2024 SPRING NEWEA MEETING: ENHANCED I/A SEPTIC SYSTEMS – UPDATE & DISCUSSION

May 20, 2024 1:00 PM – 3:30 PM

Hotel Viking, Newport, RI

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

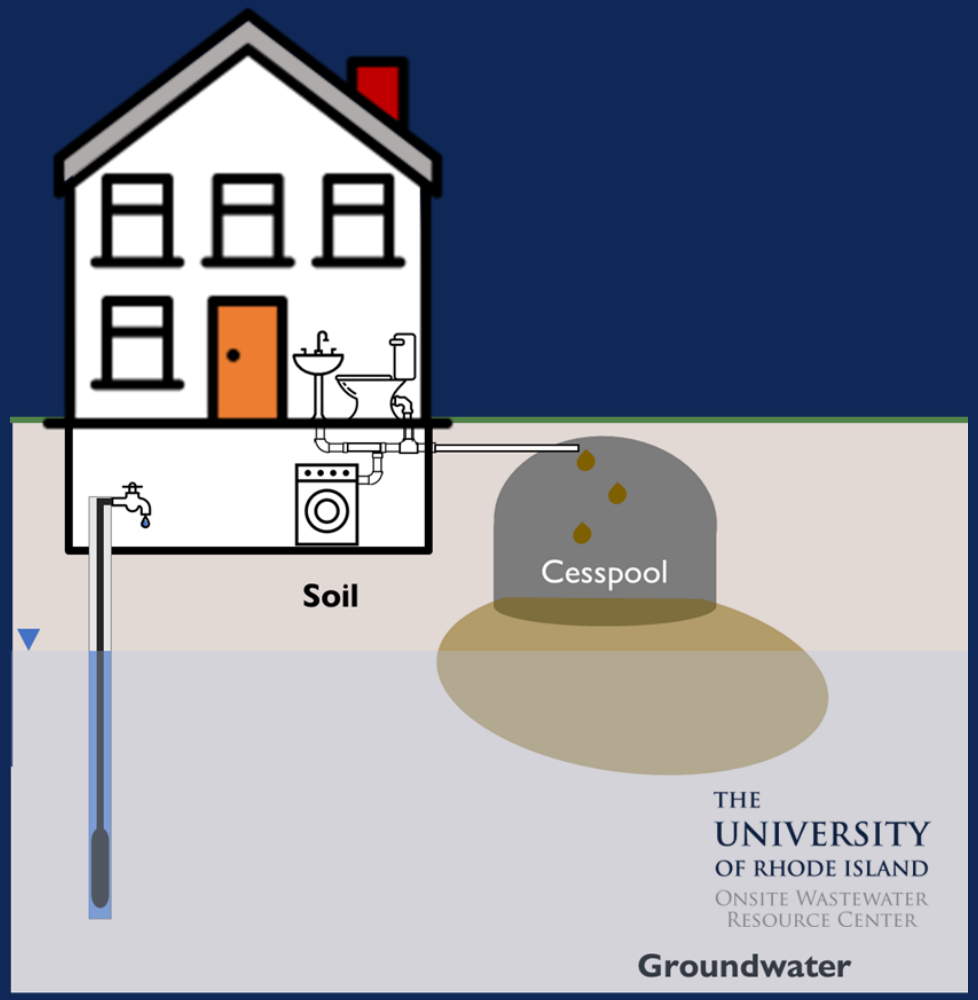
SESSION GOALS

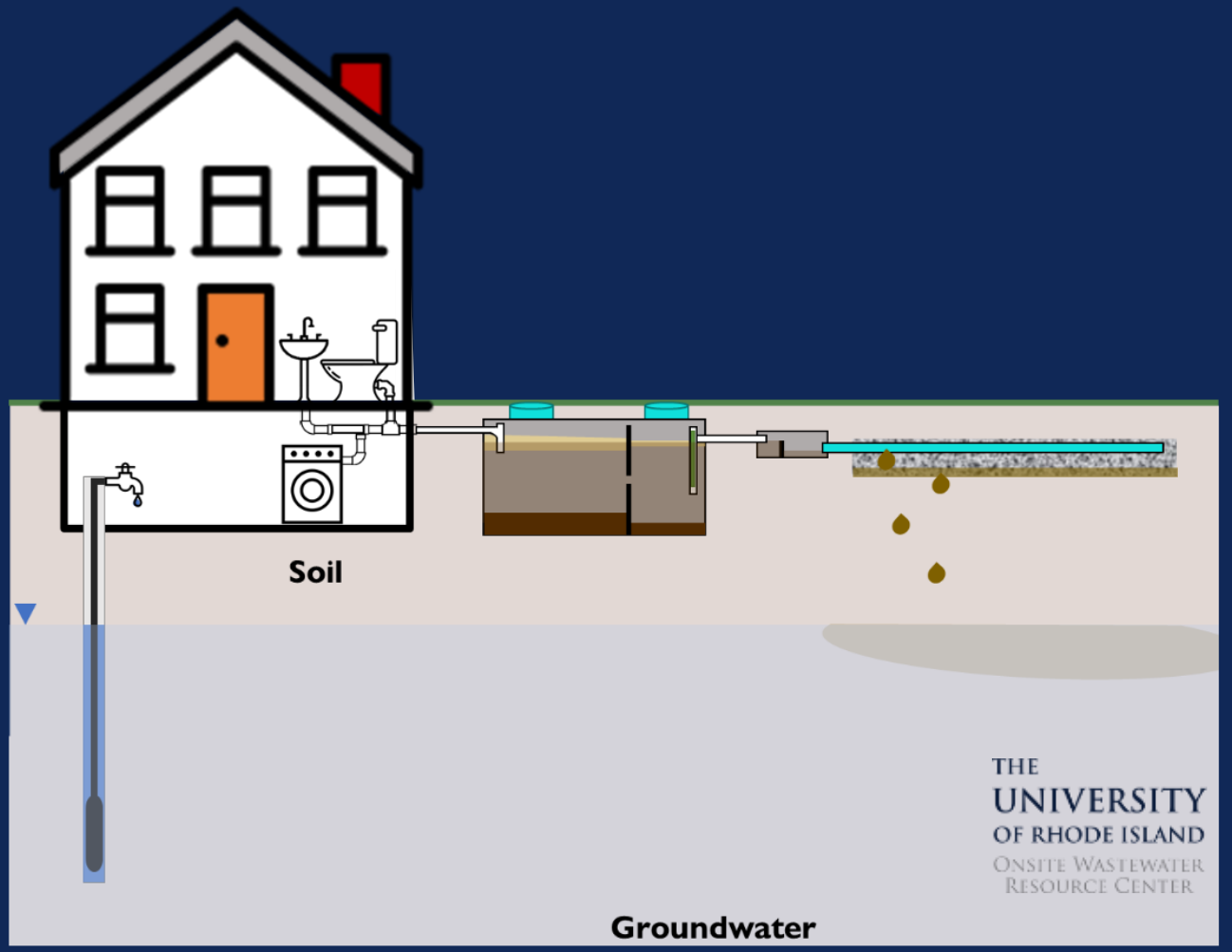
- Describe current knowledge of advanced wastewater treatment technologies
  - Share findings from ongoing research on enhanced innovative/alternative septic systems
- Share lessons learned: holistic wastewater management at the community scale
  - Case studies
  - Managing decentralized infrastructure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

ADVANCED SEPTIC SYSTEMS

Definitions & Current Knowledge

EVOLUTION OF WASTEWATER TREATMENT





HUMAN-GENERATED WASTEWATER IS RICH IN…

Nutrients (Nitrogen & Phosphorus)

