

Management of Enhanced I&A Septic Systems

Case Studies

- West Falmouth Harbor
- Wellfleet Targeted Watershed Plan
- Schubaels Pond, Barnstable

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West Falmouth Harbor Shoreline Septic Remediation Project



Map prepared by: Buzzards Bay National Estuary Program, 81-B County Road, Suite E, Mattapoisett, MA 02739. www.buzzardsbay.org. August 18, 2021

Designing a Municipal Model for Mandating, Funding, and Managing Innovative/Alternative Septic Systems June 2020

West Falmouth Harbor

Buzzards Bay Coalition

Barnstable County Department of Health & Environment (BCDHE)

Massachusetts Alternative Septic System Test Center (MASSTC)

Table 6. Current Status – CCWPC System Performance

Site	Pre-Install Load kg/yr	Post-Install Load kg/yr	% Reduction	TN Removed (kg/yr)
Nashawena1	25.35	7.77	69%	17.58
Nashawena3	30.38	2.45	92%	27.93
Nashawena4	3.88	3.88	0%	0
OldDock1	12.31	2.65	79%	9.66
Rice	4.31	2.59	40%	1.72
WF Hwy	4.86	2.26	54%	2.6
		Average	67%	59.49 kg/yr reduced
		Median	69%	131.17 lbs/yr reduced

Source: Buzzards Bay Coalition (2020)

Table 2. CCWPC Implementation Costs

ITEM	AVERAGE COST	COST RANGE
Equipment <i>(denitrification tanks)</i>	\$10,122	\$6,382-\$14,201
Engineering	\$2,512	\$2,400-\$3,650
Installation <i>(adding to an existing Title 5 system)</i>	\$17,467	\$10,405-\$21,998
Installation <i>(full upgrade)</i>	\$28,111	\$19,000-\$36,542

Buzzards Bay Coalition, 2020

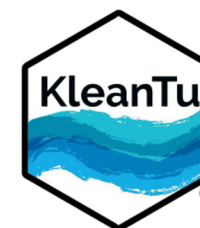
**Yearly Budgetary Cost Estimates for For
Routine Operation & Maintenance (O&M) of NitROE® 2KS WWTS**

Mass DEP Permit Status	Site Visits & Sampling Time (\$)	Mass DEP Certified Lab Analyses (\$)	Remote Sensing (\$)	Total Yearly Routine O&M Cost Estimate (\$)	Electrical Usage for Air Pump (\$)
Year 1 with Provisional Permit Status (Six site visits & Quarterly sampling)	650	600	50	1300	200
Years 2 and 3 with Provisional Permit Status (Quarterly site visits & Quarterly sampling)	500	600	50	1150	200
Year 1 with General Permit Status (Quarterly site visits & Yearly sampling)	350	150	50	550	200
Year 2 and Beyond with General Permit Status (Yearly site visit & Yearly sampling)	125	150	50	325	200

