

3. Great Pond Non-Traditional Nitrogen and Wastewater Management Technologies Update

3.1. Introduction

The following section has been written by Science Wares Inc. on behalf of the WQMC to document the non-traditional nitrogen and wastewater management technologies currently being demonstrated/piloted in the Town of Falmouth. This information was provided to GHD by the Town for inclusion in this Report.

The February 2020 Secretary's Certificate issued to the Town of Falmouth on the "Notice of Project Change for the Comprehensive Wastewater Management Plan and Targeted Watershed Management Plan – South Coast Embayments and West Falmouth Harbor" recognized the efforts the Town of Falmouth had made in evaluating and piloting nitrogen removal measures to improve water quality in its coastal pond watersheds. The Secretary's Certificate also required the Town of Falmouth to provide additional information by December 2022 on the implementation of various pilot projects outlined in the CWMP. This section is intended to provide that required additional information.

The primary funding for these investigations came from Article 17, a bond issue for \$2.77 million passed by Town Meeting and the voters in 2011. The intent was to gather information for a comprehensive analysis of options and alternatives to conventional sewers. The article was purposely broad in scope as to on-site demonstrations and pilot projects. Additional funding supporting several of the alternative projects was awarded through the Environmental Protection Agency's (EPA) Southern New England Program, and the Air Force Center for Environmental Excellence mitigation funds, totaling over \$500,000 since June 2019.

The sections listed below summarize the information that has been gathered on various projects and nitrogen-reduction strategies during the past three years:

- 3.2 Shellfish Aquaculture
- 3.3 Permeable Reactive Barriers (PRBs)
- 3.4 Eco-toilets
- 3.5 Stormwater Management
- 3.6 Fertilizer Management
- 3.7 Potential Watershed Modifications for Increased Nitrogen Attenuation
- 3.8 Measuring the Impacts of Sewering on Little Pond Water Quality
- 3.9 MassDEP Provisionally Approved Innovative / Alternative Septic Systems

3.2. Shellfish Aquaculture

Using shellfish to reduce nitrogen concentrations is a non-traditional approach for improving estuarine water quality. Oysters (*Crassostrea virginica*) have been used because they grow rapidly, typically growing from seed to a harvestable (and marketable) size in less than two years. Pilot shellfish projects continue to show beneficial results for using shellfish to reduce nitrogen concentrations as a means for improving water quality.

Town of Falmouth projects that have concluded since 2019 include the examination of oyster aquaculture growing and overwintering strategies to maximize survival and growth potential, evaluation of denitrification rates in the sediments in Bournes Pond (Appendix 3.1), Little Pond and Waquoit Bay (Appendix 3.2), and evaluating the analytical technique to quantitatively estimate the nitrogen sequestered by shellfish growth.

These projects have demonstrated that large numbers of oysters can be successfully grown in floating gear in the Town of Falmouth's estuaries, while producing measurable improvements in water quality in near-field waters. The

projects have also suggested that the accumulation of oyster waste products on nearby sediments can lead to increased rates of denitrification in these sediments.

In West Falmouth Harbor the ongoing shellfish initiative to re-establish a self-sustaining oyster reef was initiated in 2014 and was most recently surveyed in 2021. Survey results indicate the reef has become well established and continues to thrive.

In the past three years the Town of Falmouth has utilized the Water Quality Management Committee (WQMC), the Department of Marine and Environmental Services (MES), and other resources to develop and implement a contractor pilot program in Eel River in Waquoit Bay. The program contracts growers who are able to sell shellfish commercially, with the idea that this revenue can potentially more than cover the cost of seed, labor, and materials required in using the shellfish to remove nitrogen from these impaired estuaries.

