

Friends of Scarborough Marsh Water Quality Monitoring Program Report

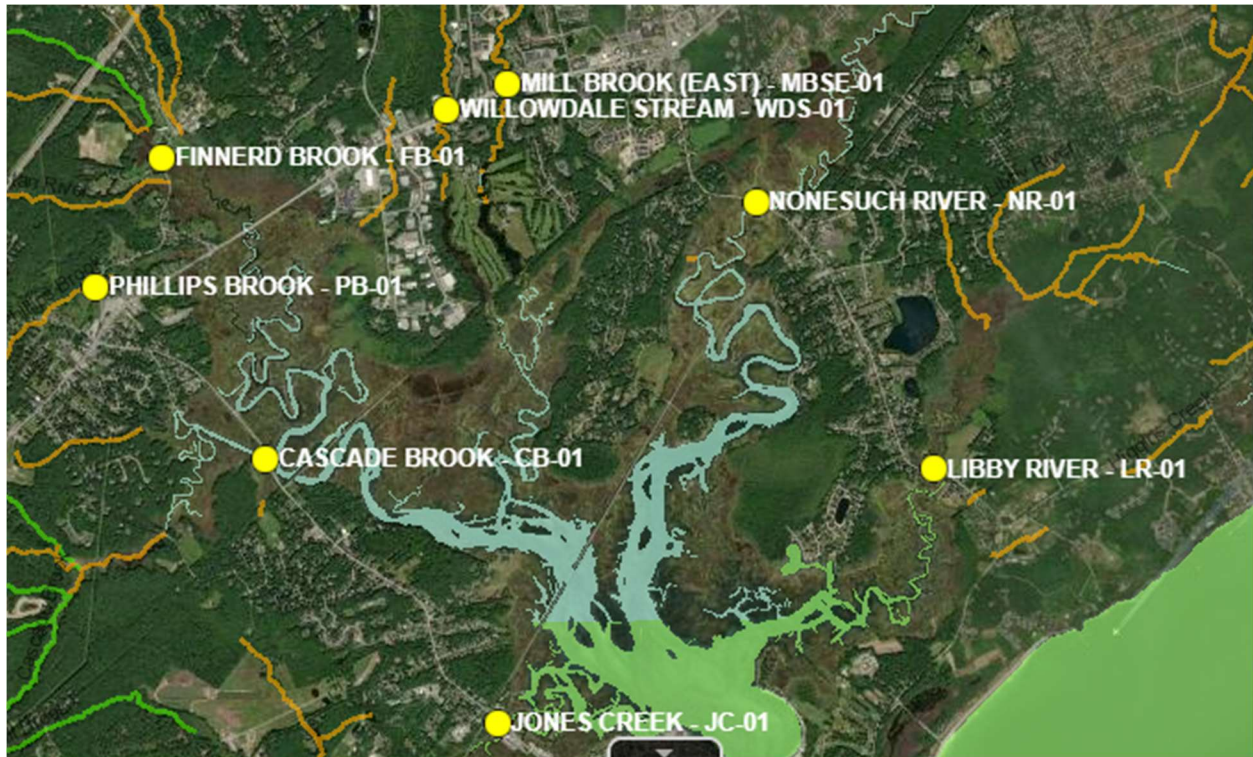
January 10, 2022

Synopsis: This report outlines findings over a three year period covering water quality monitoring efforts in the years 2019, 2020, and 2021. The water bodies that feed into the marsh were found to be overall healthy, although there is some concern for the low levels of dissolved oxygen in the tidal feeders and high levels of bacteria in most of the feeders. Fresh water feeders to the marsh were found to have somewhat high levels of bacteria and specific conductance, yet good levels of dissolved oxygen.

Methodology: Eight sites were initially identified as data collection centers based on the following criteria:

- A. Each site was to represent a major feed point to the marsh's water content
- B. Each site was to be easily accessible without impinging on any landowner's property.
- C. Each site should have a point where sampling was easily accomplished without the use of boats, waders, or other complex equipment.

