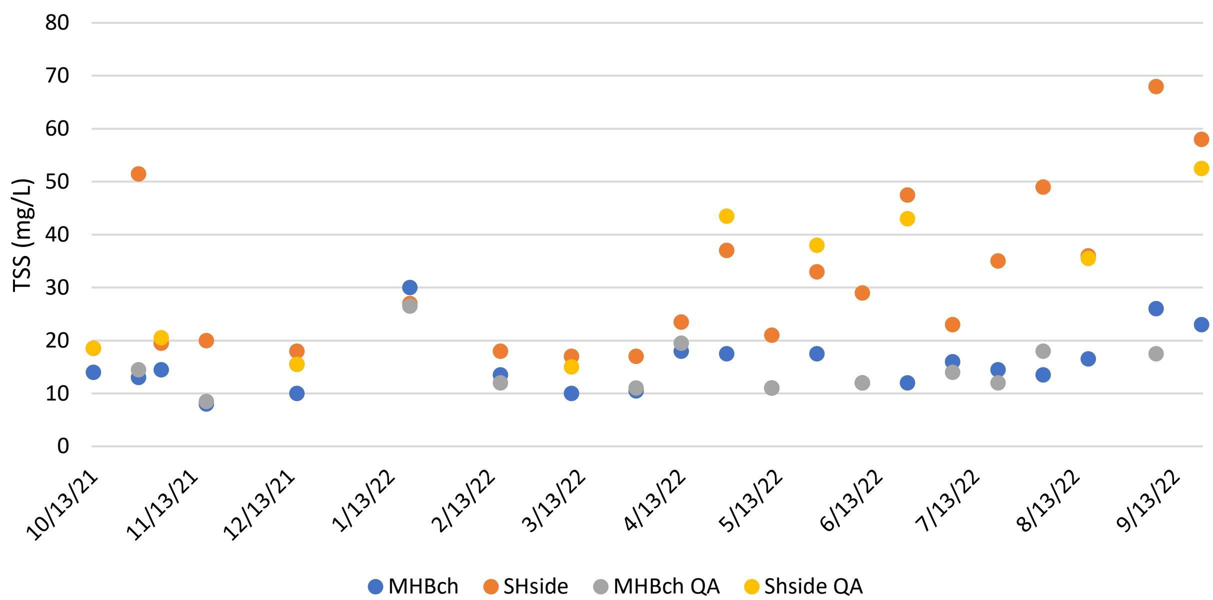
Each week a replicate set of YSI measurements were recorded and extra samples were collected at one of the two sites. Those data are included in the full data set in the appendix. YSI instrument data was very consistent and showed only small variations in the quality control data recorded. In addition to replicate data being recorded by hand, data was logged on the instrument and uploaded for long-term storage on the AACC EC server. All YSI data was checked for accuracy to ensure that data was correctly recorded and matched the logged data. Any discrepancies were inspected and corrected.

The replicate samples were processed separately in the laboratory and variation calculated. Figure 7 shows the field replicate enterococcus sample values for Year 2 of the study. As in Year 1, there was good agreement between replicates. Sample variation was lower, as a percentage of the total count, for higher values as expected. Over the course of the study, none of the samples processed warranted further analysis.



Other quality control methods, including testing each new batch of selective media and performing gram-staining on several positive and negative colonies were performed. The media pre-checks were always within 10% of the expected results (30 cfu +/- 4 as reported by Biomerieux). Similar agreement was observed between TSS replicates (Figure 8).

Figure 8. Total Suspended Solids Quality Control



Summary:

Year 2 of this study represented what in many parameters, would be described as a typical year. Rainfall, pH, and salinity all followed typical patterns throughout the year, without extreme spikes or dips. Not surprisingly, rain events of greater than 1 inch occurred, on average, once per month during the testing period, and the sampling schedule picked up the effects of those large rains about 10% of the time.

In year 1 of the study, Shady Side ENT values were higher over the course of the year, however there were not enough data points to show significance in the difference, and in fact, the full data set over two years continues to indicate that the differences are not significant. Of note, however, is the difference in how the ENT values were affected by rain events. Manhattan Beach ENT spikes showed a strong correlation with rain events, but Shady Side's ENT spikes were not clearly associated with any one variable. There was not visual evidence of pet waste left at the site, but there was more visual evidence of ducks and geese. In addition, the Shady Side site is located closer to the paved road with a paved boat ramp adjacent to the community beach. This is different from the Manhattan Beach location that is further from the paved road and has a grassy area that stretches about 50 feet from the parking area to the beach. In addition, both beaches have outfalls that drain directly next to the swim areas that may contribute to enterococcus concentrations, although neither outfall was observed to have a rapid flow at the time of any sampling event.

In conclusion, water quality at the sites chosen for this study are generally typical for community beaches along the Magothy and West Rivers. In the absence of significant rain of at least 0.2 inches, enterococcus levels are often well below the threshold of 104 cfu/100 mL established by the EPA. After a rain event, typically for a period of 24 to 48 hours after rain, there may be elevated bacterial levels. This pattern suggests that the source of enterococci is likely animal in nature due to pet waste or animal waste that is deposited in the area and is washed into the river with the runoff from a rain event. If there were a failure due to sewer leakage, more spikes would be expected on non-rain sampling dates.

There is some indication that the dynamics at the Shady Side site may be more complex than at Manhattan Beach. Of the 7 instances when the ENT values were over the 104 cfu/100 mL threshold, 3 were not associated with at least 0.2 inches of rain within 48 hours prior to collection. On several other occasions when rain of over 0.5 inches fell, the ENT values were not only below the threshold, but were below 50 cfu/100 mL. The contributions to the bacterial load at that site are worth further investigation to determine the relative input from pets, birds and humans.