Pathogens

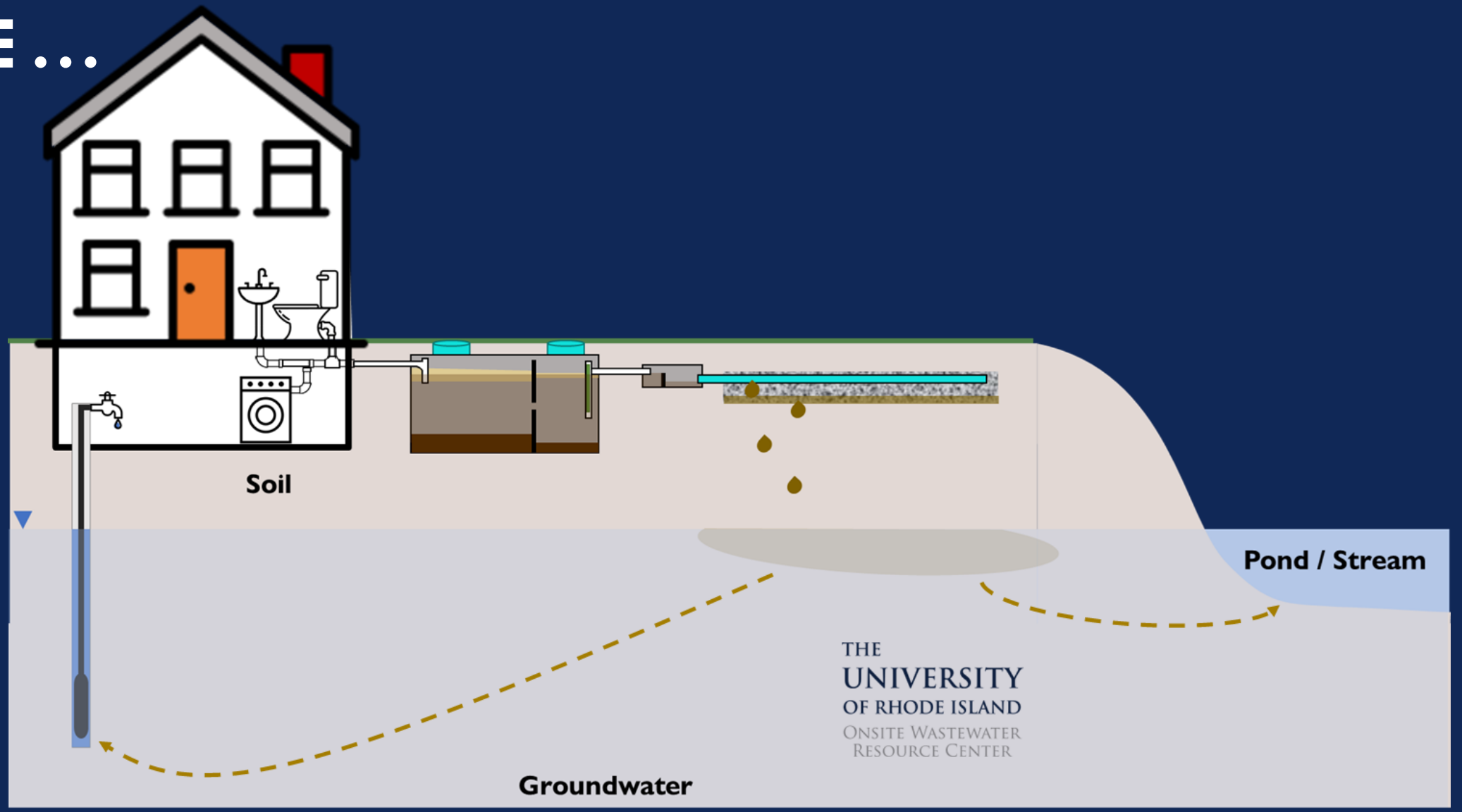
Organic materials

Other contaminants

CONVENTIONAL SYSTEMS ARE NOT DESIGNED TO REMOVE NITROGEN

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

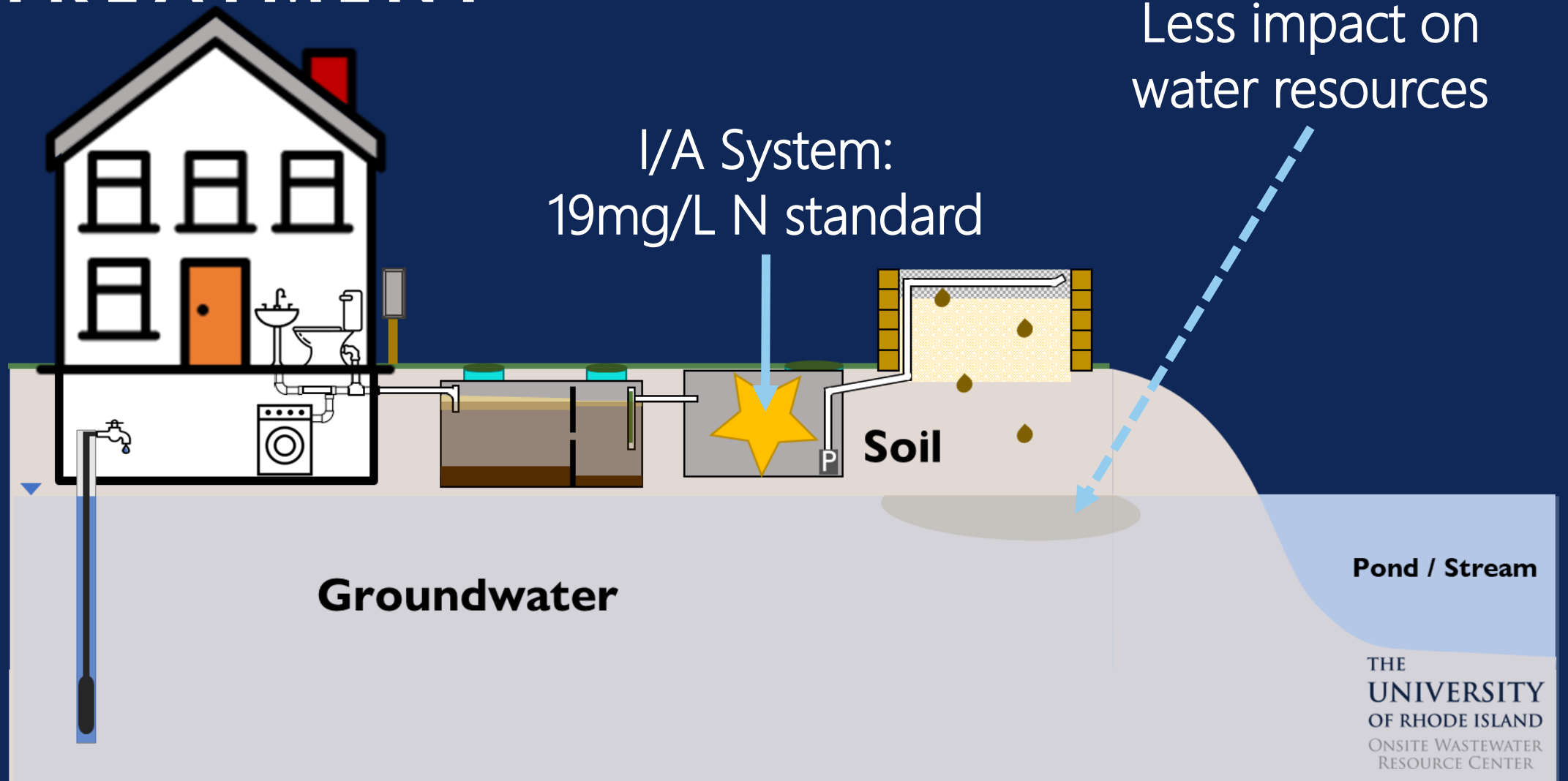
NOT REMOVING NITROGEN IS AN ISSUE…



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



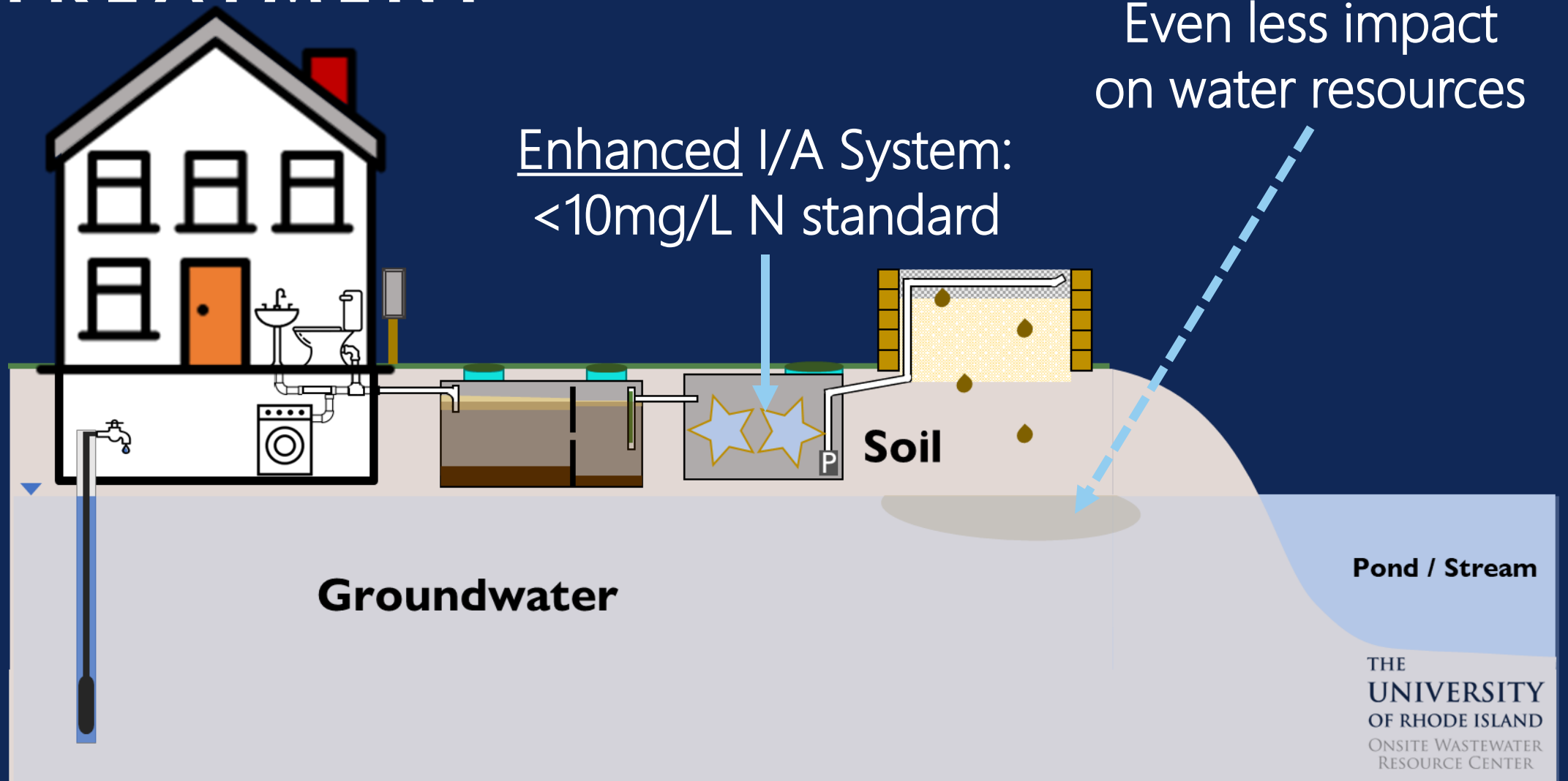
PERFORMANCE OF I/A SYSTEMS

- Currently approved technologies capable of emitting ≤19 mg/L Total N
- Actual performance in RI & MA 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



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

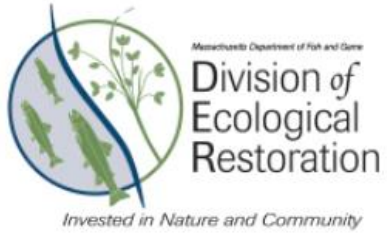
ENHANCED I&A SYSTEMS

Laura Erban

USEPA

Acknowledgments

Local farmers and other landowners



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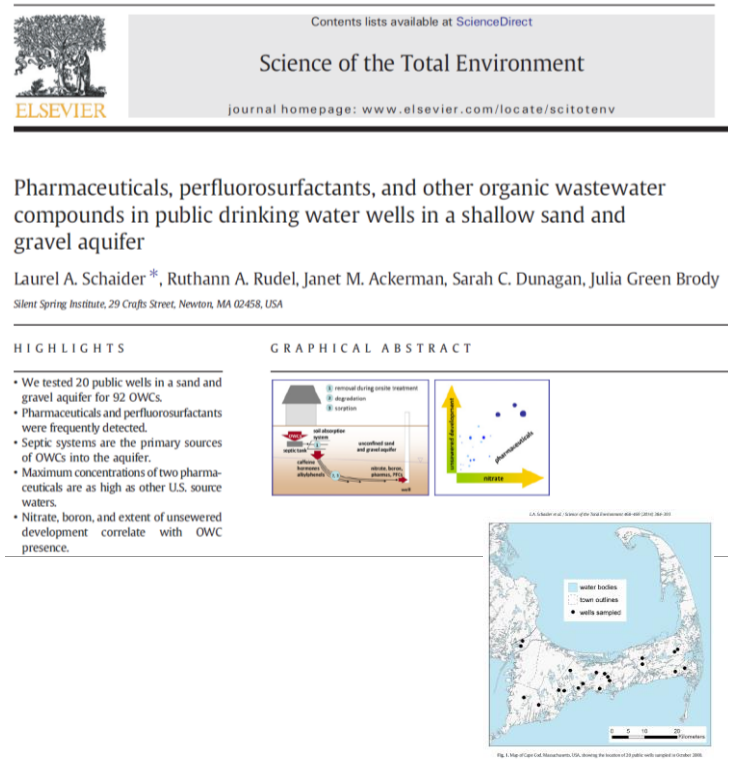
Nutrients and co-pollutants in onsite wastewater can overload water resources