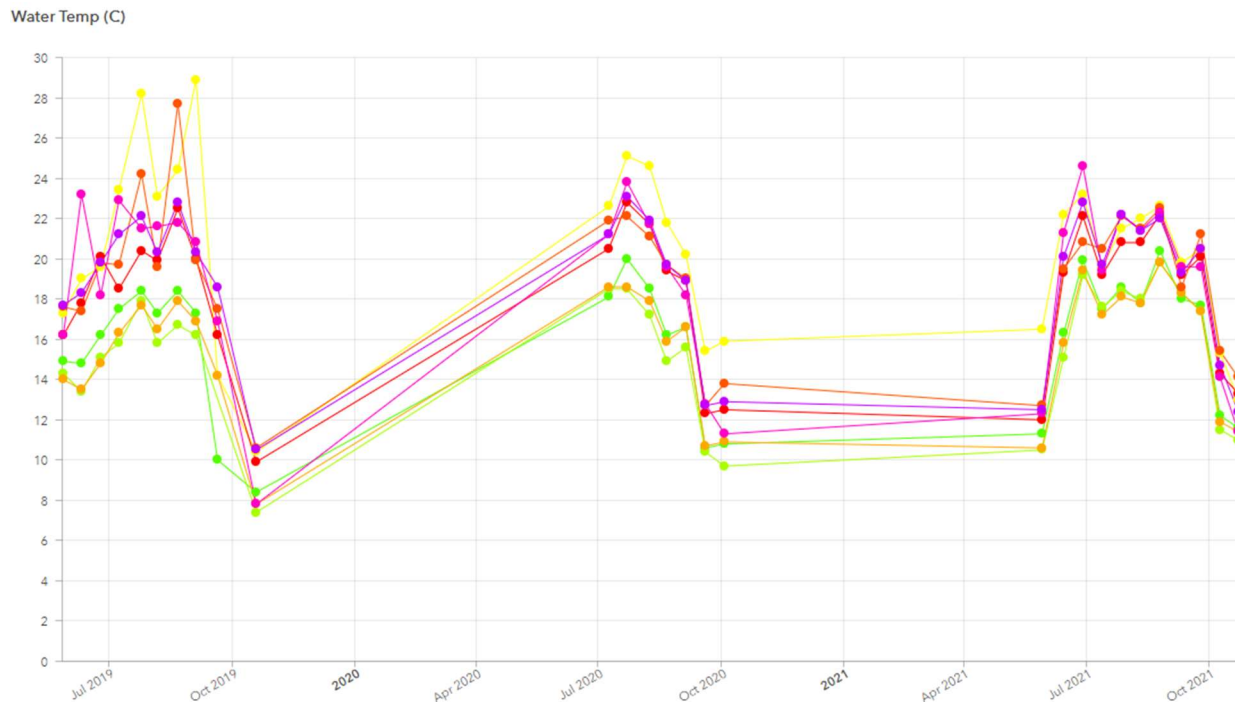
With this in mind, sites encircling the marsh were designated, GIS mapped by coordinates, and named with the cooperation of the Maine DEP. Thus collection points were identified and numbered on the Libby River (1), Nonesuch River(2), Mill Brook(3), Willowdale Stream(4), Finnerd Brook(5), Phillips Brook(6), Cascade Brook(7), and Jones Creek(8). These sites were coordinated with Maine DEP and this collection effort is part of the Maine DEP's Volunteer River Monitoring Program (VRMP). These sites can be seen in the map on the next page.