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Final plan.

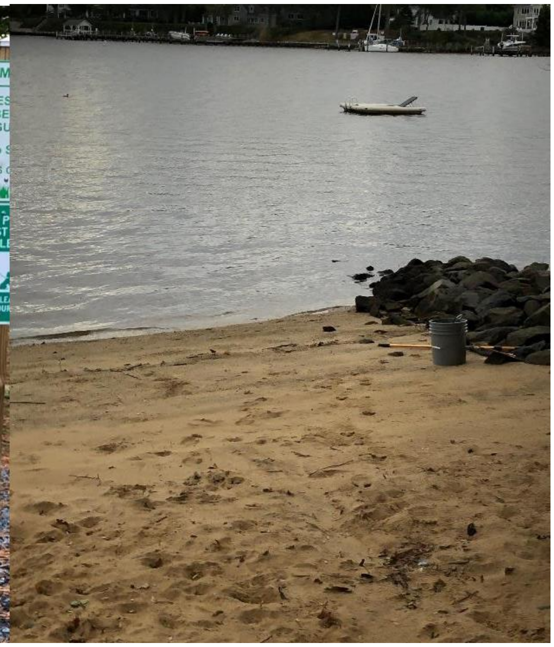
Aslan A, Anderson K, Chapman A. 2018. The impact of tides on microbial water quality at an inland river beach. J Environ Qual 47: (5)1123-1129.

Boehm A, Weisberg S. 2005. Tidal forcing of enterococci at marine recreational beaches at fortnightly and semidiurnal frequencies. Environ Sci Technol 39: (15)5575-5583.

Ek C, Porter D, Graves D, Rabon B, Cai B, Cai G, Willis R, Scott G. 2021. Enterococci contamination on Edisto Island, South Carolina: frequency, sources of contamination, and prospects on how to improve water quality. J So Carol Wat Res 8: (1)68-82.

United States Environmental Protection Agency for the Chesapeake Bay Program. 2000. Chesapeake Bay Submerged Aquatic Vegetation Water Quality and Habitat-Based Requirements and Restoration Targets: A Second Technical Synthesis.

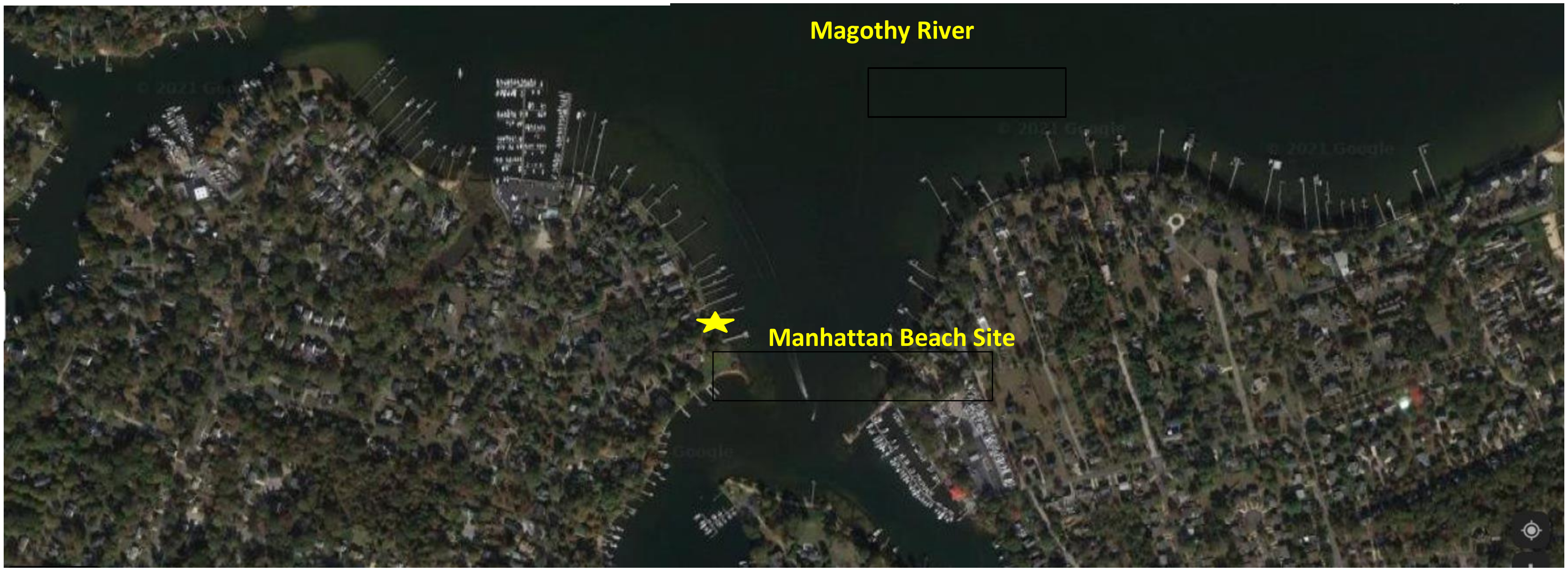
Appendix A. Site Photos



Manhattan Beach Site. The photo to the left shows the site restoration and reseeding that was done during the summer of 2021 to stabilize the site and prevent erosion. The grass has since filled in some. The photo to the right shows the beach area where sampling is conducted. The technician wades out to just over 1 m depth.


Shady Side Avalon Shores Site. The photo on the left shows the boat ramp that is right next to the community beach, and the photo on the right shows the dock that extends out adjacent to the swim area and is used for sampling.

