2024 ANNUAL MHOA CONFERENCE: ADVANCED SEPTIC SYSTEMS UPDATE - PERFORMANCE, CASE STUDIES, MANAGEMENT AND FINANCIAL IMPACT

November 13, 2024 2:40 PM – 4:30 PM

Mass Mutual Center, Springfield, MA

Dr. Alissa Cox
University of
Rhode Island

Bruce Walton
NEWEA
I/A Task Force

WELCOME!

Dr. Laura Erban
US EPA
ORD

Scott Horsley
Water Resources
Consultant

David Iorio
Izzo
RME/SUP

Brian
Baumgaertel
MASSTC

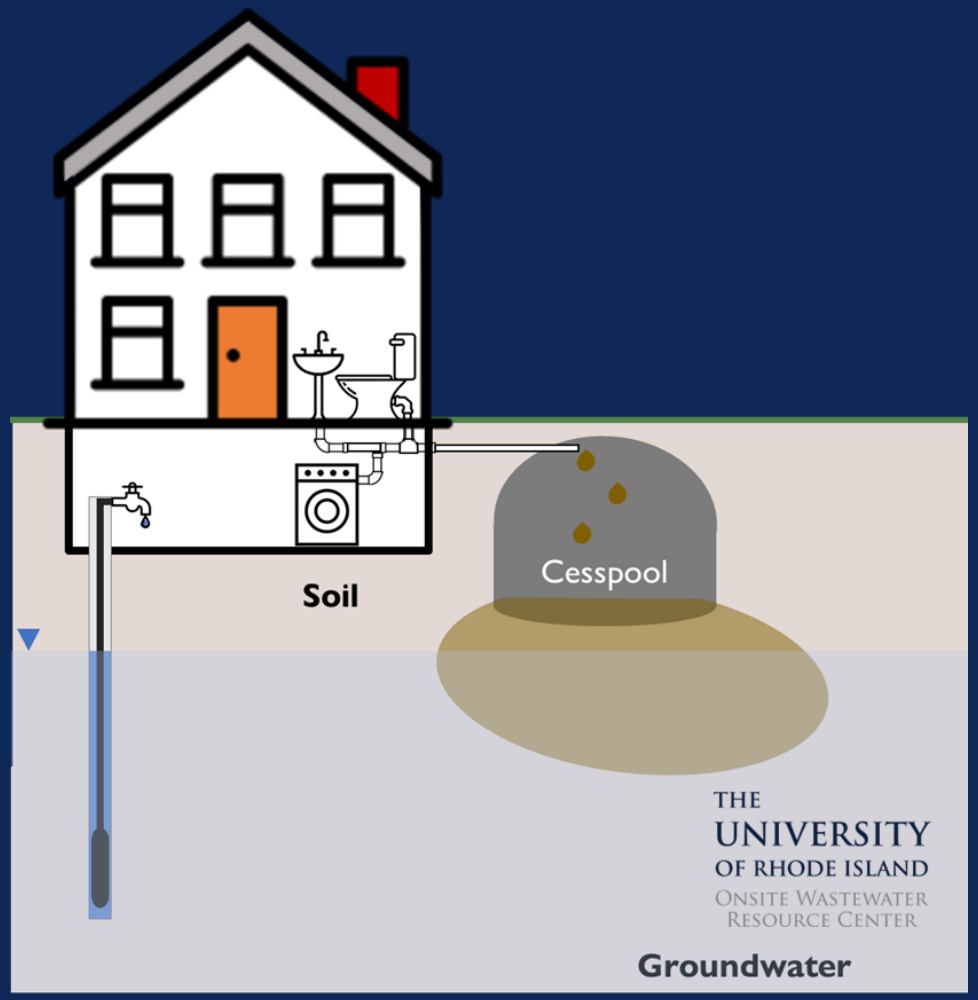
SESSION GOALS

- Describe current knowledge of advanced wastewater treatment technologies
  - Share findings from ongoing research on enhanced innovative/alternative septic systems
- Share lessons learned: holistic wastewater management at the community scale
  - Case studies
  - Managing decentralized infrastructure
  - Financial implications

ADVANCED SEPTIC SYSTEMS

Definitions & Current Knowledge

EVOLUTION OF WASTEWATER TREATMENT



HUMAN-GENERATED WASTEWATER IS RICH IN…

Nutrients (Nitrogen & Phosphorus)

Pathogens

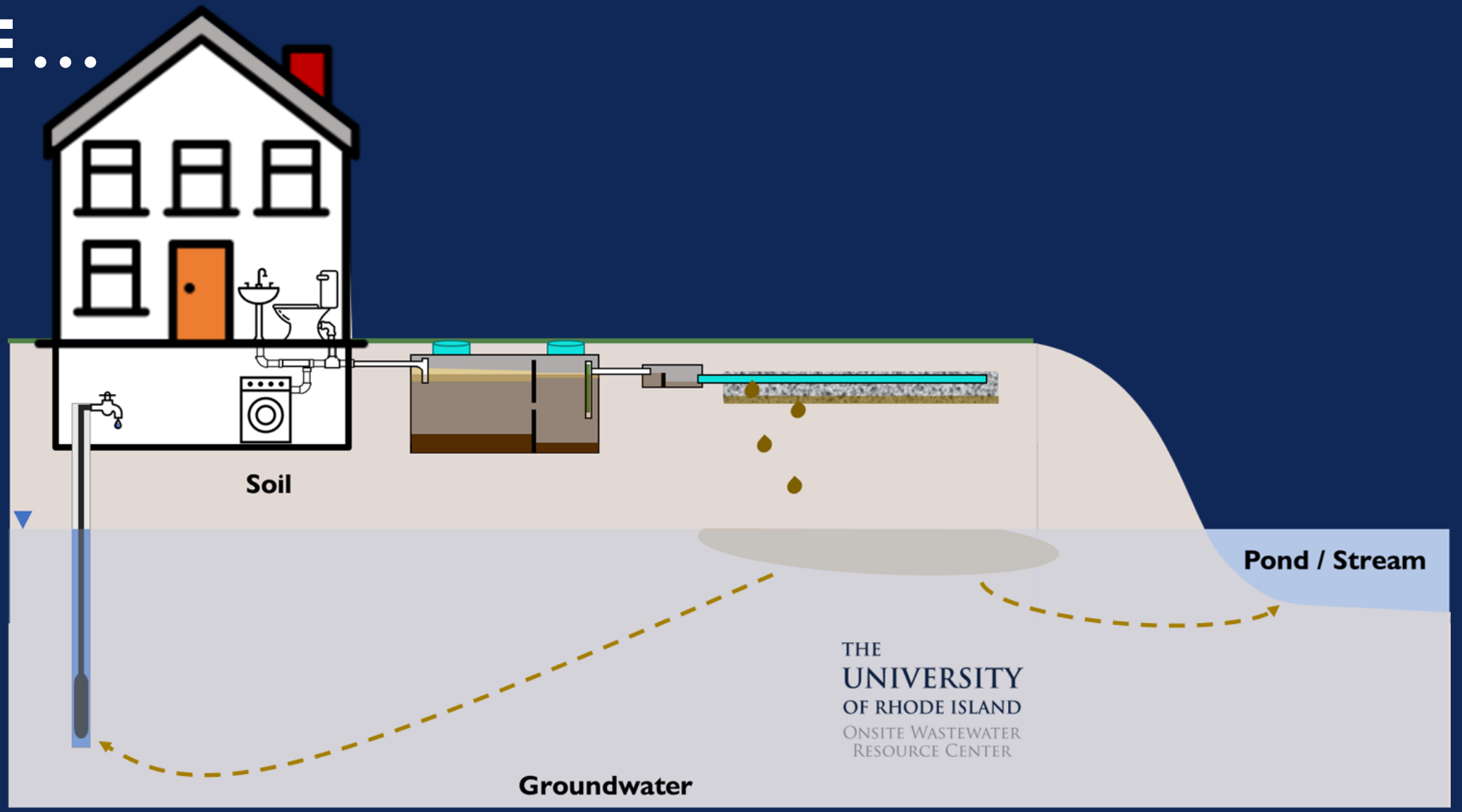
Organic materials

Other contaminants

CONVENTIONAL SYSTEMS ARE NOT DESIGNED TO REMOVE NITROGEN

Nitrogen may change forms via chemical conversions,
but most remains dissolved in water

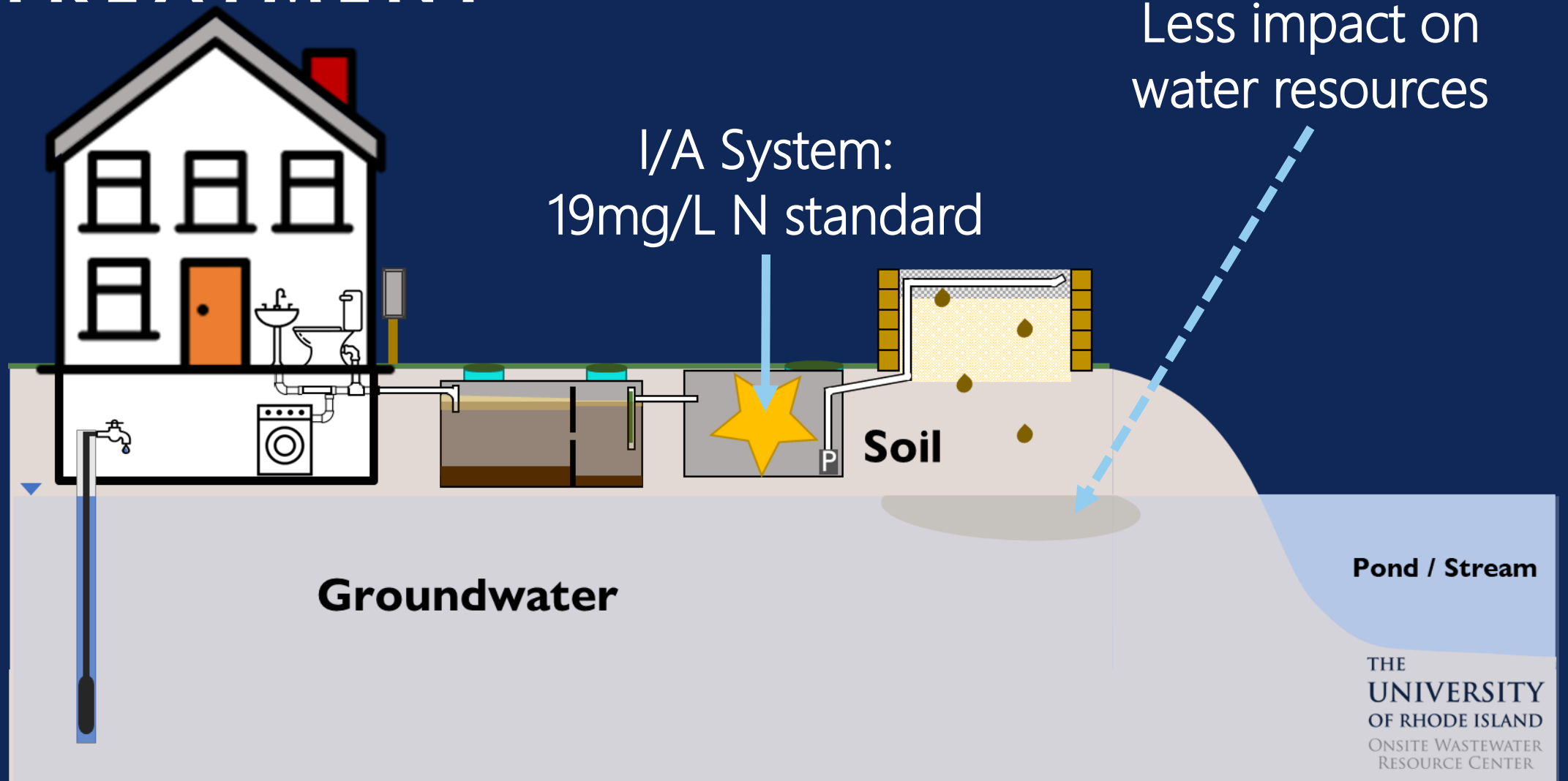
NOT REMOVING NITROGEN IS AN ISSUE…



CONVENTIONAL SEPTIC SYSTEMS ARE POOR CHOICES IN …

Nitrogen-sensitive areas	• Marine ecosystems • Drinking water sources
Densely populated areas	• Too many wastewater inputs • Not enough dilution from clean rain/groundwater recharge
Sites with many constraints	• Shallow depth to ledge / water • Horizontal setbacks

ADVANCED (I/A) WASTEWATER TREATMENT



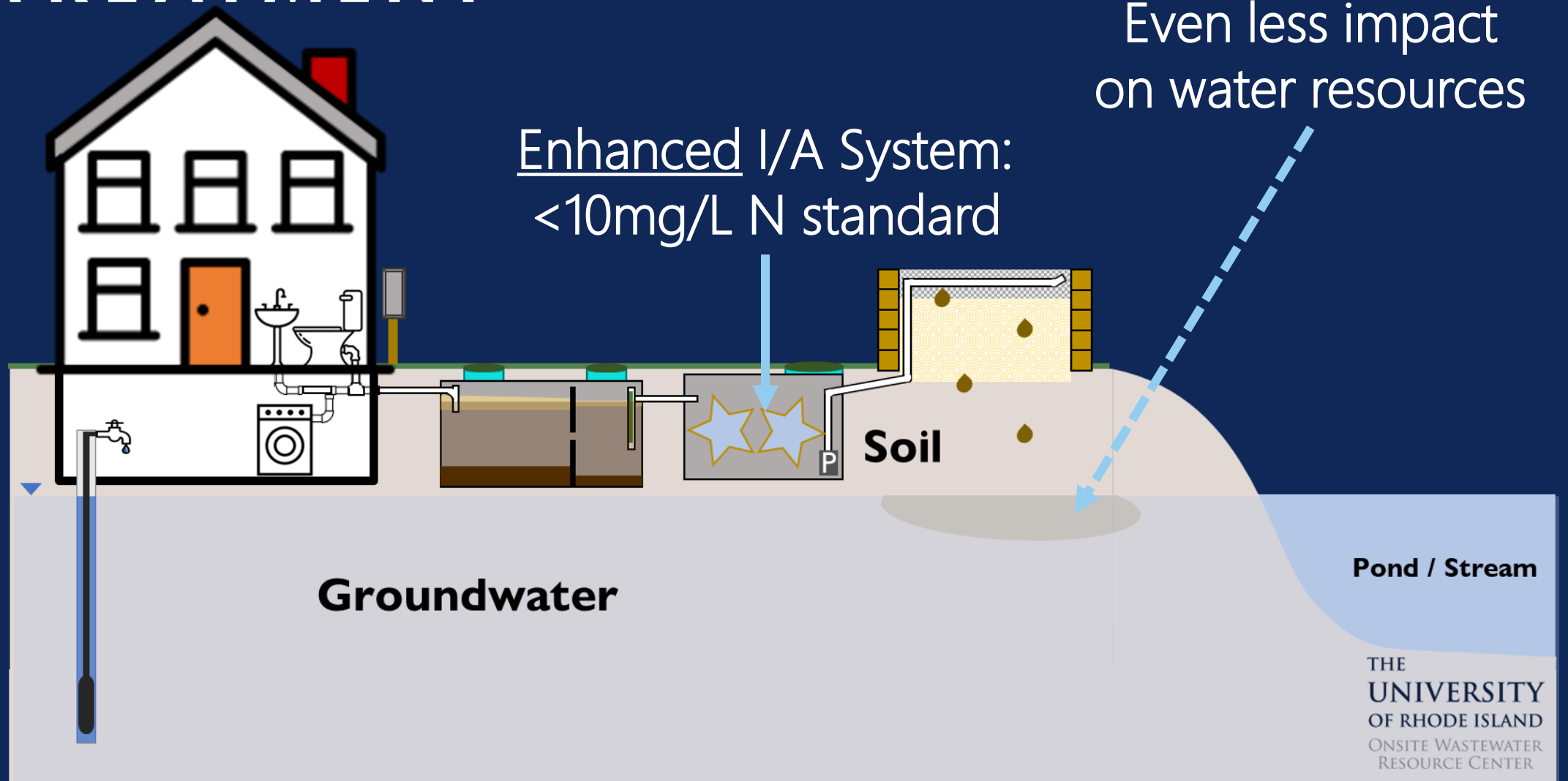
PERFORMANCE OF I/A SYSTEMS

- Currently approved technologies capable of emitting ≤19 mg/L Total N
- Actual performance in field is variable
  - Long-term performance depends on:
    - Technology selected
    - Design & Installation
    - Use / Flow
    - Level of system maintenance & monitoring
- Even with variable performance, I/A systems significantly reduce N loading to nearby waters

…WHEN 19MG/L TOTAL N IS STILL TOO MUCH…

- Coastal communities often densely developed
  - N loading can be significant
    - OWTS recharge groundwater aquifers
    - Groundwater discharged to local surface and coastal waters
- Ground and coastal surface waters affected by too much N
  - Human health impacts
  - Impaired ecosystem health
- Better treatment = less loading of pollutants to sensitive waters
  - Target: <10 mg/L total N

ENHANCED I/A (EIA) WASTEWATER TREATMENT



NEED TRAINING ON ONSITE WASTEWATER TOPICS?