The data was collected every two weeks during the months of May through October, at 8 sites as marked on the map. Data was collected on dissolved oxygen, both percentage and mg/l; specific conductance; temperature; bacteria counts; as well as a number of observational characteristics such as water appearance, water level, tidal stage and odor. Dissolved oxygen, temperature, and spc were measured with a YSI-85 meter supplied by Maine DEP. Bacteria counts come from samples collected in whirl-pack bags by volunteer monitors, and analyzed by Katahdin Labs in Scarborough Maine. Sampling dates were chosen particularly so that tidal stage was as close to low tide as possible, and testing was conducted as early in the morning as was feasible, almost always between 8 AM and 10 AM. The early morning times were to minimize the effect of daily sunlight, which naturally produces dissolved oxygen in the water. Low tide was chosen so that a maximal amount of fresh water would be present in the tidal sites.

Data and Discussion:

- Here are data charts for water temperature and dissolved oxygen over 3 years. These charts were produced at the Maine VRMP Data Dashboard, which can be found [here](#).



The colors of the data points and connecting lines are coded by the following key, which applies to all charts:

Light Orange is for Mill Brook

Green is for Willowdale Stream

Olive is for Phillips Brook

Yellow is for Nonesuch River

Red is for Libby River

Purple is for Cascade Brook

Magenta is for Finnerd Brook

Dark Orange is for Jones Creek

The temperature chart shows the expected seasonal fluctuations; warmer water in the summer and colder in fall and spring. Significantly the freshest water sources are the coldest, and the source with the highest flow of water (Nonesuch) has the highest temperature overall. More brackish water sources (Jones Creek, Finnerd Brook, Libby River) have temperatures that

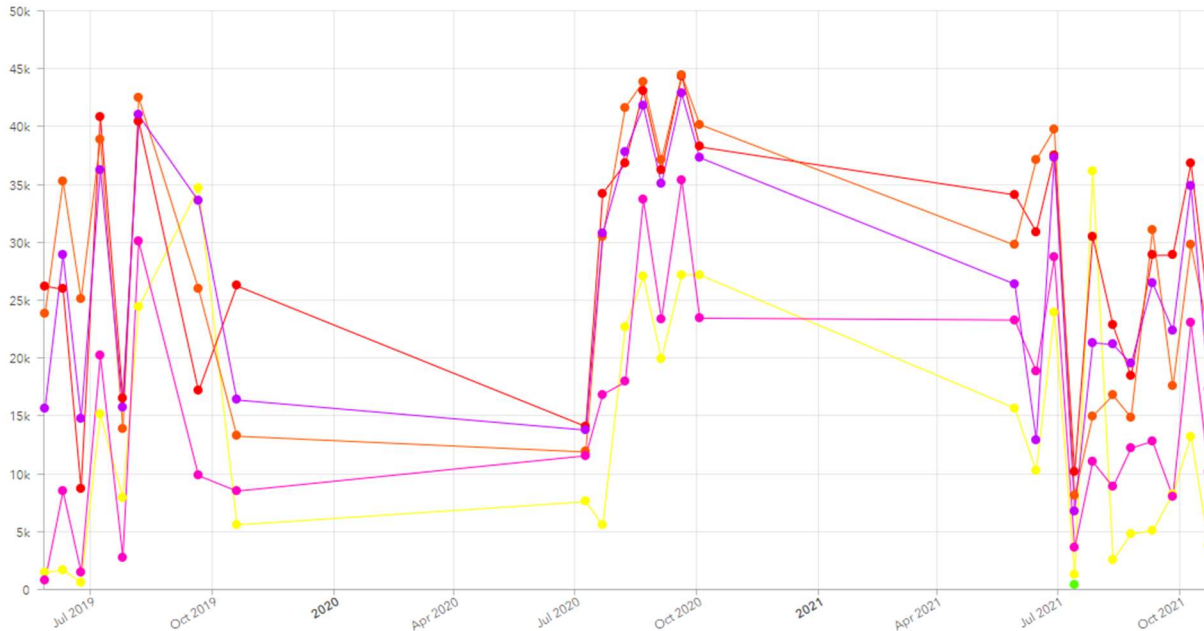
reflect the ocean temperatures more closely, and are overall higher than purely freshwater sites.



