April 21, 2022 Report to Little Compton Town Council

Little Compton Conservation Commission Study
"Do We Have Enough Water in Little Compton?"

In 2021, the Little Compton Conservation Commission continued its multi-year study to better understand the Town's freshwater resources.

Background

Little Compton's Comprehensive Plan, last updated in 2018, highlights the importance of protecting our freshwater resources. Such protection is critical, given our town's reliance on private wells and individual septic systems, and the prohibitive cost of installing public systems.

Further, surveys conducted among residents over the years have consistently ranked water protection and availability as the most important Town considerations. Yet before the Conservation Commission's study, there had been no systematic effort to try to understand the quantity of freshwater available in our wells for domestic and agricultural needs.

Conservation Commission Study

In collaboration with URI researchers, Dr. Thomas Boving and Jeeban Panthi, the Conservation Commission launched a multi-year research project in 2019 to better understand our freshwater resources. Little Compton sits almost entirely atop fractured bedrock, a geological condition that complicates efforts to predict the quantity of water available to our residents and farms. However, changes in water quality can serve as an indication of whether we have enough water for current use and future needs.

In our fractured bedrock setting, we do not have a water-laden aquifer from which to pull, nor is there water coming from "elsewhere" to feed our wells. Instead, whatever water we have available to us comes from precipitation (rain and snow) that has worked its way down into the cracks and fissures of our bedrock, eventually seeping into our wells. When the amount of precipitation changes, the amount of freshwater available to us changes in relatively short order.

In the summer of 2021, we carried out the third year of our study, replicating the well sampling procedure that we had done in 2019 and 2020. For 2021, we sampled the wells of 159 Town residents, slightly more than we had done in 2020.

We measured the well water samples for their electrical conductivity, a simple and inexpensive way to estimate the amount of dissolved solids in the water. High levels of Total Dissolved Solids (TDS) in drinking water could indicate the presence of salt water, septic system residue, or run-off from fertilizers. By monitoring changes in TDS results over a period of years, we will better understand the relationship between precipitation and groundwater quality, and be able to track any evidence of water quality degradation, which could signal water quantity concerns.

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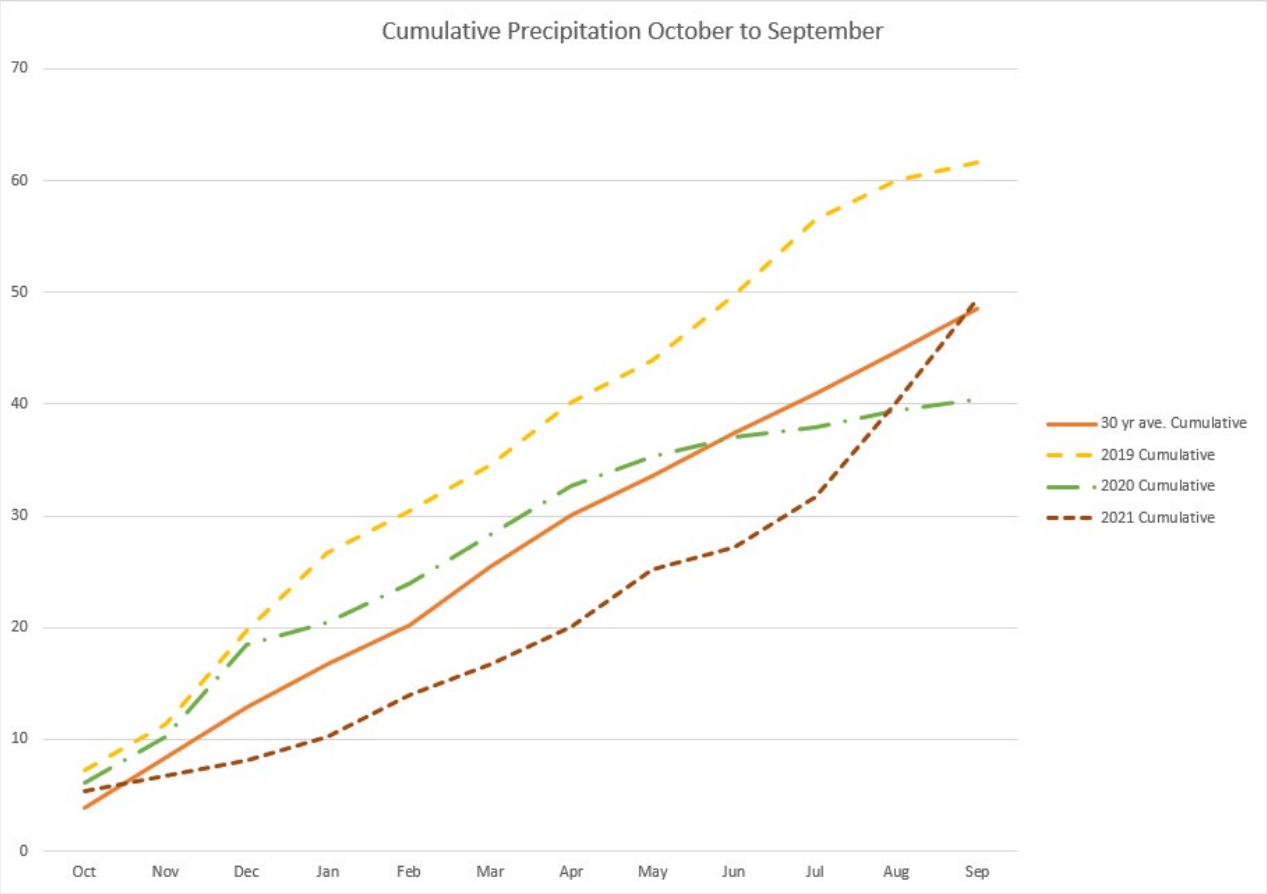
What Do The Study's Data From 2019 to 2021 Show Us?

