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Project No.: **20985**

To: **Orleans Wastewater Management Advisory Committee (WMAC)**

From: **Mike Giggey**

Subject: **Orleans Wastewater Management Planning  
Summary of Planning for Phase 3 of the Sewer System**

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The WMAC has been charged with making recommendations to the Select Board on where and how the existing sewer system should be expanded. Over the past few months, the WMAC has undertaken several investigations, has met twice monthly, and is nearing a decision on a sewer expansion recommendation. Written materials must be developed to describe the WMAC deliberations and recommendations, and to form the basis for a public outreach program. This memo is intended to begin the process of documenting the history of the project and the evaluations that have occurred.

### **History of Wastewater Planning and System Development Comprehensive Wastewater Management Planning**

During the period 2005 to 2010, the Town conducted a formal wastewater planning process led by the Wastewater Management Steering Committee. That process culminated in the 2010 Comprehensive Wastewater Management Plan (CWMP) that was approved by MassDEP in 2011. Important aspects of the CWMP are:

- A detailed needs assessment to determine the locations where conventional septic systems are not adequate to protect health and the environment.
- Identification and evaluation of all proven technologies and approaches to addressing the documented needs.
- Formulation of a recommended plan, including designated sewer service areas, sites for wastewater treatment and disposal facilities, and opportunities for use of non-traditional systems, with an estimate of costs for development and for operation and maintenance.
- Assessment of environmental impacts and mitigation measures.

The recommended plan is a six-phase program of municipal sewers leading to a wastewater treatment plant at the site of the now-former Tri-Town Septage Treatment Facility with nearby land-based disposal of high-quality effluent. The CWMP identified opportunities for the testing of non-traditional approaches to wastewater and nitrogen management, which if successful, could be used to modify later phases of the traditional core plan.

The proposed sewer system is aimed primarily at the reduction of nitrogen loading associated with private septic systems to protect coastal embayments. Other identified needs are the reduction of septic phosphorus loads upgradient of freshwater ponds, and the support for some commercial growth in the downtown area.

## Orleans Water Quality Advisory Panel (OWQAP)

When the funding of the first phase of the CWMP recommended plan failed to receive sufficient voter support, the Orleans Selectmen formed the OWQAP to chart a revised course that would be more acceptable to the public. The OWQAP met in 2014 and 2015 and approved a Consensus Agreement in March of 2015.

OWQAP supported the sewerage of the downtown area and the Meetinghouse Pond watershed and recommended that this traditional core be supplemented with non-traditional methods including coastal habitat restoration, aquaculture, floating constructed wetlands, and permeable reactive barriers (PRBs).

## Initial Construction of Sewers and Treatment Facilities

Under the direction of the new Board of Water and Sewer Commissioners, Phase 1 of the CWMP was designed and constructed to include a wastewater treatment facility and a downtown wastewater collection system. **The Orleans Wastewater Treatment Facility is now complete and started up in early March 2023.** The first phase of the sewer system was concurrently constructed and **480 downtown properties** are ready to be connected to the sewer system **now that** the treatment facility is operational. Phase 2 of the program (sewers in the Meetinghouse Pond subwatershed) **has been designed** and will serve about 440 largely residential properties.

## Evaluation of Non-Traditional Approaches

Development of an oyster-based aquaculture program has proceeded in Lonnie's Pond, with the assistance of UMass-Dartmouth and a commercial grower. After three years of intensive study, the Town has demonstrated that this technology is able to remove a nitrogen load of approximately 100 kg per year, in addition to providing ancillary benefits such as improved water clarity. This load reduction accomplishes about one-third of that necessary to restore water quality in Lonnie's Pond. A search for other aquaculture sites has not identified other opportunities to implement this nitrogen removal approach, despite its low cost. No decision has been made to extend this technology to other ponds.

A demonstration-scale PRB was installed at the Nauset Middle School in the Town Cove watershed and has been shown to reliably remove **about 160 kg/yr** of nitrogen load. This technology has also been proposed at more than ten other sites across Orleans along road rights-of-way in the Pleasant Bay and Nauset watersheds. Cost evaluations by AECOM have shown PRBs to be roughly equivalent in cost to traditional sewers.

Floating constructed wetlands were investigated in 2016 and found to be difficult to permit and not cost-effective. Similar conclusions were drawn with respect to coastal habitat restoration.

## Other Activities of Importance

Since the completion of the CWMP in 2010 and the work of the OWQAP in 2015, several important events and findings have occurred that help establish the best way forward for Orleans:

- **Pleasant Bay Watershed Permit** . In 2016, the Pleasant Bay Alliance developed a composite wastewater plan to encompass the wastewater and nitrogen management activities proposed in the four towns that span the Pleasant Bay watershed (Orleans, Brewster, Harwich and Chatham). Using that document as a basis, the Alliance and MassDEP embarked on a pilot program to develop the first-in-the-Commonwealth watershed permit. The August 2018 permit presents the allocation of nitrogen removal responsibility among the towns and a 20-year schedule for implementing those load removals. Orleans' share of the Bay-wide responsibility is approximately 7,000 kg/yr.
  - Within the first five years of the permit, Orleans has agreed to remove about 300 kg/yr from the watershed of Lonnie's Pond. It was initially expected that the shellfish harvesting project there would achieve the full 300 kg/yr commitment. With the shellfish harvesting program accomplishing only one-third of that goal, Orleans is faced with the need to remove the remaining 200 kg/yr by mid 2023.
  - In the second 5-year segment of the watershed permit (2023 to 2028), Orleans has committed to a further 4,200 kg/yr nitrogen removal. If the Meetinghouse Pond project is **constructed as planned**, it will address 2,000 kg/yr of that further commitment. A formal plan has not been established for the remaining 2,200 kg/yr commitment by 2028.
- **Freshwater Pond Studies** . Since 2018, the Town completed three management studies for freshwater ponds: Uncle Harvey's Pond, Crystal Lake and Pilgrim Lake. These studies highlight the importance of phosphorus removal from selected upgradient parcels to protect these ponds from nutrient enrichment and the resulting algae blooms. The Town has expanded the proposed Meetinghouse Pond sewer project to allow the elimination of 8 septic systems near Uncle Harvey's Pond, and has begun serious planning of options for phosphorus control for Crystal and Pilgrim Lakes.
- **Nauset Harbor and Rock Harbor Studies** . Since the completion of the Orleans CWMP, the Massachusetts Estuaries Project has completed technical evaluations of the Nauset Harbor and Rock Harbor systems. Those studies have shown the need for significant nitrogen removal in both watersheds. With the **expected** advent of a new MassDEP program for watershed permitting, Orleans and Eastham have begun the planning for watershed permits here. A joint effort at nitrogen control may provide cost and other benefits; however, additional planning is needed to better define the relative responsibilities of the two towns.
- **Evaluation of On-Site Denitrification Systems** . The Pleasant Bay Alliance, on behalf of Brewster and Orleans, undertook a detailed evaluation of the performance and cost of individual on-site treatment systems (I/A systems) for nitrogen removal. That evaluation determined the nature and extent of monitoring and maintenance activities that DEP will require. It also reviewed the nitrogen removal capabilities of dozens of commercially-available I/A systems and concluded that average effluent nitrogen concentrations less than 12 mg/l are not reliably met. The July 2020 report by Horsley-Witten concluded that I/A systems are not yet a viable option for Brewster to achieve sufficient nitrogen removal for the 319 homes where this technology was initially targeted. These conclusions also apply to similar areas where I/A systems might be used in Orleans.
- **Public Opinion** . As Orleans citizens have become comfortable with the concept of a public sewerage system, and as the viability of non-traditional approaches is better understood, an increasing number of residents have supported an expansion of the conventional sewer system.

## Proposals for Sewer System Expansion

The Town's wastewater design engineer, AECOM, formulated eight prospective sewer extensions in response to numerous inquiries about perceived needs and desires. Those eight options are:

1. Eldredge Parkway Area 1
2. Eldredge Parkway Area 2
3. Tonset Road Area 1
4. Tonset Road Area 2
5. Uncle Harvey's Pond Area
6. Crystal Lake Area
7. Pilgrim Lake Area
8. Rock Harbor Area

Wright-Pierce reviewed these options with respect to costs, nitrogen load reductions, phosphorus removal, impact on treatment plant capacity, conformance with the CWMP and regulatory requirements (see Wright-Pierce memo of September 1, 2022). The most important considerations were shown to be:

- Uncertainties in the nitrogen removal needs for Nauset and Rock Harbor suggest that sewer extensions be deferred on Eldredge Parkway, Tonset Road and in the Rock Harbor
- The importance of phosphorus removal for lake health supports sewer extensions in the areas of Crystal Lake, Pilgrim Lake and Uncle Harvey's Pond.
- The unfulfilled obligation for nitrogen removal under the Pleasant Bay watershed permit, specifically for Lonnie's Pond, could be addressed by a small expansion of a sewer extension to serve Crystal and Pilgrim Lakes.

## Wright-Pierce's Recommendation for Sewer System Expansion

Based on those considerations, Wright-Pierce recommended a sewer extension project focused on:

- phosphorus control upgradient of Crystal and Pilgrim Lakes, recognizing that the Meetinghouse Pond project has already been expanded to include homes upgradient of Uncle Harvey's Pond.
- septic system elimination on selected properties downgradient of these two lakes whose nitrogen loads directly impact Lonnie's Pond, and
- connection sewers that are part of the Eldredge Parkway option that would allow the lake protection areas to connect to the Phase 1 sewers and to address a small area in the Meetinghouse Pond watershed.

The recommended Phase 3 sewer project is located in South Orleans upgradient of Crystal Lake, Pilgrim Lake and Lonnie's Pond. It would remove nitrogen and phosphorus by eliminating 158 septic systems and sending about 25,000 gpd of wastewater to the new treatment plant. The project would eliminate the septic phosphorus loads from 28 properties upgradient of Crystal lake and 41 parcels in the watershed of Pilgrim Lake, thus fulfilling the recommendations of two recent lake management plans. AECOM has estimated that this project would cost \$23 million (2022 dollars) and would be completed in 2028. The new sewer service area would fall mostly within the original Phase 3 of the 2010 CWMP.

### Considerations for Future Sewer Extensions

One of the hallmarks of the CWMP is the focus on eliminating septic systems only where there is a demonstrated need for correction of health and environmental issues. The CWMP's recommended plan addresses the public health impacts of failed septic systems, and the protection of surface waters from nutrient enrichment while supporting measured commercial growth in the downtown area. Those CWMP precepts underly the current expansion recommendation. While many property owners seek sewer service to enhance the value of their property, or for general peace of mind, Wright-Pierce recommends that Orleans continue to restrict its public sewers to areas of well-documented health/environmental needs.