Three sites that support 20,000 sq. ft. of floating gear were identified in Eel River adjacent to Washburn Island and were permitted with contractors selected by the Town in 2019. In its current program design as outlined in the Request for Statements of Qualifications (Appendix 3.3), the Town manages the aquaculture licenses for each of the sites. The private growers are responsible for purchasing, transporting, installing, maintaining, and harvesting the shellfish. The growers are also responsible for providing any gear needed to implement the project according to town specifications. The Town has required the exclusive use of floating gear. The Town of Falmouth has made floating bags, floating working spaces (8' x 20'), upwellers, overwintering space, and gear storage space available for lease to the contracted growers. With the revenues generated from the leasing of town-owned resources for the program, the Town plans to increase its municipal propagation efforts and expand its aquaculture program.

In addition to the growing requirements, the program requires that the growers produce a minimum of 18,600 kg of net increase in harvest weight of oysters over the time that the oysters are grown in the Eel River site annually (see Appendix 3.3). Stocking density specifications for the sites were designed to fully utilize each site with 25% of the area devoted to first year oysters and the remaining 75% for second year oysters that will be harvested at the end of the season. Based on the stocking densities laid out in the program design, under normal conditions, a minimum of 279,000 oysters should be available for harvesting on an annual basis from each 0.5-acre site. To ensure compliance with harvest weight requirement, the growers are required to report the deployment and harvest weights of the oysters each season and provide samples to the town for independent analysis of nitrogen content to ensure a target nitrogen removal goal is being met. Based on municipal propagation data from various sites in Falmouth, the target for nitrogen removal per acre is 130 kg N/yr and is expected to be attainable by any commercial grower when following the draft policy on aquaculture within the estuaries.

In 2021, the first year of full-scale deployment, a total of 635,150 oysters were landed. One grower exceeded the target while the other two contracted growers did not fully utilize the specified gear as detailed, and their oyster landings were below the target. Those growers were instructed to make necessary alterations for the 2022 growing season to ensure their harvest meets the Town's target. Overall, the estimated total nitrogen removal by the Eel River pilot project in 2021 was 126 kg, 70% of the conservative target for shellfish uptake being used in the compliance plans. The 2021 removal is equivalent to sewerage approximately 25 homes using an average loading rate of 5.0 kg N/yr, while the potential for when the growing target is achieved is equivalent to 36 residential sewer connections.

