



I/A OWTS task force update—exercises in collaboration

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ABSTRACT | This article is an interim report on the distributed innovative/alternative (I/A) on-site wastewater treatment systems (OWTS) task force formed in April 2021. The task force’s charge is to collaborate with stakeholders evaluating decentralized/distributed alternatives for reducing nitrogen loads in Cape Cod watersheds and other coastal areas. A new generation of enhanced I/A septic systems is going through the rigorous Massachusetts permitting process. They appear to be cost-effective when managed as infrastructure through a responsible management entity (RME). Once permitted for General Use and supported by an RME, they could become a significant “tool in the toolbox” alongside sewers to reduce nitrogen loads. This is not a technical article. It is about how we have moved things along and lessons learned, with emphasis on funding and financing targets and approaches.

KEYWORDS | Innovative/alternative (I/A), on-site wastewater treatment systems (OWTS), distributed, decentralized, wastewater, Title 5, nitrogen sensitive area, task force, nutrient pollution, Cape Cod, responsible management entity (RME)

Cape Cod and Rhode Island coastal waters suffer from nutrient pollution, which over-fertilizes our waters, damaging streams, ponds, embayments, and coastal zones while threatening drinking water sources. According to the Massachusetts Department of Environmental Protection (MassDEP), nitrogen from septic systems causes 85 percent of this problem. Seventy-four percent of Cape Cod homes use septic systems, as do 30 percent of Rhode Island homes.

Responding to the Clean Water Act mandate to reduce nitrogen loading by half, Cape Cod towns have embarked on 30-year sewer plans that will cost \$4 billion but cover less than half of the area. What about the other half? And how can we accelerate the cleanup? If something works and is cost-effective, the tool needs to be used.

In Massachusetts as well as in Suffolk County, New York, researchers and practitioners are evaluating a new generation of enhanced innovative/advanced (I/A) on-site wastewater treatment systems (OWTS). These decentralized systems show promise for improving nitrogen reductions affordably, but most have not yet completed the evaluation process. If these systems continue to perform well, they may complement municipal sewers, particularly where housing density is low, and sewers are relatively more expensive. The challenge for bringing the

next generation of I/A OWTS to the Massachusetts market is getting the systems through expensive (\$1.5 million per system), time-consuming (at least five to six years) permitting. The Massachusetts Alternative Septic Systems Test Center (MASSTC) has identified eight such promising technologies. A NEWEA task force formed in the spring of 2021 is collaborating with stakeholders to move these technologies forward.

HISTORY OF I/A, NEWIN, AND NEWEA

When Cape Cod’s 208 Plan to satisfy Clean Water Act requirements was finalized around 2015, a study conducted on the I/A systems concluded that many did not work well at the standard of 19 mg/L effluent nitrogen. Sewers were a clear winner. The towns’ comprehensive wastewater management plans (CWMPs) naturally took a path toward sewers and centralized treatment.

Given the need to reduce nitrogen loads to Cape Cod estuaries by 50 percent and that the 19 mg/L standard is only about 33 percent less than the assumed concentration from an ordinary Title 5 septic system, it is difficult to see how the original I/A septic systems could be part of a solution. Simple, back-of-the-envelope calculations indicate that decentralized systems must perform at levels at or below 10 to 12 mg/L to have a sufficient impact on

watershed nitrogen loads. MASSTC found about eight technologies that appear to meet the 10 to 12 mg/L target, including two that were operating at or below 5 to 7 mg/L.

NorthEast Water Innovation Network’s (NEWIN) focus on I/A went back to before 2014. Its mission was to accelerate technology innovation in the water industry. In 2017, NEWIN helped put together an Innovation Showcase at the OneCape Summit in Hyannis. Five I/A vendors participated. When NEWIN merged into NEWEA in early 2020 to help create the Innovation Council, I/A continued to be a theme. A consumer primer article was published on the Innovation Council website in October 2020, and a webinar highlighting the Barnstable Clean Water Coalition (BCWC) Shubael Pond project was held in November 2020.