First and foremost, we are grateful to the 159 residents who participated in our 2021 study, and to the many others whose wells we couldn't include due to capacity constraints. For the second year in a row, we reached our goal of sampling well water from 10% of Little Compton's households, geographically distributed all across town.

With three years of study now behind us, we can begin to form some insights and draw some hypotheses about our natural water systems here in Little Compton. Future study will allow us to challenge and confirm that thinking.

As the chart below shows, the last three years have brought varying degrees of precipitation to Little Compton: 2019 was comparatively wet, 2020 was dry and 2021 was more or less in line with our Thirty Year average of precipitation:



This precipitation variability has proven to be a valuable study condition as it allows us to see in real time the impact that more and less precipitation has on Total Dissolved Solids (TDS) in our well water.

Based on three years of TDS levels, our very first take-away is just how quickly this measurement moves in relation to precipitation levels. There appears to be very little lag time between a year's precipitation activity and the resulting TDS levels. In fact, with some of our well measurements taken in July, and others in September, we see differences in TDS within months.

The chart below shows precipitation and TDS by year, clearly indicating that the more it rains and snows, the lower the levels of Total Dissolved Solids.

Year	Average TDS (ppm)	Annual Precipitation, Oct to Sep (Inches)
2019	196	61.6"
2020	271	40.5"
2021	248	49.4"

This happens for two major reasons. First, the same fissures and cracks in our bedrock that feed freshwater to our wells sometime also connect to the salt water in the ocean and bay that surround Little Compton. When precipitation has been plentiful, there is sufficient freshwater in the cracks and fissures to hold back the saltwater from reaching our wells. However, during periods of low precipitation, when there is less freshwater, the saltwater is able to advance further into the fissures and cracks, and reach wells in close proximity to the coast. This is known as "salt water intrusion". Unfortunately, freshwater demand also rises in periods of drought, as homes and farms use more water for irrigation (lawns and crops) and recreation (pools), thus increasing the chance of salt water intrusion.

Second, during periods of low precipitation, there is less freshwater to dilute the impact of our septic system leach fields, and of home and farm fertilizer use. Thus, as precipitation ebbs, the main drivers of Dissolved Solids increase: sea salt, septic residue and fertilizer.