Nitrogen Removal by Oysters in Gear 2018 Falmouth Municipal Propagation

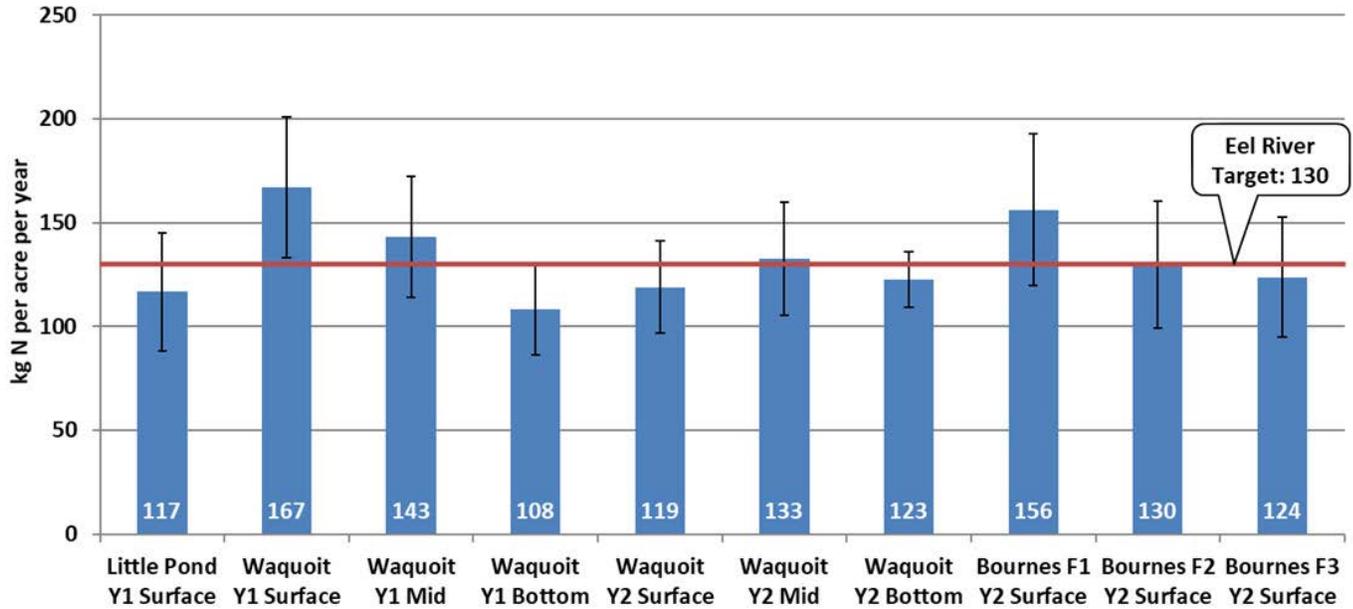


Figure 3.1 Summary of Nitrogen Removal Measurements Made by MES During 2018

With the initial success of the Aquaculture Contractor Pilot Program demonstrated in 2020 and 2021, MES has conducted initial shellfish surveys in Great Pond to determine areas and locations suitable to expand the program. Final surveys of Great Pond are being actively conducted and are projected to be completed in early 2022. The remaining estuaries will all be surveyed and evaluated for feasibility and suitability for expansion of the contractor pilot program.

MES has continued to grow oysters in Little Pond as part of its municipal propagation program. The Town currently has a minimum estimated effective nitrogen removal of 29 kg/yr from oyster aquaculture on 0.25 acres of Little Pond. The municipal aquaculture program currently has the capacity to expand to approximately 1.0 acre in Little Pond and the amount of municipal propagation varies due to availability of funding for seed purchase and staffing. Due to site constraints in Little Pond, the propagation is not likely to exceed 0.5 acres which would equate to a maximum removal of 60 kg N/yr.

Oysters grown in Little Pond are relayed to Great Pond, Green Pond, and West Falmouth Harbor for recreational and commercial harvest. MES plans to expand its municipal propagation efforts with revenues received from the Aquaculture Contractor Pilot Program and expects to continue growing oysters in Little Pond, while also using it as an aquaculture training site. The municipal shellfish efforts in Little Pond and other areas of Falmouth also support significant community engagement through countless volunteers, providing hands-on learning opportunities for students, and providing skills development opportunities for local inmates.

3.3. Permeable Reactive Barriers

The Town of Falmouth, in partnership with the Woods Hole Oceanographic Institution, was awarded a \$298,598 grant in 2019 to install a pilot injection PRB in the Great Pond watershed. This alternative utilizes a liquid carbon source (emulsified vegetable oil) injected into the groundwater flow path to stimulate the bacterial conversion of nitrate to inert nitrogen gas. The major goal of the project is to provide the data necessary to refine the long-term operational cost of an injection based PRB by more accurately determining the actual design life of the emulsified vegetable oil (EVO) in a field setting.

As outlined in the proposal (Appendix 3.4) the project was designed for the PRB to “fail” within the project performance period in order to determine the exact amount of EVO necessary for a full-scale system that should last between 5-10 years between injections. The project injected EVO along a 120-foot transect running perpendicular to the groundwater flow at the head of Great Pond. One 60 ft. length of the transect was dosed with a treatment of EVO estimated to last one year while the other side was given a dose estimated to last two years. Five multi-level and three single level monitoring wells were installed in the vicinity of the PRB. The multi-level wells each consist of 10 sampling depths to allow for vertical profiling of the performance of the injection. Quarterly monitoring of all new and existing wells within the network has been conducted since injection and continued through the late spring of 2022 to monitor the efficiency of nitrate removal, trace metals, and longevity of the EVO.

During the course of the project, the two-year side has consistently reduced the nitrate coming into the PRB to near background levels in the upper portion of the injection zone. As of January 2022, data indicates that the nitrate removal of the PRB at depth on the two-year side is showing early signs of reduced efficiency (Figure 3.2) Data from the one-year side has not shown any indication of denitrification occurring at the site perhaps because of a limited availability of carbon to stimulate the bacterial metabolic processes because of potentially uneven dispersion of the EVO within the PRB line. Monitoring of the pilot PRB project was terminated in May 2022 and a complete report of the project’s findings is anticipated in December 2022.