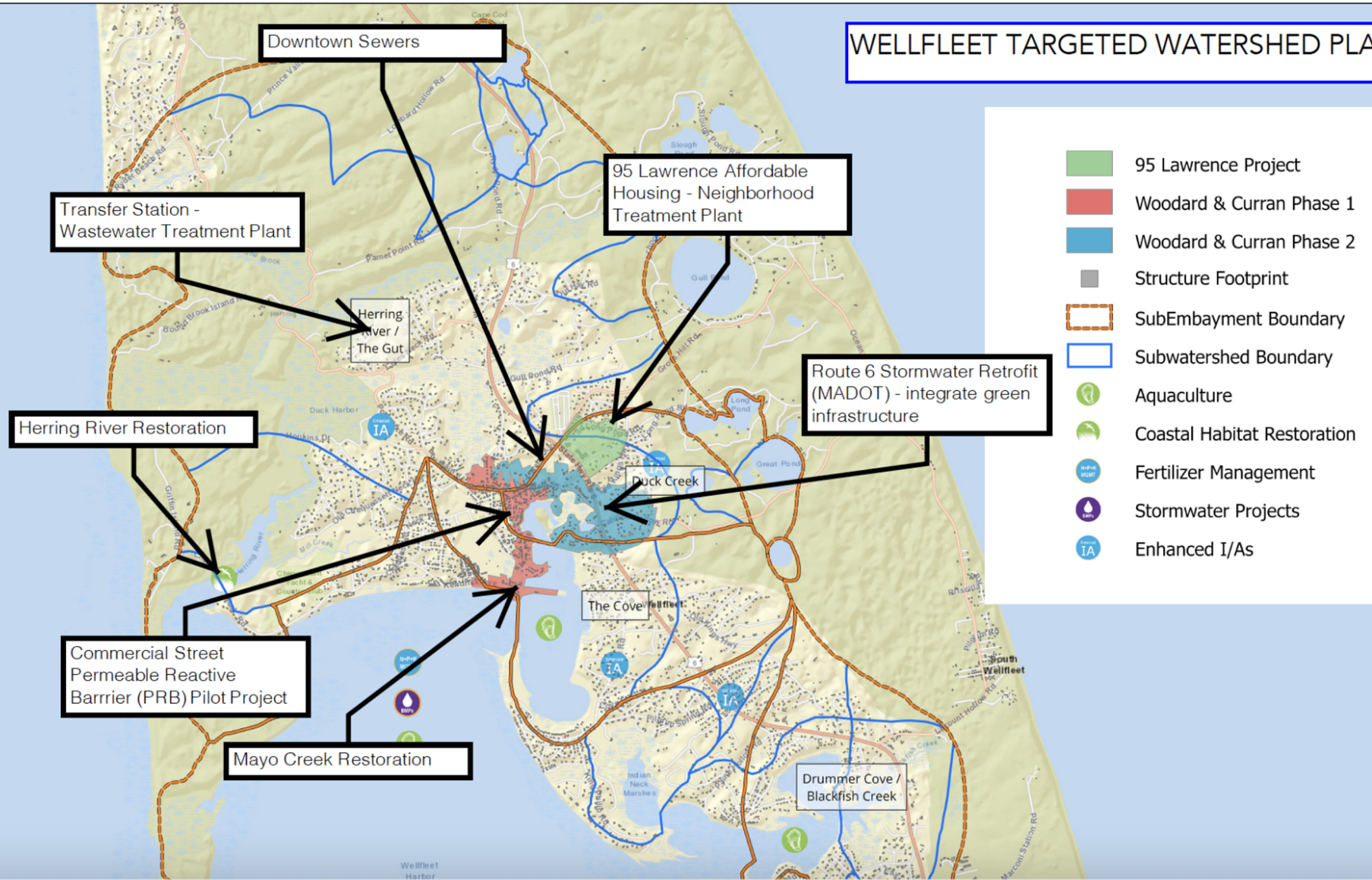
Note: Cost of Non-Routine O&M Items is Projected Below with Anticipated Spend Time Frame

- | | |
|--|-------|
| 1. Septic Tank Pump Out - \$600 every 5 years. | \$120 |
| 2. Replace Air Pump - \$700 every 5-10 years. | \$100 |
| 3. Replace Aeration Tubing - \$400 every 10 years. | \$40 |
| 4. Replace Wood Chips - \$500 every 15-20 years. | \$28 |
| 5. Replace Limestone - \$800 every 15-20 years. | \$46 |