Appendix B. Map of Sampling Locations



Appendix C. Data Table

(Note: blue-shaded Secchi values indicate the water was 'clear to bottom'. ENT values in red font are above the 104 cfu/100 mL threshold)

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
10/7/20	MHBch	S	0.00	0	70	sw9	high falling	0.2	0.7	11:09	70	20.6	11.53	8.03	7.51	4	27
10/7/20	MHBch	B	0.00	0	70	sw9	high falling	0.6	0.7			20.6	11.55	8.44	7.38		
10/7/20	Shside	S	0.00	0	73	ssw11	low falling	0.2	0.65	12:15	65	20.6	12.3	7.93	7.84	12	21.5
10/7/20	Shside	B	0.00	0	73	ssw11	low falling	0.6	0.65			20.6	12.34	7.49	7.8		
10/7/20	QA ShSide	S	0.00	0	73	ssw11	low falling	0.2	0.65	12:17	65	20.6	12.32	7.72	7.81	12	31.5
10/7/20	QA ShSide	B	0.00	0	73	ssw11	low falling	0.6	0.65			20.5	12.33	7.57	7.78		
10/21/20	MHBch	S	0.01	0	64	sse4	high rising	0.2	0.75	9:12	75	18.7	11.71	9.01	7.62	8	23.5
10/21/20	MHBch	B	0.01	0	64	sse4	high rising	0.6	0.75			18.7	11.73	9.3	7.61		
10/21/20	Shside	S	0.01	0	66	s6	low falling	0.2	0.85	10:14	80	18.9	13.77	7.39	7.68	14	32.5
10/21/20	Shside	B	0.01	0	66	s6	low falling	0.7	0.85			18.8	13.82	7.02	7.64		
10/21/20	QA MHBch	S	0.01	0	64	sse4	high rising	0.2	0.75	9:16	75	18.8	11.72	8.92	7.6	6	25.5
10/21/20	QA MHBch	B	0.01	0	64	sse4	high rising	0.6	0.75			18.8	11.75	9.24	7.66		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
11/4/20	MHBch	S	0.00	0	52	N1	high falling	0.2	0.85	9:25	85	13.5	11.64	7.99	7.25	26	17.5
11/4/20	MHBch	B	0.00	0	52	N1	high falling	0.7	0.85			13.4	11.62	8.13	6.99		
11/4/20	Shside	S	0.00	0	61	WMW2	falling	0.2	0.3	10:25	30	10.8	11.33	9.37	7.41	58	21
11/4/20	Shside	B	0.00	0	61	WNW2	falling		0.3								
11/4/20	QA MHBch	S	0.00	0	52	N1	high falling	0.2	0.85	9:30	85	13.4	11.56	7.98	7.46	8	26.5
11/4/20	QA MHBch	B	0.00	0	52	N1	high falling	0.2	0.85			13.5	11.71	7.97	7.41		
11/18/20	MHBch	S	0.00	0	42	WNW8	falling	0.2	0.85	9:30	85	12	11.53	8.87	7.2	20	16
11/18/20	MHBch	B	0.00	0	42	WNW8	falling	0.6	0.3			12	11.53	8.87	6.99		
11/18/20	Shside	S	0.00	0	44	WNW10	falling	0.2	0.3	10:33	20	8.4	12.69	9.6	7.45	136	112
11/18/20	Shside	B	0.00	0	44	WNW10	falling		0.3								
11/18/20	QA ShSide	S	0.00	0	44	WNW10	falling	0.2	0.3	10:31	20	8.3	12.54	9.9	7.45	100	111.5
11/18/20	QA ShSide	B	0.00	0	44	WNW10	falling		0.3								

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
12/16/20	MHBch	S	0.80	48	34	ENE12	falling	0.2	0.8	9:40	80	5.7	10.31	11.86	7.74	32	21
12/16/20	MHBch	B	0.80	48	34	ENE12	falling	0.6	0.8			5.8	10.41	12.04	7.73		
12/16/20	Shside	S	0.90	48	34	ENE13	falling	0.2	0.6	8:49	60	6.8	12.29	11.46	7.79	160	27
12/16/20	Shside	B	0.90	48	34	ENE13	falling	0.5	0.6			6.8	12.26	11.15	7.82		
12/16/20	QA MHBch	S	0.80	48	34	ENE12	falling	0.2	0.8	9:42	80	5.9	10.42	11.7	7.8	32	24
12/16/20	QA MHBch	B	0.80	48	34	ENE12	falling	0.6	0.8			5.8	10.49	11.65	7.81		
1/13/21	MHBch	S	0.00	0	27	NE1	falling	0.2	0.8	8:23	80	4.4	4.29	16.12	7.94	2	7
1/13/21	MHBch	B	0.00	0	27	NE1	falling	0.6	0.8			4.4	4.29	16.29	7.66		
1/13/21	Shside	S	0.00	0	30	E1	falling	0.2	0.45	9:37	45	2.8	5.45	13.95	8.41	2	40.5
1/13/21	QA ShSide	S	0.00	0	30	E1	falling	0.2	0.45	9:39	45	2.8	5.45	15.46	8.61	2	35
2/10/21	MHBch	S	0.00	0	32	N4	falling	0.2	0.65	8:32	65	3	8.99	13.76	7.77	58	17
2/10/21	MHBch	B	0.00	0	32	N4	falling	0.5				3.1	8.99	13.73	7.64		
2/10/21	Shside	S	0.00	0	35	N5	low falling	0.2	0.35	9:36	35	3.4	10.03	15.13	8.35	70	15
2/10/21	QA ShSide	S	0.00	0	35	N5	low falling	0.2	0.35	9:38	35	3.4	10.04	14.85	8.48		17.5