MassDEP clearly would not, and should not, bet on one vendor or technology to drive a standard change. That puts too much risk in one basket. At least three to four viable solutions are needed to support a regulatory or practice change.

Stakeholders who must implement and live with new solutions would like to see perfect engineering. That is unrealistic. Any technical or management innovation will have a learning curve and problems to be solved. Part of the social agenda is working within that framework and helping stakeholders become comfortable that risks are manageable. As Zee Crocker, executive director of BCWC paraphrased, *We cannot let perfection become the enemy of good.*

Thus, NEWEA cannot pick a winner, but we can highlight promising solutions. At each vendor webinar an explicit statement was made that we are not endorsing any one technology or vendor.

STRATEGY AND TACTICS

NEWEA does not have the resources to solve a problem such as this. We can be a convening authority that brings relevant stakeholders together and starts or continues conversations leading to better understanding and common strategies. EPA has engaged with stakeholders to explore and evaluate solutions to Cape Cod’s nitrogen problem. We worked to amplify the lessons learned and expand the conversation through our network via webinars and other means.

Webinar Marketing

One thing we learned after the first webinar was the need to broaden our event marketing. The first webinar was promoted only to the Massachusetts Health Officers Association. Subsequently, we promoted our webinars to over 30 organizations, inviting them to spread the word. It made a difference in the attendee counts and where attendees came from. In fact, we had registrations from 21 states.

Task Force Basics

NEWEA’s charge to the I/A OWTS task force is as follows: *The I/A OWTS task force works to create a regulatory and market environment favorable to advancing technologies and adoption of enhanced I/A OWTS to protect our communities. The task force aims to facilitate collaboration among innovators, water utilities, and regulators to bring viable solutions to market faster and more economically.*

The group’s objective is to be ready with multiple, General Use permitted solutions when the comprehensive wastewater management plan (CWMP) five-year adaptive management reviews start coming around in 2025. Once Massachusetts issues General Use permits for multiple I/A OWTS and approves an associated management process, it can be a model for the rest of the country.

Our regulatory structures face several pressures to expand watershed protections and recovery. In June, MassDEP announced plans to expand Title 5 to include nitrogen sensitive areas (NSAs). For Cape Cod this would include 30 estuaries with established total maximum daily loads (TMDLs). As of this writing, MassDEP is working toward public comment with a target to finalize regulations in early 2023.

Complex issues characterize this situation. A conversation may start with one topic, but multiple tangential issues get brought up. As a result, often no progress seems to be made. Part of the task force’s agenda therefore is to isolate items that could be discussed and moved forward without much reference to the other complexities. In this case, and with a lot of discussion, the issues are as follows:

- Which technologies and/or vendors are promising enough to consider?
- How do we manage them to ensure they will work to specification over 30 years?
- How do we fund and finance them, both for permitting and adoption?

Five webinars and a charrette addressed these three issues over the past year.

State, towns, counties, consulting engineers, and utilities are all risk averse. These important decisions are, if wrong, difficult and expensive to undo. We must ensure that permitted systems will perform as promised.

The range of stakeholders includes the following:

Massachusetts Department of Environmental Protection	Barnstable Clean Water Coalition	Massachusetts Health Officers Association
EPA Region 1 and its Southeast New England Program	Cape Cod Commission	Town department of public works and water leaders
EPA Office of Research and Development	Buzzards Bay Coalition	Consulting water engineers
Massachusetts Alternative Septic Systems Test Center of Barnstable County	Pleasant Bay Alliance	Vendors
The Nature Conservancy	Association to Preserve Cape Cod	Academics
	NEIWPCC (New England Interstate Water Pollution Control Commission)	NEWEA
	National On-site Water Recycling Association	
	Yankee On-site Wastewater Association	

Resources Web Page

Early on it was clear that individual conversations and webinars would not be enough to effect change. We created a web page (newea.org/resources/innovation/resources) to capture information. We posted videos as well as slide sets and a charrette readout, along with articles and links for self-education for both professionals and consumers.