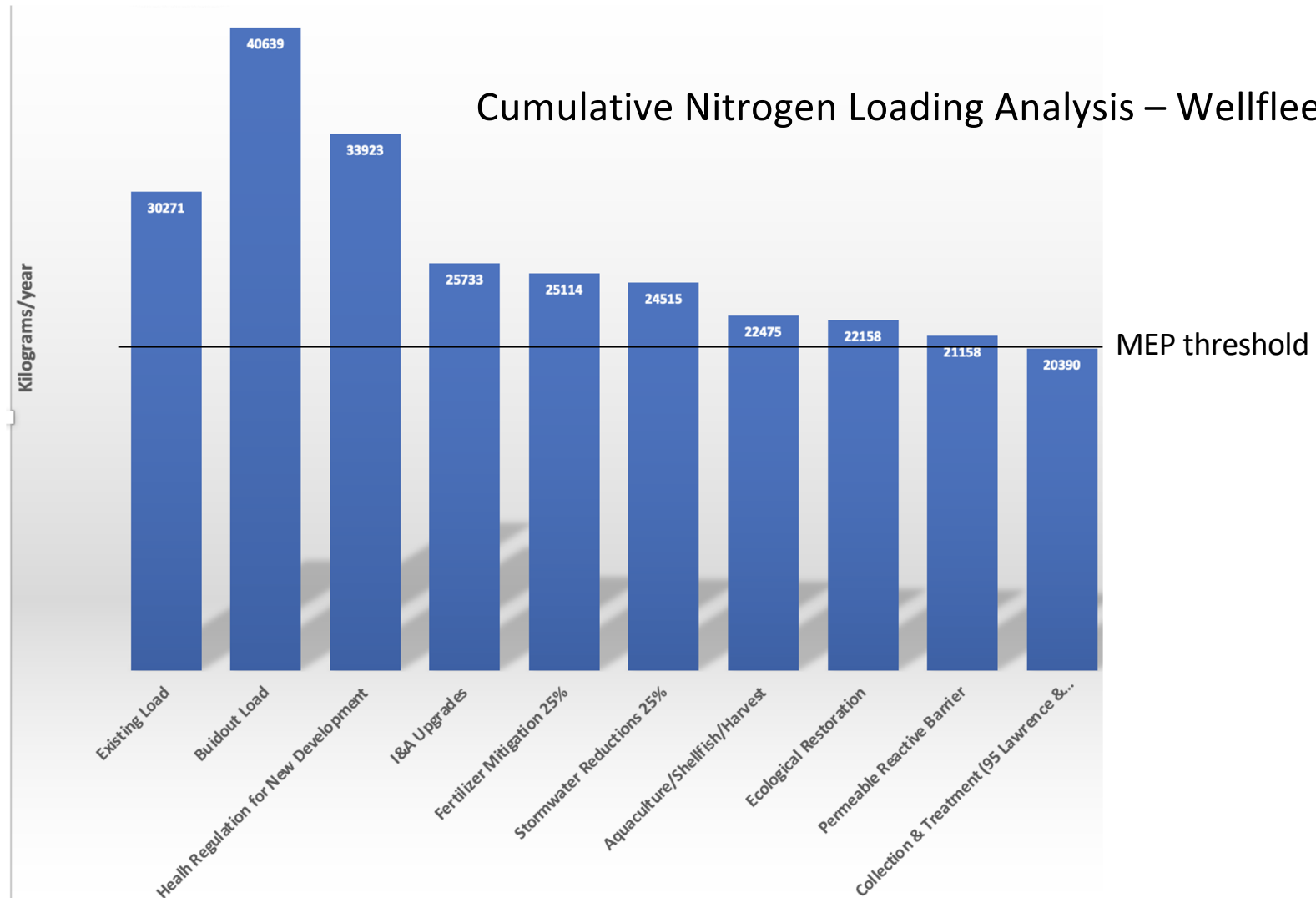
Total + 334 = \$859/year

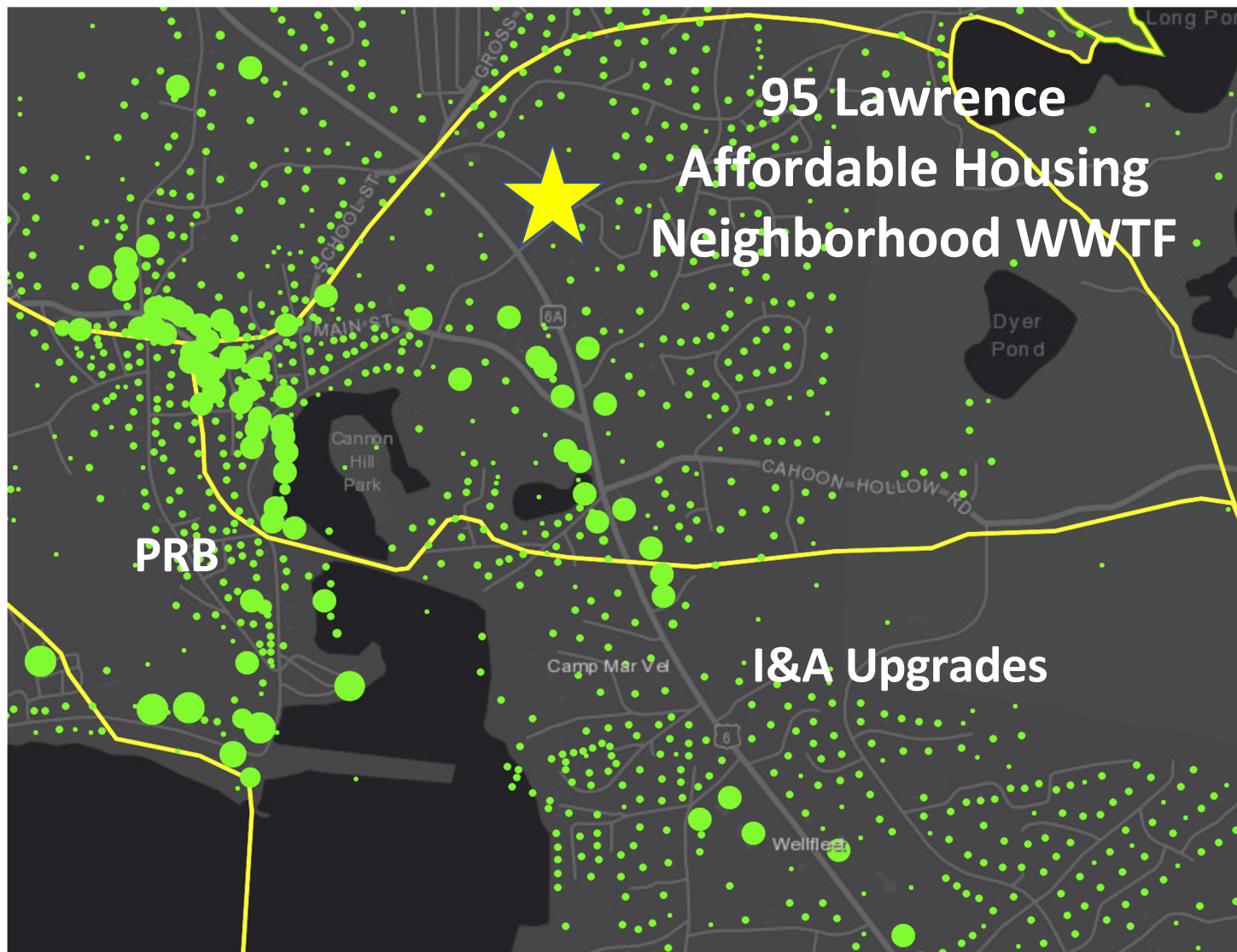


WELLFLEET TARGETED WATERSHED PLAN

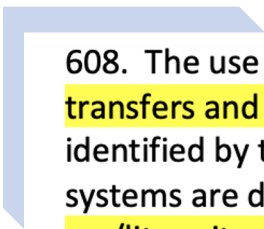


Cumulative Nitrogen Loading Analysis – Wellfleet Harbor





Projects funded at
Wellfleet Town
Meeting 2021




608. The use of a nitrogen reducing system is required for all new, repairs, all property transfers and upgrades within the Wellfleet Harbor Embayment System watersheds as identified by the Massachusetts Estuaries Project (MEP) report (2017). Nitrogen reducing systems are defined as those systems technologies approved by MADEP and rated at 19 mg/liter nitrogen or better.

609. “Enhanced” nitrogen reducing systems are defined as those technologies that have average nitrogen effluent concentrations less than 10 mg/liter or demonstrate a net average nitrogen removal rate of 75% or greater as demonstrated by third-party testing. Currently the Board of Health recognizes the following technologies as enhanced: NITRO, NITREX, and the sawdust-based system known as the “Layer Cake” technology (Heufelder, 2019). Other technologies may be petitioned by applicants for review by the Board of Health and must present third-party testing data.