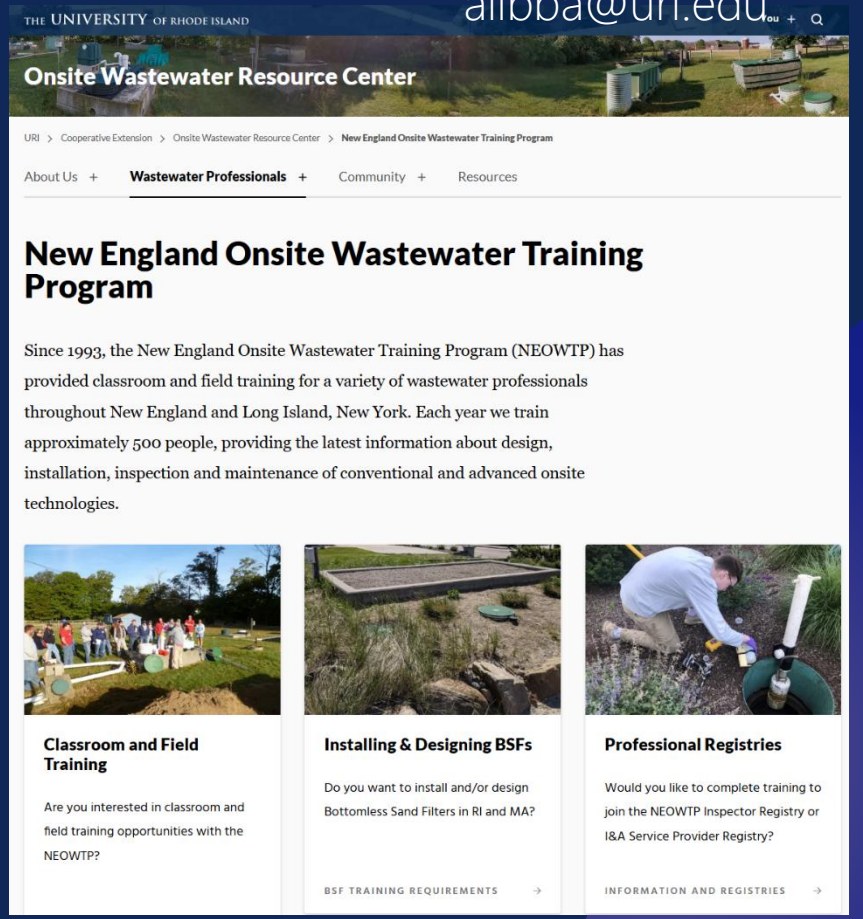
Alissa Cox
alibba@uri.edu

University of Rhode Island

- New England Onsite Wastewater Training Program
  - Field, Classroom and Online Training options year-round
  - Ask about custom training!

Approved TCHs for…

- Registered Environmental Health Specialist / Registered Sanitarian (REHS/RS)
- MA Title V Soil Evaluators (SE) and System Inspectors (SI)



uri.edu/owt/wastewater-professionals/

or search "URI wastewater training"

EIA TECHNOLOGIES ON THE HORIZON

- Neighborhood-level demonstration pilot project in MA: Dr. Laura Erban
- Holistic wastewater management at the community level – implementation case studies in MA: Scott Horsley
- Managing Septic Systems as Infrastructure: David Iorio Izzo & Brian Baumgaertel
- Financial implications of upgrading existing septic systems to EIAs in MA: Bruce Walton

Q&A opportunities after each section + at end of session

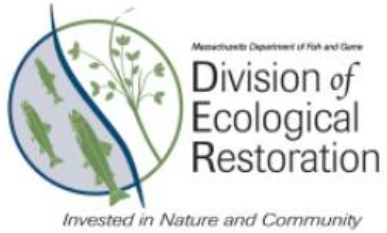
ENHANCED I&A SYSTEMS: FIELD PERFORMANCE OF ENHANCED SEPTIC SYSTEMS WITH WOODCHIP BIOREACTORS TO REDUCE NITROGEN LOADING IN BARNSTABLE, MA (CAPE COD)

Laura Erban

USEPA

Acknowledgments

Local farmers and other landowners



Disclaimer: *The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency. Any mention of trade names, products, or services does not imply an endorsement by the U.S. Government or the U.S. Environmental Protection Agency. The EPA does not endorse any commercial products, services, or enterprises.*

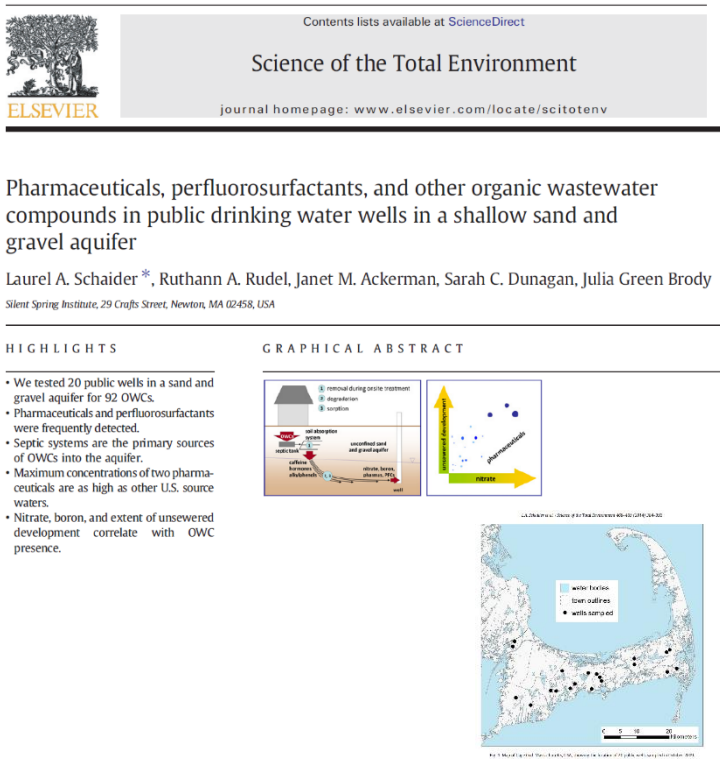
Nutrients and co-pollutants in onsite wastewater can overload water resources

The New York Times

A Toxic Stew on Cape Cod: Human Waste and Warming Water

Climate change is contributing to electric-green algae blooms. Massachusetts wants a cleanup of the antiquated septic systems feeding the mess, but it could cost billions.

Ashley Fisher, director of the Mashpee Department of Natural Resources in Massachusetts, took samples from the bed of the Mashpee River earlier this month.



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

ELSEVIER

Pharmaceuticals, perfluorosurfactants, and other organic wastewater compounds in public drinking water wells in a shallow sand and gravel aquifer

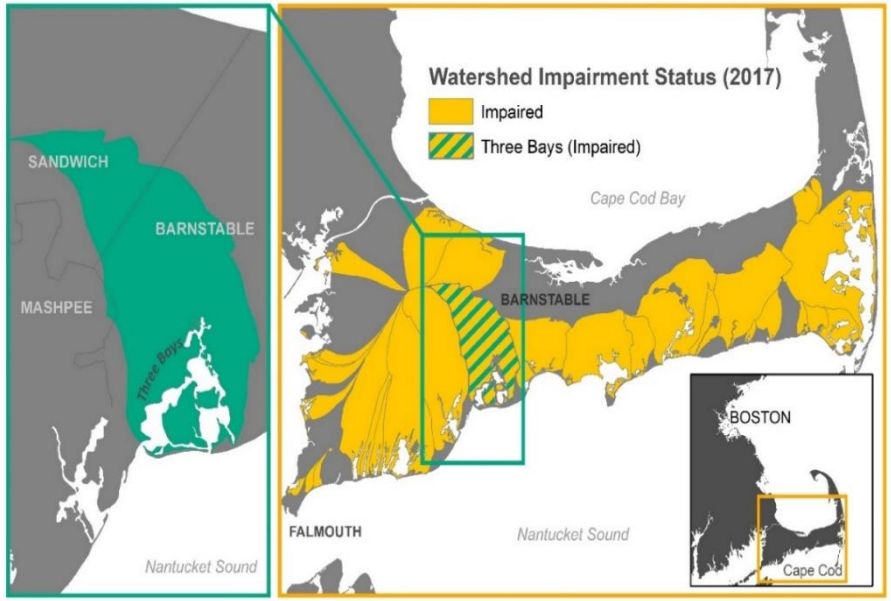
Laurel A. Schaider *, Ruthann A. Rudel, Janet M. Ackerman, Sarah C. Dunagan, Julia Green Brody

Silent Spring Institute, 29 Crafts Street, Newton, MA 02458, USA

HIGHLIGHTS

- We tested 20 public wells in a sand and gravel aquifer for 92 OWCs.
- Pharmaceuticals and perfluorosurfactants were frequently detected.
- Septic systems are the primary sources of OWCs into the aquifer.
- Maximum concentrations of two pharmaceuticals are as high as other U.S. source waters.
- Nitrate, boron, and extent of unsewered development correlate with OWC presence.

GRAPHICAL ABSTRACT



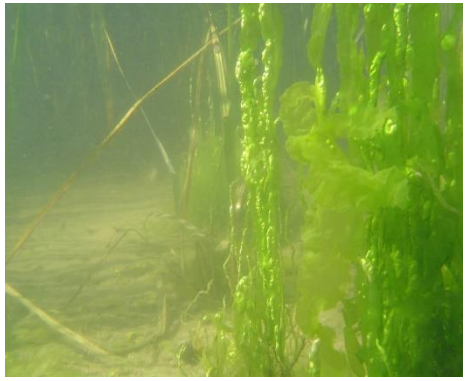
More than 30 Cape Cod watersheds have Total Maximum Daily Loads (TMDLs) for nitrogen.
Source: Twichell et al., 2019. EPA/600/R-19/107

EPA United States Environmental Protection Agency

Cape Cod communities are pursuing multiple means of load reduction

- TMDLs call for >50% reduction in nitrogen (N) loading from septic systems Cape-wide.
- Sewer expansion and complementary approaches for recurring and legacy pollution.
- Clean Water Act Section 208 Plan Update Technologies Matrix identifies many interventions, including enhanced decentralized or onsite wastewater treatment.

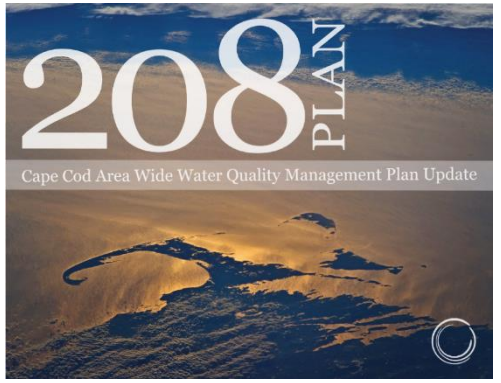
USGS



Buzzards Bay Coalition

NYTimes

Town of Mashpee



Cape Cod Commission, 2015

EPA United States Environmental Protection Agency

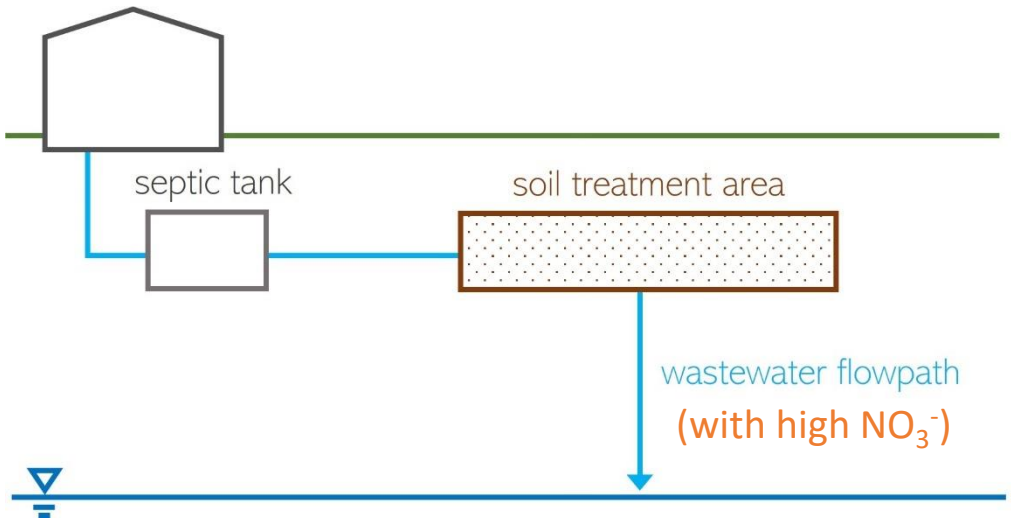
Improving wastewater treatment takes time

- Innovative/Alternative (I/A) septic systems in Massachusetts have historically sought to meet a performance goal of 19 mg/L total nitrogen (TN) in effluent.
- New regulations (2023) set a more stringent goal for best available nitrogen reducing technologies of 10 mg/L TN
- 50 installations and 3 years of monitoring are required for general use approval.
- Few high-performing, or enhanced I/A (EIA) options are available to users.