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
3/3/21	MHBch	S	0.06	48	34	SSW5	falling	0.2	0.9	8:32	90	5.4	9.11	12.5	7.79	2	17.5
3/3/21	MHBch	B	0.06	48	34	SSW5	falling	0.7	0.9			5.4	9.11	12.72	7.82		
3/3/21	Shside	S	0.10	48	47	W5	rising	0.2	0.6	10:06	40	4.8	7.77	14.54	8.5	162	28
3/3/21	Shside	B	0.10	48	47	W5	rising	0.4	0.6			4.4	7.6	14.15	8.2	122	
3/3/21	QA MHBch	S	0.06	48	34	SSW5	falling	0.2	0.9	8:39	90	5.5	9.11	12.45	7.8	2	18.5
3/3/21	QA MHBch	B	0.06	48	34	SSW5	falling	0.7	0.9			5.3	9.12	12.53	7.8		
3/17/21	MHBch	S	0.01	24	40	S4	rising	0.85	0.85	8:25	85	8	7.55	11.11	7.72	2	11
3/17/21	MHBch	B	0.01	24	40	S4	rising	0.85	0.85			7.9	7.55	11.1	7.65		
3/17/21	Shside	S	0.01	24	41	SE7	falling	0.9	0.9	9:34	90	8.9	9.66	10.69	8.06	84	22
3/17/21	Shside	B	0.01	24	41	SE7	falling	0.9	0.9			8.9	9.67	11.01	7.98		
3/17/21	QA ShSide	S	0.01	24	41	SE7	falling	0.9	0.9	9:43	90	8.9	9.66	10.63	8.13	72	17
3/17/21	QA ShSide	B	0.01	24	41	SE7	falling	0.9	0.9			8.9	9.66	10.69	8.11		
4/7/21	MHBch	S	0.00	0	56	WNW1	falling	0.2	0.8	8:30	80	13.2	5.6	8.97	7.6	6	15.5
4/7/21	MHBch	B	0.00	0	56	WNW1	falling	0.6	0.8			13.3	5.61	9.02	7.63		
4/7/21	Shside	S	0.00	0	55	ENE2	rising	0.2	0.7	9:48	60	14.6	7.18	11.72	8.49	2	27
4/7/21	Shside	B	0.00	0	55	ENE2	rising	0.5	0.7			14.2	7.16	11.73	8.24		
4/7/21	QA MHBch	S	0.00	0	56	WNW1	falling	0.2	0.8	8:36	80	13.2	5.59	8.86	7.62	2	18
4/7/21	QA MHBch	B	0.00	0	56	WNW1	falling	0.6	0.8			13.2	5.59	9.16	7.63		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
4/7/21	QA MHBch	S	0.00	0	56	WNW1	falling	0.2	0.8	8:36	80	13.2	5.59	8.86	7.62	2	18
4/7/21	QA MHBch	B	0.00	0	56	WNW1	falling	0.6	0.8			13.2	5.59	9.16	7.63		
4/21/21	MHBch	S	0.01	48	61	SSW10	rising	0.2	0.9	8:30	80	15	5.52	9.62	8.14	4	22.5
4/21/21	MHBch	B	0.01	48	61	SSW10	rising	0.7	0.9			15	5.52	9.68	8.07		
4/21/21	Shside	S	0.10	48	61	SSW13	rising	0.2	0.95	9:31	70	15.4	7.68	8.5	7.79	14	27.5
4/21/21	Shside	B	0.10	48	61	SSW13	rising	0.8	0.95			15.4	7.71	8.61	7.84		
4/21/21	QA ShSide	S	0.10	48	61	SSW13	rising	0.2	0.95	9:34	65	15.5	7.69	8.48	7.82	4	26.5
4/21/21	QA ShSide	B	0.10	48	61	SSW13	rising	0.8	0.95			15.5	7.7	8.59	7.86		
5/5/21	MHBch	S	0.10	24	64	N1	falling	0.2	1	8:21	95	18.6	7.09	11.11	8.5	10	13
5/5/21	MHBch	B	0.10	24	64	N1	falling	0.8	1			18.4	7.08	10.8	8.41		
5/5/21	Shside	S	0.30	24	64	SSW4	rising	0.2	0.8	9:24	60	19.3	9.32	9.48	8.62	220	34
5/5/21	Shside	B	0.30	24	64	SSW4	rising	0.6	0.8			18.9	9.46	7.71	8.27		
5/5/21	QA MHBch	S	0.10	24	64	N1	falling	0.2	1	8:27	95	18.6	7.09	11.17	8.54	10	18.5
5/5/21	QA MHBch	B	0.10	24	64	N1	falling	0.8	1			18.5	7.09	11.06	8.5		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
5/19/21	MHBch	S	0.00	0	64	W4	rising	0.2	0.9	8:18	55	21.3	3.36	13.16	9.62	10	29.5
5/19/21	MHBch	B	0.00	0	64	W4	rising	0.7	0.9			21.8	9.07	6.43	8.02		
5/19/21	Shside	S	0.00	0	70	W5	rising	0.2	0.8	9:23	55	21.7	9.05	6.54	8.05	16	29
5/19/21	Shside	B	0.00	0	70	W5	rising	0.6	0.8			21.5	9.04	6.3	8.01		
5/19/21	QA ShSide	S	0.00	0	70	W5	rising	0.2	0.8	9:26	55	21.8	9.07	6.43	8.02	18	31.5
5/19/21	QA ShSide	B	0.00	0	70	W5	rising	0.6	0.8			21.7	9.04	6.49	8.04		
6/2/21	MHBch	S	0.00	0	68	SSW 2	rising	0.2	0.85	9:10	85	20.19	5.58	3.98	6.81	10	15
6/2/21	MHBch	B	0.00	0	68	ssw2	rising	0.65	0.85			20.2	5.61	4.14	6.72		
6/2/21	Shside	S	0.00	0	72	SSE7	rising	0.2	0.9	10:54	50	21.6	8.38	7.64	7.88	10	39.5
6/2/21	Shside	B	0.00	0	72	SSE7	rising	0.7	0.9			21.3	8.39	6.73	7.65		
6/2/21	QA Shside	S	0.00	0	72	SSE7	rising	0.2	0.9	10:58	50	21.6	8.38	7.47	7.85		42
6/2/21	QA Shside	B	0.00	0	72	SSE7	rising	0.7	0.9			21.2	8.39	6.4	7.62		
6/16/21	MHBch	S	0.80	48	69	NW7	rising	0.2	1	8:40	70	25.18	5.88	8.59	8.13	56	15
6/16/21	MHBch	B	0.80	48	69	NW7	rising	2.8				25.16	5.89	8.49	8.05		
6/16/21	Shside	S	1.20	48	69	NW7	rising	0.2	0.8	9:57	50	24.6	8.3	6.24	7.62	20	46
6/16/21	Shside	B	1.20	48	69	NW7	rising	0.6				24.6	8.27	6.1	7.59		
6/16/21	QA MHbch	S	0.80	48	69	NW7	rising	0.2	1	8:43	70	25.15	5.88	8.5	8.15	40	21
6/16/21	QA MHbch	B	0.80	48	69	NW7	rising	2.58				25.14	5.88	8.41	8.12		
6/16/21	QA ShSide	S	1.20	48	69	NW7	rising	0.2	0.8	10:00	50	24.8	8.31	6.37	7.65	40	42