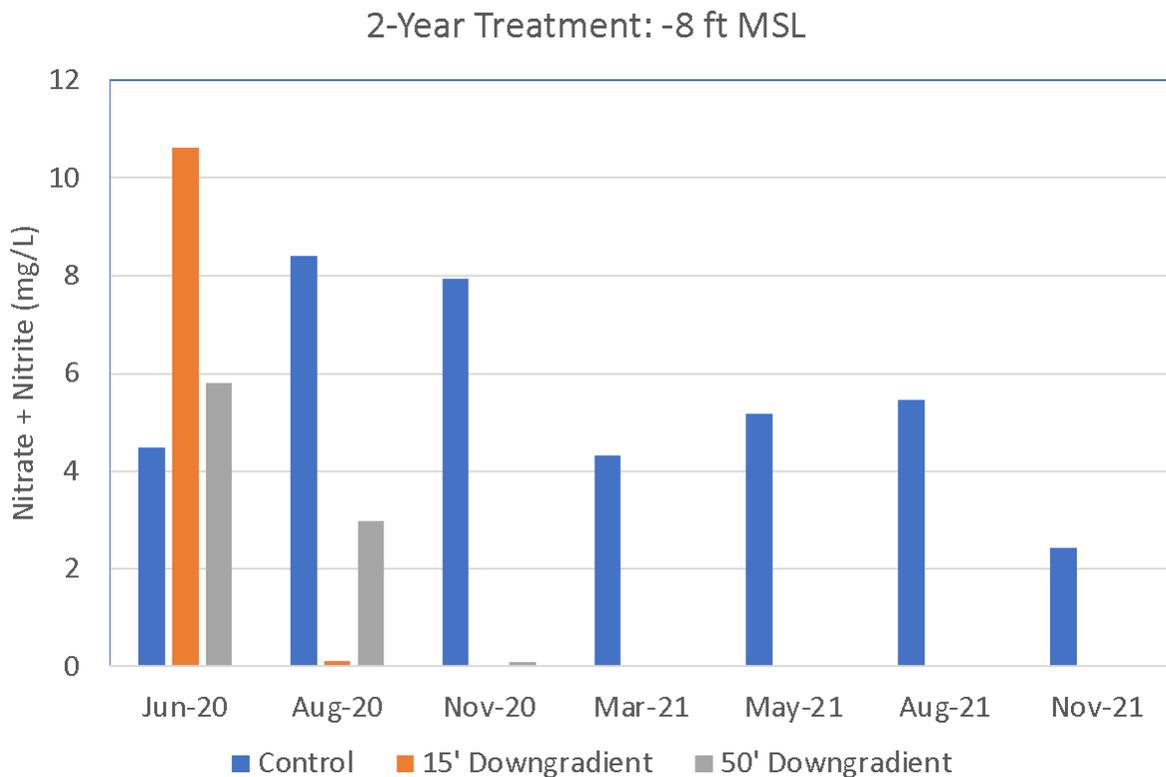


Figure 3.2 Pre- and Post-EVO Injection Time Series of Nitrate+Nitrite

3.4. Eco-toilets

In 2018, Falmouth completed a pilot project to evaluate the nitrogen-removal, costs, and public acceptance aspects of eco-toilets, which can be either composting or urine-diverting fixtures or combinations thereof. To encourage participation in this voluntary project, three different incentive programs over a three-year period were provided. Public participation in the Eco-Toilet Pilot Project was low in Falmouth, despite significant financial incentives including a \$5,000 grant, a free professional home evaluation and ongoing outreach to encourage participation. Of the 170 people who showed initial interest in eco-toilets, 55% indicated they ultimately chose not to participate due to factors such as

the effort involved in ongoing operation and maintenance of the eco-toilet and a concern over resale value of the home. Cost was only a factor for 10% of respondents who did not choose to participate. Based on the poor response to the eco-toilet program in Falmouth, eco-toilets are not included as a separate non-traditional technology for watershed planning purposes in Falmouth. They continue to be listed as an Innovative/Alternative (I/A) septic system option. In watersheds where I/A septic systems are the recommended solution for TMDL-compliance, property owners will also be able to select eco-toilets that achieve the same level of nitrogen-removal as is required for I/A septic systems. At this time, Falmouth does not have plans to pursue additional eco-toilet initiatives.