Sampling by MASSTC photo: L. Erban

Enhancing onsite wastewater treatment

conventional septic system



* Note that the diagram is simplified and not to scale!

alternatives

- separate waste streams
  (urine diversion, composting toilets, tight tanks)
- add treatment stage(s) for mixed effluent


Agronomy for Sustainable Development (2021) 41: 56
https://doi.org/10.1007/s13593-021-00675-2

RESEARCH ARTICLE

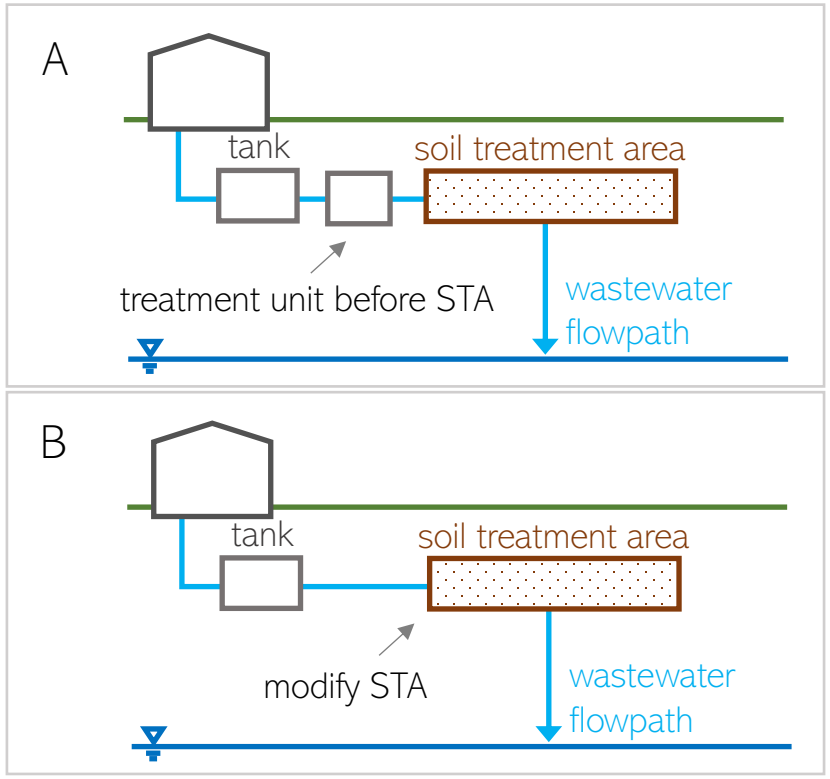
Sanitized human urine (Oga) as a fertilizer auto-innovation from women farmers in Niger

Hannatou O. Moussa[1] · Charles I. Nwankwo[2] · Ali M. Aminou[3] · David A. Stern[4] · Bettina I. G. Haussmann[5] · Ludger Herrmann[2]

Accepted: 29 January 2021 / Published online: 29 July 2021

Enhancing onsite wastewater treatment of nitrogen (N)

alternative septic systems



* Note that the diagram is simplified and not to scale!

- Designs with a lignocellulosic carbon source can provide a high degree of N removal.
- Two designs (proprietary and non-proprietary) use woodchips in this demonstration effort.

A

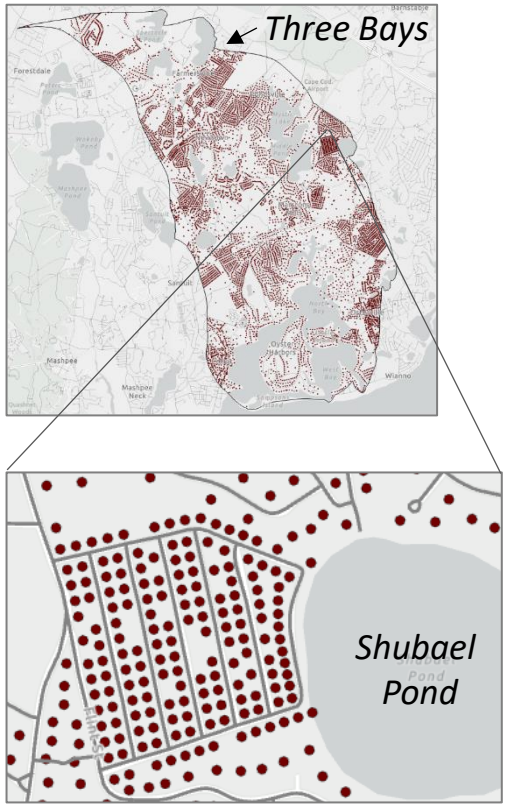
NiTROE® treatment unit
by KleanTu LLC

B

modified STA
by MASSTC

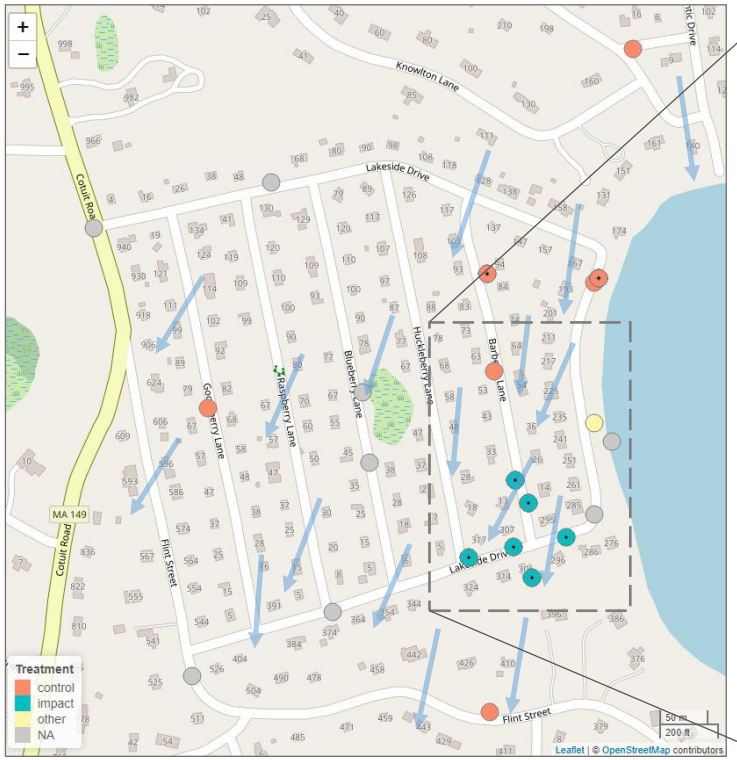
Demonstration setup

watershed screening



● onsite wastewater treatment system

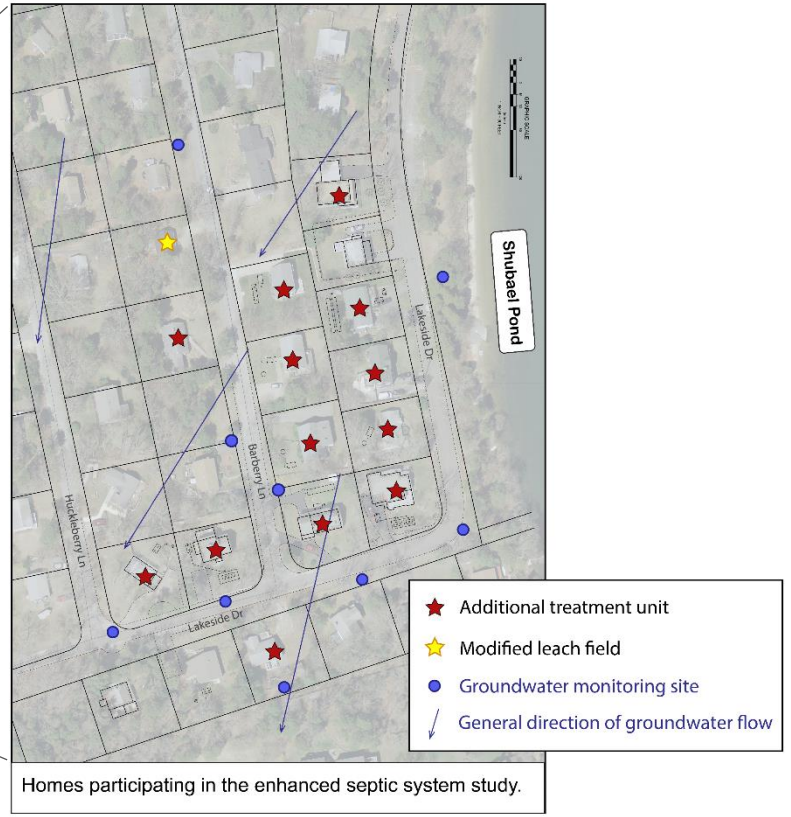
well network



• Indicates multiple sampling depths at site

General direction of groundwater flow

EIA septic systems (n = 14)



Homes participating in the enhanced septic system study.

Partners

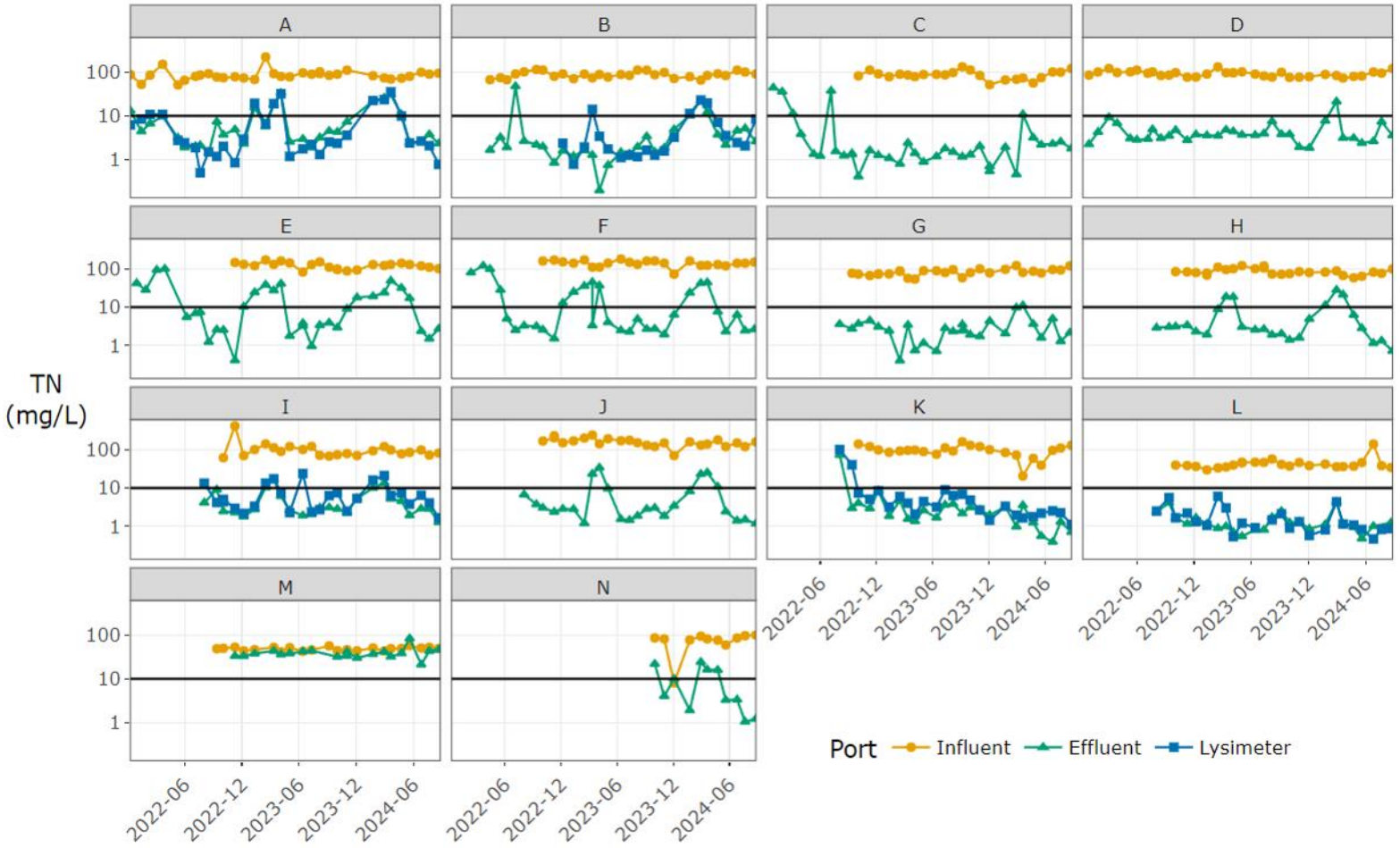
Barnstable Clean Water Coalition

USGS science for a changing world

EPA

TOWN OF BARNSTABLE

Performance monitoring: N concentrations over time



- monthly samples > 2 years
- continuous flow metering
- >90% reduction in TN
- In effluent samples (n = 375):
  - 77% < 10 mg/L
  - 49% < 3 mg/L

TN = 10 mg/L

Partners

Barnstable Clean Water Coalition

MASSTC The Massachusetts Alternative Septic System Test Center

EPA

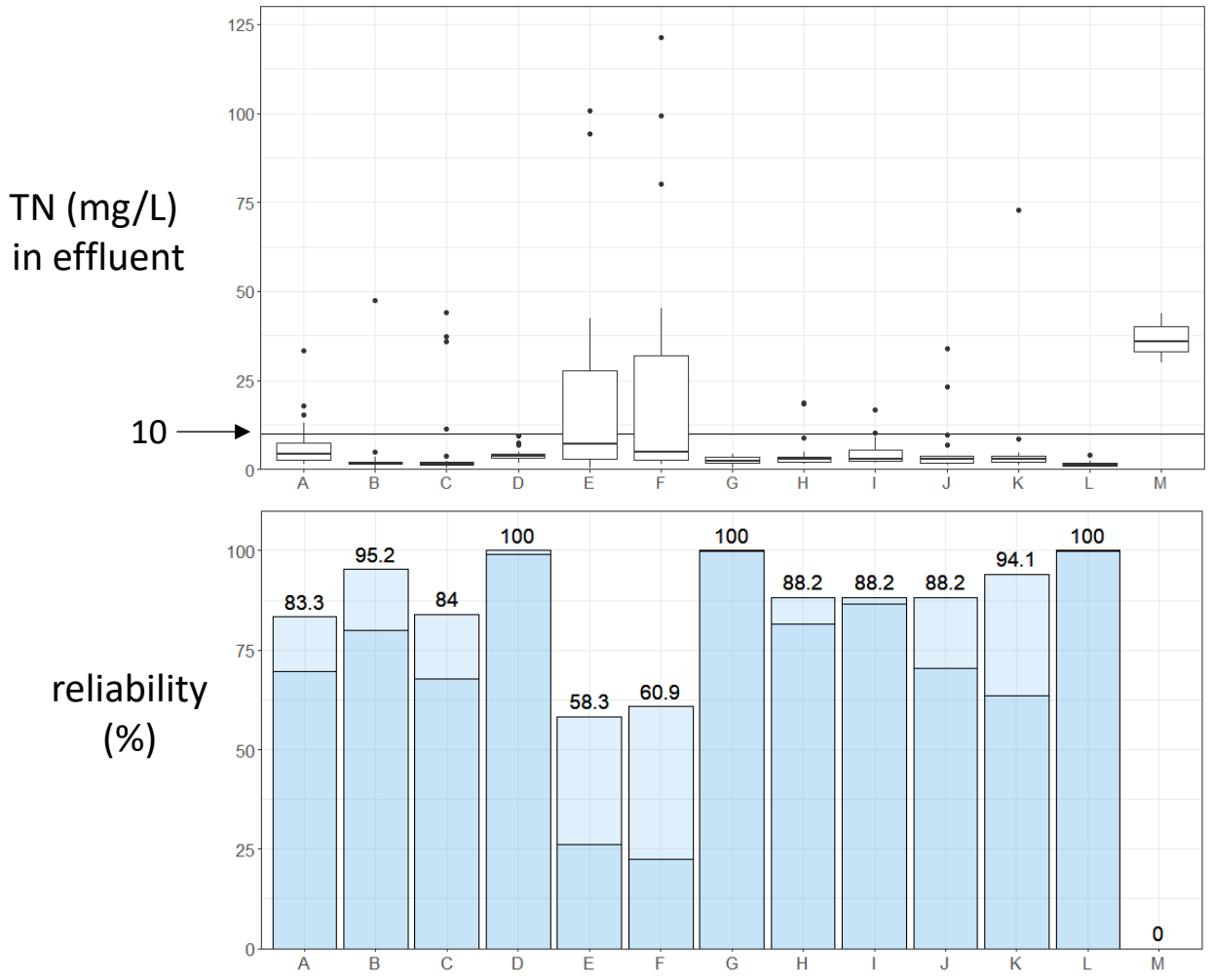
homeowners

Preliminary Information-Subject to Revision. Not for citation.