6/16/21	QA ShSide	B	1.20	48	69	NW7	rising	0.8				24.6	8.29	6.04	7.58		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
7/7/21	MHBch	S	0.00	0	84	N0	falling	0.7	0.9	8:29	90	27.31	7.58	7.46	7.57	4	19.5
7/7/21	MHBch	B	0.00	0	84	N0	falling	0.2				27.3	7.59	7.54	7.54		
7/7/21	Shside	S	0.00	0	89	SSW2	falling	0.2	0.5	10:25	50	28.58	9.62	4.49	7.49	2	31.5
7/7/21	Shside	B	0.00	0	89	SSW2	falling										
7/7/21	QA MHBch	S	0.00	0	84	N0	falling	0.7	0.9	8:38	90	27.3	7.59	7.72	7.63		14
7/7/21	QA MHBch	B	0.00	0	84	N0	falling	0.2				27.3	7.58	7.48	7.59		
7/7/21	QA ShSide	S	0.00	0	89	SSW2	falling	0.2	0.5	10:26	50	28.65	9.64	5.32	7.46	4	31.5
7/7/21	QA ShSide	B	0.00	0	89	SSW2	falling										
7/21/21	MHBch	S	0.00	0	77	W4	falling	0.2	1	8:46	80	28.63	7.61	6.68	8.3	82	14.5
7/21/21	MHBch	B	0.00	0	77	W4	falling	0.8				28.58	7.62	6.54	7.92		
7/21/21	Shside	S	0.00	0	81	WNW4	falling	0.2	0.6	10:24	35	28.7	10.19	6.15	7.87	24	45.5
7/21/21	Shside	B	0.00	0	81	WNW4	falling	0.4									
7/21/21	QA ShSide	S	0.00	0	81	WNW4	falling	0.2	0.6	10:27	35	28.71	10.2	6.16	7.89	20	45.5
7/21/21	QA ShSide	B	0.00	0	81	WNW4	falling	0.4									
7/21/21	QA MHBch	S	0.00	0	77	W4	falling	0.2	1	8:49	80	28.67	7.61	6.82	8.28	54	15.5
7/21/21	QA MHBch	B	0.00	0	77	W4	falling	0.8				28.63	7.61	6.64	7.98		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
8/4/21	MHBch	S	0.00	0	72	NNE7	falling	0.2	1	11:01	70	26.46	6.46	6.39	9.07	26	16.5
8/4/21	MHBch	B	0.00	0	72	NNE7	falling	0.8				26.41	6.46	6.48	9.01		
8/4/21	Shside	S	0.00	0	72	NE9	falling	0.2	0.6	10:16	35	25.62	9.98	5.07	7.53	6	40.5
8/4/21	QA MHBch	S	0.00	0	72	NNE7	falling	0.2	1	11:04	70	26.43	6.46	6.48	9.08		
8/4/21	QA MHBch	B	0.00	0	72	NNE7	falling	0.8				26.44	6.46	6.45	9.07		
8/4/21	QA ShSide	S	0.00	0	72	NE9	falling	0.2	0.6		35	25.63	9.98	5.08	7.6	2	41
8/4/21	QA ShSide	B	0.00	0	72	NE9	falling										
8/18/21	MHBch	S	1.60	48	79	SSW3.6	falling	0.2	0.9	8:46	90	28.2	6.39	5.68	7.92	332	10
8/18/21	MHBch	B	1.60	48	79	SSW3.6	falling	0.9				28.2	6.4	5.5	7.9		
8/18/21	Shside	S	1.53	48	83	SSE13	rising	0.2	0.9	10:20	40	28.2	9.03	3.63	7.39	94	40
8/18/21	QA MHBch	S	1.60	48	79	SSW3.6	falling	0.2	0.9	8:49	90	28.2	6.41	5.54	7.93	284	10
8/18/21	QA MHBch	B	1.60	48	79	SSW3.6	falling	0.9				28.2	6.48	5.31	7.9		
9/1/21	MHBch	S	0.23	48	75	S5	Falling	0.2	1	8:28	95	29.1	7.18	6.37	8.32	16	12.5
9/1/21	MHBch	B	0.23	48	75	S5	Falling	0.8				29.1	7.18	6.54	8.33		
9/1/21	Shside	S	0.10	48	73.5	S10	Rising	0.2	1	9:32	35	28.4	9.82	3.39	7.52	28	47
9/1/21	Shside	B	0.10	48	73.5	S10	Rising	0.8				28.3	9.82	2.78	7.52		
9/1/21	QA ShSide	S	0.10	48	73.5	S10	Rising	0.2	1	9:43	35	28.4	9.82	3.57	7.51	20	46
9/1/21	QA ShSide	B	0.10	48	73.5	S10	Rising	0.8				28.4	9.82	2.82	7.47		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
9/15/21	MHBch	S	0.00	0	73	S5	falling	0.2	1	8:27	75	25.8	6.47	7.63	8.46	2	21.5
9/15/21	MHBch	B	0.00	0	73	S5	falling	0.8				25.7	6.47	7.34	8.42		
9/15/21	Shside	S	0.00	0	74	SW6.9	rising	0.2	0.9	9:40	25	26.1	9.17	5.38	7.86	10	42
9/15/21	Shside	B	0.00	0	74	SW6.9	rising	0.7				26	9.15	5.21	7.85		
9/15/21	QA MHBch	S	0.00	0	73	S5	falling	0.2	1	8:32	75	25.8	6.48	7.63	8.46	2	13
9/15/21	QA MHBch	B	0.00	0	73	S5	falling	0.8				25.7	6.48	7.48	8.42		
10/13/21	MHBch	S	0.10	24	66	N0	rising	0.2	1	8:32	70	21.9	5.34	6.64	8.17	18	14
10/13/21	MHBch	B	0.10	24	66	N0	rising	0.8				22.1	5.41	6.7	8.23		
10/13/21	Shside	S	0.06	24	69	S5	rising	0.2	1	9:46	70	21.4	8.28	6.65	7.92	7	18.5
10/13/21	Shside	B	0.06	24	69	S5	rising	0.8				21.4	8.3	6.32	7.88		
10/13/21	QA ShSide	S	0.06	24	69	S5	rising	0.2	1	9:55	70	21.5	8.31	6.75	7.93		18.5
10/13/21	QA ShSide	B	0.06	24	69	S5	rising	0.8				21.3	8.28	6.27	7.86		
10/27/21	MHBch	S	1.70	48	55	WNW12	rising	0.2	1	8:15	85	17.8	7.66	6.39	7.4	316	13
10/27/21	MHBch	B	1.70	48	55	WNW12	rising	0.8				18	7.78	6.61	7.5		
10/27/21	Shside	S	1.30	48	57	NW15	rising	0.2	0.4	9:34	30	15.3	9.73	7.93	7.67	200	51.5
10/27/21	QA MHBch	S	1.70	48	55	WNW12	rising	0.2	1	8:25	85	17.8	7.6	6.03	7.39		
10/27/21	QA MHBch	B	1.70	48	55	WNW12	rising	0.8				18.1	7.92	3.13	7.42	376	14.5