3.5. Stormwater Management

The Town of Falmouth's Department of Public Works engineering staff is charged with administering the Town's Stormwater Management Program. In 2021, The Falmouth Select Board adopted Stormwater Management Rules and Regulations. Falmouth Department of Public Works staff have worked to identify several candidate locations to implement stormwater Best Management Practices (BMP) for nitrogen removal. Based on subsequent field investigations of the several identified catchment areas and the necessary steps to implement the BMP, the Town has decided to further review the effectiveness of emerging technologies such as media boxes prior to carrying out any specific stormwater management projects.

The Town has been working towards mapping all known outfalls, stormwater BMPs, and receiving waterbodies with impairments. In 2020, the Town completed a BMP pollutant reduction estimate summary for its existing structural stormwater BMPs located within a contributing watershed to an impaired waterbody (Appendix 3.5). All known BMPs and waterbodies have been mapped, as well as a number of outfalls. Initial catchment delineations have also been completed based on topographic mapping and available stormwater system information. As the Town completes a survey of existing BMPs, the nutrient reduction estimates will be updated per the Municipal Separate Storm Sewer System (MS4) permit requirements. The Falmouth Department of Public Works continues to employ Best Management Practices in all its road improvement projects.

Recent examples of projects utilizing Best Management Practices include:

1. Teaticket Path reconstruction project where significant drainage improvements redirecting stormwater through a sedimentation basin, weirs, and gravel trench to improve water quality.
2. New employee parking lot constructed behind Town Hall with pervious pavement to control stormwater.
3. Coonamessett Gateway Park which includes a series of weirs, swales, and rain gardens to control stormwater.

As part of the stormwater and runoff management public outreach efforts, the Town distributes seasonal flyers on fertilizer use and grass clipping management and leaf litter removal and distributes informational flyers encouraging the proper management of pet waste with all pet registration/renewal applications (Appendix 3.6).

3.6. Fertilizer Management

Since the adoption of the Nitrogen Control Bylaw for Fertilizer in 2012 (Appendix 3.7), the Town continues its efforts on public education and enforcement of the conditions set forth in the bylaw. The efforts include an annual mailing by the Department of Marine and Environmental Services to the owners of approximately 2,700 properties within 100 feet of all coastal estuaries as well as an insert in the bill going to 22,000 town water accounts (Appendix 3.6). Adherence to the Nitrogen Control Bylaw is now also a Standard Condition included in all Order of Conditions issued by the Town of Falmouth Conservation Commission.

3.7. Potential Watershed Modifications for Increased Nitrogen Attenuation

As part of the Town of Falmouth's approach for examining strategies to meet the TMDL in its watersheds, the Town has begun to evaluate the effectiveness of modifications to upstream environments to reduce nitrogen inputs in downstream estuaries.

3.7.1. Mill Pond Restoration Project

The Town of Falmouth partnered with the University of Massachusetts Dartmouth School of Marine Science and Technology (SMAST) to conduct a study on nutrient cycling in Mill Pond, a 16-acre heavily degraded freshwater pond located directly upstream from Green Pond and responsible for attenuation of approximately 62% of its nitrogen inputs that would otherwise enter Green Pond (Unruh et al. 2018). The main objective in the management of Mill Pond is the control of the nitrogen and phosphorus loads entering Green Pond. Since 2019, the Town has implemented several of the recommendations made by SMAST (see Appendix 3.9 – Unruh et al. 2018), and those recent efforts are detailed below.