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

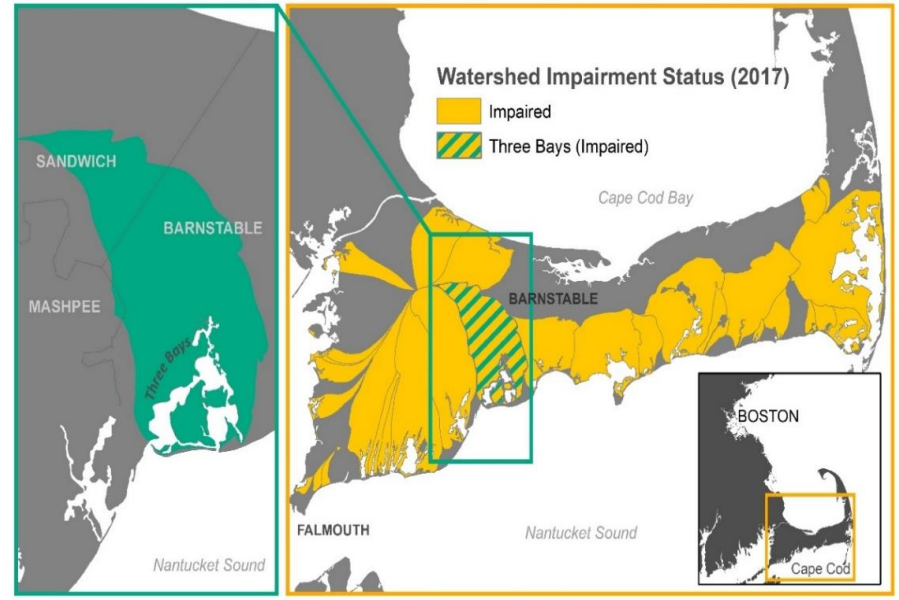
Laurel A. Schaider *, Ruthann A. Rudel, Janet M. Ackerman, Sarah C. Dunagan, Julia Green Brody

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

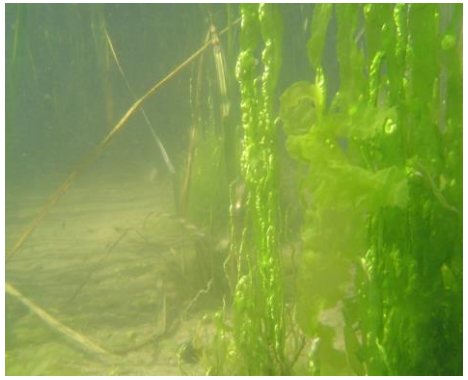


More than 30 Cape Cod watersheds have Total Maximum Daily Loads (TMDLs) for nitrogen.
Source: Twichell et al., 2019. EPA/600/R-19/107

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.

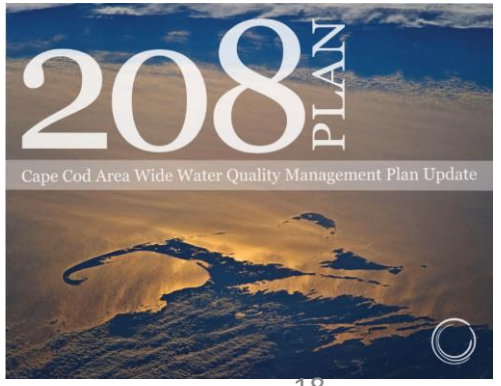
USGS



Buzzards Bay Coalition

NYTimes

Town of Mashpee



Cape Cod Commission, 2015

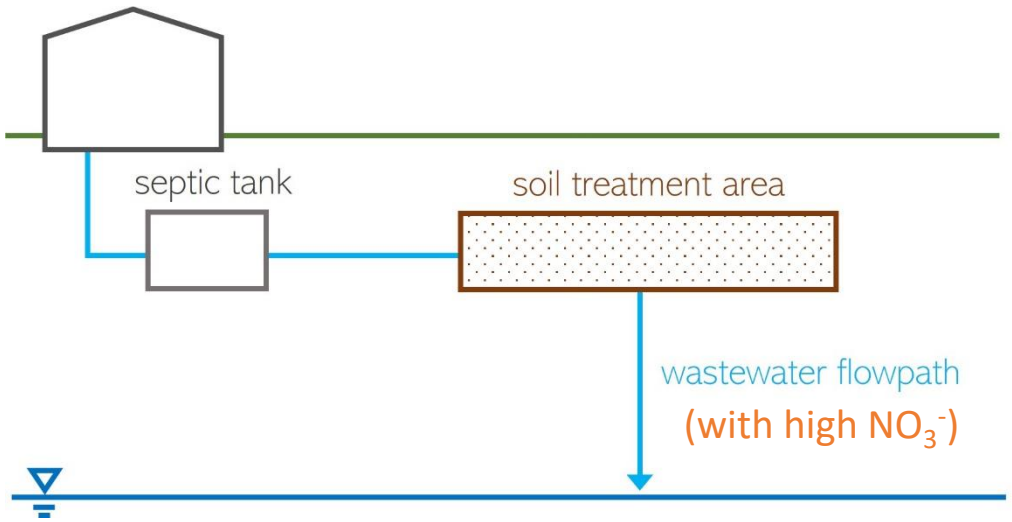
Improving wastewater treatment takes time

- 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 options (EIA) 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

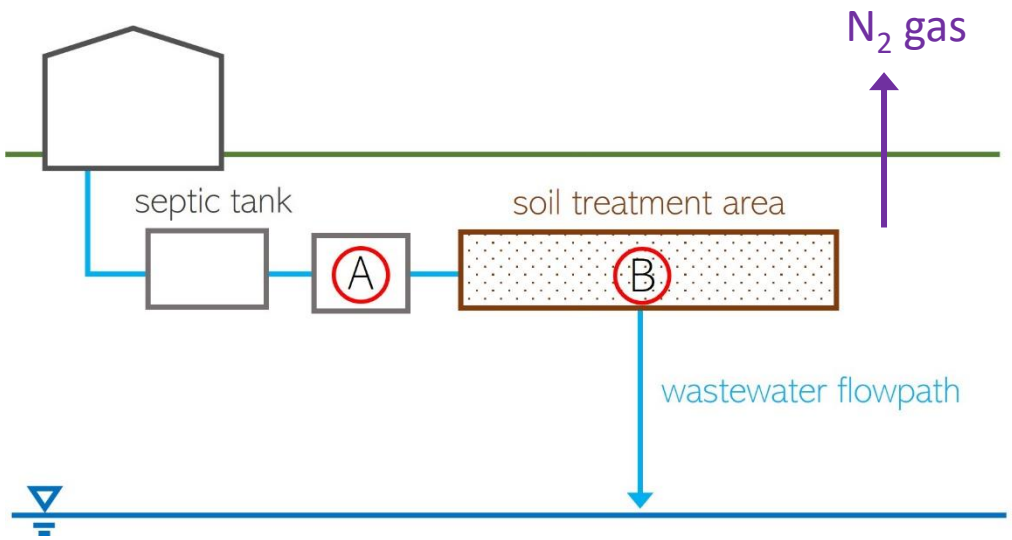
Sanitized human urine (Oga) as a fertilizer auto-innovation from women farmers in Niger

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

alternative septic system



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

Septic systems designed for nitrogen removal:

A) add a treatment unit after the septic tank and before soil treatment area (a.k.a. leach field)

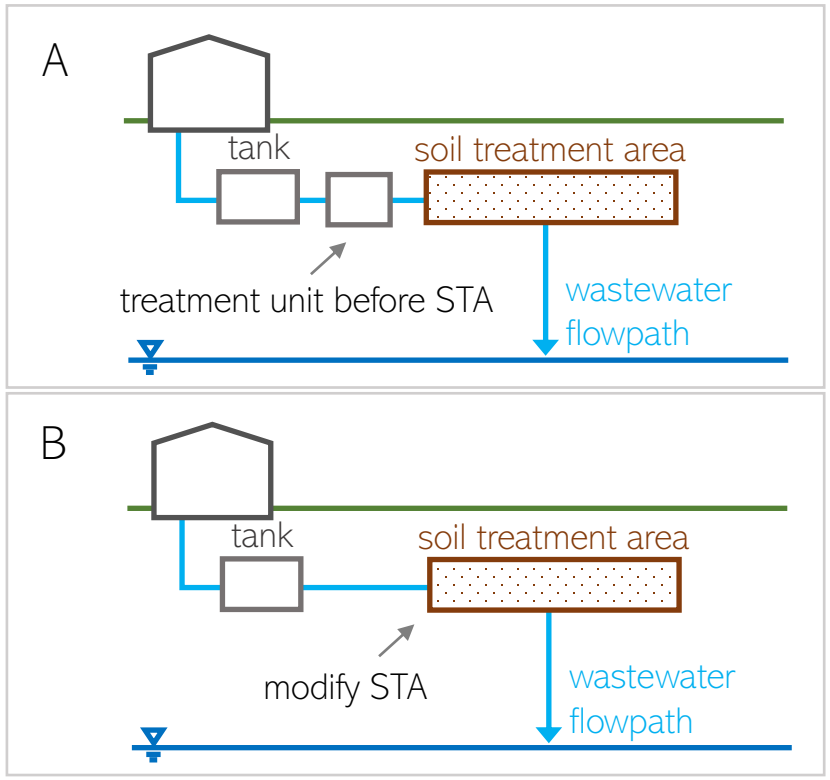
OR

B) modify the soil treatment area

(in general terms)