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
11/3/21	MHBch	S	0.12	24	37	SW3	falling	0.2	1	8:29	100	15.5	8.21	7.44	7.55	30	14.5
11/3/21	MHBch	B	0.12	24	37	SW3	falling	0.8				15.5	8.2	7.73	7.57		
11/3/21	Shside	S	0.10	24	43	W6	falling	0.2	0.4	9:50	40	12.3	9.06	9.54	7.97	12	19.5
11/3/21	QA ShSide	S	0.10	24	43	W6	falling	0.2	0.4	9:59	40	12.3	9.05	9.25	8	12	20.5
11/17/21	MHBch	S	0.00	0	39	N2	falling	0.2	1	8:29	100	10.9	6.23	10.6	8.22	4	8
11/17/21	MHBch	B	0.00	0	39	N2	falling	0.8	1			11.7	6.47	10.74	8.23		
11/17/21	Shside	S	0.00	0	51	S4	rising	0.2	0.5	9:34	50	9.7	8.31	11.15	8.57	8	20
11/17/21	QA MHBch	S	0.00	0	39	N2	falling	0.2	1	8:35	100	10.9	6.58	10.36	8.24	2	8.5
11/17/21	QA MHBch	B	0.00	0	39	N2	falling	0.8	1			11.7	6.69	10.37	8.25		
12/15/21	MHBch	S	0.00	0	39	NW4	falling	0.2	1	8:32	100	7.1	7.55	11.5	7.67	2	10
12/15/21	MHBch	B	0.00	0	39	NW4	falling	0.8	1			7.1	7.55	11.87	7.7		
12/15/21	Shside	S	0.00	0	45	SW5	rising	0.2	0.3	9:47	30	6.6	10.16	13.17	8.24	2	18
12/15/21	QA Shside	S	0.00	0	45	SW5	rising	0.2	0.3	9:51	30	6.6	10.16	12.84	8.29	2	15.5
1/19/22	MHBch	S	0.00	0	32	S8	falling	0.2	0.55	8:39	55	2.2	8.17	13	7.74	22	30
1/19/22	Shside	S	0.00	0	39	N4	falling	0.2	0.34	9:49	34	1.4	7.67	14.19	7.96	364	27
1/19/22	QA MHBch	S	0.00	0	32	S8	falling	0.2	0.55	8:48	55	2.4	8.24	12.71	7.77	18	26.5
2/16/22	MHBch	S	0.00	0	30	SE7	falling	0.2	1	8:37	100	3.9	8.24	13.44	7.93	2	13.5
2/16/22	MHBch	B	0.00	0	30	SE7	falling	0.8				3.9	8.26	13.55	7.67		
2/16/22	Shside	S	0.00	0	35	SE8	falling	0.2	0.4	9:46	40	3.7	9.59	14.09	8.37	16	18
2/16/22	QA MHBch	S	0.00	0	30	SE7	falling	0.2	1	8:39	100	3.9	8.25	13.38	7.98	2	12
2/16/22	QA MHBch	B	0.00	0	30	SE7	falling	0.8				3.9	8.27	13.42	7.96		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
3/10/22	MHBch	S	0.70	48	36	NW4	rising	0.2	1	8:26	100	8.4	5.9	10.84	7.97	10	10
3/10/22	MHBch	B	0.70	48	36	NW4	rising	0.6				8.4	5.9	10.84	8.1		
3/10/22	Shside	S	0.80	48	40	N6	rising	0.2	0.6	9:59	60	9.6	8.03	10.5	7.9	170	17
3/10/22	QA Shside	S	0.80	48	40	N6	rising	0.2		10:01	60	9.6	8.03	10.37	7.91	160	15
3/30/22	MHBch	S	0.00	0		W1	falling	0.2	1	8:33	85	8.2	5.23	11.25	7.84	8	10.5
3/30/22	MHBch	B	0.00	0		W1	falling	0.8				8.5	5.29	11.4	7.93		
3/30/22	Shside	S	0.00	0		W1	falling	0.2	0.35	9:43	35	6.7	7.27	13.11	8.17	2	17
3/30/22	QA MHBch	S	0.00	0		W1	fallling	0.2	1	8:35	85	8	4.97	11.26	7.79	14	11
3/30/22	QA MHBch	B	0.00	0		W1	falling	0.8				8.5	5.36	11.06	7.79		
4/13/22	MHBch	S	0.00	0	54	SE2	low	0.2	1	8:28	95	12.8	6.18	9.87	7.86	2	18
4/13/22	MHBch	B	0.00	0	54	SE2	low	0.8				12.9	6.39	9.79	7.97		
4/13/22	Shside	S	0.00	0	69	NE1	falling	0.2	0.56	9:44	50	15.2	7.38	7.22	7.56	16	23.5
4/13/22	QA MHBch	S	0.00	0	54	SE2	low	0.2	1	8:36	95	12.8	6.3	9.67	7.83	2	19.5
4/13/22	QA MHBch	B	0.00	0	54	SE2	low	0.8				12.8	6.35	9.62	7.83		
4/27/22	MHBch	S	0.10	24	50	WNW11	falling	0.2	1	8:26	85	16	4.76	10.56	8.44	2	17.5
4/27/22	MHBch	B	0.10	24	50	WNW11	falling	0.8				16.4	4.84	10.39	8.42		
4/27/22	Shside	S	0.10	24	57	WNW13	falling	0.2	0.35	9:44	35	15.2	7.14	8.38	7.85	4	37
4/27/22	QA Shside	S	0.10	24	57	WNW13	falling	0.2	0.35	9:47	35	15.2	7.14	8.03	7.68	2	43.5

