# Horsepen Creek 2020 Water Quality Monitoring Summary Report

Horsepen Creek, a tributary of the St. Mary's River in Camden County, Georgia, was identified as having high levels of fecal coliform bacteria in 2015. These high levels were determined to be from non-point source pollution runoff from failing septic systems in the community through which the creek runs. In 2017, the EPA awarded Camden County 319 Grant funding to inspect, pump, and replace failing septic systems in the bacterially impaired Horsepen Creek watershed in the Browntown community. As a partner organization, the St. Marys Riverkeeper began bacterial water quality sampling in Horsepen Creek in December 2017 in order to monitor the health of the watershed throughout the septic system replacement process.

The St. Marys Riverkeeper samples at 5 sites (figure 1) designated during previous monitoring (sites 1-5) by the University of Georgia within the Horsepen Creek watershed, and added two sites on the St. Mary's River mainstem (sites 6 and 7). These sites are sampled once per month at the same time of day but at varying tidal stages. Samples are tested for *Escherichia coli* levels in accordance with Georgia Adopt a Stream bacterial sampling protocols. *E. coli*, a species of fecal coliform, is considered a good indicator of the presence of pathogens (Edberg et al. 2000). We collect one sample per site using Whirl-Pak baggies, which are then sealed and transferred to our lab in a cooler with ice. We also collect observational data such as tidal stage, recent rainfall, water clarity, and surface water conditions. Using a micropipette and 3M petrifilm plates, we plate three 100ml plates per sample. Along with a control using distilled water, we incubate these plates for 24 hours at 35°C. The number of *E. coli* bacteria colony forming units (cfu) per 100 ml are counted, and averaged for each sample.

Figure 1. Horsepen Creek sample sites.
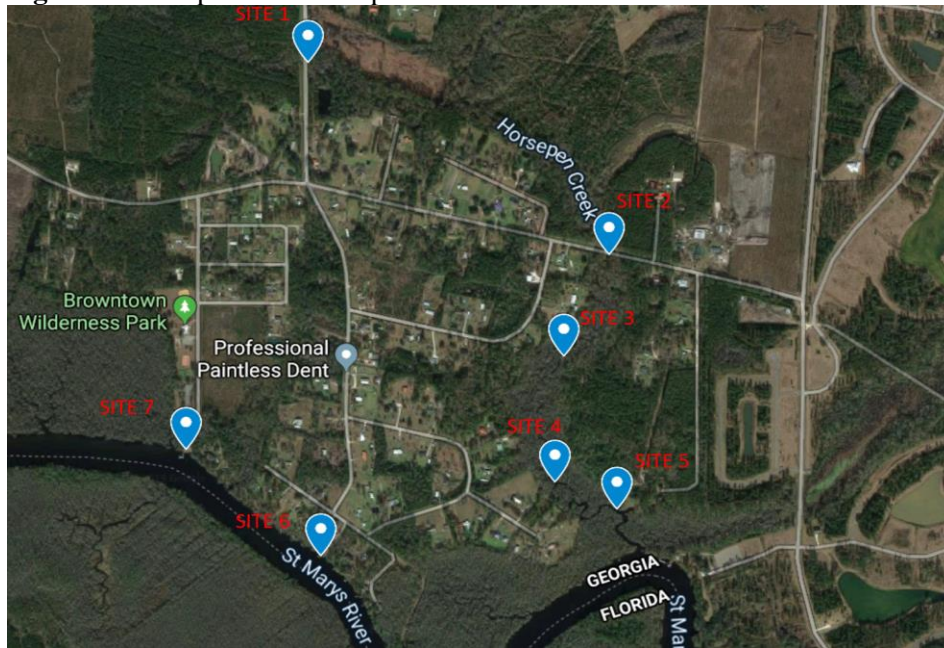
During initial monitoring in 2018, we sampled once per week for a 30 day period in both January and July in order to obtain initial winter and summer season site geometric means (figure 2). Between these two sampling periods, the Camden county Department of Health began inspecting and pumping septic systems. We found no significant difference in mean *E. coli* cfu/100 ml counted in the winter season compared with mean *E. coli* counted in the summer season. The highest individual sample count in winter was 2266 cfu/100 ml, and the highest individual sample count in summer was 600 cfu/100 ml. Water temperatures of sites in winter ranged from 3 to 13°C, while water temperatures of sites in summer ranged from 24 to 28°C. January 2018 rainfall at the nearest rainfall station was 3.64 inches, while July 2018

rainfall was 8.86 inches (weather.gov). E. coli levels are affected by both rainfall and water temperature (Medema, Bahar, and Schets 1997). Higher water temperatures increase the replication rate of bacteria, and more rainfall allows increased runoff into streams. Because we had both higher temperatures and more rainfall in July, we would expect to see higher counts. There was no significant difference in winter and summer counts, however, indicating that septic system pumping that began in the Browntown community in April 2018 mitigated fecal coliform levels in Horsepen Creek.

Figure 2. 2018 Summer and Winter geometric means.

Cfu counts remained lower throughout much of the summer in 2018, in spite of multiple precipitation events. 2018 was a very wet precipitation year, and the Browntown community has a high water table. As a result, Septic systems were delayed in being replaced following inspection and pumping. In the latter half of 2018, coliform counts began to rise again, particularly near site 3 (figure 3). Site 3 was the closest sample site to a septic tank deemed to be highest priority for replacement after inspections occurred. Once this septic tank was replaced in winter 2019, cfu results immediately dropped again.