Reliability of individual systems

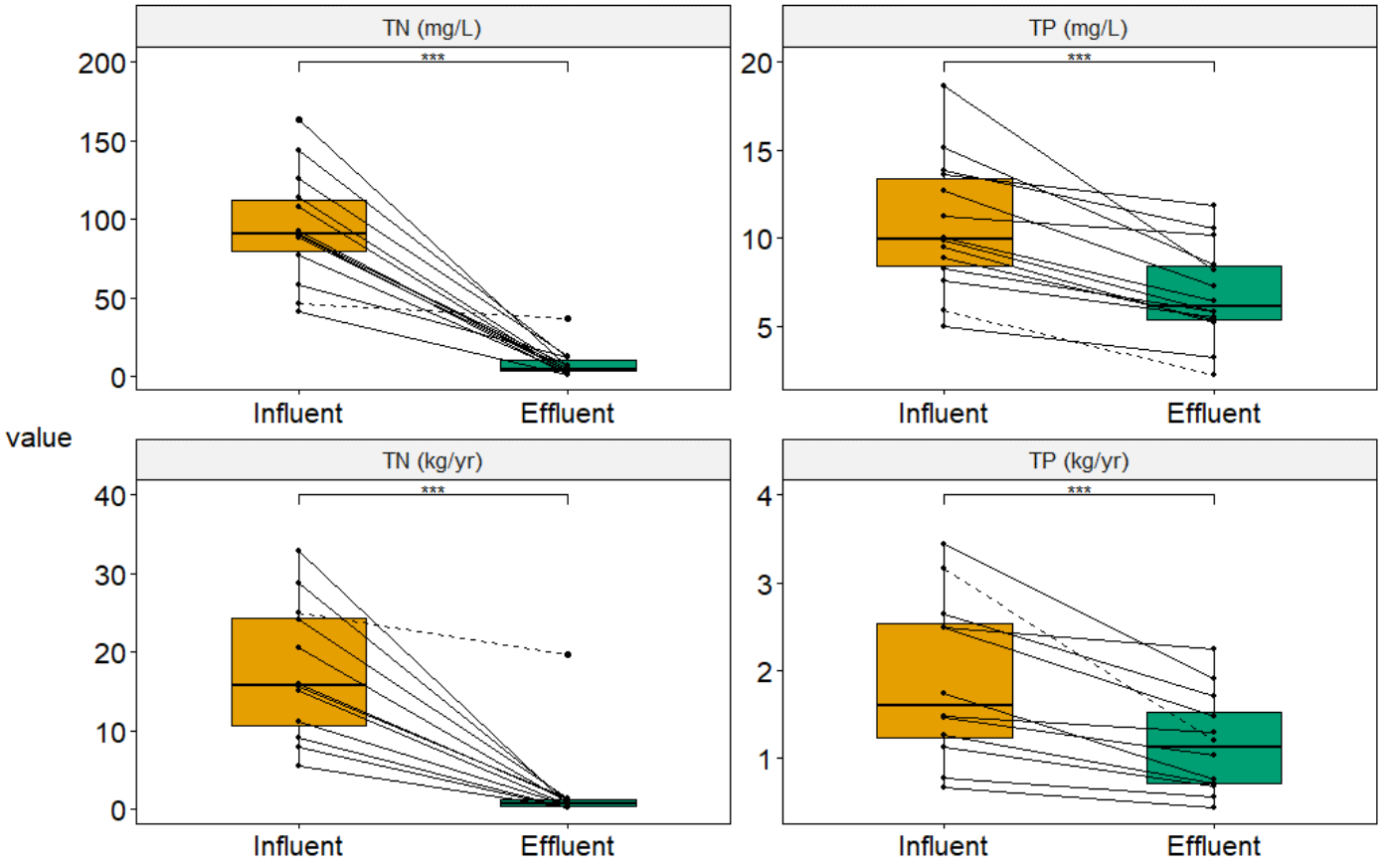
- Varies by household, technology, system adjustments.
- High performance requires good design, use, and maintenance.
- Monitoring and maintenance costs scale with number of systems.
- How might we implement cluster systems and/or responsible management entities (RME)?

data through 2023-12



Erban et al., J. Enviro. Manage., 2024

Nutrient (N & P) reductions and mass loads



Erban et al., J. Enviro. Manage., 2024

- Load estimates are based on mean daily flow and mean monthly concentration for systems with flow meters and a least one calendar year of data.
- Boxes depict spread in estimates among systems.
- Estimates are sensitive to aggregation method.

Partners

homeowners

EPA United States Environmental Protection Agency

EIA septic system performance: beyond nutrients

Ecological Engineering 161 (2021) 106157

Contents lists available at ScienceDirect

Ecological Engineering

journal homepage: www.elsevier.com/locate/ecoleng

Removing 80%–90% of nitrogen and organic contaminants with three distinct passive, lignocellulose-based on-site septic systems receiving municipal and residential wastewater

Christopher J. Gobler[a,b,*], Stuart Waugh[a], Caitlin Asato[a], Patricia M. Clyde[a,b], Samantha C. Nyer[a,b], Molly Graffam[a,b], Bruce Brownawell[b], Arjun K. Venkatesan[a,c], Jennifer A. Goleski[b], Roy E. Price[a,b], Xinwei Mao[a,c], Frank M. Russo[a,c], George Heufelder[d], Harold W. Walker[a,1]

[a] New York State Center for Clean Water Technology, Stony Brook University, Stony Brook, NY 11794, USA
[b] School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY 11794, USA
[c] Department of Civil and Environmental Engineering, Stony Brook University, Stony Brook, NY 11794, USA
[d] Massachusetts Alternative Septic System Test Center (MASSTC), Barnstable County Department of Health and Environment, Barnstable, MA 02630, USA

frontiers | Frontiers in Marine Science

TYPE Original Research
PUBLISHED 23 May 2023
DOI 10.3389/fmars.2023.1069599

Check for updates

OPEN ACCESS

EDITED BY
Wei-Bo Chen,
National Science and Technology Center for Disaster Reduction(NCDR), Taiwan

REVIEWED BY
Lisa Krimsky,
University of Florida, United States
Ming Ye,
Florida State University, United States

*CORRESPONDENCE
Alexie N. Rudman
alexie.rudman@capecod.gov

RECEIVED 14 October 2022
ACCEPTED 08 May 2023
PUBLISHED 23 May 2023

Factors in homeowners' willingness to adopt nitrogen-reducing innovative/alternative septic systems

Alexie N. Rudman[1,2*], Kate K. Mulvaney[1], Nathaniel H. Merrill[1] and Katherine N. Canfield[1]

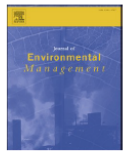
[1]Office of Research and Development, United States Environmental Protection Agency, Narragansett, RI, United States, [2]Oak Ridge Institute for Science and Education, Oak Ridge Associated Universities, Oak Ridge, TN, United States

Journal of Environmental Management 370 (2024) 122737

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman



Research article

Reducing wastewater nitrogen loading by >90% with carbon-amended septic systems: A field demonstration in Barnstable (Cape Cod), Massachusetts

Laura E. Erban[a,*], Sara K. Wigginton[b], Brian Baumgaertel[b], Bryan Horsley[b], Timothy D. McCobb[c], Zenas Crocker[d], Scott Horsley[e], Timothy R. Gleason[a]

[a] U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, RI, USA
[b] Massachusetts Alternative Septic System Test Center, Sandwich, MA, USA
[c] U.S. Geological Survey, New England Water Science Center, Northborough, MA, USA
[d] Barnstable Clean Water Coalition, Osterville, MA, USA
[e] Horsley Consulting, Cotuit, MA, USA

EIA septic systems in context

- One of many solutions
- Total mass of pollutants
- Values and perceptions of people
- Limitations and co-benefits

Wetland restoration site. Photo: K. Canfield

	Site Scale	Neighborhood	Watershed	Cape-Wide
Reduction	Standard Title 5 System	Cluster Treatment System: Single or Two-stage	Conventional Treatment	Fertilizer Management ❖
	I/A Title 5 Systems	Satellite Treatment	Advanced Treatment	Compact and Open Space Development ❖
	Enhanced I/A Systems	Nutrient Reducing Development ❖		
	Toilets: Composting, Incinerating, Packaging, Urine Diverting	Transfer of Development Rights ❖		
	Hydroponic Treatment			
Remediation		Constructed wetlands		Stormwater: Best Management Practices (BMPs) ❖
		Phytoirrigation		
	Permeable Reactive Barriers (PRB)			
	Phytoremediation			
	Stormwater: Bioretention/ Soil Media Filters	Fertigation Wells: Turf, Cranberry Bogs		
		Stormwater: Constructed Wetlands		
Restoration		Aquaculture/Shellfish Farming		
		Coastal Habitat Restoration		
		Inlet/Culvert Widening		
		Constructed Wetlands: Floating		
		Pond and Estuary Circulators		
		Surface Water Remediation Wetlands		
		Pond and Estuary Dredging		

legacy wastewater pollution

❖ Policy

Adapted Technologies Matrix from Cape Cod Area Wide Water Quality Management ("208") Plan Update (2015)

EPA
United States
Environmental Protection
Agency

Questions?

erban.laura@epa.gov

Laura Erban, PhD

Office of Research and Development
Center for Environmental Measurement and Modeling, Atlantic Coastal Environmental Sciences Division