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
5/11/22	MHBch	S	0.00	0	59	N11	falling	0.2	1	8:32	80	15.9	4.46	10.2	8.12	16	11
5/11/22	MHBch	B	0.00	0	59	N11	falling	0.7	1			15.9	4.46	10.21	8.11		
5/11/22	Shside	S	0.00	0	61	N12	rising	0.2	0.9	9:39	65	15.7	6.48	10.33	8.25	30	21
5/11/22	Shside	B	0.00	0	61	N12	rising	0.7	0.9			15.7	6.49	10.47	8.26		
5/11/22	QA MHBch	S	0.00	0	59	N11	falling	0.2	1	8:38	80	15.9	4.46	10.29	8.17	10	11
5/11/22	QA MHBch	B	0.00	0	59	N11	falling	0.7	1			15.9	4.47	10.24	8.15		
5/25/22	MHBch	S	0.50	24	62	NE7	falling	0.2	1	9:42	90	20.7	4.66	9.33	8.66	70	17.5
5/25/22	MHBch	B	0.50	24	62	NE7	falling	0.8	1			20.7	4.65	9.29	8.67		
5/25/22	Shside	S	0.50	24	65	NE9	rising	0.2		11:05	55	20.6	7.45	6.7	7.3	40	33
5/25/22	Shside	B	0.50	24	65	NE9	rising	0.6	0.8			20.6	7.48	6.75	7.38		
5/25/22	QA Shside	S	0.50	24	65	NE9	rising	0.2		11:07	55	20.7	7.45	6.13	7.29	20	38
5/25/22	QA Shside	B	0.50	24	65	NE9	rising	0.6				20.6	7.47	6.64	7.3		
6/8/22	MHBch	S	0.17	24	73	NNW4	rising	0.2	1	9:41	65	24.8	6.38	5.92	8.25	6	12
6/8/22	MHBch	B	0.17	24	73	NNW4	rising	0.8	1			24.4	6.37	5.39	8.15		
6/8/22	Shside	S	0.04	24	79	NNW4	rising	0.2	0.9	11:11	40	25.3	8.39	5.04	7.38	8	29
6/8/22	Shside	B	0.04	24	79	NNW4	rising	0.7	0.9			24.8	8.4	5.73	7.52		
6/8/22	QA MHBch	S	0.17	24	73	NNW4	rising	0.2	1	9:43	65	24.8	6.38	6.09	8.22	4	12
6/8/22	QA MHBch	B	0.17	24	73	NNW4	rising	0.8	1			24.3	6.37	5.86	8.17		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
6/22/22	MHBch	S	0.00	0	71	SW1	falling	0.2	1	8:47	70	23.7	7.32	6.17	7.55	14	12
6/22/22	MHBch	B	0.00	0	71	SW1	falling	0.8				23.7	7.32	7.6	7.51		
6/22/22	Shside	S	0.00	0	72	SE3	rising	0.2	0.7	10:45	40	24	9.67	5.08	7.28	10	47.5
6/22/22	Shside	B	0.00	0	72	SE3	rising										
6/22/22	QA ShSide	S	0.00	0	72	SE3	rising	0.2	0.7	10:45	40	24.1	9.71	3.86	7.25	8	43
6/22/22	QA ShSide	B	0.00	0	72	SE3	rising										
7/6/22	MHBch	S	0.70	24	83	EW6	rising	0.2	1	9:21	60	27.4	7.45	6.54	7.81	72	16
7/6/22	MHBch	B	0.70	24	83	EW6	rising	0.8	1			27.4	7.5	6.68	7.78		
7/6/22	Shside	S	1.05	24	86	NE7	rising	0.2	0.8	10:37	60	28.4	10.11	6.03	7.6	8	23
7/6/22	Shside	B	1.05	24	86	NE7	rising	0.6	0.8			27.9	10.1	5.63	7.56		
7/6/22	QA MHBch	S	0.70	24	83	EW6	rising	0.2	1	9:25	60	27.4	7.41	6.53	7.82	78	14
7/6/22	QA MHBch	B	0.70	24	83	EW6	rising	0.8	1			27.4	7.51	6.28	7.81		
7/20/22	MHBch	S	0.00	0	79	EW4	rising	0.2	1	9:08	75	28.2	8.57	5.13	7.54	20	14.5
7/20/22	MHBch	B	0.00	0	79	EW4	rising	0.8	1			28.1	8.61	4.88	7.46		
7/20/22	Shside	S	0.00	0	85	NE3	rising	0.2	0.8	10:40	30	30.3	11.83	6.82	8	8	35
7/20/22	Shside	B	0.00	0	85	NE3	rising	0.6	0.8			30	11.85	6.39	7.9		
7/20/22	QA MHBch	S	0.00	0	79	EW4	rising	0.2	1	9:09	75	28.3	8.49	5.17	7.57		12
7/20/22	QA MHBch	B	0.00	0	79	EW4	rising	0.8	1			28.1	8.58	4.91	7.58		

