



OARS Bacteria Monitoring Results - 2022

Updated Nov. 2, 2022

Following is a summary of OARS' monitoring results for 2022 for *E. coli* bacteria at the core 6 locations in the Assabet, Sudbury, and Concord rivers, plus one in River Meadow Brook. Thanks to the Greater Lowell Community Foundation for supporting this monitoring.

2022 Results (May 16, 2022 – September 12, 2022):

| Site # | Description | River | Samples | Exceed-ences | % Exceeded | 2022 Geo-Mean | 2021 Geo-Mean | 2020 Geo-Mean | 2019 Geo-Mean |
|---------|-----------------------------|--------------|---------|--------------|------------|---------------|---------------|---------------|---------------|
| ABT-077 | USGS gage, Maynard | Assabet | 9 | 5 | 56% | 193 | 164 | 289 | 121 |
| ABT-162 | Cox St, Hudson | Assabet | 9 | 1 | 11% | 123 | 119 | 203 | 161 |
| CND-009 | Rogers St Bridge, Lowell | Concord | 9 | 3 | 33% | 203 | 153 | 216 | 147 |
| CND-093 | Rt 4 Carter Ave, Billerica | Concord | 9 | 0 | 0% | 9 | | | |
| RVM-001 | Lawrence St, Lowell | River Meadow | 9 | 9 | 100% | 504 | 412 | 427 | |
| SUD-137 | Little Farms Rd, Framingham | Sudbury | 9 | 0 | 0% | 102 | | | |
| SUD-236 | Rt 135, Ashland | Sudbury | 8 | 4 | 50% | 201 | 169 | 348 | 151 |

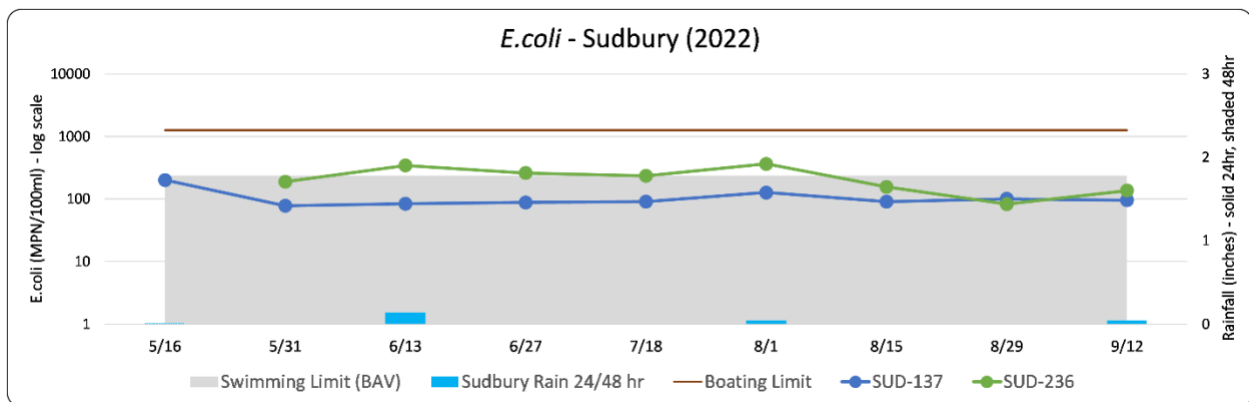
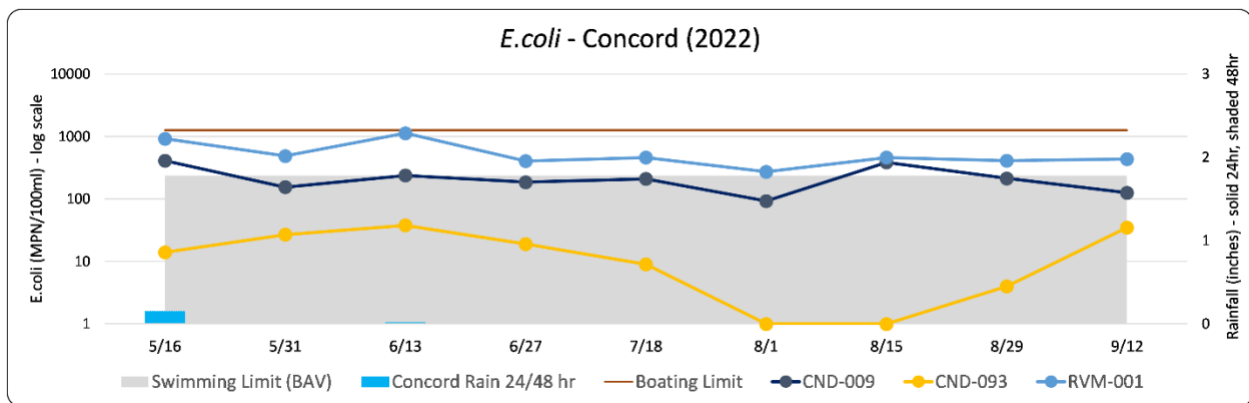
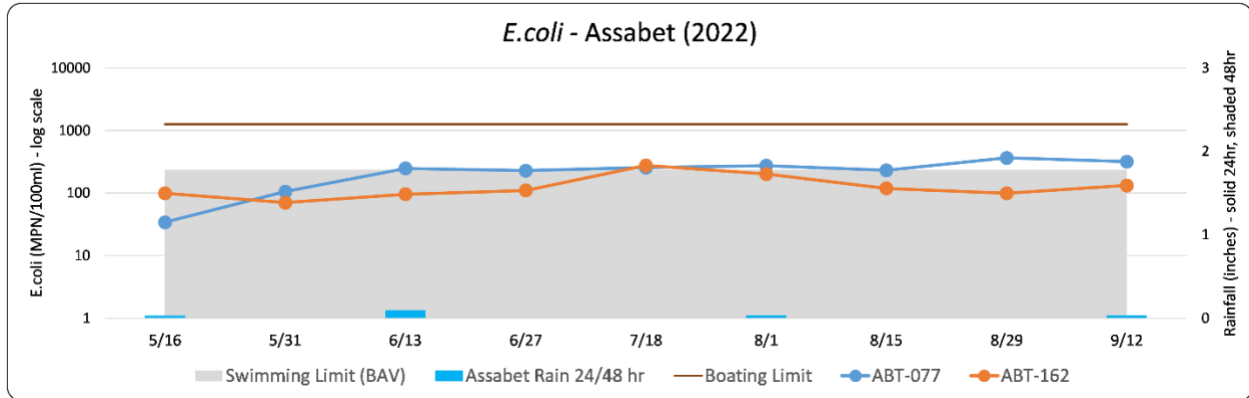
*(Pink shading designates > 25% exceedance of BAV threshold or swimming geo-mean exceedance.)
(See graphs of data below for details and explanations of thresholds.)*