Figure 3. Horsepen Creek bacterial results 2018-2020.

In summer 2019, we did see a small uptick in counts following septic replacement, showing that there was still some fecal contamination (figure 4). Additionally 2019 was a very dry year with less non-point runoff into the watershed. Site 1 was dry throughout much of the summer and we were unable to sample there. Camden County identified 20 additional septic systems to replace in 2020, and completed all but 2 replacements as of August 2020. The replacement of these additional septic systems does seem reflected in our results, which are lower this summer despite having higher average precipitation. Because of the pandemic, we can assume that additional stress was added to these septic systems during quarantine, but that stress is not reflected in our results. Aside from one sample from a low water site 1 in September, all 2020 samples for Horsepen Creek were below 410 cfu/ 100 ml, the state level for which designated recreational waterbodies should be below.

Figure 4. Horsepen Creek results following completion of first phase of septic replacement.
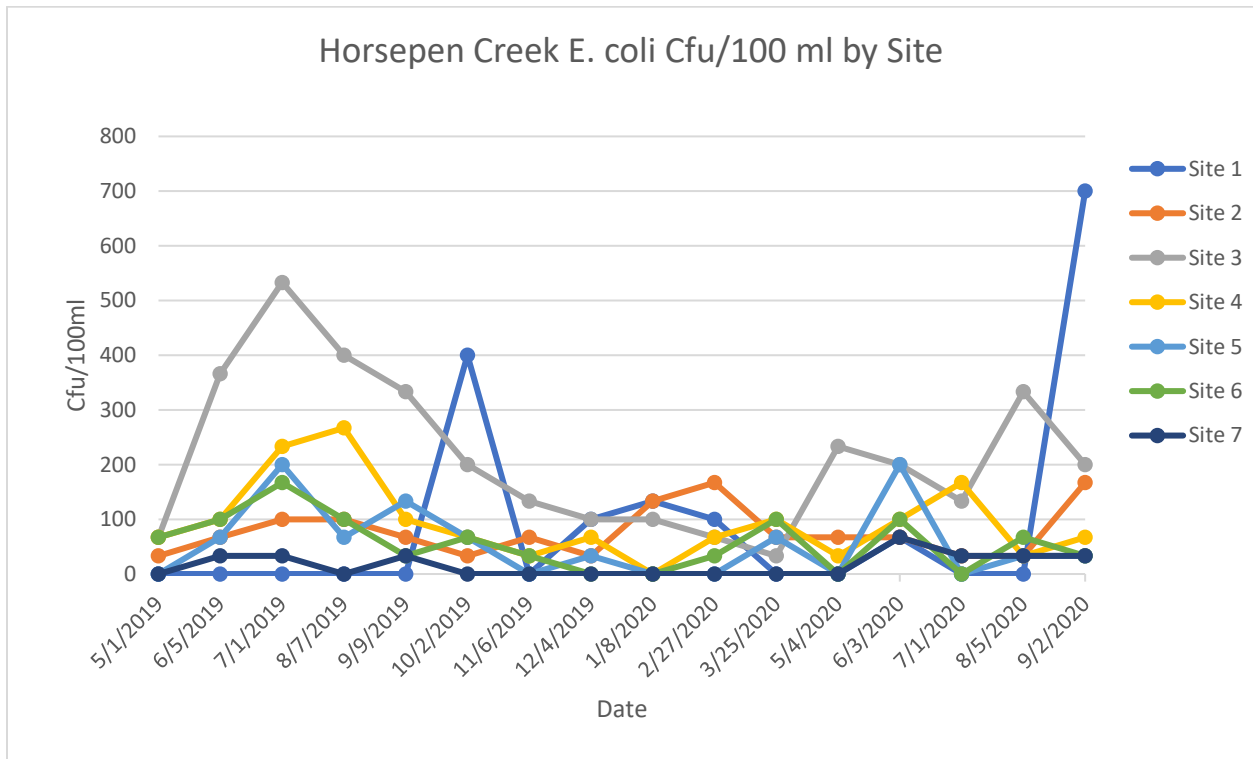
We have also seen an improvement in observational data results. Water clarity visually improved over time, particularly at the furthest upstream site, site 1. This site often had visible indicators showing poor water quality, including high levels of algae, high turbidity and sedimentation, and surface film. We no longer see visual indicators of poor water quality at this site, and in January 2020 we recorded macroinvertebrates for the first time at this site. Macroinvertebrates are considered indicator species (Gaufin, 1973), and are sensitive to poor water quality. We observed two crayfish (Procambarus spp.) at the site, indicating that the creek supports sensitive species.

References

Gaufin, A.R., 1973. Use of aquatic invertebrates in the assessment of water quality. In *Biological methods for the assessment of water quality*. ASTM International.

Edberg, S.C.L., Rice, E.W., Karlin, R.J. and Allen, M.J., 2000. Escherichia coli: the best biological drinking water indicator for public health protection. *Journal of Applied Microbiology*, *88*(S1), pp.106S-116S.

Medema, G.J., Bahar, M. and Schets, F.M., 1997. Survival of Cryptosporidium parvum, Escherichia coli, faecal enterococci and Clostridium perfringens in river water: influence of temperature and autochthonous microorganisms. *Water Science and Technology*, *35*(11-12), pp.249-252.