Date	Station	layer	rain (in)	hr prior	air temp (F)	wind	tide	Depth (m)	Total depth (m)	Time	Secchi (cm)	Temp (C)	Sal (ppt)	DO (mg/L)	pH	Ent cfu/ 100 ml	TSS (mg/L)
8/3/22	MHBch	S	0.00	0	79	SW2	rising	0.2	1	9:13	70	28.4	8.25	5.78	7.63	50	13.5
8/3/22	MHBch	B	0.00	0	79	SW2	rising	0.7	1			28.4	8.25	6.14	7.61		
8/3/22	Shside	S	0.00	0	83	SW	falling	0.2	0.7	10:44	30	30.6	11.01	9.56	8.22	4	49
8/3/22	Shside	B	0.00	0	83	SW	falling	0.5	0.7			29.8	11	7.07	7.9		
8/3/22	QA MHBch	S	0.00	0	79	SW2	rising	0.2	1	9:22	70	28.5	8.27	5.71	7.63	42	18
8/3/22	QA MHBch	B	0.00	0	79	SW2	rising	0.7	1			28.4	8.26	5.63	7.62		
8/17/22	MHBch	S	0.00	0	70	SE2	rising	0.2	1	9:13	75	27.5	9.26	5.06	7.55	6	16.5
8/17/22	MHBch	B	0.00	0	70	SE2	rising	0.8	1			27.5	9.26	4.95	7.5		
8/17/22	Shside	S	0.00	0	76	SW5	falling	0.2	1	10:45	40	27.3	11.72	7.54	7.98	10	36
8/17/22	Shside	B	0.00	0	76	SW5	falling	0.8	1			26.8	11.68	5.88	7.73		
8/17/22	QA ShSide	S	0.00	0	76	SW5	falling	0.2	1	10:45	40	27.5	11.71	7.25	8	2	35.5
8/17/22	QA ShSide	B	0.00	0	76	SW5	falling	0.8	1			26.8	11.68	5.95	7.84		
9/7/22	MHBch	S	0.61	24	71	N2	fallling	0.2	0.8	8:27	75	26.3	10.86	4.71	7.64	4	26
9/7/22	MHBch	B	0.61	24	71	N2	falling	0.6	0.8			26.3	10.86	4.59	7.63		
9/7/22	Shside	S	0.72	24	73	SW9	falling	0.2	0.55	9:37	25	26.3	10.86	4.68	7.73	10	68
9/7/22	QA MHBch	S	0.61	24	71	N2	falling	0.2	0.8	8:31	75	26.3	10.86	4.71	7.66	12	17.5
9/7/22	QA MHBch	B	0.61	24	71	N2	falling	0.6	0.8			26.3	10.86	4.7	7.65		
9/21/22	MHBch	S	0.00	0	66	SE	falling	0.2	1	8:21	80	24.6	11.66	5.46	7.8	6	23
9/21/22	MHBch	B	0.00	0	66	SE	falling	0.8	1			24.5	11.65	6.21	7.77		
9/21/22	Shside	S	0.00	0	69	SE	fallin	0.2	0.8	9:40	30	25.2	13.83	5.87	7.98	4	58
9/21/22	Shside	B	0.00	0	69	SE	falling	0.6	0.8			25	13.83	4.99	7.87		

9/21/22	QA ShSide	S	0.00	0	66		falling	0.2	0.8	9:45	30	25.2	13.84	5.62	7.94	18	52.5
9/21/22	QA ShSide	B	0.00	0	66		falling	0.6	0.8			25	13.83	4.82	7.84		