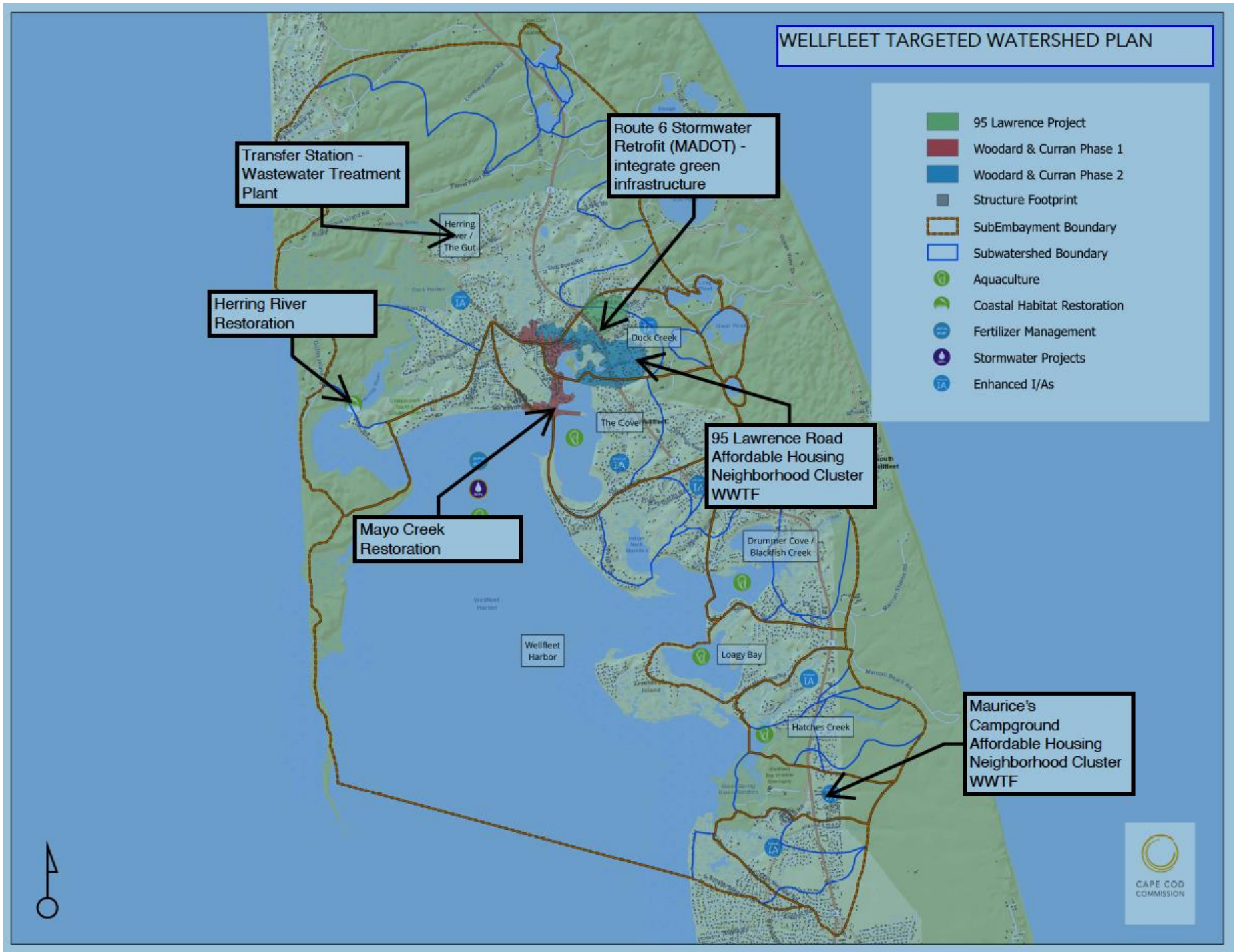
CASE STUDIES: I/As AS INFRASTRUCTURE

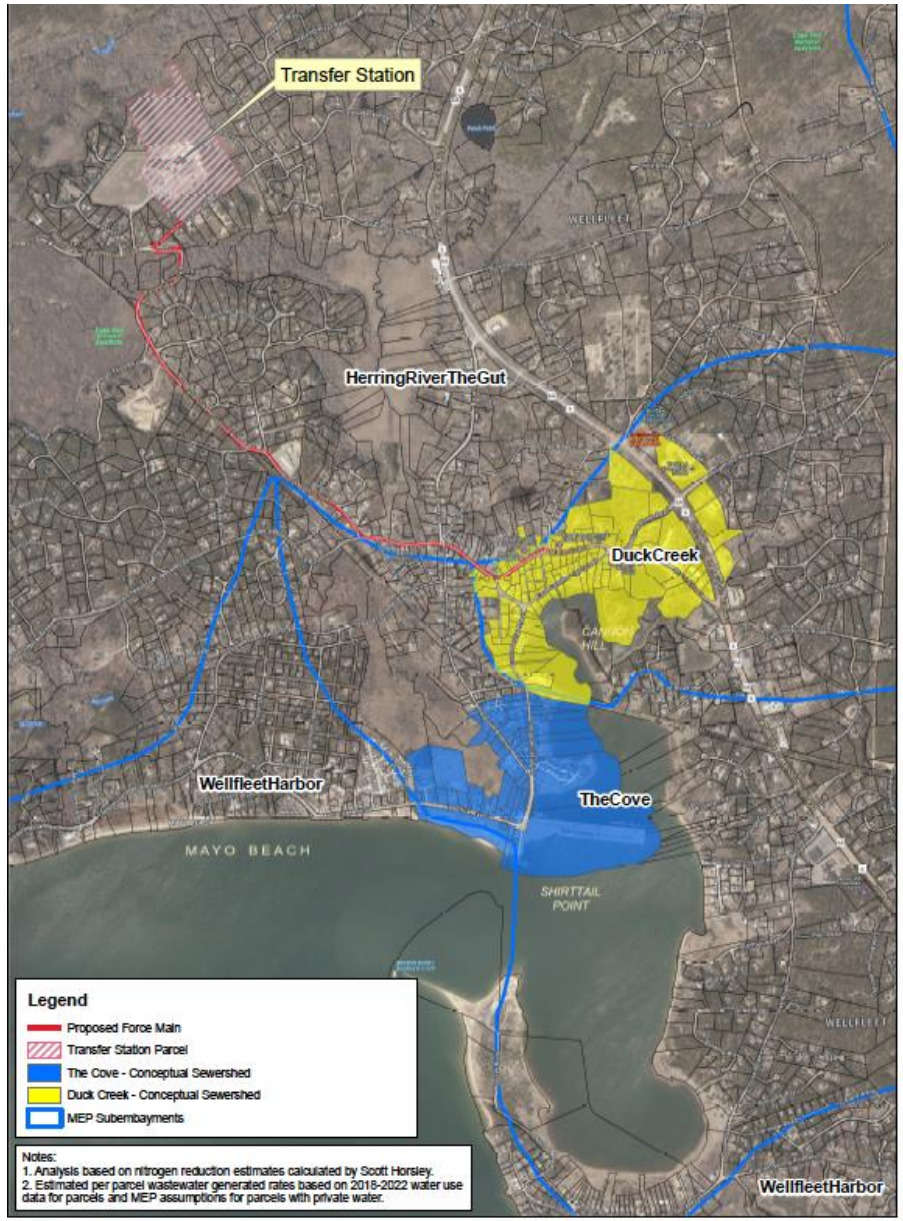
Scott Horsley

Water Resources Consultant

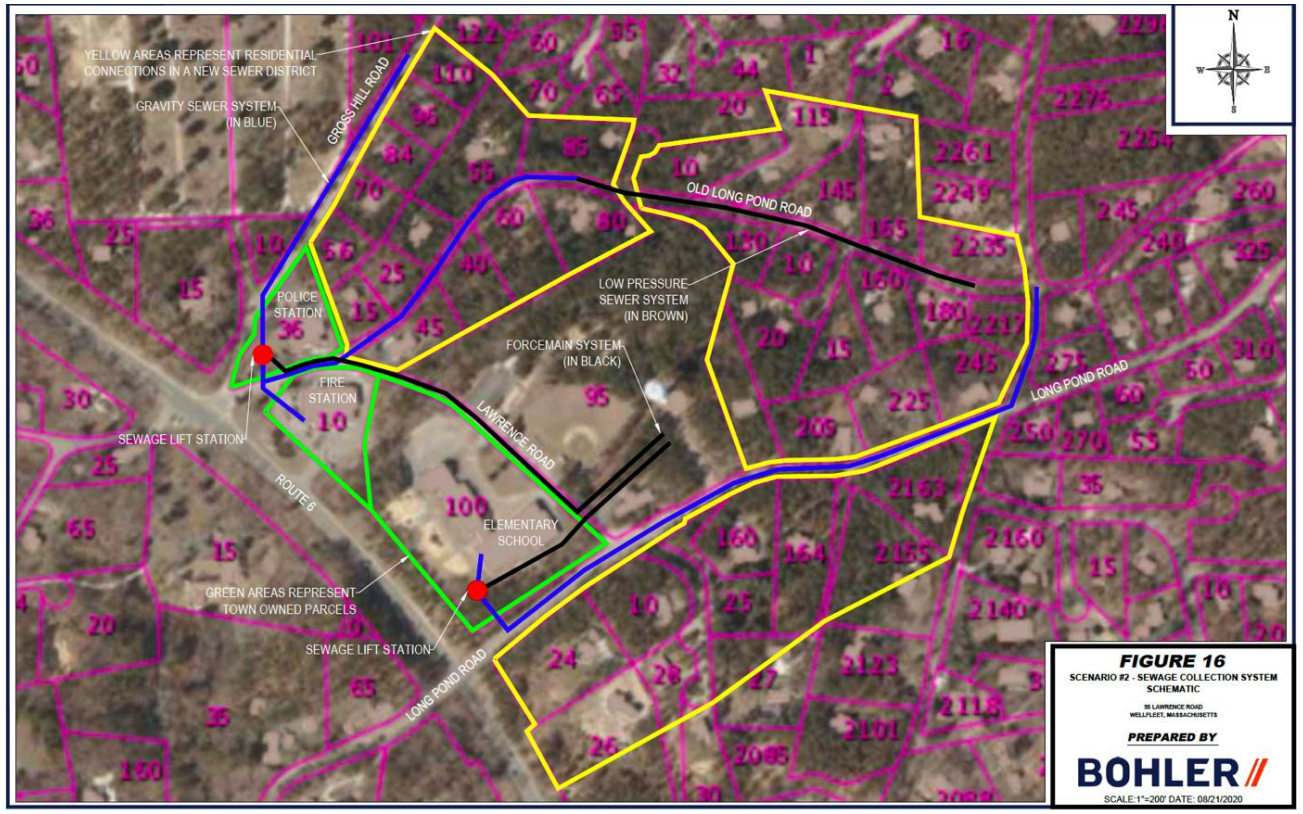
Wellfleet Targeted Watershed Management Plan (TWMP) Update

Scott Horsley, Water Resources Consultant

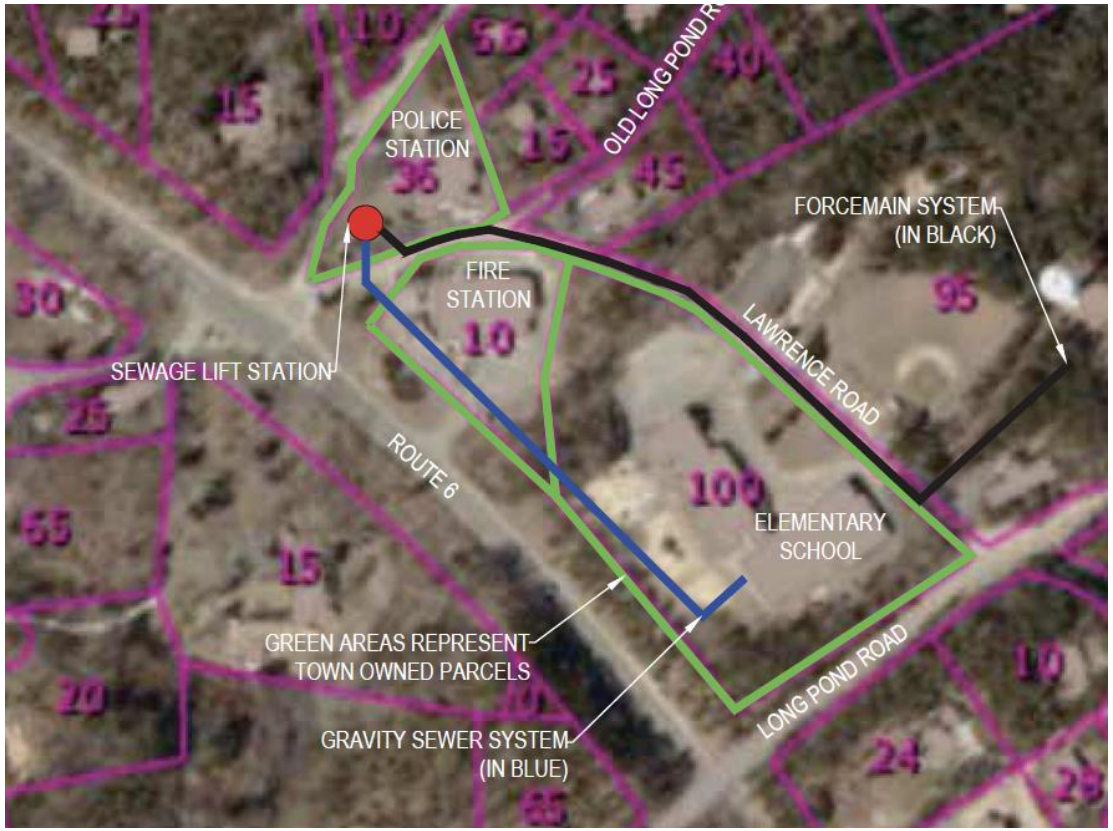

WELLFLEET TARGETED WATERSHED PLAN
95 Lawrence Project
Woodard & Curran Phase 1
Woodard & Curran Phase 2
Structure Footprint
SubEmbayment Boundary
Subwatershed Boundary
Aquaculture
Coastal Habitat Restoration
Fertilizer Management
Stormwater Projects
Enhanced I/As
Transfer Station - Wastewater Treatment Plant
Route 6 Stormwater Retrofit (MADOT) - integrate green infrastructure
Herring River Restoration
Mayo Creek Restoration
95 Lawrence Road Affordable Housing Neighborhood Cluster WWTF
Maurice's Campground Affordable Housing Neighborhood Cluster WWTF
Herring River / The Gut
Duck Creek
The Cove
Drummer Cove / Blackfish Creek
Wellfleet Harbor
Loagy Bay
Hatches Creek
CAPE COD COMMISSION


Transfer Station
HerringRiverTheGut
DuckCreek
WellfleetHarbor
TheCove
MAYO BEACH
SHIRTTAIL POINT
WellfleetHarbor
Legend
Proposed Force Main
Transfer Station Parcel
The Cove - Conceptual Sewershed
Duck Creek - Conceptual Sewershed
MEP Subembayments
Notes:
1. Analysis based on nitrogen reduction estimates calculated by Scott Horsley.
2. Estimated per parcel wastewater generated rates based on 2018-2022 water use data for parcels and MEP assumptions for parcels with private water.
GHD
TOWN OF WELLFLEET, MASSACHUSETTS
PRELIMINARY SEWER ANALYSIS
MEP THRESHOLD HYBRID COMPLIANCE APPROACH - CONCEPTUAL SEWERSHED LAYOUT
Project No. 11216492
Revision No. -
Date 05/27/2022
FIGURE 1

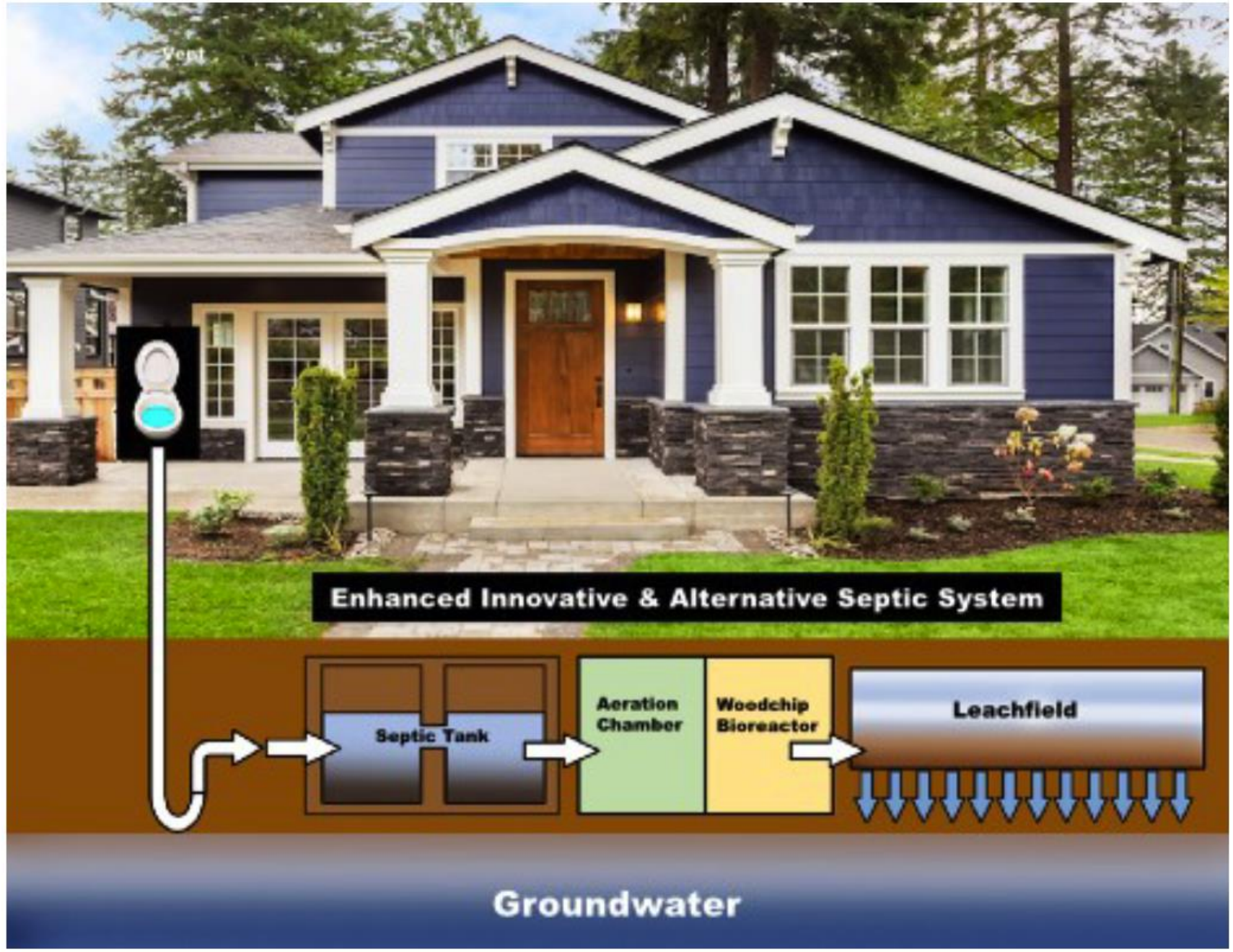
95 Lawrence Road Affordable Housing Project