The dissolved oxygen chart shows that freshwater feeders have overall higher DO content than the salt water/brackish sources. Their levels seem to remain above the class A level as designated by the blue horizontal line on the chart, which indicates a healthy waterbody. The levels for the other sources are troublesome in that their levels are way below what would be considered healthy, even below the class C designation which is a minimum acceptable level.

II. Here are charts for specific conductance, separated into tidal and freshwater sources.

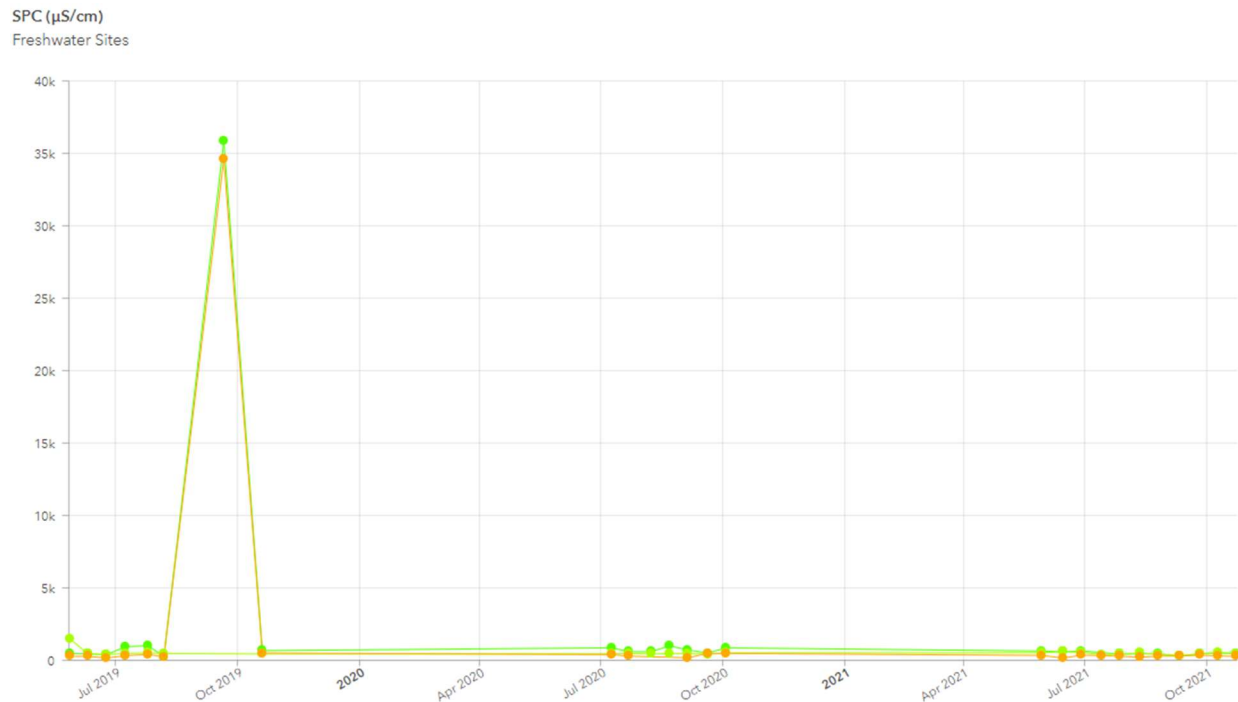
SPC ($\mu\text{S}/\text{cm}$)
Tidal Sites



These sites are tidal, and the spc reflects salinity. You can see that salinity for the Nonesuch River is overall lower, which reflects its larger discharge of freshwater than the other sources. Jones Creek, on the other hand, has the consistently highest salinity measurements, reflecting the low percentage of fresh water in its flow. The variations here between testing dates are more of a reflection of how close to low tide the readings were taken; the closer to low tide, the less saline the readings would be. A deeper dive into each testing date would be needed to verify this relationship.