3.7.1.1. Macrophyte Harvesting

One approach the Town piloted was to attempt to reduce the nutrient load being recycled within Mill Pond by harvesting the macrophytes. Reducing the macrophyte biomass in the pond should reduce the nutrient load to the sediments and water column of Mill Pond when the plants begin to decay in the fall. In addition, a reduction in the surface-level plants should allow for more wind-driven surface layer mixing which may aid in odor control.

It was thought harvesting would have multiple benefits including the removal of the harvested macrophyte material and its associated nutrient load; visual and odor reduction to address neighborhood concerns, and an allowance for the ecosystem service of plant growth that continually removes phosphorus from the sediments. This form of macrophyte management is considered an adaptive management approach needing evaluation of its effectiveness prior to establishing a long-term maintenance plan.

Since 2019, the Town pursued this strategy and in October 2020 completed the initial harvesting. The Town harvested all accessible plants from the surface of the pond equivalent to 10,000 kg of vegetation (wet weight). Subsequent analysis of the plant matter yielded less nitrogen and phosphorus removal per kg than anticipated from pilot measurements (see Appendix 3.9 – Unruh et al. 2018). In total, the harvesting efforts removed 21 kg N and 3.4 kg P from the system (see Appendix 3.10 - Ells et al. 2021) at a cost of \$743/kg N. This does not include the generous no-cost shore support of the Department of Public Works staff to move the harvested material to its final disposal location. The Town determined this strategy was not cost effective for nitrogen removal and has decided not to continue this effort.

3.7.1.2. Supplemental Aeration

The Notice of Intent filed for the macrophyte harvesting also included piloting the technique of providing supplemental oxygen to the sediments of Mill Pond during the critical highly anoxic summer months to promote the natural denitrification occurring in the sediments. Seasonal aeration was permitted and piloted in the summer of 2020.

Nanobubble technology was chosen to use in the pond due to the longer retention time of the physical nanobubbles and their Brownian movement¹. By supersaturating the water with nanobubbles in the deployment area, the physics of the movements of the nanobubbles suggested that a portion of those bubbles should have been delivered to the sediments while others were dispersed throughout the water column prior to releasing their oxygen content. Data from the 2020 pilot season indicated that the oxygen demand in the pond's current state (eutrophic and heavily vegetated) was too high to isolate a clear signal in increased oxygen availability from the aeration activities even in the immediate

¹ Brownian movement is defined as the erratic random movement of microscopic particles in a fluid, as a result of continuous bombardment from molecular motion of the surrounding medium.

vicinity of the generator output (Ells et al. 2021). This also indicated that to provide a meaningful supplement of oxygen would require a much larger system with a greater cost that would need to be maintained for years.

It is believed that the most cost-effective approach for improving bottom water aeration will be to implement strategies that minimize the density of macrophytes in the water column including the reduction of nutrient inputs into the pond. This should increase the efficiency of natural processes of oxygen transfer from the atmosphere at the surface and mixing into the lower waters.

3.7.1.3. Construction of a Detention Pond

This is a preferred management option and best management practice for cranberry bogs to increase the retention time of water coming from upstream to allow plant matter and fine sediments to settle prior to being washed downstream into Mill Pond. In 2021, the Town completed the excavation of a 0.25-acre detention pond in the cranberry bogs immediately upstream from Mill Pond. Due to its recent installation, there has been no monitoring to determine the effectiveness of this strategy, however SMAST estimates this strategy could reduce the nitrogen and phosphorus loads to Mill Pond by 192 and 40 kg/yr respectively (Unruh et al. 2018). A monitoring plan is being developed with monitoring proposed to begin in the spring of 2022.

3.7.1.4. Additional Strategies

In 2021, the Town partnered with SMAST to pilot a new technology for nutrient reduction not previously listed as a recommendation in the assessment by Unruh et al. (2018) (Appendix 3.9). A pilot-scale modular permeable reactive barrier (Appendix 3.11) was deployed in the channel of the cranberry bogs upstream from the site of the detention pond. This system consisted of an array of mesh bags filled with woodchips (for nitrogen reduction) and Alum (for phosphorus reduction). Deployment of the modular permeable reactive barrier system was included in the Notice of Intent (NOI) for the detention pond and has been permitted within the detention pond and main input channel into Mill Pond. Data from this pilot project is currently being analyzed to determine its effectiveness and the most efficient and cost-effective strategy to scale up the deployment.