Option A – Neighborhood System



Option B – Municipal Buildings


Vent
Enhanced Innovative & Alternative Septic System
Septic Tank
Aeration Chamber
Woodchip Bioreactor
Leachfield
Groundwater

Wellfleet Targeted Watershed Management Plan - Cost/Sensitivity Analysis

Table 8 – Comparative Costs – Wastewater Alternatives

	Concentration	N load	N reduction		Cost	
	mg/liter	kg/year	kg/year	percentage	capital	$/kg
Title 5 system	23.6	4.73				
I&A @ 5 mg/liter	5	0.90	3.83	81%	$ 35,000	$ 457
I&A @ 8 mg/liter	8	1.44	3.29	69%	$ 35,000	$ 533
I&A @ 11 mg/liter	11	1.98	2.74	58%	$ 35,000	$ 638
I&A @ 19 mg/liter	19	3.43	1.30	28%	$ 35,000	$ 1,344
Town-wide WW @ 3 mg/l	3	0.54	4.19	89%	$ 76,400	$ 912
Town-wide WW @ 5 mg/l	5	0.90	3.83	81%	$ 76,400	$ 998
Downtown WW @ 3 mg/l	3	0.54	4.19	89%	$ 109,800	$ 1,311
Downtown WW @ 5 mg/l	5	0.90	3.83	81%	$ 109,800	$ 1,435
Cluster Treatment A @ 6 mg/l	6	174	511	75%	$ 4,703,300	$ 460
Cluster Treatment A @ 10 mg/l	10	290	395	58%	$ 4,703,300	$ 595
Cluster Treatment B @ 6 mg/l	6	124	365	75%	$ 2,546,210	$ 349
Cluster Treatment B @ 10 mg/l	10	207	282	58%	$ 2,546,210	$ 451

Wellfleet Targeted Watershed Plan Costs ($ M)

Sewer Collection & Treatment

95 Lawrence Road Affordable Housing WWTF

I&A Septics

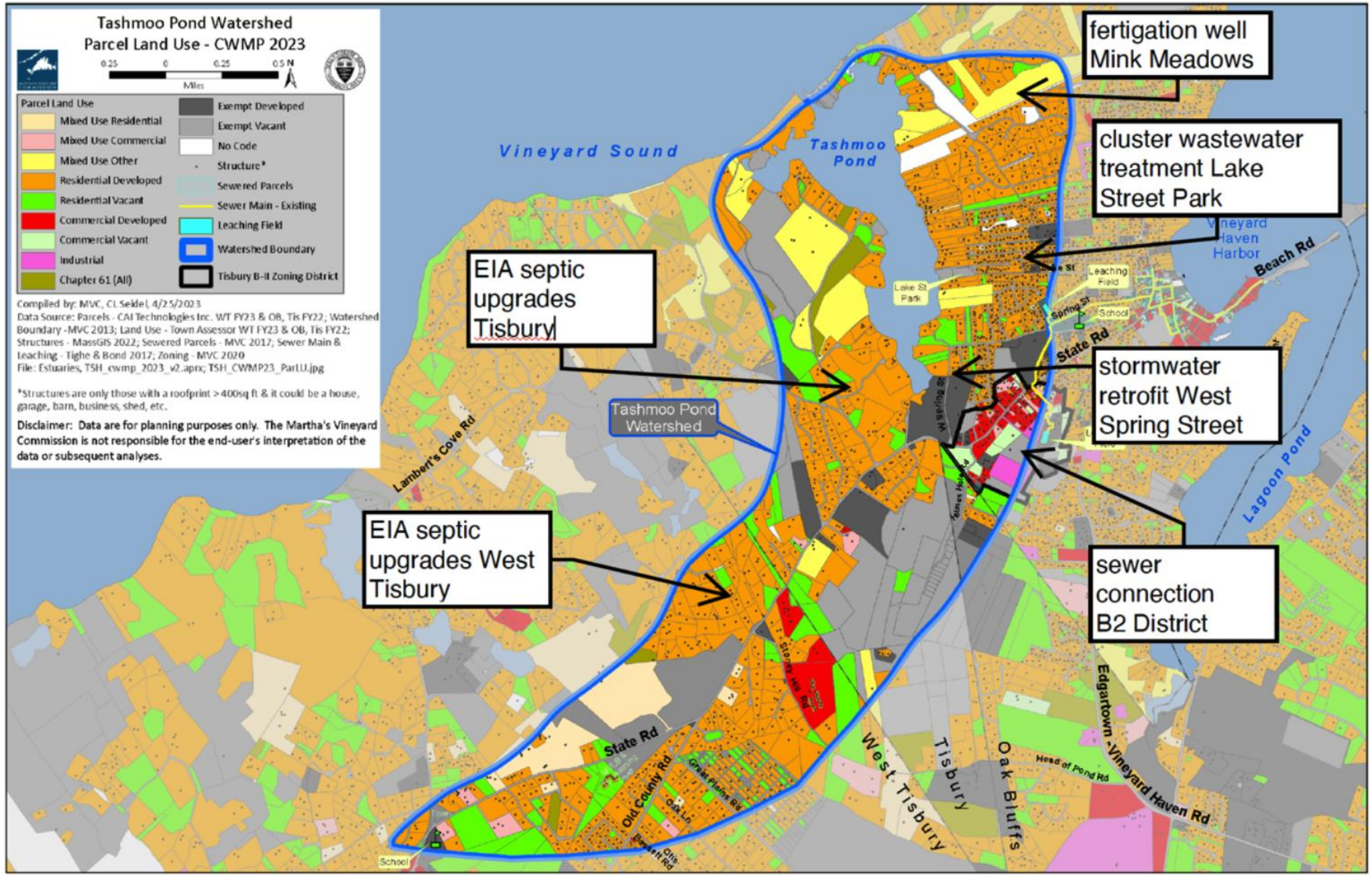
	Scenario A Hybrid	Scenario B Traditional
Collection System	$9.4	$80.4
Wastewater Treatment	$10.9	$32.7
Sewer Laterals	$3.2	$27.5
Design	$2.0	$11.3
Construction Services	$5.0	$30.7
Total Municipal Centralized Infrastructure	$30.5	$182.6
Collection System	$0.8	$0.8
Wastewater Treatment	$0.9	$0.9
Leaching System	$0.2	$0.2
Design & Contingencies	$0.6	$0.6
Total 95 Lawrence Capital Costs	$2.5	$2.5
I&A Septics	$63.0	$44.9
Design	$10.6	$7.5
Total I&A Septics	$73.6	$52.4
TOTAL COSTS (millions)	$106.6	$237.5

Lake Tashmoo Targeted Watershed Management Plan (TWMP)

Town of Tisbury

Scott Horsley

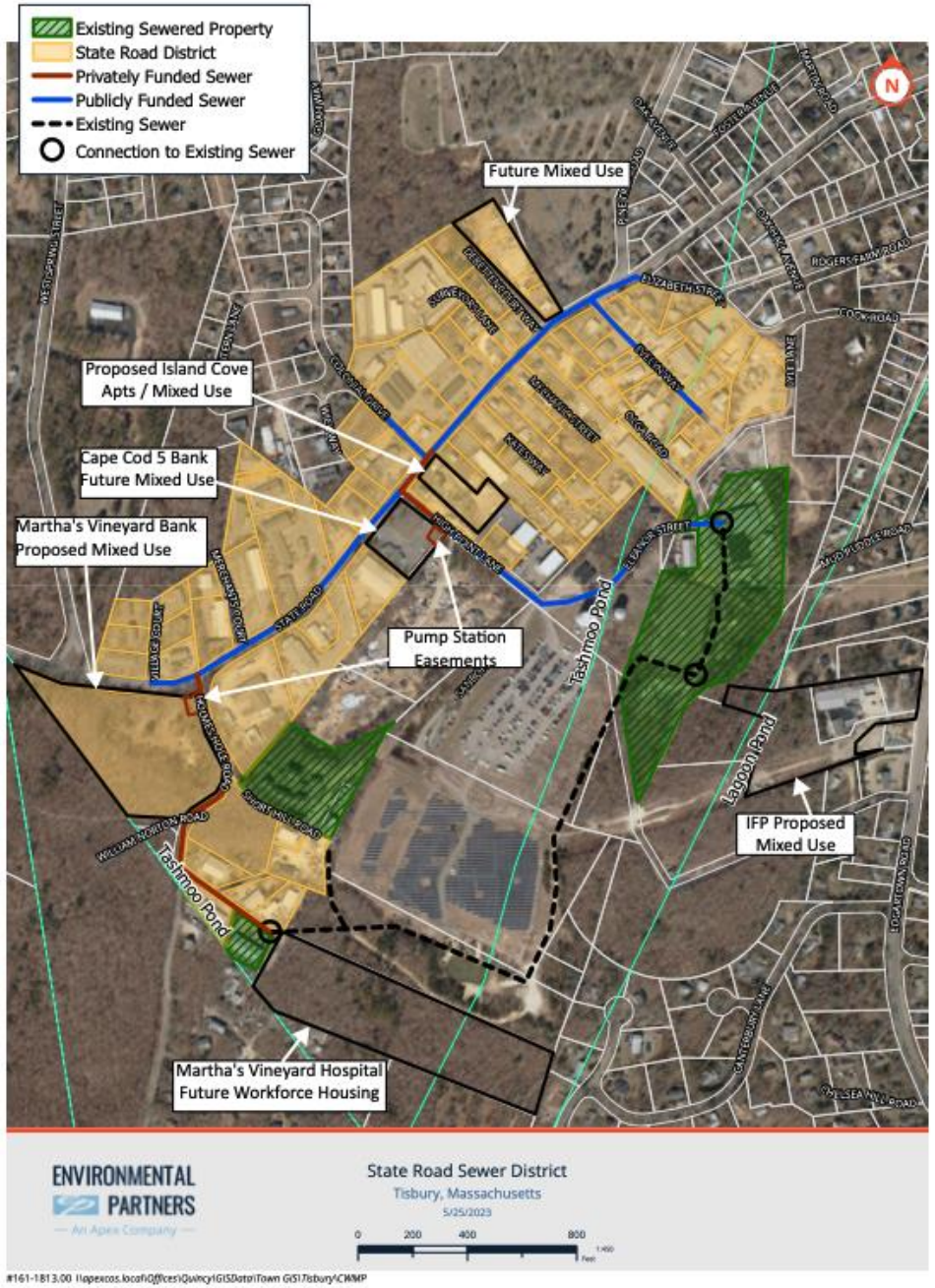
Water Resources Consultant


Tashmoo Pond Watershed
Parcel Land Use - CWMP 2023
0.25 0 0.25 0.5 N
Miles
Parcel Land Use
Mixed Use Residential
Mixed Use Commercial
Mixed Use Other
Residential Developed
Residential Vacant
Commercial Developed
Commercial Vacant
Industrial
Chapter 61 (All)
Exempt Developed
Exempt Vacant
No Code
Structure*
Sewered Parcels
Sewer Main - Existing
Leaching Field
Watershed Boundary
Tisbury B-II Zoning District
Compiled by: MVC, CL Seidel, 4/25/2023
Data Source: Parcels - CAI Technologies Inc. WT FY23 & OB, Tis FY22; Watershed Boundary -MVC 2013; Land Use - Town Assessor WT FY23 & OB, Tis FY22; Structures - MassGIS 2022; Sewered Parcels - MVC 2017; Sewer Main & Leaching - Tighe & Bond 2017; Zoning - MVC 2020
File: Estuaries, TSH_cwmp_2023_v2.aprx; TSH_CWMP23_ParLU.jpg
*Structures are only those with a roofprint > 400sq ft & it could be a house, garage, barn, business, shed, etc.
Disclaimer: Data are for planning purposes only. The Martha's Vineyard Commission is not responsible for the end-user's interpretation of the data or subsequent analyses.
fertigation well Mink Meadows
cluster wastewater treatment Lake Street Park
EIA septic upgrades Tisbury
stormwater retrofit West Spring Street
EIA septic upgrades West Tisbury
sewer connection B2 District
Vineyard Sound
Tashmoo Pond
Tashmoo Pond Watershed
Lambert's Cove Rd
Lake St Park
Leaching Field
Spring St
School
State Rd
Beach Rd
Vineyard Haven Harbor
Lagoon Pond
Edgartown - Vineyard Haven Rd
Head of Pond Rd
West Tisbury
Tisbury
Oak Bluffs
Old County Rd
Great Plains Rd
Oak Ln
Stoney Hill Rd
School

Nitrogen Reduction Strategy (2043)

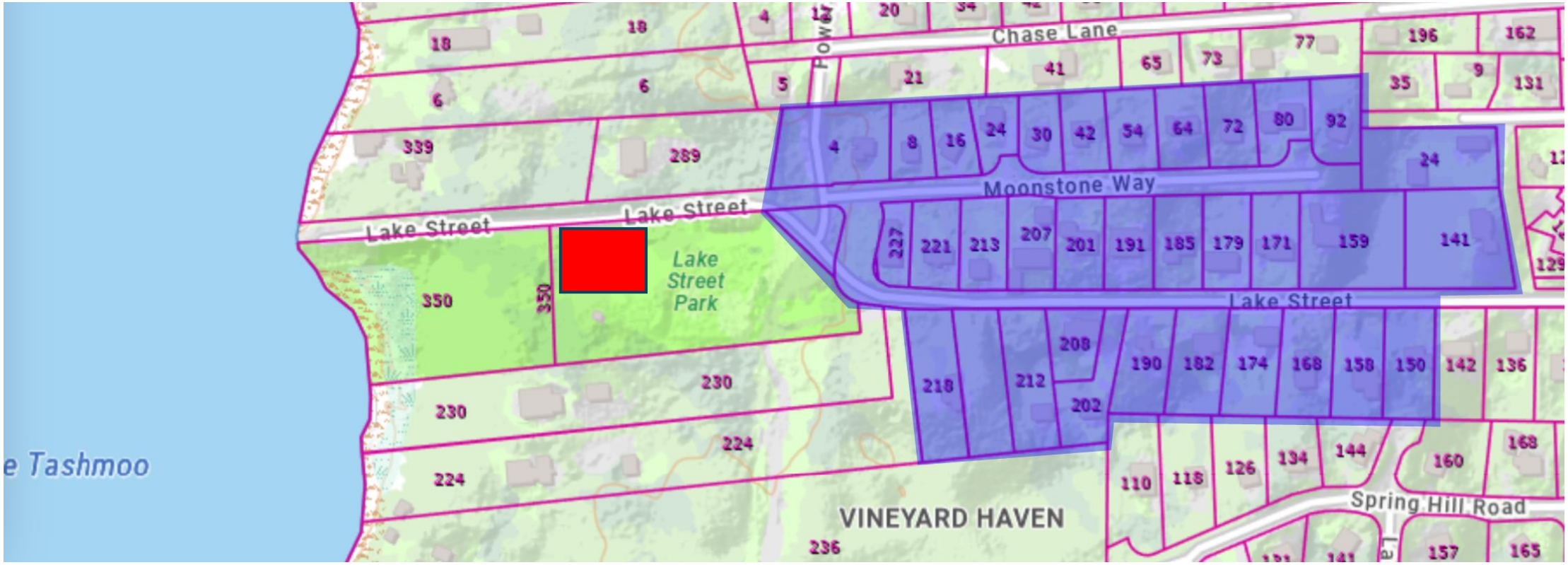
Technology/Strategy	Calculation Summary			Reduction (kg/yr)
Sewering (B2 District)	16330	gals/day		560
Enhanced I&A Septics	838	upgrades	x 171 gals/day x (26.25 - 10.0) mg/liter	3217
Cluster Treatment	9900	gals/day	x (26.25 - 5.0) mg/liter	291
Fertilizer Management	25	percent	x 457 kg/year	114
Stormwater Retrofits	25	percent	x 715 kg/year	179
TOTAL				**4361**