The next chart is for the freshwater sites but there are some anomalous readings included which skew the charts. In this case the spc readings reflect the presence of contaminants such as heavy metals, salt runoff from roads, leakage from point sources, etc. Looking at the data site-by-site and testing event by event (you can get these at the VRMP site, but not on the charts seen here), one can see that Willowdale Stream has an overall higher level of spc than the other two sites. Interestingly enough Phillips

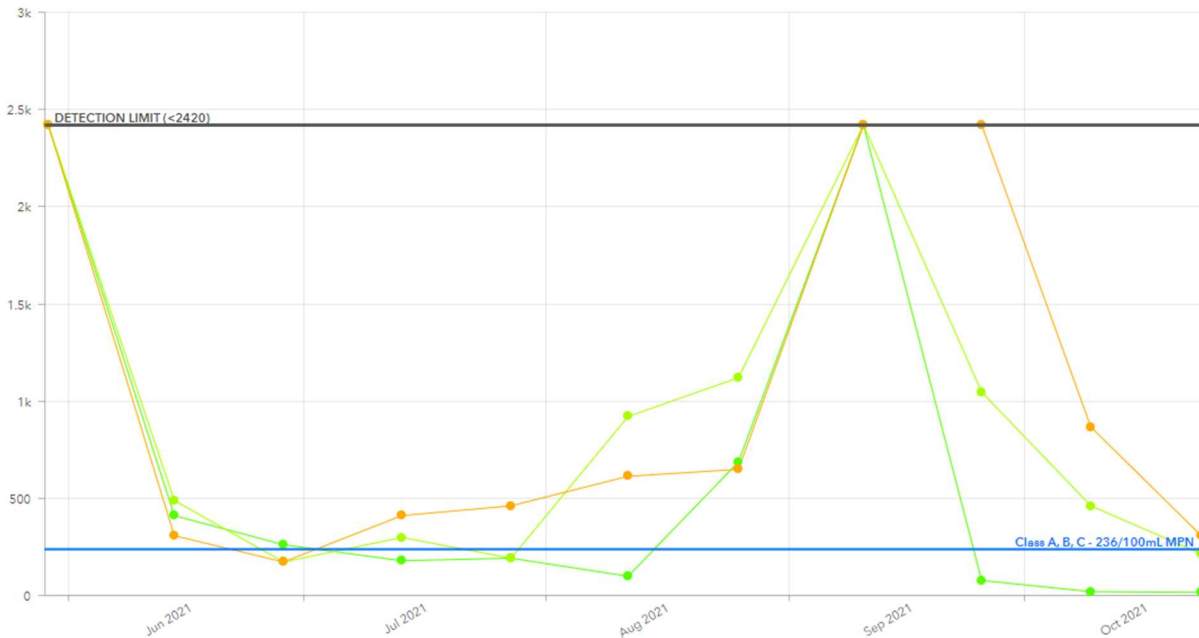
Brook, which is the subject of an investigation into its health by the DEP, does not seem to have the highest readings. For comparison, the EPA identifies levels of between 150 and 500 as indicators of a waterway that is healthy for aquatic life. Looking at the ranges of spc values for the three freshwater sampling sites, the readings vary from site to site. Mill brook readings are most acceptable, being between 170 and 400 for almost all readings. Phillips Brook readings are generally at the high end of the acceptable range, between 400 and 500, and sometimes in the 500-600 range. Willowdale Stream readings are often above the 500 level, indicating possible difficulties with this source. A more complete description of spc and its significance can be found [here](#).



- III. Here are two charts for bacteria content, e coli for the freshwater sites and enterococcus for the salt water sites. At the end of last season, after two years of testing for total fecal coliform, the Maine DEP informed us that it would be more useful to test for these specific bacteria in these specific environments, because these were universally accepted as standards and levels have been determined for acceptability in both environments. The problem with the total