3.7.2. Coonamessett River Restoration Project

The Coonamessett River flows from Coonamessett Pond to Great Pond, a total length of about 4,750 meters (15,580 feet). The Massachusetts Estuaries Project (MEP) report for the Great Pond watershed (Howes, 2005) estimates that over 50% of the unattenuated nitrogen load to Great Pond enters via the Coonamessett River.

In 1971, the Town of Falmouth acquired approximately 45 acres of cranberry bogs along the lower reach of the Coonamessett River south of Sandwich Road. The bogs are divided into three main areas: Lower Bog, Middle Bog, and Reservoir Bog. Cultivation of Lower Bog ceased in 2010, and Middle and Reservoir Bogs were retired in 2013. Lower Bog was restored to wetlands in 2018.

As part of the restoration process, the river channel was physically lengthened by making it more sinuous in order to increase the water's residence time within the wetland and increase the potential for greater nitrogen attenuation prior to discharging into Great Pond.

Since 2019 the wetland restoration of Middle Bog and Reservoir Bog have been completed. The Coonamessett River Restoration Project was led by the Town of Falmouth Conservation Commission with the support of nearly two dozen partners. Major funding sources include National Oceanic and Atmospheric Administration (NOAA), Massachusetts Environmental Trust, Massachusetts Fish & Game/Division of Ecological Restoration, US Fish and Wildlife Service, and the Town of Falmouth.

To monitor the potential nitrogen attenuation due to the bog restoration efforts, the Woods Hole Research Center (WHRC) was contracted in 2018 to install several sampling wells and monitor eleven stations along the entire length of the Coonamessett River. This research project is quantifying the physical and nitrogen dynamics of the river over a three-year period. Initial water quality monitoring and characterization of the nitrogen export from the river began in 2019 and has continued through early 2021.

3.8. Measuring the Impacts of Sewering on Little Pond Water Quality

Concurrent with the implementation of the Little Pond sewerage project, the Town partnered with both United States Geological Survey (USGS) and Marine Biological Laboratory (MBL) to establish baseline groundwater-quality data for the area. They have been conducting separate studies measuring the nitrogen in groundwater entering Little Pond before and after sewerage to provide a true test case of the nitrogen reduction impact of sewers.

The objective of Falmouth's \$40 million investment in sewerage the approximately 1,400 sewer connections in the lower watershed of Little Pond was not solely the reduction of nitrogen inputs into the pond, but the restoration of water quality and clarity, and regrowth of eelgrass, an increase in diversity of the benthic community and infauna habitat quality. Given the length of time nitrogen has had to accumulate in the pond, immediate results are not to be expected. But Little Pond will provide a valuable demonstration project of an impaired water body where an 88% reduction in the nitrogen load is being achieved through sewerage, while all other inputs are being held largely constant.

This should provide useful information as the town plans for larger sewerage projects around the larger, but similar, coastal ponds to the east of Little Pond in the years ahead.

Prior to sewerage portions of the Little Pond watershed, the Town partnered with USGS and EPA on a project to monitor the groundwater beneath the Maravista Peninsula using a series of 18 monitoring wells installed at key locations within a neighborhood on the eastern side of Little Pond. The objectives of the study are to assess groundwater levels and water quality beneath a densely developed coastal neighborhood undergoing a conversion from septic systems and cesspools to municipal sewers and develop an understanding of water-quality conditions before and after installation of the sewers.

Groundwater sampling by the USGS began in June of 2016 and has continued to date. The most recent report compiles the monitoring data from 2016-2019 (McCobb et al. 2021, Appendix 3.12). Data from the USGS efforts are beginning to show the impacts of sewerage on the groundwater in Maravista while the continued monitoring data from the Pond Watch Monitoring Program will indicate when the effects of sewerage have reached Little Pond. Although early in the restoration process, unpublished results from the September 2020 sampling event indicate decreasing trends in median nitrate concentrations at 11 of 14 monitoring sites.