610. The Town of Wellfleet provides an incentive program for installations of “enhanced” nitrogen reducing systems. Incentives include the following options:

- a) a grant of \$12,500 or tax exemption in the amount of \$12,500, and
- b) allowance for an additional bedroom, or
- c) allowance for an accessory dwelling unit (provided it is affordable)

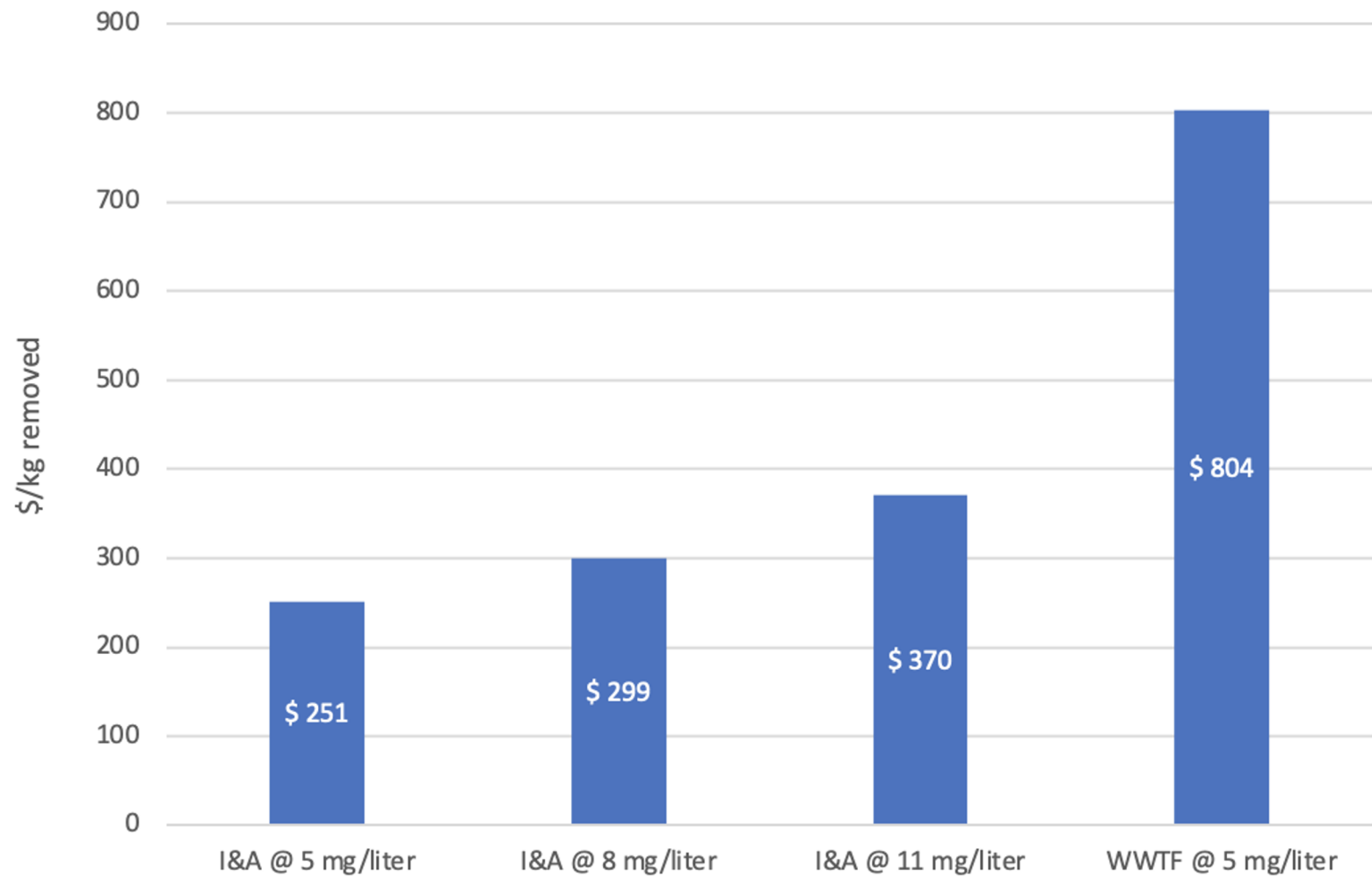
611. Any property owner who has installed an “enhanced” alternative septic system may, upon approval by the Board of Health, defer connection to town sewer to allow them to utilize their alternative septic as long as the system remains in compliance.