Note: Calculations include conversion factors of 3.785 liters/gallon and 1,000,000 mg/kg



Core Sewer Area
B2 Zoning District

Cluster Wastewater Treatment System – Lake Street Park



Note: Conceptual Plan

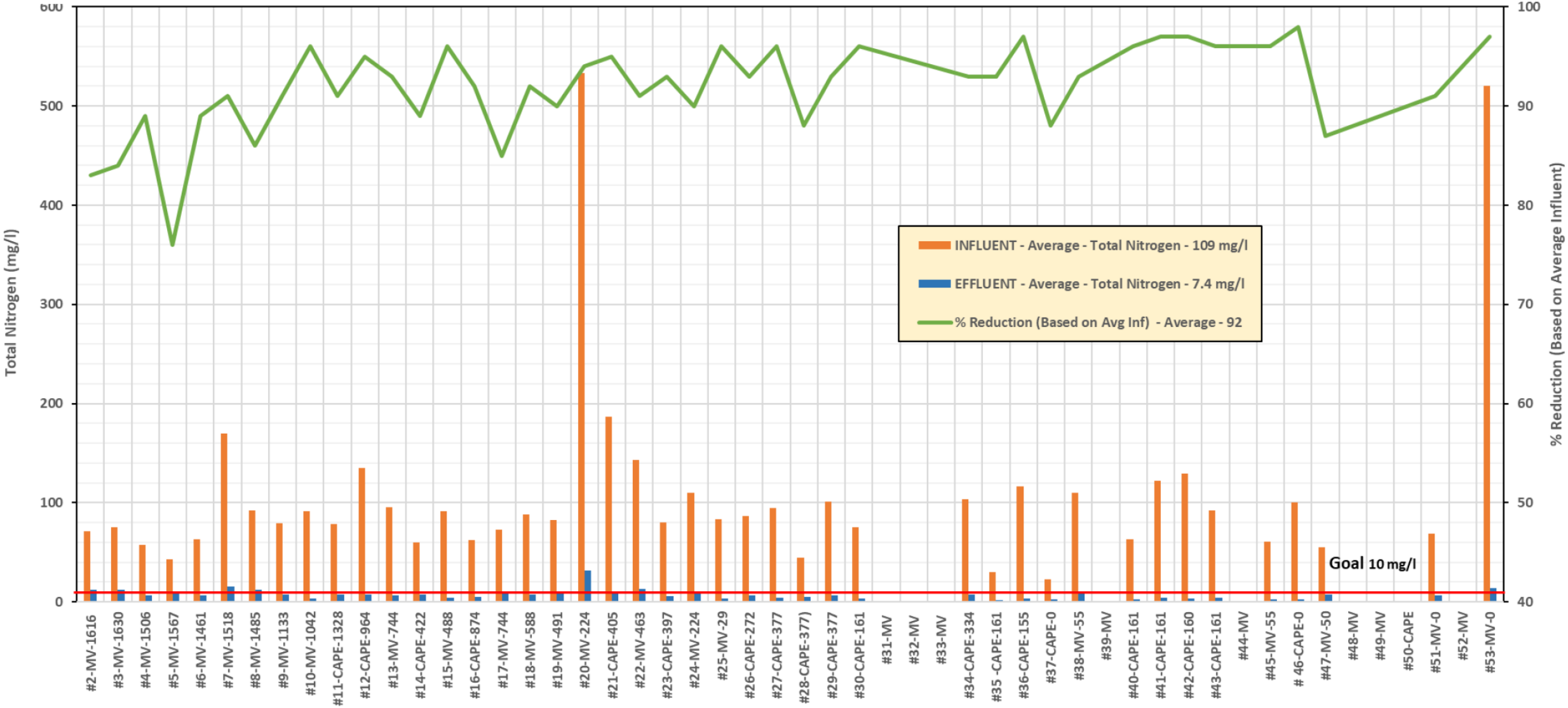
KleanTu Wastewater Treatment Technologies ®

Average Total Nitrogen - Influent & Effluent

Installation #

Location - MV/ Cape Cod

Total Days of Operational Monitoring



Enhanced Innovative & Alternative (EIA) Septic Systems
Actual (As-Built) Costs
(including engineering design fees)

		Number	Construction Cost	Engineering Design	Total Cost Per System	Updated Cost Estimates 2023 (add $10,000)
Retrofit of Existing Title 5 System						
	Buzzards Bay Coalition	4	$24,891	$3,000	$27,891	
	Barnstable Clean Water Coalition	4	$19,852	$6,351	$26,203	
	Average		$22,372	$4,676	$27,047	$37,047
Partial Upgrade (replace septic tank or leachfield)						
	Barnstable Clean Water Coalition	2	$27,981	$6,351	$34,332	$44,332
Full Upgrades (including both septic tank and leachfield)						
	Buzzards Bay Coalition	4	$35,535	$3,000	$38,535	
	Barnstable Clean Water Coalition	2	$32,808	$6,351	$39,159	
	Average		$34,172	$4,676	$38,847	$48,847
	OVERALL AVERAGE COSTS				**$33,409**	**$43,409**

References:
Buzzards Bay Coalition, Designing a Municipal Model for Mandating, Funding, and Managing I&A Septic Systems, June 2020
Barnstable Clean Water Coalition, Schubael's Pond Study, 2022

tri
the resource inc.
for Community and Economic Development

			FILL IN THE BLUE BOXE	FILL IN THE BLUE BOXE	FILL IN THE BLUE BOXE	FILL IN THE BLUE BOXE	FILL IN THE BLUE BOXES
PROJECT ID	TRHR21-13T	**CONTRACTOR:**	Reis Excavating	JW Dubis	Ken Rose Septic	Northeast Construction	Sweeney Excavation Corp.
PROPERTY OWNER	Anne & Alexander Marshall	CONTACT:	justin Reis	Eugene Dubis	Kevin Rose	Robert Tulloch	Shay Perry, PM/Estimator
STREET ADDRESS	6 Katharine Rd.	ADDRESS:	515 tubman rd	79 Stonehil Rd	PO Box 1443	32 Sara Ann Ln	P.O. Box 2078
TOWN, STATE, ZIP	Truro MA 02653	TOWN:	brewster	Chatham	Wellfleet	Brewster	Sagamore Beach
PHONE	508-349-6224	STATE:	ma	ma	ma	ma	MA
CELL	340-690-3236	ZIP:	2631	2633	2667	2631	2562
EMAIL	amarshall02@aol.com	PHONE:		508-945-0283	5083496804	508-989-4169	774-269-1914
YEAR BUILT	1972	CELL:	5082404837				774-283-3701
BID DUE DATE	11/9/2023	EMAIL:	eisexcavatingllc@gmail.co	pam@jwdubis.com	enroseseptic@comcast.ne	rstnec@aol.com	y@sweeneyexcavatingcorp

TYPE OF WORK	SEPTIC INSTALL
	I/A NitROE system
CONTACT:	Jean Stanley
PHONE:	508-694-6521
EMAIL:	jean@resource.org

Bids received by Jean Stanley, Program Director before 2pm 11/09/2023

WWU #	ESTIMATE		PRICE	PRICE	PRICE	PRICE	PRICE
1	**NitROE SYSTEM**						
A	Install according to design						
B	Perform all elements included in Septic WWU		$ 16,500.00	$ 54,875.00		$ 28,969.00	$ 32,582.00
C	Landscaping restoration		$ 1,000.00	$ 2,500.00		$ 1,000.00	$ 3,218.00
			$ 17,500.00	$ 57,375.00	$ 21,325.00	$ 29,969.00	$ 35,800.00
2	**KLEANTU NitROE SYSTEM**						
	System	*cost provided by KleanTu*	$ 23,500.00	$ 23,500.00	$ 23,500.00	$ 23,500.00	$ 23,500.00
	OM contract	*cost provided by KleanTu*	$ 1,300.00	$ 1,300.00	$ 1,300.00	$ 1,300.00	$ 1,300.00
			$ 24,800.00	$ 24,800.00	$ 24,800.00	$ 24,800.00	$ 24,800.00
JOB TOTAL			**$ 42,300.00**	**$ 82,175.00**	**$ 46,125.00**	**$ 54,769.00**	**$ 60,600.00**
			2 weeks after permit	3 wks from award	after obtaining permit	soon after permit	11/15/2023
			5 days	1 week	1 week	5-8 days	5 days

Tisbury Health Regulations

SECTION 5. INSTALLATION OF ENHANCED DE-NITRIFICATION TECHNOLOGY

5.2 The following situations are "triggers" for the purposes of section 5.1:

a) a new wastewater treatment system is required to serve a **Property** (i.e., new construction);

b) at the time of replacement, upgrade or relocation of a property's existing wastewater treatment system;

c) additional development on the **Property** or a change in use or in intensity of use (or potential use) which would increase wastewater Nitrogen discharge beyond the Board of Health approved system capacity irrespective of whether the existing wastewater treatment system has excess sanitation capacity[1];

d) at the time that a **Property** is transferred to another owner.


QUESTIONS?

BREAK

ADVANCED SEPTIC SYSTEM UPDATES – PART 2

Dr. Alissa Cox
University of
Rhode Island

Bruce Walton
NEWEA
I/A Task Force

WELCOME BACK!

Dr. Laura Erban
US EPA
ORD

Scott Horsley
Water Resources
Consultant

David Iorio
Izzo
MASSTC

Brian
Baumgaertel
MASSTC

SESSION GOALS

- Describe current knowledge of advanced wastewater treatment technologies
  - Share findings from ongoing research on enhanced innovative/alternative septic systems
- Share lessons learned: holistic wastewater management at the community scale
  - Case studies
  - Managing decentralized infrastructure
  - Financial implications

Q&A opportunities after each section + at end of session

MANAGING I/As: THE SEPTIC UTILITY PROGRAM

David Iorio Izzo & Brian Baumgaertel

Massachusetts Alternative Septic System Technologies Center

Barnstable County Department of Health

MASSTC


MASSTC
The Massachusetts Alternative
Septic System Test Center

WHAT IS A RME?

- A Responsible Management Entity (RME) functions much like a sewer utility, but with a focused mission on managing residential Innovative/Alternative (I/A) septic systems. Its role is crucial in ensuring these systems operate efficiently, safeguarding both public health and the environment.
- In Barnstable County, our RME is the Septic Utility Program (SUP)

WHAT CAN A RME PROVIDE?

- Permitting & Installation:
  - ensure systems meet regulatory & environmental standards
- Operation & Monitoring:
  - Continuous oversight to guarantee systems function at their best
- Long Term Care:
  - providing maintenance & support to extend the system's

WHAT CAN THE SUP DO FOR A TOWN?

- Cost Distribution and Regulatory Compliance:
  - Coordinate & manage multiple I/A system installations through a competitive bidding process.
  - Instead of individual homeowners navigating the procurement process alone, the SUP can pool resources and solicit bids for multiple installations simultaneously.
  - This approach not only drives down costs through economies of scale but also ensures consistent quality & adherence to regulatory standards.

- Operation and Management (O/M) of Systems:
  - Offers comprehensive solutions for the ongoing O/M of I/A systems.
  - By bidding for an operator to oversee a series of systems, we streamline administrative tasks for homeowners & operators while ensuring consistent maintenance standards.
  - Under this model, the SUP assumes responsibility for contracting with operators, simplifying payment processes, & providing homeowners with a single point of contact for their system needs.
- Unbiased Third-Party Oversight:
  - Can serve as an impartial third party, conducting sampling and inspections to verify system performance and regulatory compliance.
  - This unbiased oversight helps instill confidence in residents & regulatory agencies alike, fostering transparency & accountability throughout the process.

QUESTIONS?

FINANCIAL IMPACT MODELING: EIA ON CAPE COD

Bruce Walton

Chair of the NEWEA I/A Task Force

CONTEXT

- Drivers
  - Location Value
  - Time Value
  - Performance
  - Cost
- We Support the Cape Cod Commission Hybrid Approach – Sewers **AND**, not Or, EIAs, etc.
- Directional Model – Generally Right vs Precisely Wrong

APPROACH – TOTAL SYSTEM COST

- The Nature Conservancy (TNC) estimates about 129,000 Title 5 homes on the Cape. Need to upgrade about half.
- Town of Barnstable CWMP (2020)
  - Sewer 12,000 homes to satisfy Clean Water Act, yielding 55% homes sewered
  - 30 years in three 10-year phases (roughly 40%, 40%, 20% N removed/phase)

APPROACH – TOTAL SYSTEM COST (CONT.)