In a separate study, the MBL has been monitoring groundwater along the shoreline of Little Pond through a series of 12 wells installed along the immediate shoreline around the entirety of the pond. Through the Semester in Environmental Sciences Program (SES) at MBL, undergraduate students have collected and analyzed samples since the summer of 2016.

Most of the Town's MEP reports were completed in the early 2000's using data that is now about 20 years old. Ahead of realizing the potential effects of sewerage in the Little Pond watershed, the Town funded an updated baseline evaluation of Little Pond water quality following the same protocols as were used for the MEP study in 2006 (Appendix 3.12).

This updated baseline will characterize the benthic infaunal communities present in the system that serve as indicators on the health of the system in location where eelgrass is not present as well as to map present macroalgae and eelgrass assemblages. The assessment data are coupled with the level of diversity (H') and evenness (E) of the benthic community and the total number of individuals to determine the infaunal habitat quality. Data for this effort was collected during the summer of 2021. A report on the findings of the baseline evaluation is anticipated in Fall 2022 (see Appendix 3.13 – project scope).

3.9. MassDEP Provisional Innovative / Alternative Systems

Beginning in 2010, the Town and the general public became increasingly aware of a wide variety of I/A septic systems available either 'off the shelf' or under development as prototypes. As part of the investigation into technologies that

could reduce nitrogen discharged to the groundwater at or near the source, the Town's Water Quality Management Committee decided to pursue in situ testing of several such systems. The Town partnered with the Buzzards Bay Coalition (BBC) in 2016 on the West Falmouth Harbor Shoreline Septic Remediation Project to install advanced I/As systems as part of the pilot project with the goal to achieve an effluent concentration of 12 mg TN/L for each I/A septic system or 70% removal.

The project was initiated in 2016 and initially installed 20 I/A systems in the West Falmouth watershed as a part of Phase I. Phase II expanded the project to include an additional 10 I/A installations within West Falmouth. The final I/A systems in Phase II of the project were installed in 2020. The BBC continues to monitor all systems within the project area and report performance to the County.

The Department of Environmental Protection (DEP) currently requires that advanced I/A septic systems must meet a standard of 19 mg TN/L.

A review conducted in 2021 by the Town on the cost and performance of I/A systems as recorded by the Barnstable County Septic Management Program indicated that fewer than half of the I/As installed in Falmouth with data reported in the last five years, on average perform at the level of ≤ 19 mg N/L (Appendix 3.14). Based on the TMDL targets, the Town considers the standard of 19 mg N/L to be too high to effectively improve the health of an impaired estuary and considers the documented performance of the systems with General Use approval to be inadequate. The review also highlighted three main roadblocks which prevent the widespread use of I/As from being a practicable alternative to sewerage including the excessive requirements to get a system to General Use approval, the required capital, operating, maintenance, and monitoring costs, and the limited nitrogen reduction credit recognized by the state.

Since 2019, the Town has been involved in several joint efforts with regional partners and representatives from the State on establishing a responsible management entity (RME) either on a regional or municipal level for the management of I/A systems (Appendix 3.15). Additionally, the Town has been involved in independent discussions with the MassDEP on how to accelerate General Use approval for the several highly promising technologies able to achieve ≤ 10 mg TN/L which include NitROE, Nitrex and the layer cake design.

In 2021, the Water Quality Management Committee began drafting a proposed bylaw that would mandate the use of I/As within a 300 ft. boundary of specified impaired watersheds (Appendix 3.16). The specified estuaries are those that could potentially meet their TMDL using I/A septic systems capable of achieving an average effluent concentration ≤ 10 mg N/L. The watersheds that have the potential to meet their TMDLs using I/As alone included in the current proposed bylaw are West Falmouth Harbor, Quissett Harbor, and Fiddler's Cove.