Our 2022 Bacteria monitoring highlighted the same sites of concern as previous years. The Ashland, Lowell, and Maynard sites all had seasonal geometric means above the swimming threshold of 126 CFU/100 ml. The Hudson site was close to this limit, but this site has a history of low bacteria levels in dry weather and high bacteria levels in wet weather, indicating a dominance of storm-water surface pollution. This year was very dry, so Hudson was consistent with the historical pattern, though it is not clear what caused the spike on July 18th. The fact that Ashland, Lowell, and Maynard are all showing consistent high bacteria levels in dry weather indicates a high probability of sanitary sewer contamination.

This year we moved two sites in order to expand our monitoring scope. The Concord River site at Rt. 225 was always very clean (geo-mean between 27 and 40 CFU/100 ml), so we moved it downriver to Rt. 4. The new site has turned out to be even cleaner, with a 2022 geo-mean of only 9 CFU/100 ml. Two sampling events at this site during the middle of the drought returned results at the lowest possible detection level. The Sudbury River site at Rt. 20 was also almost always clean (geo-mean between 33 and 113), so we moved it upriver to Little Farms Rd. This new site has also had consistent low bacteria levels, with a 2022 geo-mean of 102 CFU/100 ml.

We are also monitoring one site in River Meadow Brook as part of our special study of bacterial contamination there. Bacteria levels this year in River Meadow Brook remained very high. Over the last two years, we identified several hot spots along the brook where contaminants seem to be entering. This year, we took our study two steps further. We conducted qPCR DNA analysis on two samples to find out whether the *E. coli* bacteria is from humans or animals. Preliminary results confirmed that there is human DNA in the water samples. We also conducted a survey for detergents in pipes emptying into River Meadow Brook. This survey identified three pipes with sanitary sewage signals. A more detailed review of this study will be issued separately.

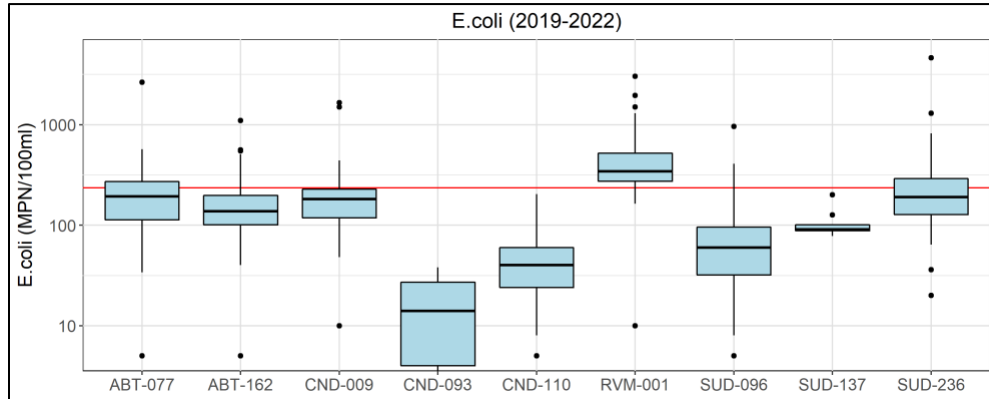
Graphs of Data by River (2022):