“There are many, many tasks on the ‘to do’ list to successfully address nitrogen impairment of water quality in southeastern Massachusetts. The I/A task force’s efforts help build a coalition of interested parties, people who can tackle various parts of the problem, and expand the number of issues, and the depth of those issues, that we can work on. The I/A task force’s emphasis on a responsible management entity (RME) helped the understanding of how to develop a functional RME, fund it, and run it. The I/A task force helped MassDEP and the municipalities that may be involved come together and work on the topic. Ultimately, this greatly expands the capacity, and increases the likelihood that a functional RME can be created, funded, and operated successfully.”

— LEALDON LANGLEY, DIRECTOR, DIVISION OF WATERSHED MANAGEMENT, MASSDEP

EPA SNEP and Webinars

In late 2020 EPA Southeast New England Program (SNEP) expressed a desire to collaborate more with the private sector. At its request in January 2021, we provided input to SNEP’s strategic five-year plan and to a three-day workshop that the program was planning on I/A systems for June 2021. To publicize these developments, in September 2021 we held a webinar to present the results of the June EPA workshop. MASSTC had identified eight promising technologies from its research. We then held a series of three webinars in November, December, and January to enable each vendor to present, answer questions, and prepare a spreadsheet that collected common data. We also highlighted nitrogen sensor developments from EPA’s Sensor Challenge. A sensor developed at Stony Brook University (Long Island, New York) won the challenge and subsequently went through a rigorous, successful, six-month ISO testing protocol at MASSTC. It is now being made into a product and field-tested under a corporate name.

OM&M—RME Charrette

To address operations, maintenance, and monitoring (OM&M), we conducted a charrette at the January 2022 NEWEA Annual Conference. Thirty senior water professionals convened (live and on Zoom) to consider how to manage I/A. As a starting point stakeholders embraced EPA’s concept of a responsible management entity (RME) to manage OM&M. How do you guide its creation and structure? Taking to heart EPA’s suggestion to

listen before talking, we invited presentations from core stakeholders at the federal, state, county, town, and regional levels (including Long Island) to share their perspectives. Then we broke into four study groups and debated questions that included a vision for I/A in 10 years. We had solicited from key participants the most impactful questions, right up until the week before the charrette. The key concept was to manage I/A as infrastructure. Other regions have learned that leaving it to the homeowner to manage an advanced OWTS has often proven ineffective. It is too easy, for instance, to turn off a blower inadvertently, and then you have lost the performance value of the I/A system. Based on WEF’s definitions, systems managed centrally via RME would be considered distributed systems, so we will use that term going forward in this article.

Funding and Financing

In early May 2022 we hosted a webinar on funding and financing I/A, again inviting presentations from federal and state agencies. We also received a presentation from a “B Corp” focused on architecting and raising funds from impact investors. This organization focuses on developing public-private partnerships (PPPs) and programs that use pay-for-performance financing. In such cases, investors expect a return that includes a social component, and based on the program’s performance compared to the social agenda, investor returns could be greater or lesser. This is important to fit the best solution to the need and not rush to the cheapest solution only.

OTHER ACTIONS

Task Force—Start by Listening

In March 2021 a core team presented to the NEWEA Government Affairs Committee on our efforts. NEWEA leadership formalized our activities under a task force to help “nurture” our activities. NEWEA has provided great support. Since formation, the task force has grown to about 25 participants, including several members new to NEWEA. We have monthly conference calls. Members include water engineers, town department of public works employees, vendors, academics, MASSTC, and other key players. We found that talking regularly with key stakeholders helped identify high-value activities.

Mailings and Inquiries

Over the past few years, the author had developed a mailing list of around 250 consumers and water professionals, mostly around Cape Cod. The mailing philosophy was “infrequent and irregular” so as not to overwhelm people. In describing to consumers why we were doing this, we told them that we needed them to be educated and would eventually need their voices to be heard. This mailing program was a way to achieve that in a light-lift mode. As a measure of success, only one consumer has opted out over the past year. As a

result of the visibility from these mailings, we have received several consumer inquiries about how they could proceed on their own properties. We have tried to be responsive, again without picking winners and by connecting them to appropriate engineering firms that could provide guidance.

FUNDING THE WORK

Funding is a work in process. We are building a sustainable strategy, including public and private sources, to fund Cape Cod’s water quality path to nitrogen load reduction. The first step was the webinar in May 2022 on funding and financing I/A. That set the table and was notable in the number of clarifying questions asked by water professionals.

Estimated Capital Needs

The initial, approximate capital needs are as follows:

\$10 million over three to five years to achieve General Use permitting for promising I/A solutions:

- The objective will be to achieve General Permit status for at least three to four systems.
- The vendor’s cost to permit a system in Massachusetts is high. Once in Provisional Use status, the state calls for three years of monitoring and manual data collection on 50 systems before awarding a General Use permit. Towns have been reluctant to embrace I/A until a system has a General Use permit. Vendors cannot afford over \$1.5 million and five to six years just to get permitted. They go to other states where the only requirement is a National Science Foundation certification (assurance that a trusted independent certification organization has tested a product). Thus, little progress has been made in permitting. We need large chunks of external (generally federal, state, or non-governmental organization) money to move pilots forward. For example, the BCWC has already spent \$500,000 on the Shubael Pond project (see BCWC website) along with support from EPA, U.S. Geological Survey (USGS), and The Nature Conservancy (TNC). It was helped by a previous Massachusetts Clean Energy Center (MassCEC) \$150,000 grant to a promising vendor. The grant helped it move through the Pilot Use permit phase to a Provisional Use permit in May 2020.
- We are working to accelerate permitting with new, remote sensor-based data collection approaches, but that is a long road, too; this estimate assumes no change to current regulations.

\$3 million over five years to stand up a pilot RME to manage I/A installations as infrastructure. MASSTC will manage the pilot. At scale it would be self-sustaining through user fees, but the initial standup will require investment funding.

\$100 million to \$150 million per year starting in four to five years to finance adoption on the order of 3,000

Task Force Activities and Links

Distributed Nitrogen Removing I/A Septic Systems Webinar
November 20, 2020

Update on a New Generation of Enhanced I/A Septic Systems Webinar, September 15, 2021

I/A On-site Wastewater Treatment Technologies Webinars
November 16, 2021, December 14, 2021, January 11, 2022

Annual Conference Charrette on I/A OWTS OM&M (RME)
January 24, 2022

I/A Septic Systems Funding and Financing Webinar
May 3, 2022

RME Charrette Readout: newea.org/wp-content/uploads/2022/03/I_A-RME-Charrette-Readout.docx-3.pdf

Primer Article: newea.org/2020/10/09/distributed-nitrogen-removing-i-a-septic-systems-a-2020-primer-for-cape-cod/

Task Force Events and Links: for details see—newea.org/resources/innovation/resources/

to 5,000 systems per year in Cape Cod. That system number is simply the current annual number of Title 5 installations. Nantucket, Martha’s Vineyard, and the southern coast have similar problems and would significantly add to these numbers.

Growth capital for small companies ramping up an order of magnitude above current revenue levels.

Funding Sources

As of October 2022, MASSTC has received grant funding to help stand up the pilot RME, including an initial \$100,000 from TNC and \$1.15 million from EPA SNEP over the next five years. That is less than one-fourth of the projected standup cost.

Some funding will come from Clean Water State Revolving Funds (SRF) and other federal and state programs such as Barnstable County’s Community Septic Management Loan Program, soon to be renamed Aquifund. A challenge will be to put distributed systems on the SRF map. Over the last two decades, while 25 percent of the state’s homes are on septic systems, only about 2 percent of SRF funds have gone to distributed systems. Nationally, 24 percent of the nation’s 26 million homes use septic systems. Of those 6.2 million homes, 10 percent drain into impaired water bodies, yielding at least a \$21 billion market. This may explain why WEF recently announced the creation of a national task force on distributed systems.

Ultimately, we will need to access private funds, with the amount to be determined. We are evaluating impact investment advisors to create a sustainable funding and financing architecture for Massachusetts. We will emphasize performance-based pricing to drive focus on best-performing systems rather than simply the cheapest ones. That is expected to be challenging, so one deliverable will be a compelling investment

thesis for impact investors. And we will seek a partner to tap impact investment markets; the RME will oversee this exercise.