Proposed Health Regulation

Nitrogen Loading Reductions I&A septic

	mg/liter	kg/year	reduction			cost		\$/kg
I&A @ 5 mg/liter	11	2.20	2.53		53%	\$ 28,111	\$	370
I&A @ 8 mg/liter	8	1.60	3.13		66%	\$ 28,111	\$	299
I&A @ 11 mg/liter	5	1.00	3.73		79%	\$ 28,111	\$	251
WWTF @ 5 mg/liter	5	1.00	3.73		79%	\$ 90,000	\$	804





**Schubael Pond I&A
Septic Study**

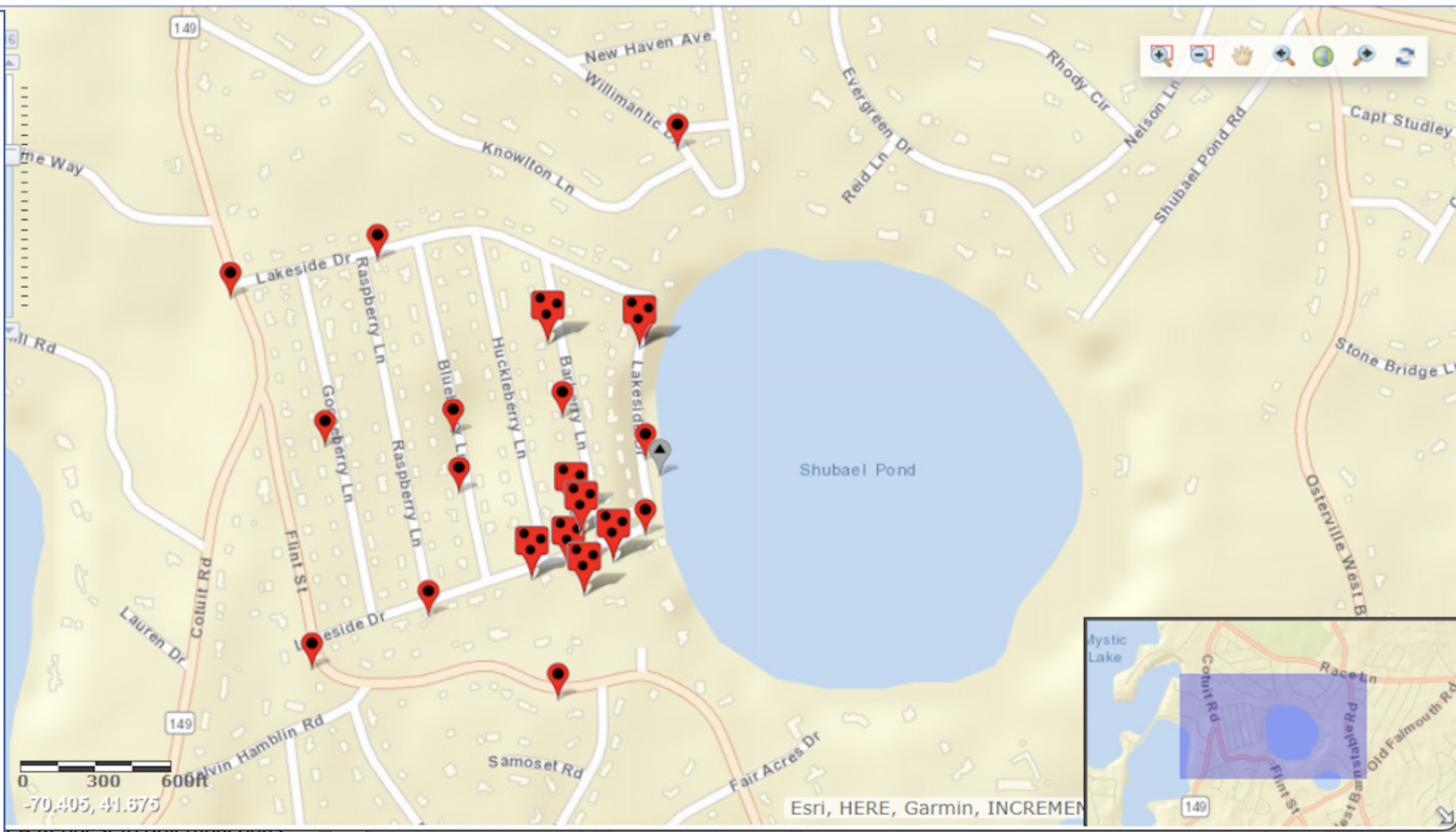
Barnstable Clean
Water Coalition

U.S. Environmental
Protection Agency,
Office of Research &
Development (USEPA
ORD)

U.S. Geological Survey
(USGS)

The Nature
Conservancy (TNC)

Town of Barnstable





Revised: 2021-07-30
By: L Erban

DRAFT SUBJECT TO CHANGE

SEPTIC INSTALLATIONS

** 225 Phase 0-1
* 26 Phase 2
217 Under consideration
for a later phase

GROUNDWATER MONITORING

Mean nitrate, as N, (NO₃-N, mg/L)
at sampling location (Jun-2021)*

- NA
 ● < 1
 ● 1-2
 ● 2-4
 ● 4-8
 ● 8-16

* Preliminary data- do not cite.
some results pending, deeper
samples (alt < 32 ft) excluded)

- Water table well
- Well cluster
- Multilevel sampler

← Hydraulic gradient vector

- Retrofit existing Title 5 systems
- Groundwater Monitoring Wells
(Pre vs Post)
- Influent & Effluent Monitoring
(including lysimeters)
- Installation & Testing of USEPA
Nitrogen Sensors
- Installation & Testing of Remote
Operation Monitoring