To highlight the impact of precipitation activity on the level of Total Dissolved Solids, the maps below show, through different colors, the measurements across town for TDS for each of the three years of our study: 2019, 2020 and 2021. Again, remember that 2019 was wet, 2020 dry and 2021 close to normal:

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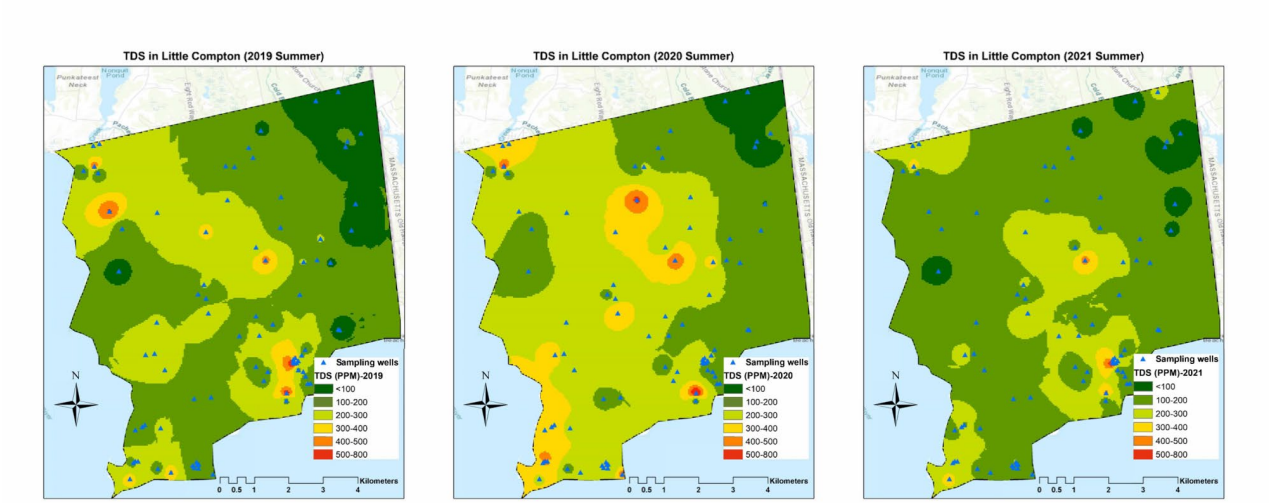

A few things to note in these maps. First, we clearly see lower levels of Total Dissolved Solids across town in both 2019 and 2021, the two wetter years of the three. Second, we see in each of the maps small areas of very high TDS readings. These elevated measurements are usually signs of individual wells adversely affected by a highly local source of TDS or contaminates. Third, and finally, we note that the low-lying area of Sakonnet Point shows higher TDS levels than other areas in town. This, we surmise, is due to saltwater reaching wells near the coast. In particular, the driest year, 2020, resulted in the highest TDS levels around the harbor at Sakonnet Point, supporting our hypothesis that there was less freshwater available to hold back seawater from infiltrating wells.

Are We Able to Draw Any Conclusions at this Early Stage?

Our three years of results seem to confirm just how critical precipitation is to the amount of freshwater we have available for use across town. While that is not a surprise, the seeming speed with which freshwater levels respond to annual precipitation is.

If we had large reserves of freshwater held in aquifers below us, then we would expect that it would take annual precipitation longer to effect TDS changes in our drinking water. The fact that precipitation levels so quickly affect TDS readings is indication that our freshwater resources, particularly near the coast, are finite in nature. It hints at our vulnerability to drought and, in coastal locations, to saltwater intrusion that will be exacerbated by sea level rise.

While climate change models have forecasted that precipitation in the Northeastern United States is likely to increase, the benefits to Little Compton of more rain may not be noticeable. Models

suggest that increased precipitation will come as heavier rains over short periods of time, with excess rainwater running off to the ocean and bay before it has a chance to percolate into our bedrock.

Further, our summers are getting hotter, and longer. With population swelling around Town at the same time, water use is at its highest. If we were to see several dry years in a row, it is possible that wells near the coast would suffer from saltwater intrusion.

What Comes Next?

We do recommend that homeowners test their well water periodically. Continued diligence will help protect water quality. Please contact your plumber, or Alyson McCann at URI Cooperative Extension alyson@uri.edu to get more information on private well testing (https://web.uri.edu/safewater/private-well-testing-and-protection/).

With results from three years now in place, we plan to continue our TDS sampling program in 2022. With repeated sampling, we can better gauge if changes in the results indicate evidence of longer-term water quality degradation, and thus water quantity concerns.

Our 2022 program will be conducted over the upcoming summer months. If you participated in 2019, 2020 or 2021, we will contact you for your permission to again sample your well. If you have given us your name in the past, but we have been unable to include you in the study to date, we will make every effort to include your well this year, but can make no promises. If you are totally new to the study, we ask that you go to our website https://littlecomptonwaterstudy.com/ where you will find a link to complete a short survey.