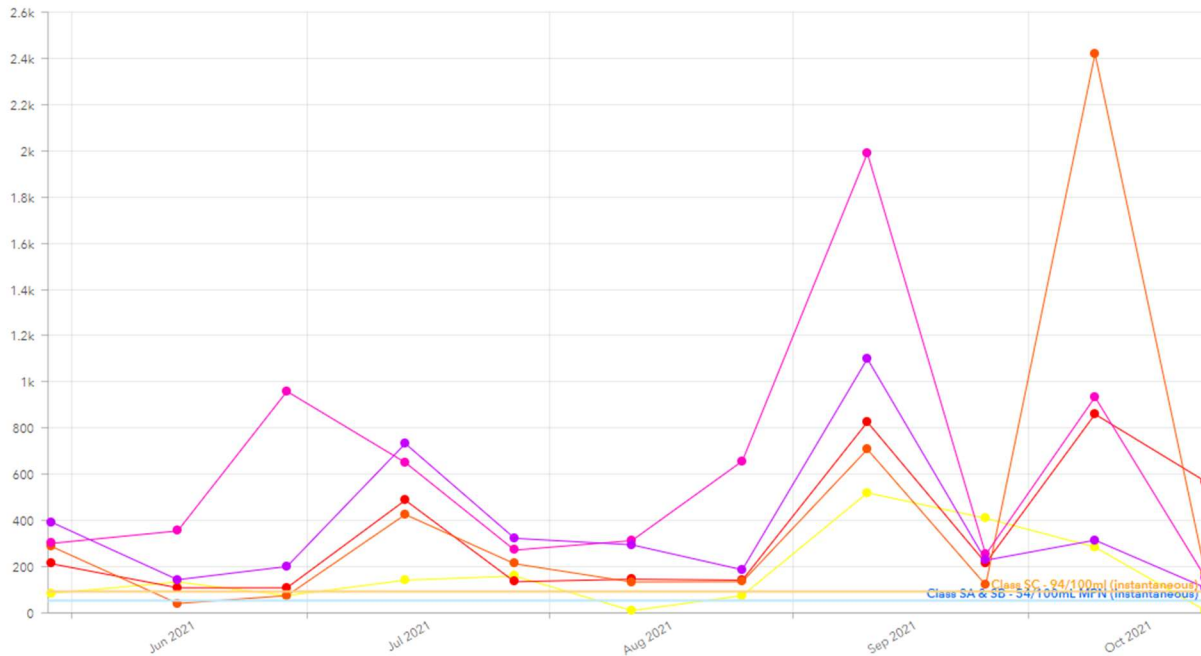
fecal coliform counts is that this sometimes includes factors such as runoff from leaves and animal feces, which are naturally occurring sources. This problem was explained in studies that were provided at previous board meetings. Thus data for only one season are presented here and on the VRMP site.

E. coli (MPN/100ml or CFU/100ml)



Here the acceptable level can clearly be seen as the blue horizontal line. While the levels vary and there is a huge spike in September, one can see that the Willowdale numbers are generally acceptable, while the numbers for both Mill Brook and Phillips Brook are generally above the acceptable level, which indicates possible problems with the watersheds. This is in agreement with previous studies of both Mill Brook (previously done by FOSM) and Phillips Brook (ongoing by DEP). Of interesting note is the fact that the spike occurred when there was a large rain storm the day before the testing date, and the water levels were unusually high. This could indicate a large amount of temporary runoff of sewage, or could be a sign of what happens naturally when water levels are high.

Enterococcus (MPN/100ml)



This chart shows the enterococcus levels for the salt water sources to the marsh. Of note is the fact that almost all readings are above the acceptable level as shown by the horizontal blue line. The one source that is below this line is the Nonesuch River, which is notably less saline and more fresh water. Since enterococcus is a salt water bacterium, this is not surprising. The e coli levels in this waterway may have been found to be high had they been tested, due to the fresh water content.

IV. Conclusions:

While there are some reasons for optimism for the overall health of the marsh's water sources in the dissolved oxygen levels of the water, there are also some troubling signs. As more data are collected, these patterns will become more apparent and can be addressed in more detail. Particularly, more data is needed on bacteria levels over time to determine the severity of the issue.