Enhancing onsite wastewater treatment of nitrogen

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

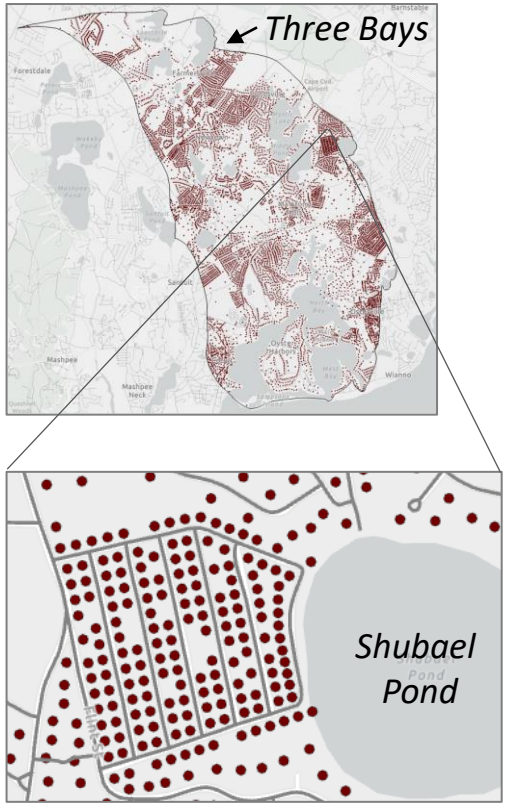
NiTROE® treatment unit
by KleanTu LLC

B

modified STA
by MASSTC

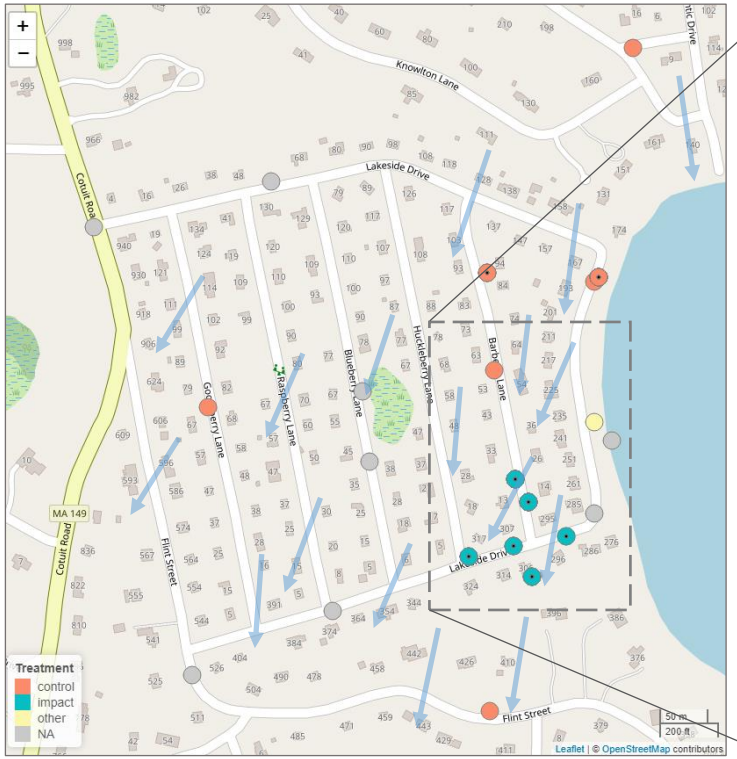
Demonstration setup

watershed screening



● onsite wastewater treatment system

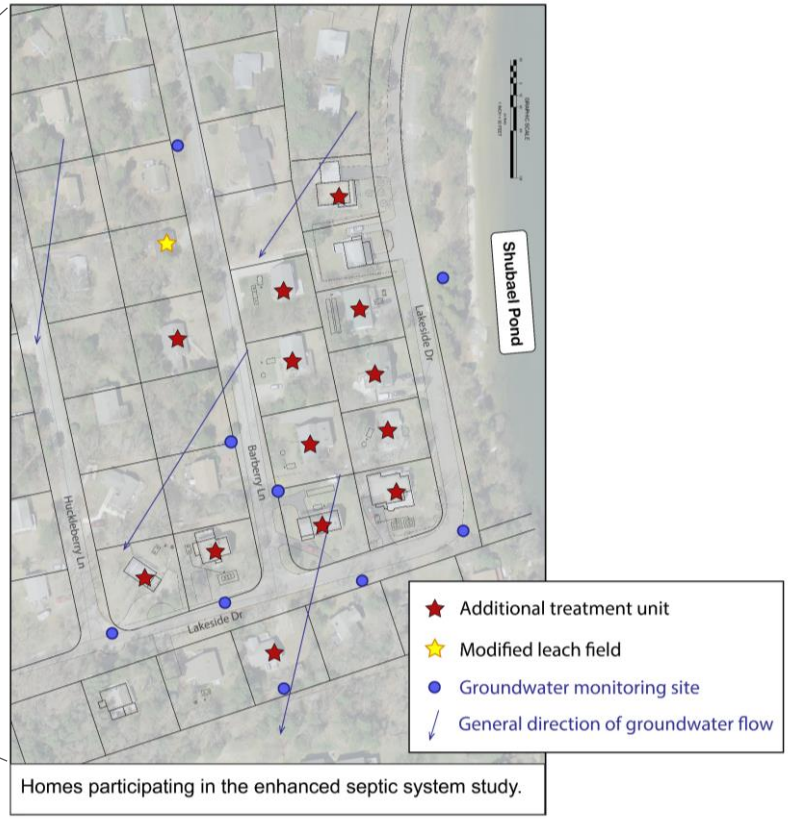
well network



• 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

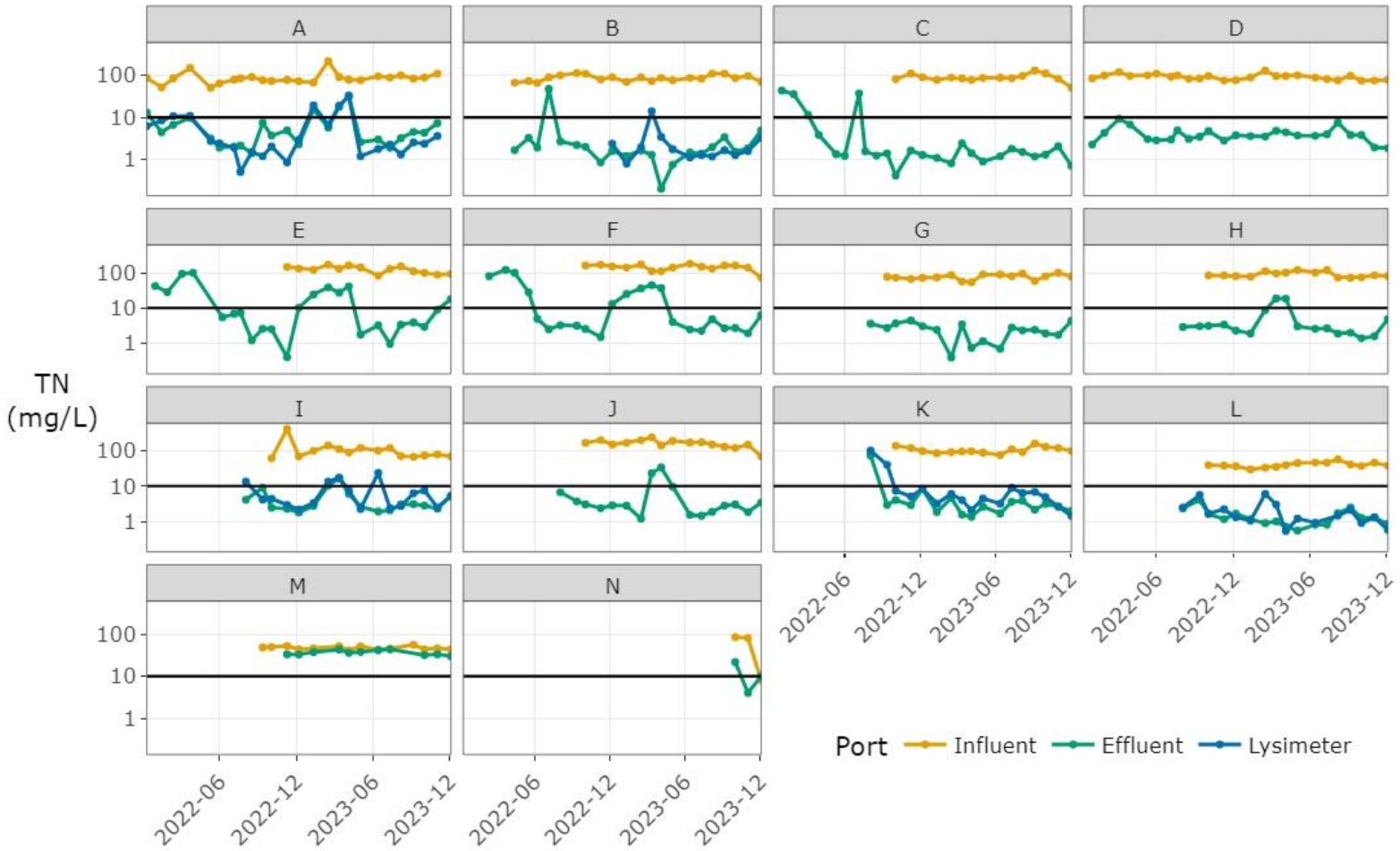
Barnstable Clean Water Coalition

USGS science for a changing world

EPA

TOWN OF BARNSTABLE

Performance monitoring: nitrogen concentration



Monthly samples for more than 2 years

Continuous flow metering

Order of magnitude reduction in TN

Effluent samples:

- 83% < 10 mg/L
- 50% < 3 mg/L

TN = 10 mg/L

Partners

Barnstable Clean Water Coalition

MASSTC The Massachusetts Alternative Septic System Test Center

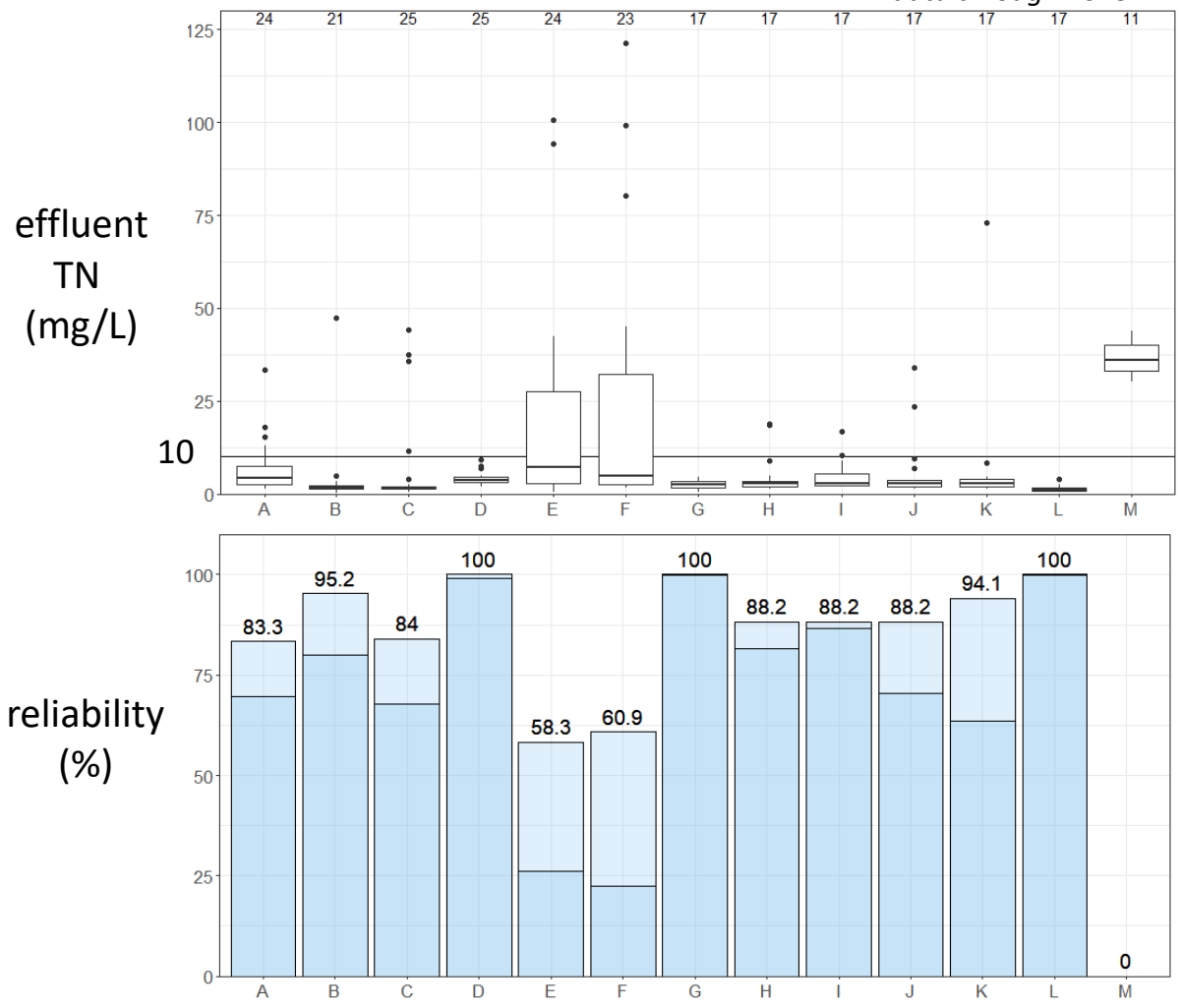
EPA

homeowners

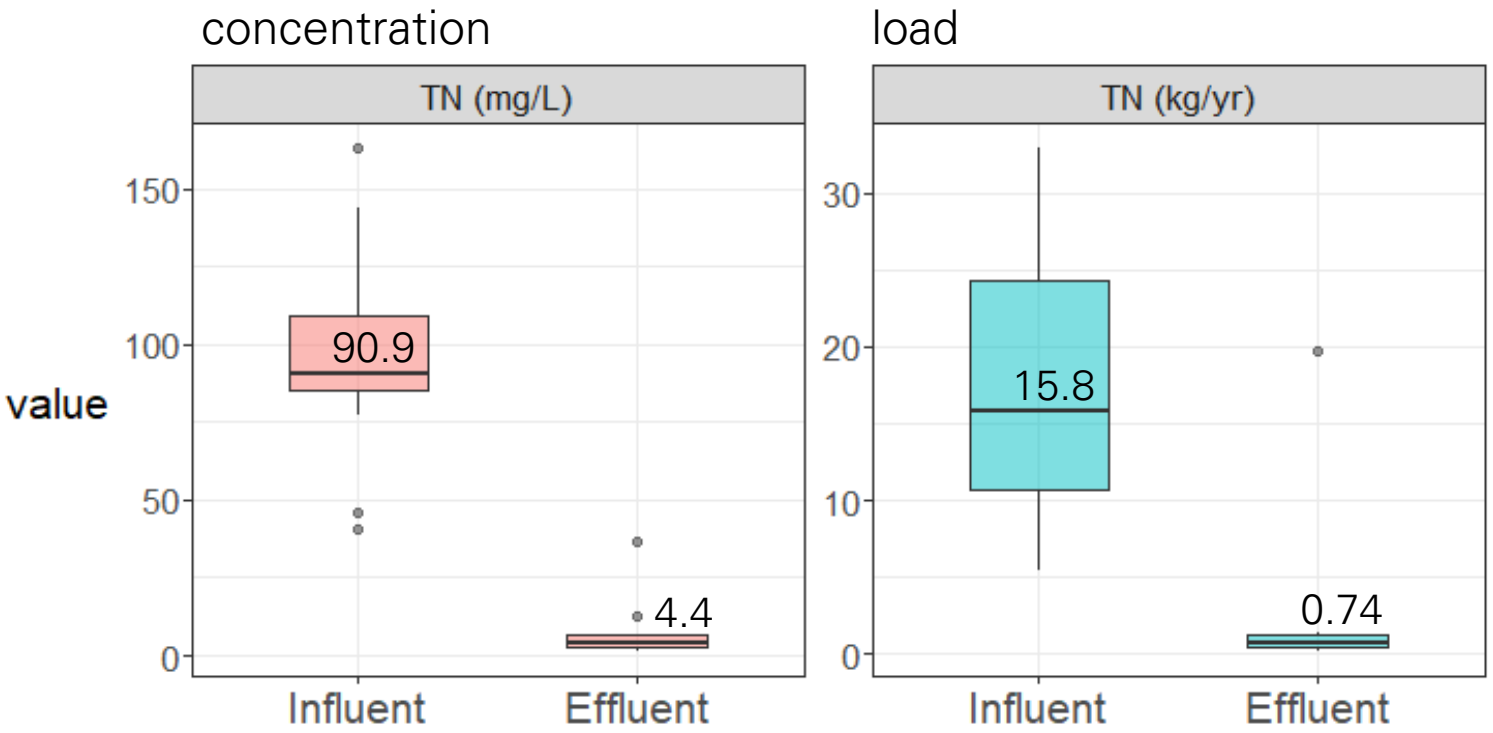
Reliability of individual systems

- 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



Overall: N concentration and load reductions exceed 90%



as of 2023-12 (11 to 25 months of sample data)
Labels are median values for the group of systems (n=12)

Preliminary Information-Subject to Revision. Not for citation.

Load estimates based on mean daily flow, mean monthly concentrations for systems with flow meters and a least one calendar year of data.

Boxes depict spread in estimates across systems.

Median total nitrogen (TN) reduction:*

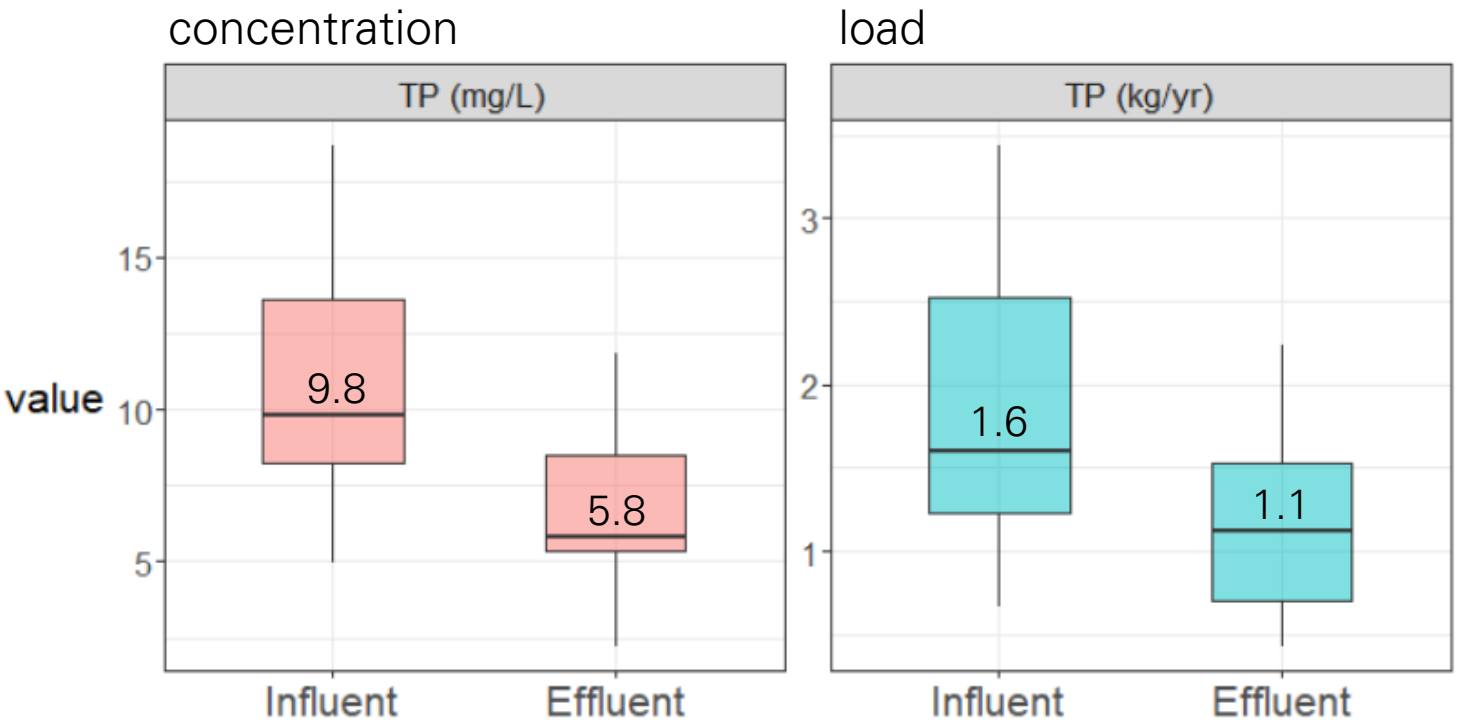
concentration: 95%
load: 95%

* values are sensitive to samples included and method of estimation

Partners

homeowners

P reductions are lower (note: systems were not designed for this purpose)



as of 2023-12 (11 to 25 months of sample data)
Labels are median values for the group of systems (n=12)

Preliminary Information-Subject to Revision. Not for citation.

Load estimates based on mean daily flow, mean monthly concentrations for systems with flow meters and a least one calendar year of data.

Boxes depict spread in estimates across systems.

Median total phosphorus (TP) reduction:*

concentration: 41%
load: 31%

* values are sensitive to samples included and method of estimation

Partners

homeowners

United States Environmental Protection Agency

EIA septic system performance: beyond nutrients

frontiers | Frontiers in Marine Science

TYPE Original Research
PUBLISHED 23 May 2023
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OPEN ACCESS

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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

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

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

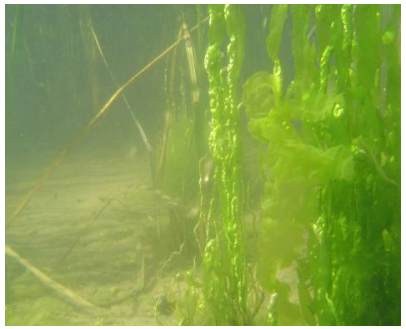
❖ Policy

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

Summary and directions

- Significant reduction of onsite wastewater N loads is possible
- Incentives are limited
- Consequences of the status quo are indirect and remote
- Design and (redesign) for resilience
- Center equity: who pays, who benefits?

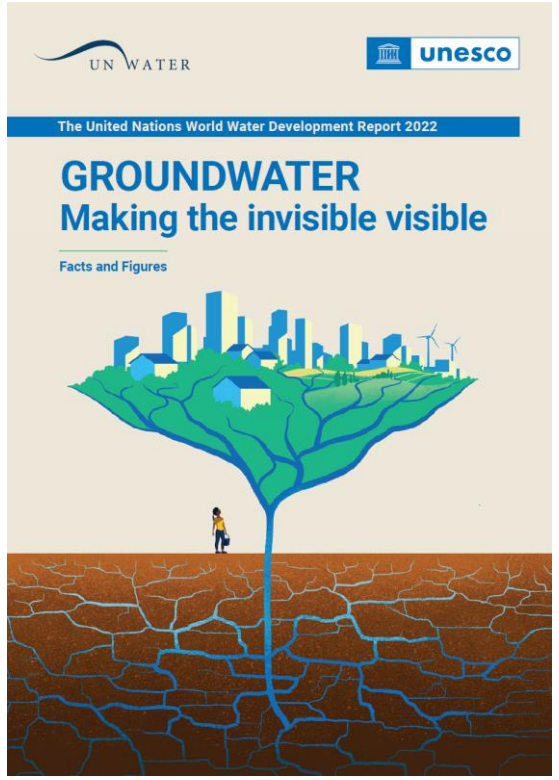
USGS



Buzzards Bay Coalition

NYTimes

Town of Mashpee



"…once groundwater becomes contaminated, it can be extremely difficult and costly to remedy."