Hopefully, our approach will be a model for other areas with similar nutrient pollution problems, such as North Carolina, Florida, the Chesapeake Bay, and Hawaii. Long Island is already moving down this path, and we are learning from each other.

OUTCOMES

How do you measure success? That is always a question in exercises such as this. One metric is webinar attendance. We attracted over 500 webinar attendees from 21 states and two foreign countries. The average webinar attendance was 100, with a range of 70 to 168. We identified 375 separate registrants. This forms the core of a database of interested parties for future outreach.

Another metric is website activity. As of early October, 750 individuals had accessed the Task Force Resources website with 1,075 page views, and 1,350 individuals had accessed the Consumer Primer article with 1,775 page views. This article was posted to the Innovation Council website a year before the Task Force Resources page was created.

According to Lealdon Langley, director of MassDEP's Division of Watershed Management, our efforts have helped create "momentum" for I/A systems and helped answer some questions the division had. We sense more towns are considering I/A systems within their CWMPs, including in some cases financial incentives to homeowners for installing them. MASSTC has noted increased interest from new vendors who want their systems tested.

System Cost and Price Performance Picture

Everyone is interested in cost and price performance. Cost is a challenging topic. It is site specific. It is also complex and must focus on capital, operating, and financing issues and assumptions. For this article the cost figures are based on the author's conversations and website reviews, not on any formal quotes or a definitive study.

For a two- to three-bedroom home, and based on recent projects, it appears a fully installed I/A system today should cost \$30,000 to \$35,000; inflation is of course affecting both I/A and sewerage costs. The best performing systems may cost more. For a retrofit installation, where the septic box and leach field are preserved, the number may be in the mid to upper \$20,000s. OM&M in the Provisional Permit stage could run \$1,200 to \$1,400 per year, dropping to about \$800 per year with a General Use Permit. With an RME in place and effective management, that cost could be driven down to the \$500 per year range.

Estimated average new sewer costs to a town range from \$70,000 to \$110,000 per home. As a reference point, the Town of Barnstable 2020 CWMP noted an average sewer charge of \$400 per year, growing at 3 percent annually.

Acknowledging that I/A systems at 10 to 12 mg/L are not performing at the level of a centralized treatment plant, where the author understands average sustained

performance to be 5 to 7 mg/L, the I/A capital costs appear to be 25 to 50 percent the capital cost for sewers; one-third seems a fair number. Operating costs will be marginally higher for I/A, but not high enough to catch up with "centralized" treatment on a 20-year basis. For example, assuming \$800 per year I/A OM&M cost versus a \$400 per year sewer bill, over 20 years I/A costs only \$8,000 more, much smaller than a capital cost differential of \$35,000 to \$75,000.

Adjusting for performance differentials, I/A is still cost-effective and seems a good tool.

LESSONS FROM THE PAST YEAR'S COLLABORATION

- Get great people involved, then listen to them
- Let multiple voices shape the deliverables
- Be flexible and open to change as the conversation develops
- Engage all stakeholders, including the doubters (they sharpen the discussion)
- In a situation of great complexity, focus on issues where you can make progress

WHAT'S NEXT?

- Develop an investment thesis, including pay-for-performance structures, for impact investors; help go to market with it on behalf of the RME
- Help draft a roadmap for integrating new, data-rich, sensor-based approaches into systems management and eventually into permitting
- Identify and engage political champions
- Engage with WEF's new Distributed Water Infrastructure task force
- Add phosphorus to the task force agenda, because of its impact on freshwater ponds

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ABOUT THE AUTHOR

Bruce Walton is a third-generation Cape Cod homeowner with an interest in water quality. He chairs NEWEA's I/A OWTS task force. Recently retired, he spent almost 40 years as an executive recruiter in Boston focused on family-owned, mid-cap industrial and technology businesses. Most recently he was a partner with Battalia Winston after positions with startup Conley and Company and global recruiters Heidrick and Struggles and Russell Reynolds Associates. He was a former board member of the NorthEast Water Innovation Network.



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