Let's look at using EIA for half of those homes

- Calculate Total KG N Removed/year by Sewering 6000 Homes
- Match Number of EIAs Needed to Remove Same N as Sewering
  - Depending on Assumptions, need 6343-7400 EIAs (6-23% more)
- Calculate Cost Impact

TOTAL COST CALCULATIONS

Sewer Capital Cost

- Collection System – Sewer Line
- Connection – Home to Sewer
- Treatment Plant
- Soft Costs

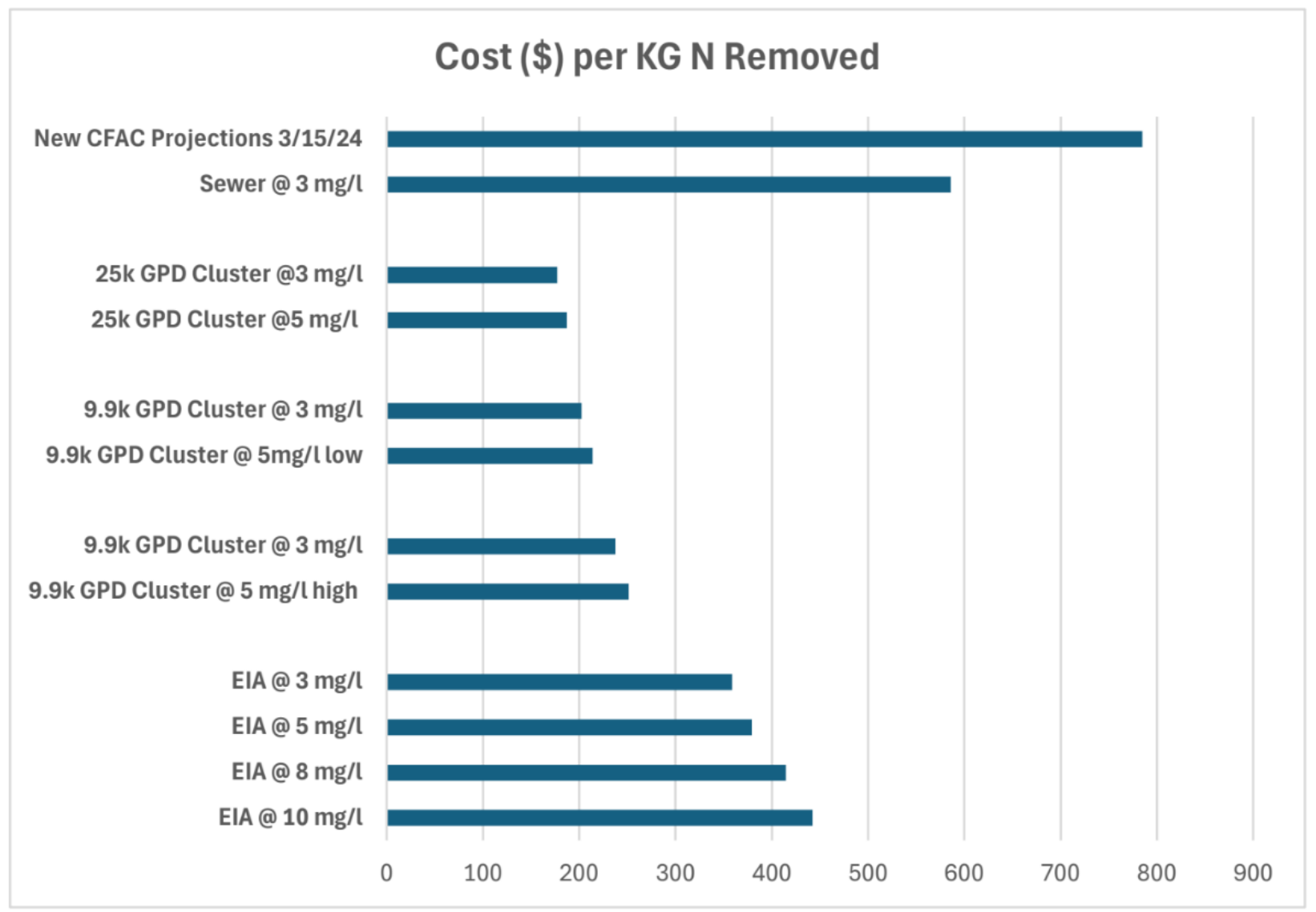
EIA Capital Costs @ 60% Retrofit

- Design & Permitting
- Equipment
- Installation
- RME

TOTAL COST CALCULATIONS

- Sewer Operations & Maintenance (O&M)
  - Direct and Indirect Costs from FY 2024 Operating Budget
  - Allocation based on Percentage of Flow from Current Homes
- EIA Operations, Maintenance & Monitoring (OM&M)
  - Weighted Average over 20 Years including Provisional and General Permit Periods
  - Operations, Remote Monitoring, Sampling, RME, Replacement Costs
- Both were $1100-$1200/home/year. Consider this a wash.

EIAs, CLUSTERS & SEWERS - PER HOME COST PER KG REMOVED - PRELIMINARY



* % reduction relative to conventional Title 5 system

PERFORMANCE - INFLUENT AND EFFLUENT

- Influent from the Home
  - At 30-35% reduction from Title 5 systems, assume 40 mg/l .
  - 65-95+ mg/l observed at Shubael Pond. Impact? Needs study.
- MADEP Effluent (mg/l) Standards
  - Title 5 – 26.25 – The comparison point.
  - I/A (General Permit, now) – 19
  - EIA (Provisional Permit & Target) - 10
    - New Regulations - System must achieve permit level 90% of time.
  - BANRT – Currently @ <5 median performance, <10 mean.
    - Best Available Nitrogen Reducing Technology

MODELING VARIABLES – 2-4 BEDROOMS (2023)

- EIA Capital Cost - $50k/home — Anecdotal Range $35k-$60k+
- Sewering Capital Cost - $100k/home — Anecdotal Range $80k -$120k
- O&M vs OM&M – A wash — Anecdotal Range $1,200-$1,500/yr.
- EIA Performance – 10 or 5 mg/l Effluent N
  - Reduction from 40 to 10 or 5 = 30 or 35 mg/l.
- Sewering Performance – 3 mg/l Effluent N
  - Reduction from 40 to 3 = 37 mg/l.
- Influent N – 40 (MADEP standard) or 65 mg/l

FINDINGS @ 50% EIAs

Case (Influent N and Effluent N)	EIA Savings
MADEP (40 and 10 or 5 mg/l)	$230m - $283m
Observed (65 and 10 or 5 mg/l)	$262m - $290m
Cost of Waiting to Phase 3 (20% vs 50% EIA)	
MADEP Case	$104m – $127m
Observed Case	$118m - $131m

OPPORTUNITIES/VISION

- Use All Tools in the Toolbox. Portfolio Thinking. Adaptive Management Mentality.
- Save Town Money. Get/trade N credits.
- Subsidize (Homeowner) To Equalize (and still save town $).

SUBSIDIZE TO EQUALIZE

- "Who pays for what" is a political discussion.
- Barnstable essentially caps new sewer homeowner cost at about $20,000.
- Sewer @ $100k/home = $80,000 subsidy
- If the town supports EIAs to the same homeowner cost
  - EIA @ $50k/home = $30,000 subsidy
- Town could save $50k/home and eliminate a political problem.

TAKE AWAYS AND RECOMMENDATIONS

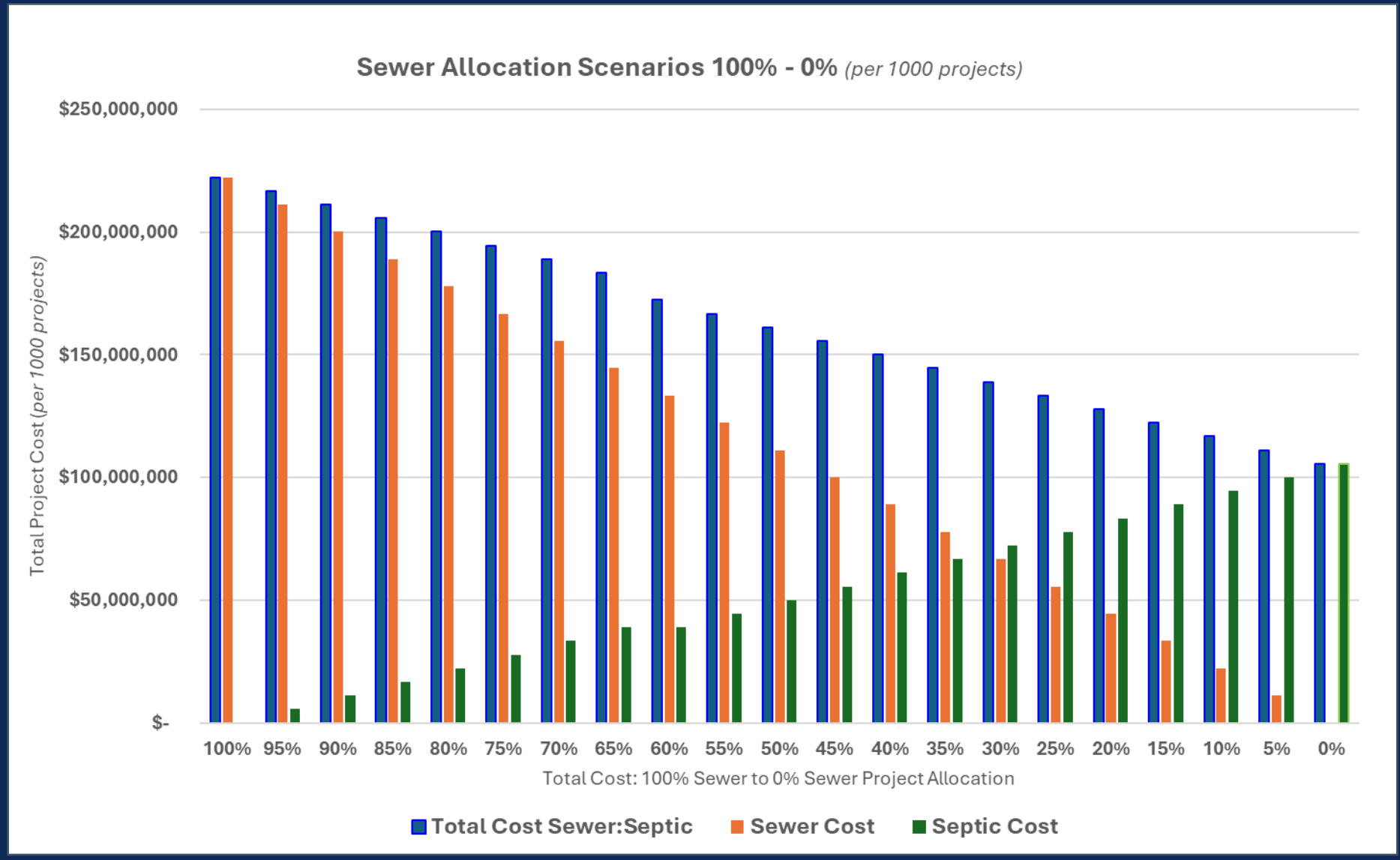
- Numbers are Big
- Don’t Wait – Prepare, Learn, Adapt
- Incorporate Trigger Ordinances

THE NATURE CONSERVANCY

- Has been building a Financial Modeling Tool for strategic decision makers to evaluate Sewer and EIA Septic projects
- Purpose:
  - Assess Total Costs
  - Explore Total Funding Needs
  - Evaluation of Economic Impacts

SEWER:SEPTIC RATIO IMPLICATIONS

- This visual represents a "project mix" of Sewer:Septic (per 1,000 projects. There are up to 128,855 Cape-wide)
- Highest Project Costs are Associated with 100% Sewer Projects
- Lowest Project Costs are Associated with 100% EIA Septic Projects
- IF Cost is a Driving Factor -- Towns Should Assess What Project Mix is best fit



TISBURY TRIGGER ORDINANCE UPDATED 9/26/23

EIAs are required when (emphasis mine):

a) a new wastewater treatment system is required to serve a Property (i.e., **new construction**);

b) at the time of **replacement, upgrade or relocation** of a property's existing wastewater treatment system;

c) **additional development on the Property** or a change in use or in intensity of use (or potential use) which would increase wastewater Nitrogen discharge beyond the Board of Health approved system capacity irrespective of whether the existing wastewater treatment system has sanitation capacity;

d) at the time that a Property is **transferred to another owner**


QUESTIONS?

CLOSING THOUGHTS

EIAs = CRITICAL

- We need diversified wastewater treatment options
  - More tools in toolbox
- Managing decentralized infrastructure proactively is critical to long-term viability
- Current funding mechanisms need work


THE ELEPHANT IN THE ROOM

OUR COASTAL COMMUNITIES ARE BEARING THE BRUNT OF CLIMATE CHANGE

WE ARE NOT (YET) PLANNING FOR CHANGES IN SEA LEVEL, PRECIPITATION PATTERNS, OR GROUNDWATER TABLES WHEN DESIGNING AND INSTALLING ADVANCED SYSTEMS

Photo: M. Dowling

LET'S MAKE SURE OUR COMMUNITIES ARE PLANNING HOLISTICALLY

From watershed-wide management of wastewater,
financing infrastructure that protects water quality,
system design and installation,
responsible use / operation
to system maintenance and monitoring

NEED TRAINING ON ONSITE WASTEWATER TOPICS?

Alissa Cox
alibba@uri.edu

University of Rhode Island

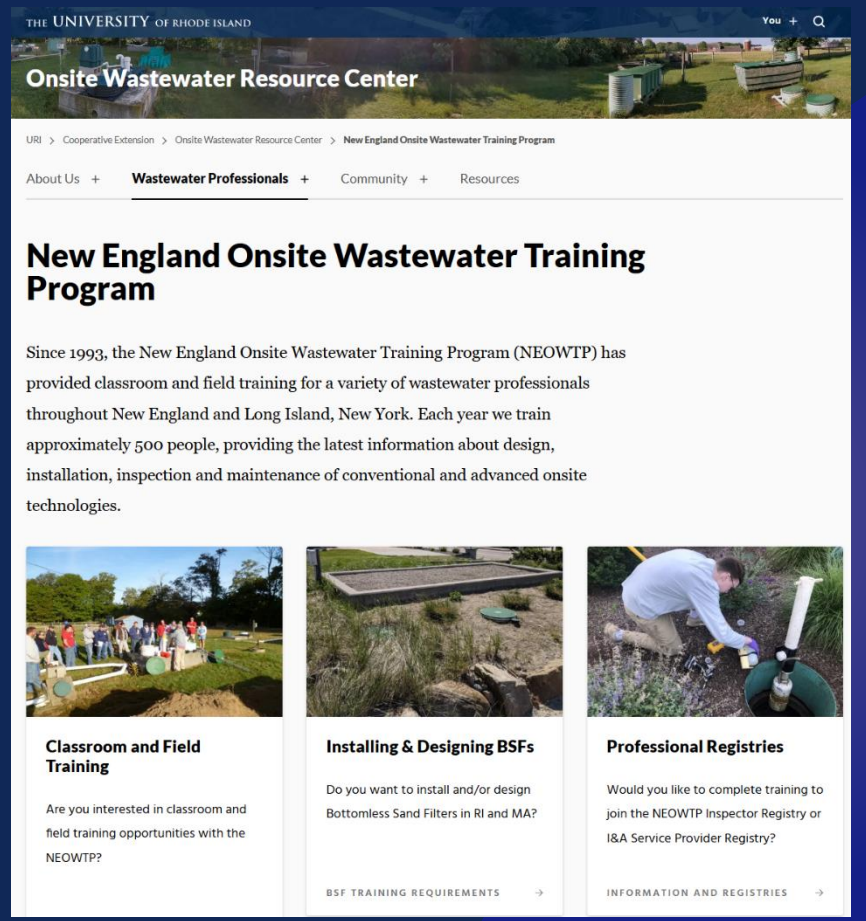
- New England Onsite Wastewater Training Program
  - Field, Classroom and Online Training options year-round

TCHs for…

- Registered Environmental Health Specialist / Registered Sanitarian (REHS/RS)
- MA Title V Soil Evaluators (SE) and System Inspectors (SI)

uri.edu/owt/wastewater-professionals/

or search "URI wastewater training"



QUESTIONS?

Bruce Walton
bwalton@battaliawinston.com

Alissa Cox
alibba@uri.edu

Laura Erban
erban.laura@epa.gov

Scott Horsley
scotthorsley208@gmail.com

David Iorio Izzo
david.iorioizzo@capecod.gov

Brian Baumgaertel
bbaumgaertel@capecod.gov

NEWEA Onsite Wastewater Task Force Self-Education Website

www.newea.org/resources/innovation/resources