United States Environmental Protection Agency

Questions?

erban.laura@epa.gov

Laura Erban, PhD

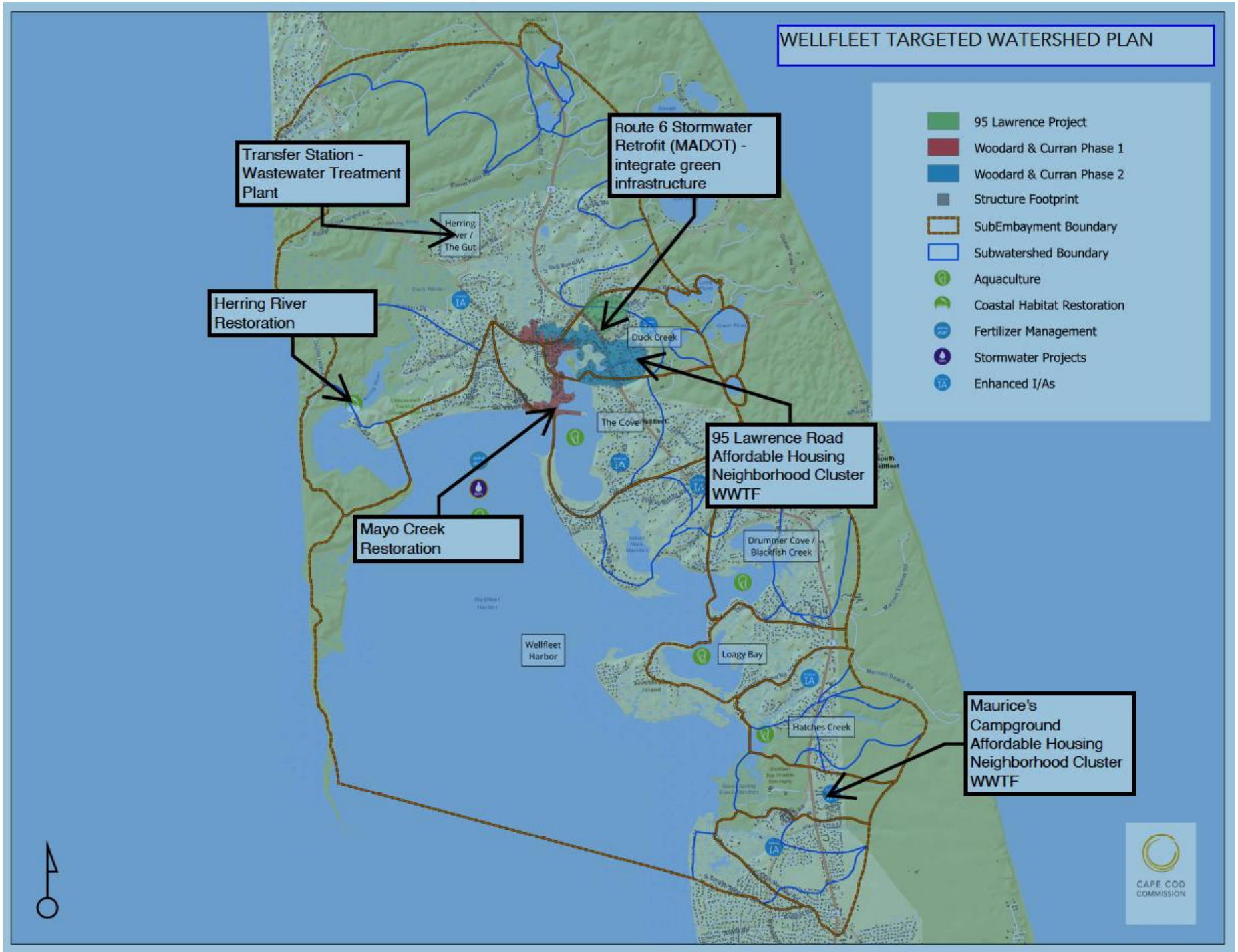
Office of Research and Development
Center for Environmental Measurement and Modeling, Atlantic Coastal Environmental Sciences Division

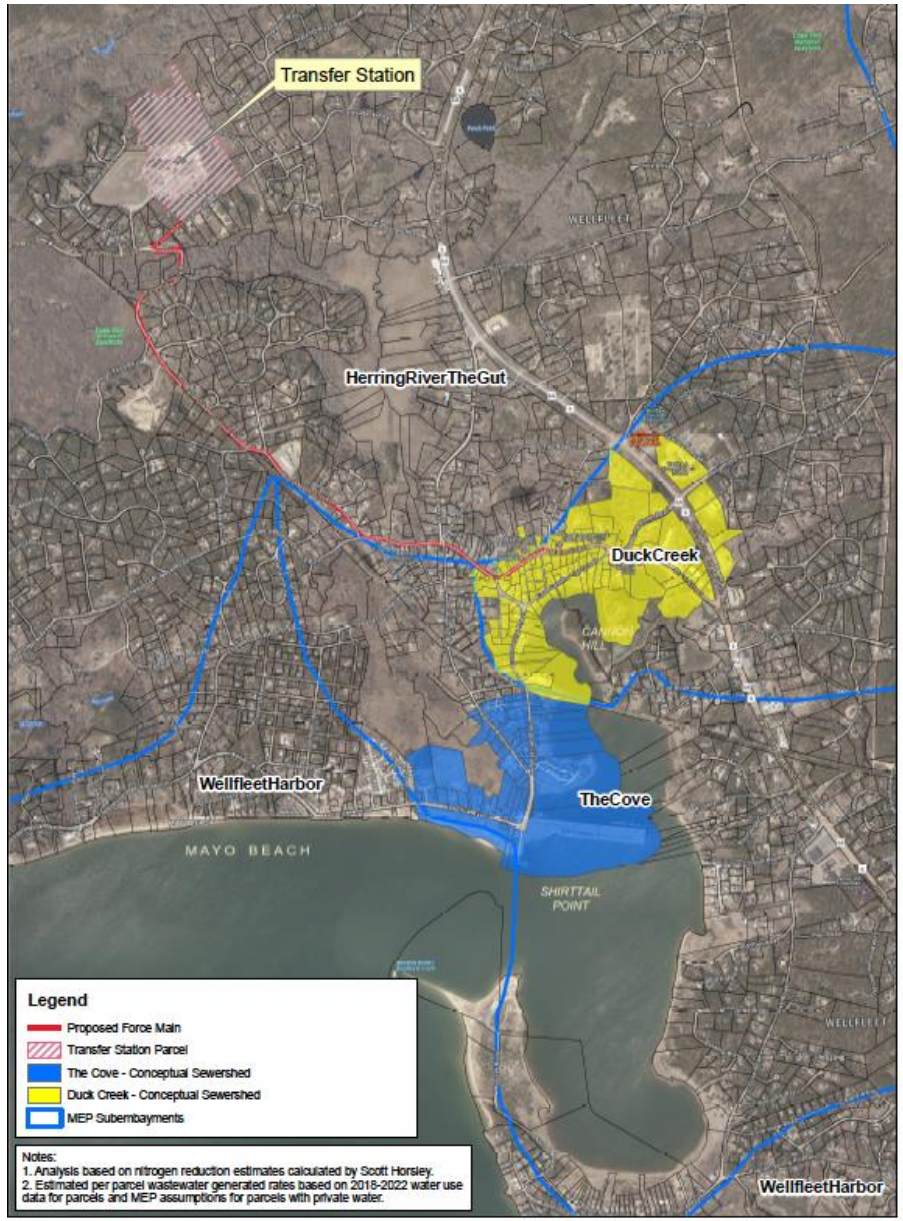
CASE STUDIES: EIAS AS INFRASTRUCTURE

Scott Horsley

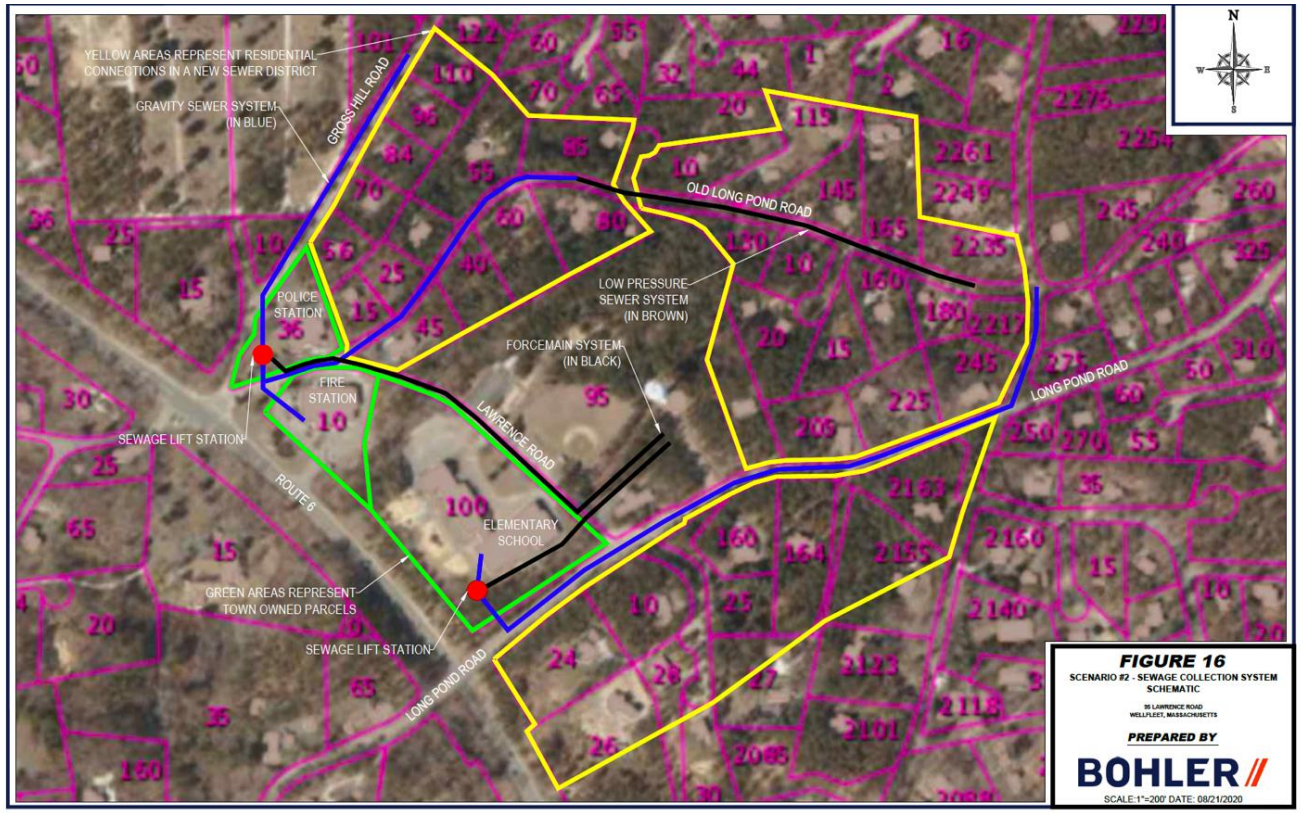
Water Resources Consultant

Wellfleet Targeted Watershed Management Plan (TWMP) Update
Scott Horsley, Water Resources Consultant

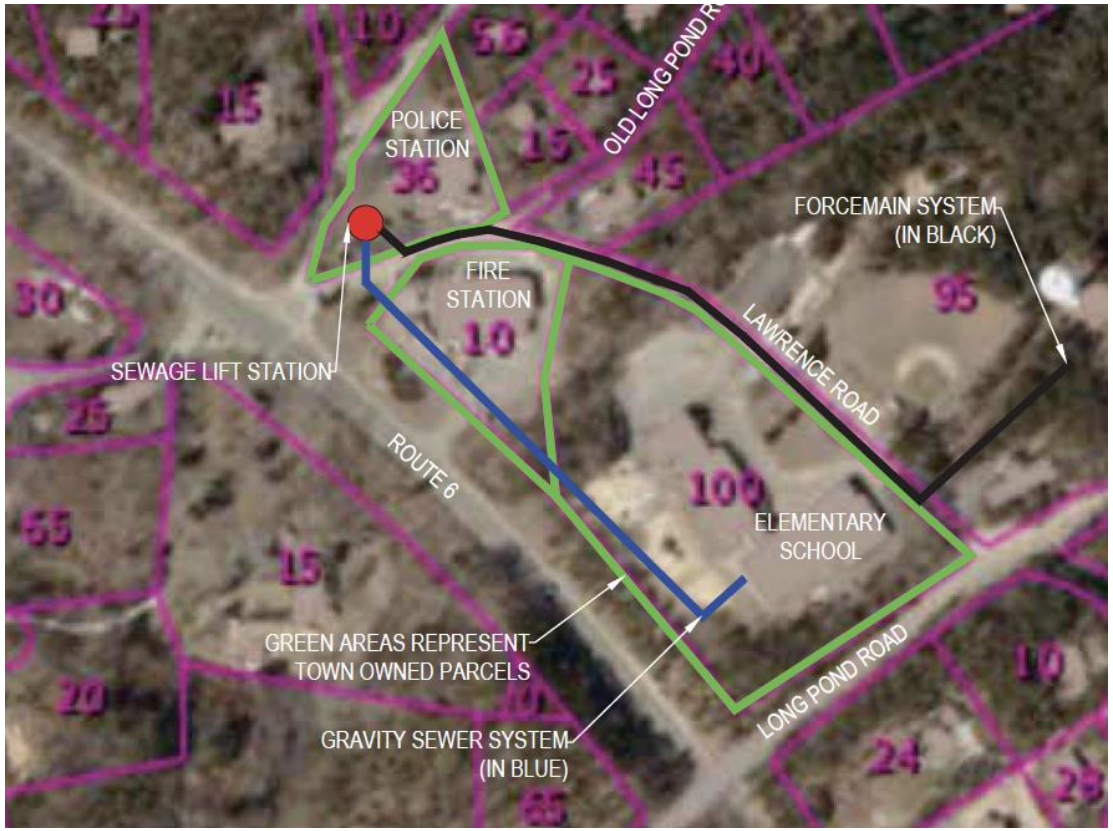

WELLFLEET TARGETED WATERSHED PLAN
95 Lawrence Project
Woodard & Curran Phase 1
Woodard & Curran Phase 2
Structure Footprint
SubEmbayment Boundary
Subwatershed Boundary
Aquaculture
Coastal Habitat Restoration
Fertilizer Management
Stormwater Projects
Enhanced I/As
Transfer Station - Wastewater Treatment 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
FIGURE 1

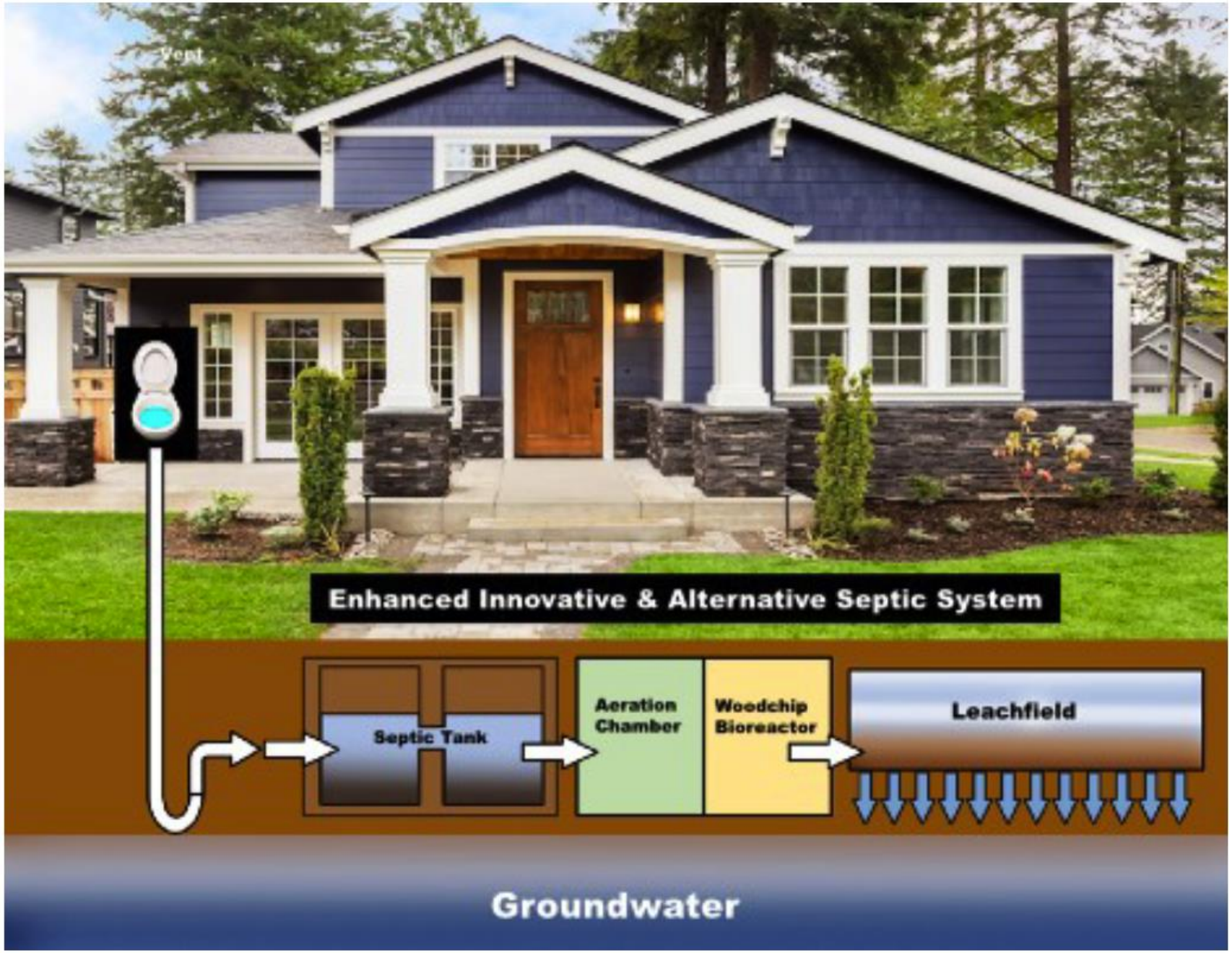
95 Lawrence Road Affordable Housing Project



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

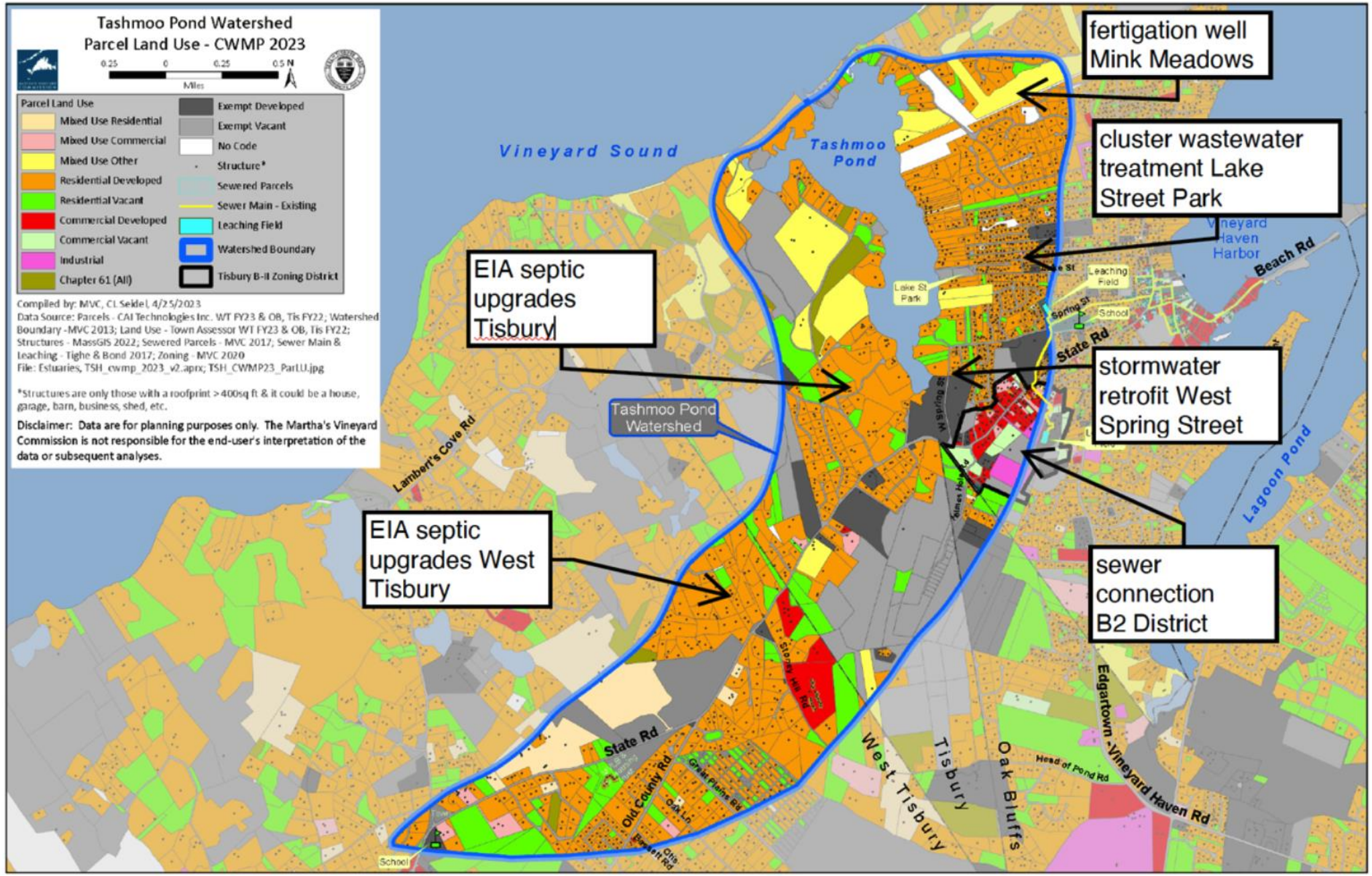
	Scenario A Hybrid	Scenario B Traditional
Collection System	$9.4	$80.4
Wastewater Treatment	$10.9	$32.7
Sewer Laterals	$3.2	$27.5
Design	$2.0	$11.3
Construction Services	$5.0	$30.7
Total Municipal Centralized Infrastructure	$30.5	$182.6
Collection System	$0.8	$0.8
Wastewater Treatment	$0.9	$0.9
Leaching 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

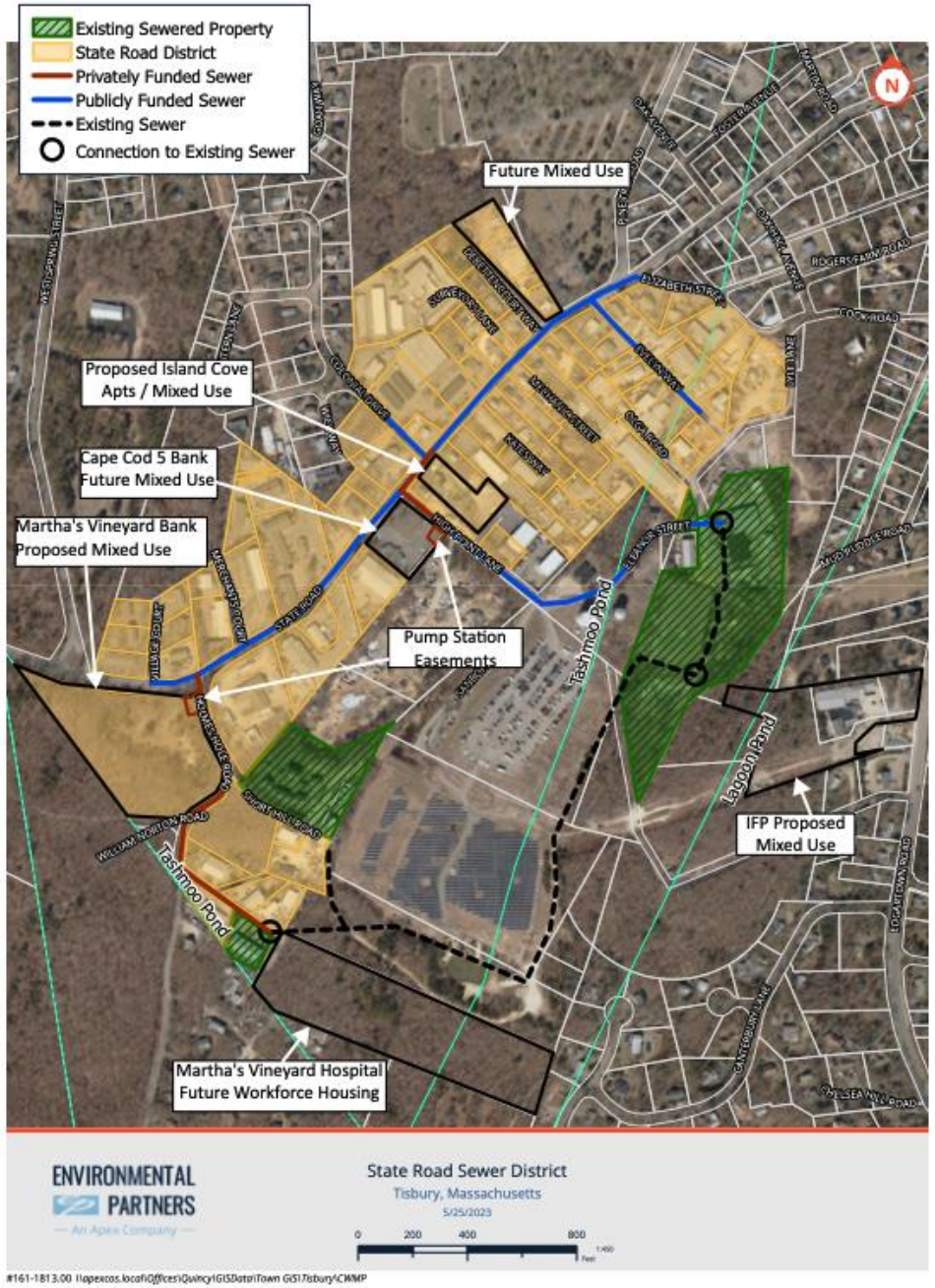
Water Resources Consultant


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 Hills Rd
School

Nitrogen Reduction Strategy (2043)

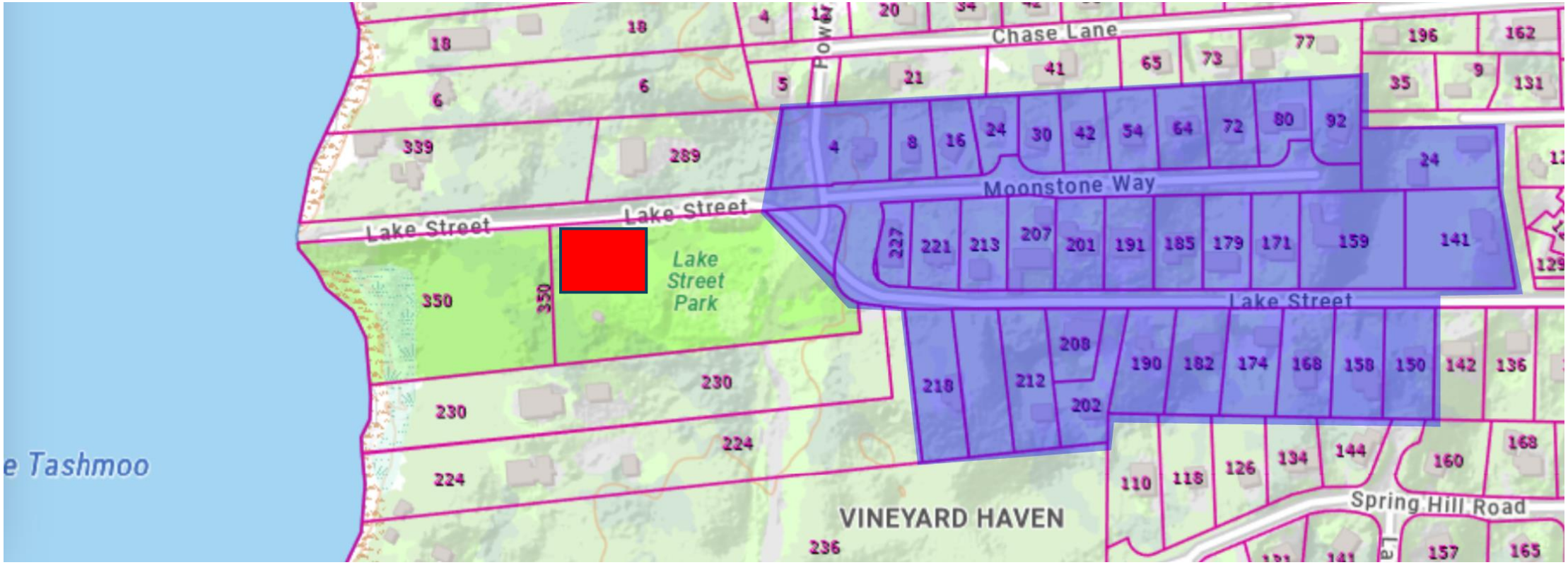
Technology/Strategy	Calculation Summary			Reduction (kg/yr)
Sewering (B2 District)	16330	gals/day		560
Enhanced I&A Septics	838	upgrades	x 171 gals/day x (26.25 - 10.0) mg/liter	3217
Cluster Treatment	9900	gals/day	x (26.25 - 5.0) mg/liter	291
Fertilizer Management	25	percent	x 457 kg/year	114
Stormwater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

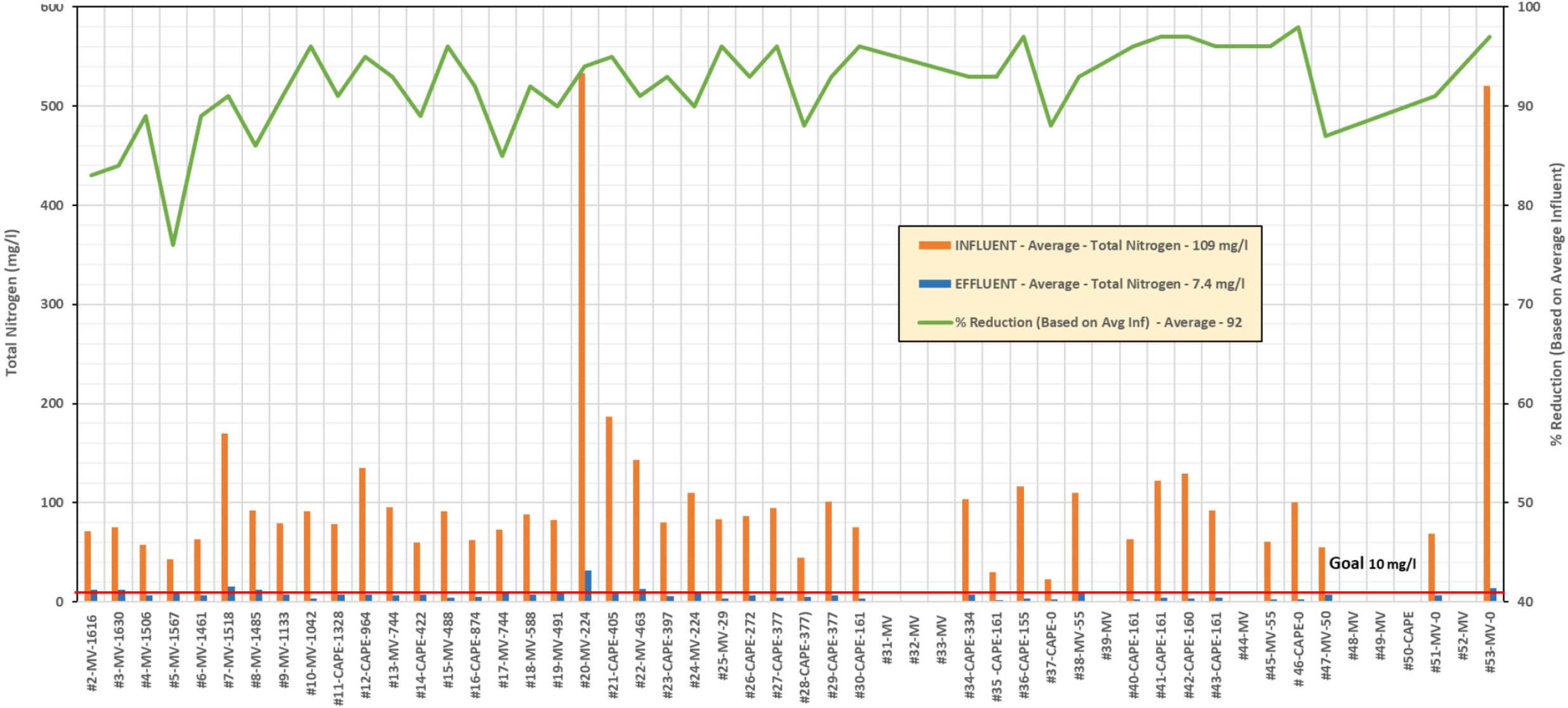
KleanTu Wastewater Treatment Technologies

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

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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