Remote Operation Monitoring will save \$\$

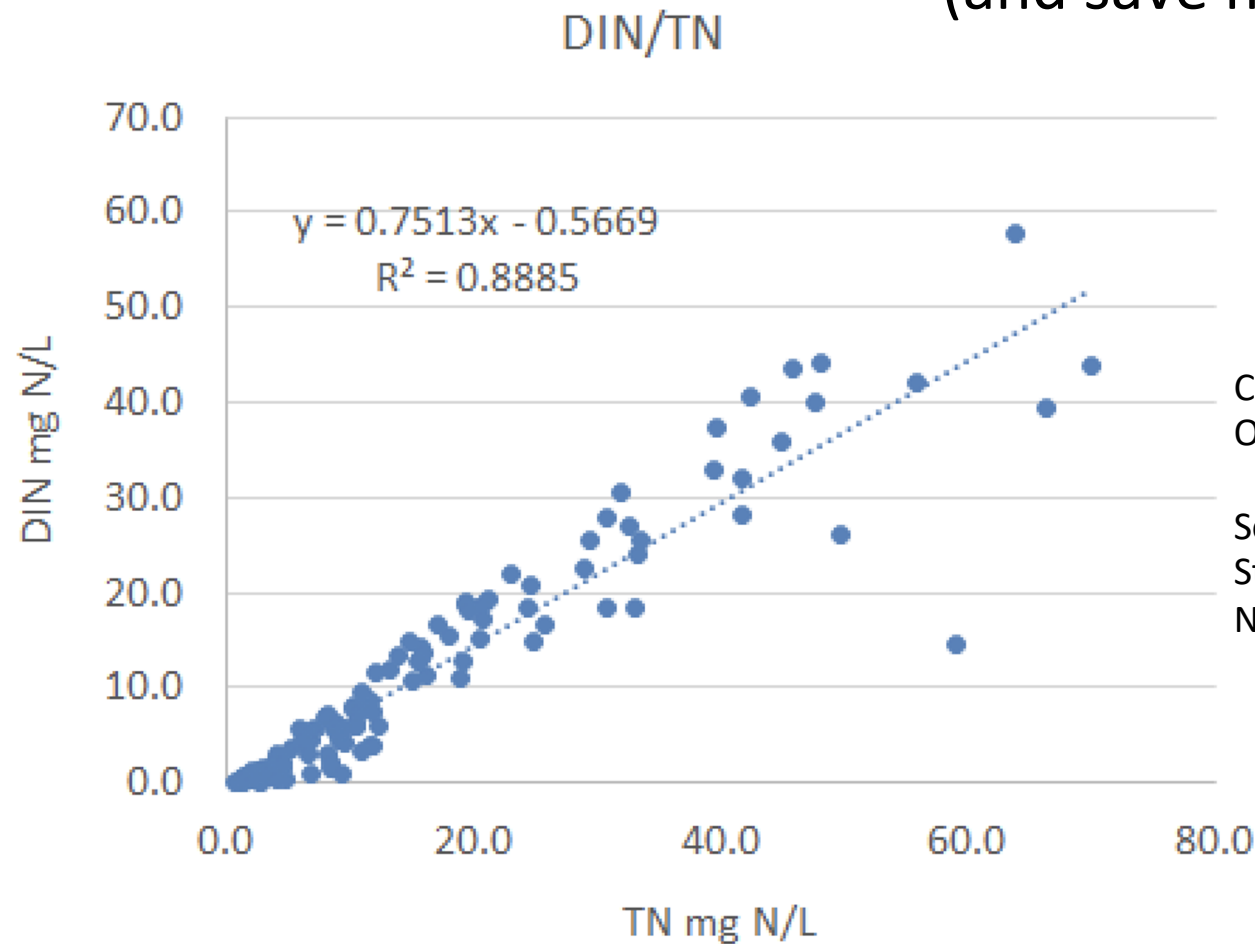
<http://34.219.45.18/>

KleanTu Remote Sensing Box



Box Tag	Current Pressure (psi)	Current Temp (°C)	Min Pressure Alert (psi)	Max Pressure Alert (psi)	Min Temp Alert (°C)	Max Temp Alert (°C)	Update Time	Email
13A GA WW Temp	2.11097	23.687	1	4	5	30	00 Days & 00:00:05 Hours ago	jsmith@kleantu.com
2YS	2.31627	-999	1	4	-999	30	00 Days & 00:00:07 Hours ago	jsmith@kleantu.com
Pirates A	0.14317	24.687	-999	999	-999	999	00 Days & 00:00:13 Hours ago	jsmith@kleantu.com
13B GA Air Temp	2.30416	27.812	1	4	5	35	00 Days & 00:00:13 Hours ago	jsmith@kleantu.com
3SR	2.26967	19.375	1	5	5	30	00 Days & 00:00:01 Hours ago	jsmith@kleantu.com

Can we use remote Nitrate Sensor to monitor performance (and save more \$\$)?



Correlation of Nitrate (DIN) to Total Nitrogen
On-Site Wastewater Effluent

Source: Dr. Christopher Gobler
Stony Brook University
NY State Center for Clean Water Technology

Summary

- *Enhanced I&A septic systems can achieve >75% N reduction and 5 mg/liter (similar to WWTF)*
- *Can be used in hybrid watershed plan to achieve MEP N thresholds*
- *Consistent with CLF lawsuit (Clean Water Act)*
- *Effective in removing contaminants of emerging concern (CECs)*
- *Average cost for retrofit of existing system - \$17,500*
- *Average cost of new system (or full replacement) - \$28,000*
- *Estimated O&M cost for enhanced I&A (NITROE) - \$859/year*
- *Operation & Maintenance simplified with remote operation monitoring and RME*
- *Future potential for remote effluent screening w N sensor*