E. coli is used as an indicator of fecal contamination in water bodies, and the EPA has defined safety thresholds for recreational swimming and boating. The Beach Action Value (BAV) for single samples is 235 CFU/100 ml. The swimming threshold for the geometric mean of a series of samples over a 30 to 90-day period is 126 CFU/100 ml, and no more than 10% of samples can exceed 410 CFU/100 ml. Bacteria data are normally analyzed on a logarithmic scale because bacteria multiply exponentially. Culturable bacteria can be enumerated in either CFU/100 ml (Colony Forming Units) or MPN/100 ml (Most Probable Number), which are statistically interchangeable.

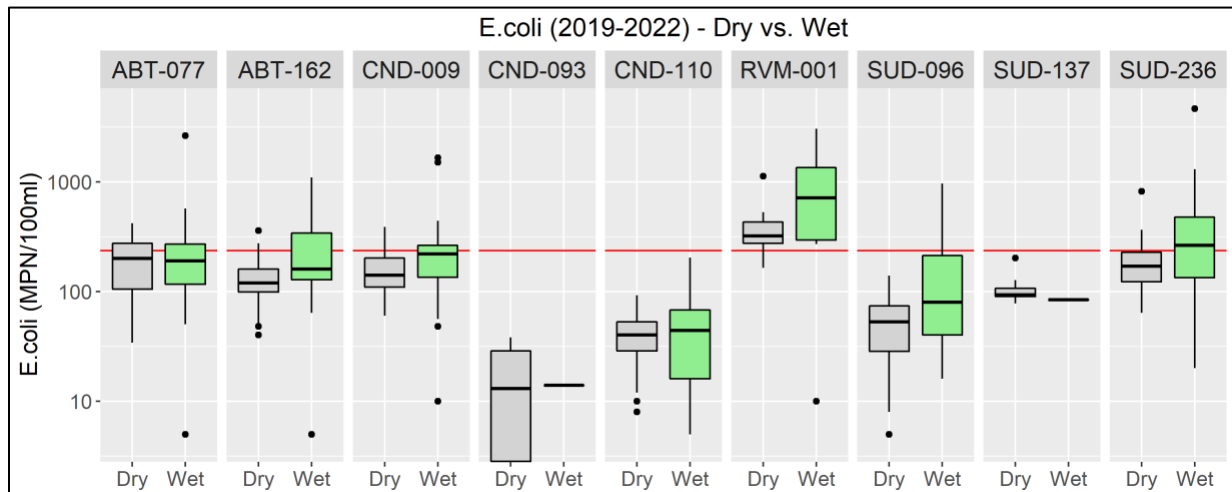
Full Data since 2019:

The following graph summarizes all OARS *E. coli* results since 2019 by site. The boxplots depict the middle 50% of the data, and the upper and lower whisker lines depict the upper and lower 25% of the data. The points represent outliers. With the exception of a few outliers, all of the sites consistently tend to a narrow range of bacterial contamination. Sites CND-093, CND-110, SUD-096, and SUD-137 have all been consistently below the BAV swimming threshold (red line). Site RVM-001 is almost always above the BAV threshold. The remaining sites tend to be near the BAV threshold depending on conditions. This by-site stability helps us identify which sites to focus more studies on and allows us to move to new sampling locations without being required to sample the original locations every year.



Dry vs. Wet Weather:

The following graph groups *E. coli* results based on the previous 48-hour precipitation. Wet weather is defined as 48-hour precipitation exceeding 0.10 inches, and dry weather is less than 0.10 inches. When dry weather *E. coli* is high, such as at sites ABT-077 and RVM-001, there is most likely a sanitary sewer source of bacteria that provides flow during all weather conditions. When *E. coli* is only high in wet weather, such as at site SUD-096, the bacteria source is most likely from surface runoff. Sites ABT-162, CND-009, and SUD-236 have definite wet-weather signals, but the dry-weather results are also high enough to raise concerns. In the case of CND-009, the wet-weather signal could be reflecting the high-flows coming from River Meadow Brook (RVM-001), which enters the Concord just upstream of CND-009 and has confirmed sewer contamination. This wet vs. dry analysis helps us know what types of contamination sources to look for.



Map of Mainstem Sampling Locations:

