6TH ANNUAL
CAPE COASTAL CONFERENCE
DECEMBER 4-5, 2018



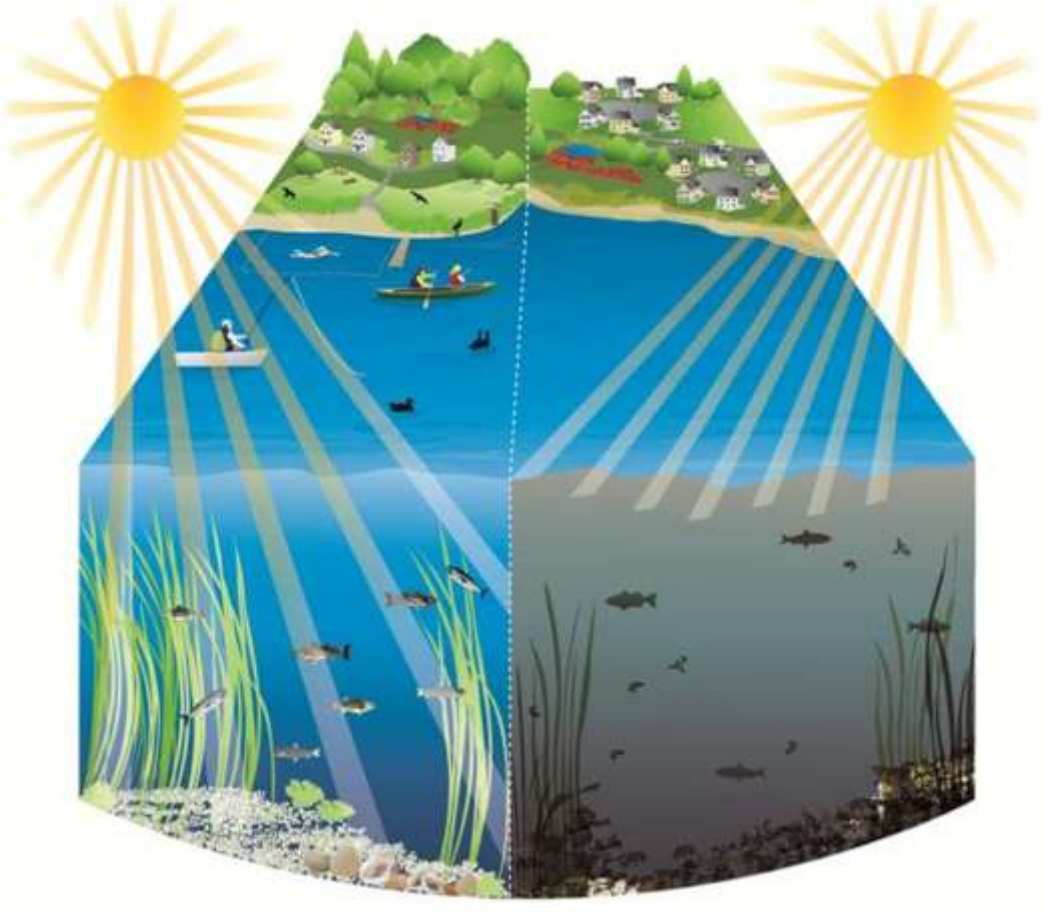
West Falmouth Harbor Nitrogen-Reducing Septic System Demonstration Project

Maureen Thomas

Buzzards Bay Coalition

www.savebuzzardsbay.org

Nitrogen Pollution



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Eelgrass

Degraded → *Healthy*

Photo credit: Dr. Joseph Costa & George Hampson

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Credit: Christine Hochkeppel/Cape Cod Times

Credit: Milt Williamson/Boston Globe

Solutions to Nitrogen Pollution

- Sewering
- Nitrogen reducing septic systems
- Bio-extraction
- Fertilizer reduction
- Stormwater remediation

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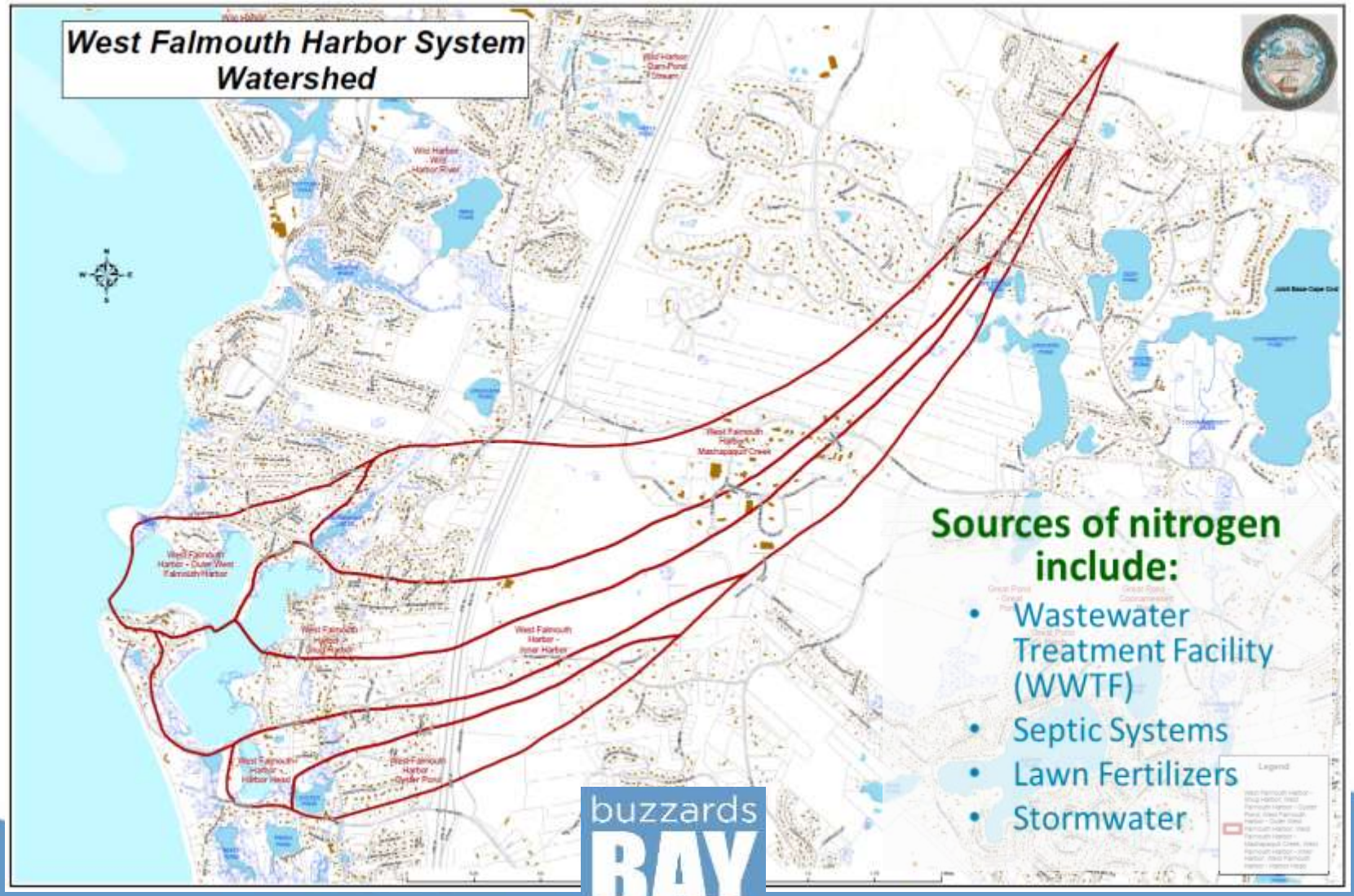
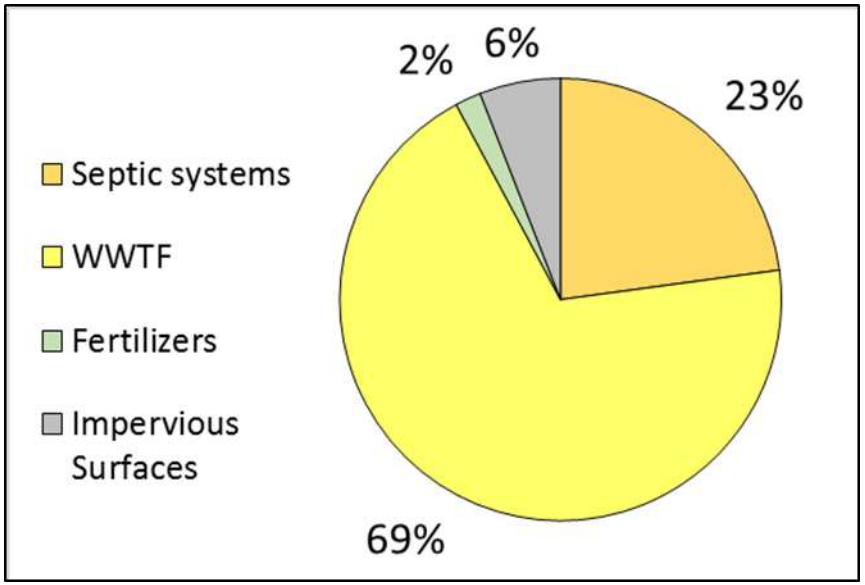
West Falmouth Harbor Nitrogen Pollution Sources

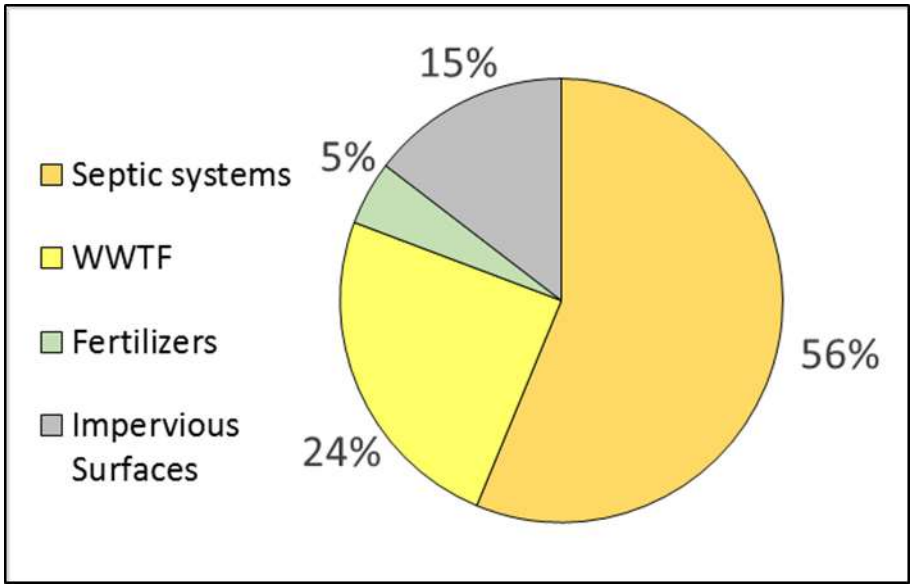


West Falmouth Harbor Nitrogen Pollution Sources

Prior to 2005 WWTF Upgrade



After WWTF Upgrade & Plume Dissipation



Source: West Falmouth MEP Report (Howes et al. 2006)

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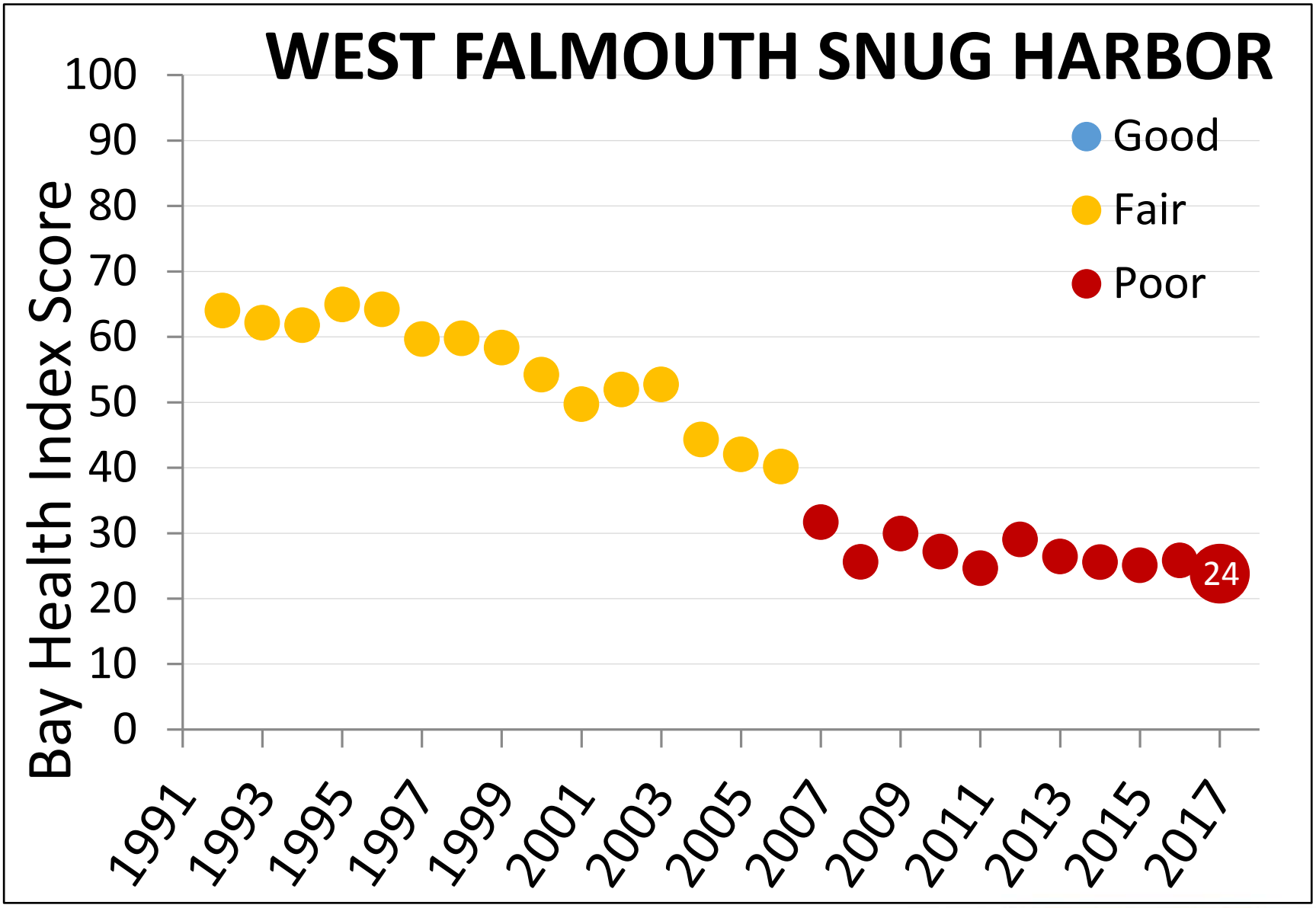

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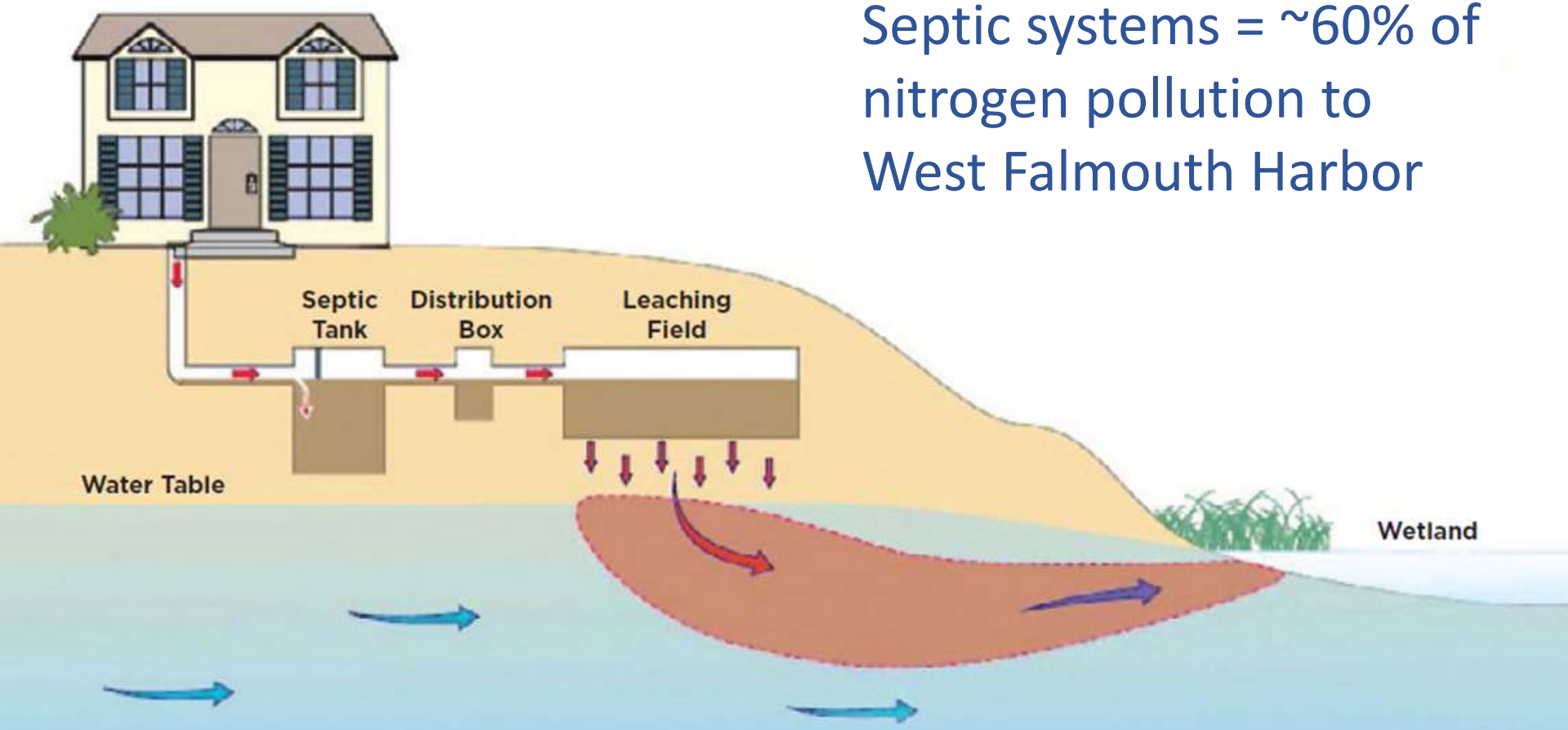
Conventional Septic Systems

Septic systems = ~60% of nitrogen pollution to West Falmouth Harbor



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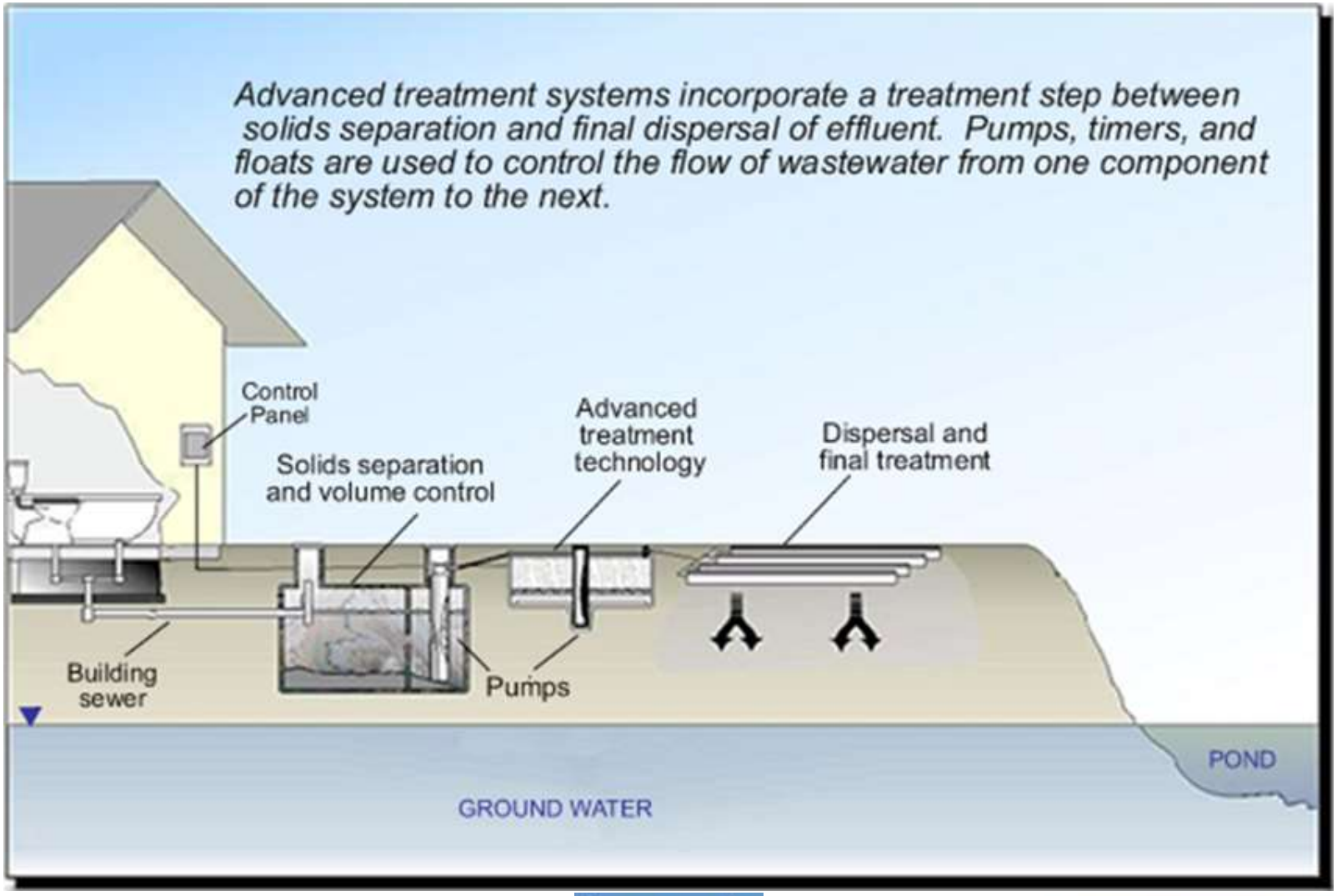
Nitrogen-Reducing Septic Systems



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West Falmouth Harbor Shoreline Septic Remediation Project

Phase I & II Project Partners

SNEP
Southeast New England Program

CAPE COD COMMISSION
CCWPC

West Falmouth Village Association

BCDHE
Barnstable County Department of Health and Environment
Promote - Protect - Support

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WFHSSR Scope

- Upgrade 30 existing septic systems within 300 feet of MHW of the harbor to nitrogen-reducing systems
- Use best available technologies that meet 12 mg/L total nitrogen removal or less
- Provide $10,000 subsidies to Phase I & $7,500 for Phase II homeowner volunteers
- Evaluate total costs & implementation logistics
- Monitor & report results

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Candidate Properties

Prioritized by:

- Subwatershed
- Age & Type of septic system
- Distance from MHW
- Home use

Map prepared by: Buzzards Bay National Estuary Program, 2870 Cranberry Highway, East Wareham, MA 02538. www.buzzardsbay.org March 10, 2015

Qualifying Technologies

Nitrogen-reducing technologies meeting 12 mg/L TN	
AdvanTex AX20RT	Layered Soil Treatment Area
Amphidrome-SBR	Nitrex
Biobarrier MBR	NJUN
Bioclere	RUCK
Blackwater	Hydro-Kinetic
BUSSE Green Tech	Waterloo Biofilter
Eliminite	SepticNET
GPC	SeptiTech
Hoot	

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Demonstration Project Process

- 30 Homeowner volunteers
- Homeowners sign contract with Town of Falmouth
- Engineer selection
- Technology selection & system design
- Permitting
  - Board of Health
  - Conservation
  - MassDEP pilot approvals
- Installer selection
- Implementation
- $10,000 or $7,500 subsidy
- O & M contract
- I/A system notice recorded on deed
- 1+ year of free sampling

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Identifying 30 Participants

- West Falmouth Village Association (WFVA) connection
- Letters sent from WFVA & Coalition to top 60 priority homeowners
- Consulted with neighborhood leaders
- Held vendor workshop
- Met with interested candidates to discuss technologies & assess feasibility

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Site Suitability Considerations

- Review of existing plans & existing septic system
- Soils
- Groundwater elevation
- Lot size
- House coverage

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Decision Support Tool

NAME:

WEST FALMOUTH PROPERTY ADDRESS:

DATE:

Please tell us how important the follow characteristics are to you based on the following scale:

First Cost (equipment and installation)	
20 Year Present Worth (including O&M)	
Energy Use	
Aesthetics	
Complexity	

1 = very important
2 = important
3 = somewhat important
4 = not very important
5 = not a concern

Is there another criteria not listed here that is important to you?

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Support Tool Summary

System Name Contact Website	Decision Tool Total Score	Average Estimated Installed System Cost	Annual Cost for Quarterly Inspections	Lab Costs after 1st year	Monthly Energy Use (kWh)*	20 year Present Worth for O&M**	Company Warrantee on System	Special Considerations	Number of Pumps
NJUN Systems Duncan Corley 404-925-1289 http://www.njunsystems.com/	9.0	$17,800	$800	$305	25	$44,095	2 years	Below ground installation/at grade	0 mech 2 air
Nitrex (Lombardo Associates) Lombardo Associates 617-964-2924 http://www.lombardoassociates.com/	17.0	$24,800	$800	$305	30	$49,305	2 years, 5 years for pumps	Below ground installation/at grade	1 mech typically
Waterloo Biofilter Greg Corman 519-856-0757 Chris James 519-830-1490 http://waterloo-biofilter.com/	17.0	$23,550	$850	$305	30	$49,305	2 years	Below ground installation/at grade	3 mech
Hoot BNR Ron Suchecki 254-299-0821 http://hootsystems.com/about-hoot-systems/	15.0	$21,650	$600	$305	63	$41,125	3 years	Part of unit located above ground (small box for fan)	1 mech
Eliminite +Puraflo Tom Kallenbach 406-581-1613 http://www.eliminite.com/index-1.html#	17.0	$13,550	$600	$305	70	$36,245	5 years	Below ground installation/at grade	2 mech
SES Environmental: Hydro-Kinetics Camel McGill 401-785-0130 or 508-406-8381 http://www.seswastewater.com/hydro-kinetic.html	19.0	$24,550	$1,000	$305	86	$57,577	2 years	Below ground installation Covers raised ~3" above grade	1 mech 1 air

- Technology Name, Contact, Website
- Decision Support Tool Total Score
- Average Estimated Installed System Cost
- Annual Cost for Quarterly Inspections
- Lab Costs after 1st year
- Monthly Energy Use (kwh)
- 20 year present worth for O & M
- Company Warranty
- Number of Pumps
- Special Considerations

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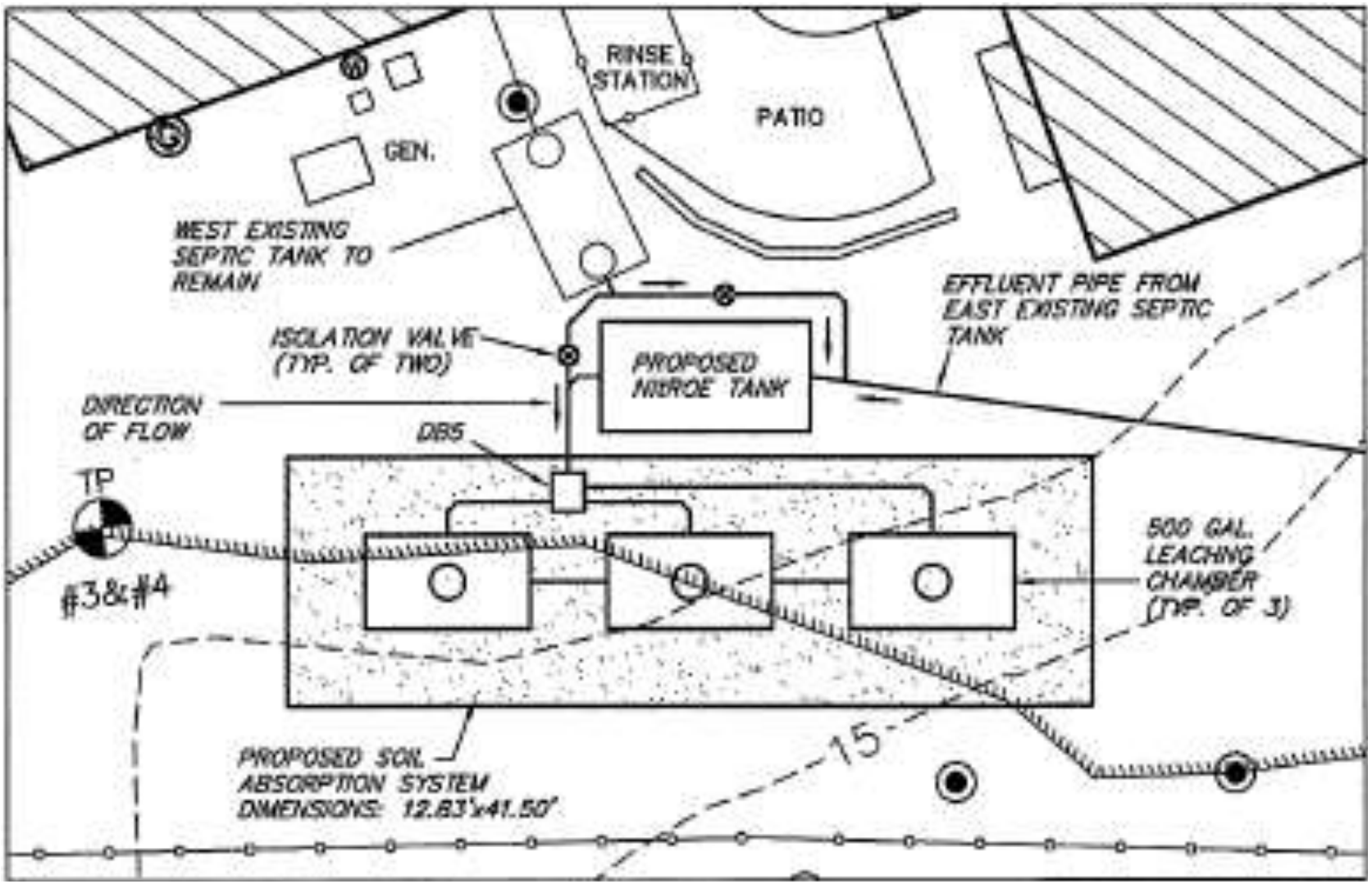
Design & Engineering



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Permitting

Falmouth Health Department

Falmouth Conservation Commission

59 Town Hall Square, Falmouth, Massachusetts 02540

(508) 495-7445 FAX (508) 457-2511

Massachusetts Department of Environmental Protection

Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Approval of Alternative Technology for Site Specific Piloting Use – BRPW64b

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Implementation

24 Installations completed

13 Cesspools upgraded

4 Technologies installed

- 9 Blackwater tanks
- 7 Hoot systems
- 5 Eliminite tanks
- 1 Layer cake
- 1 Fast with Perc-Rite Drip Dispersal
- 1 Perc-Rite

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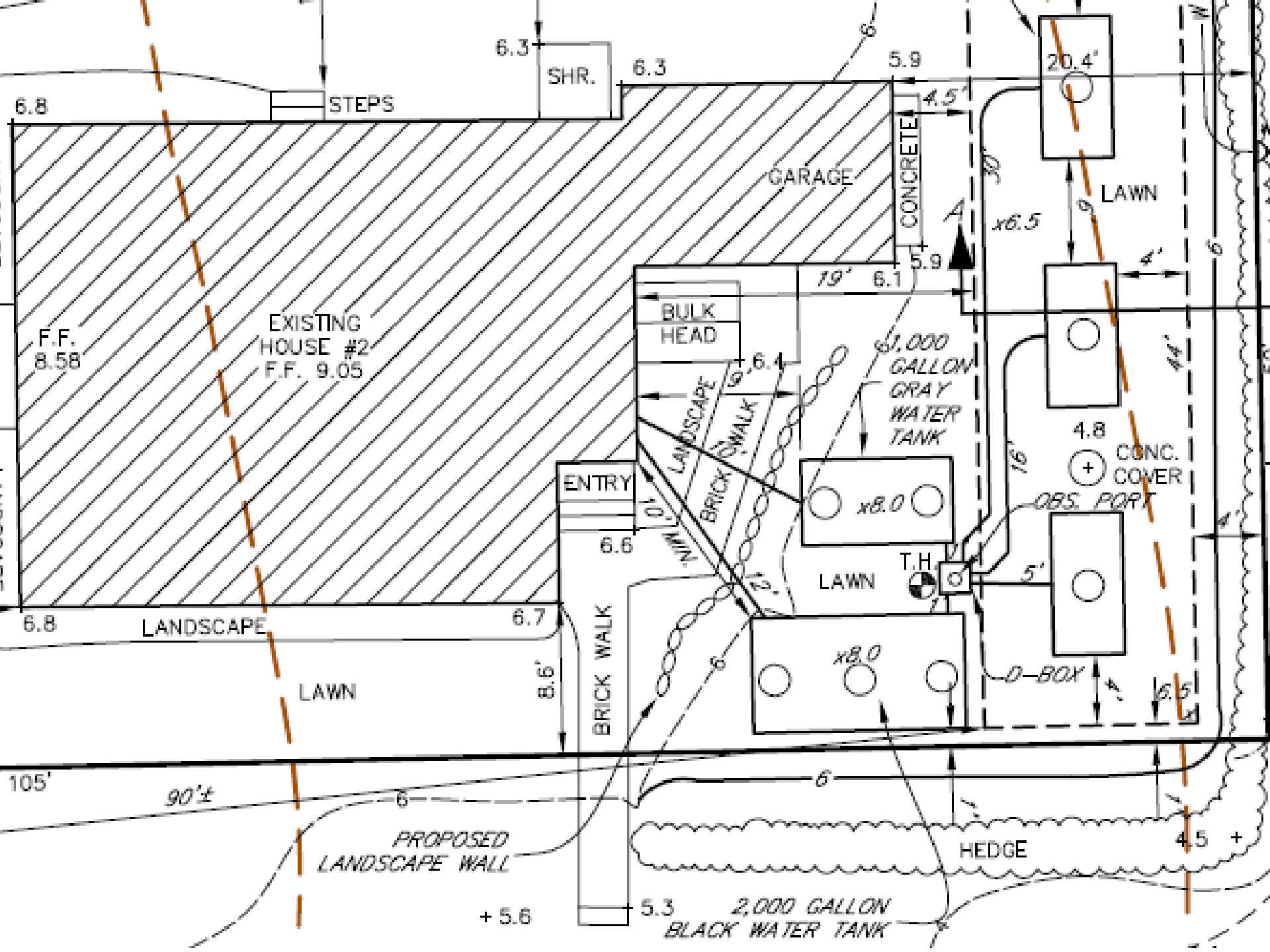
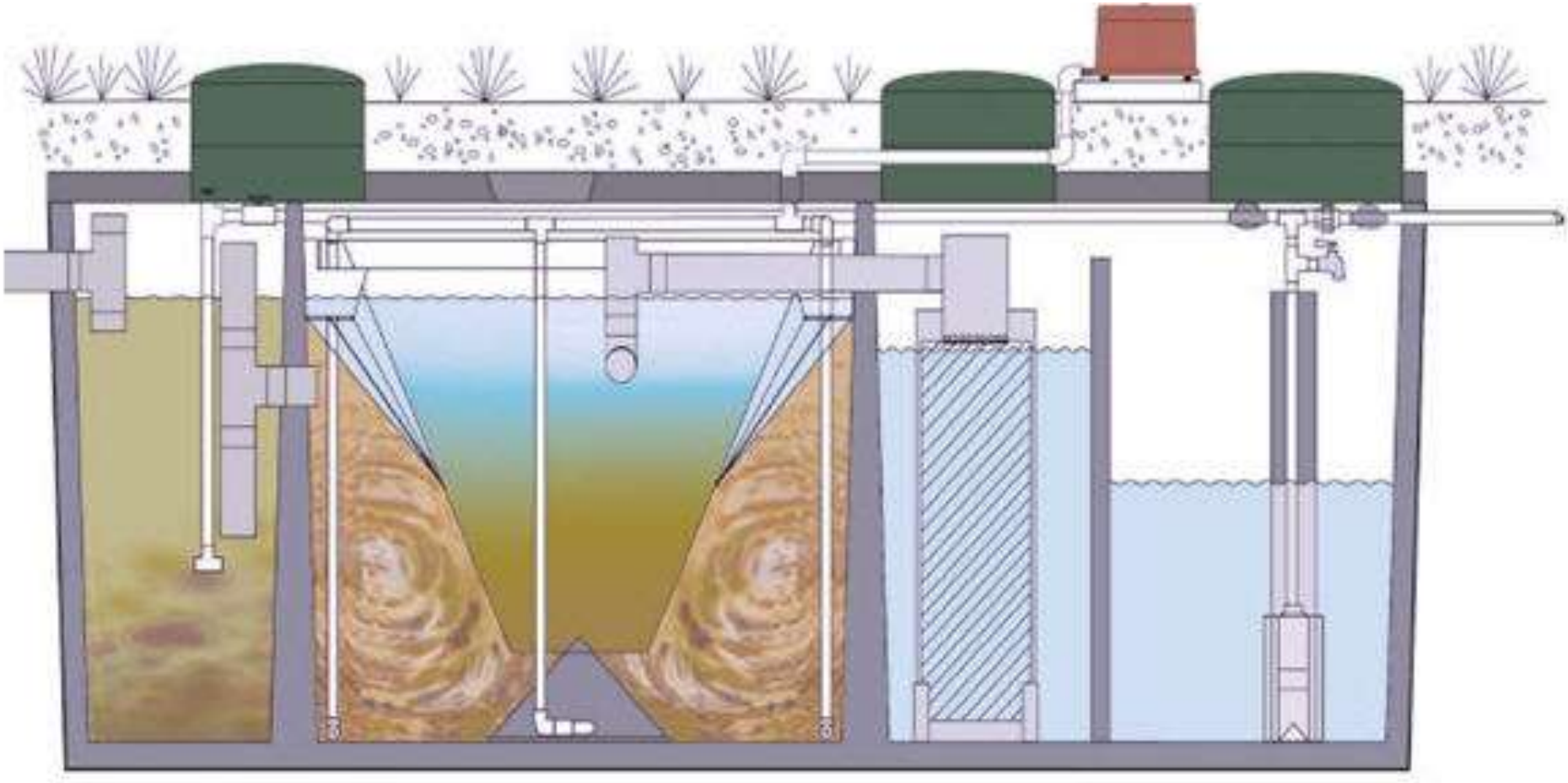
Technologies
Blackwater Tank

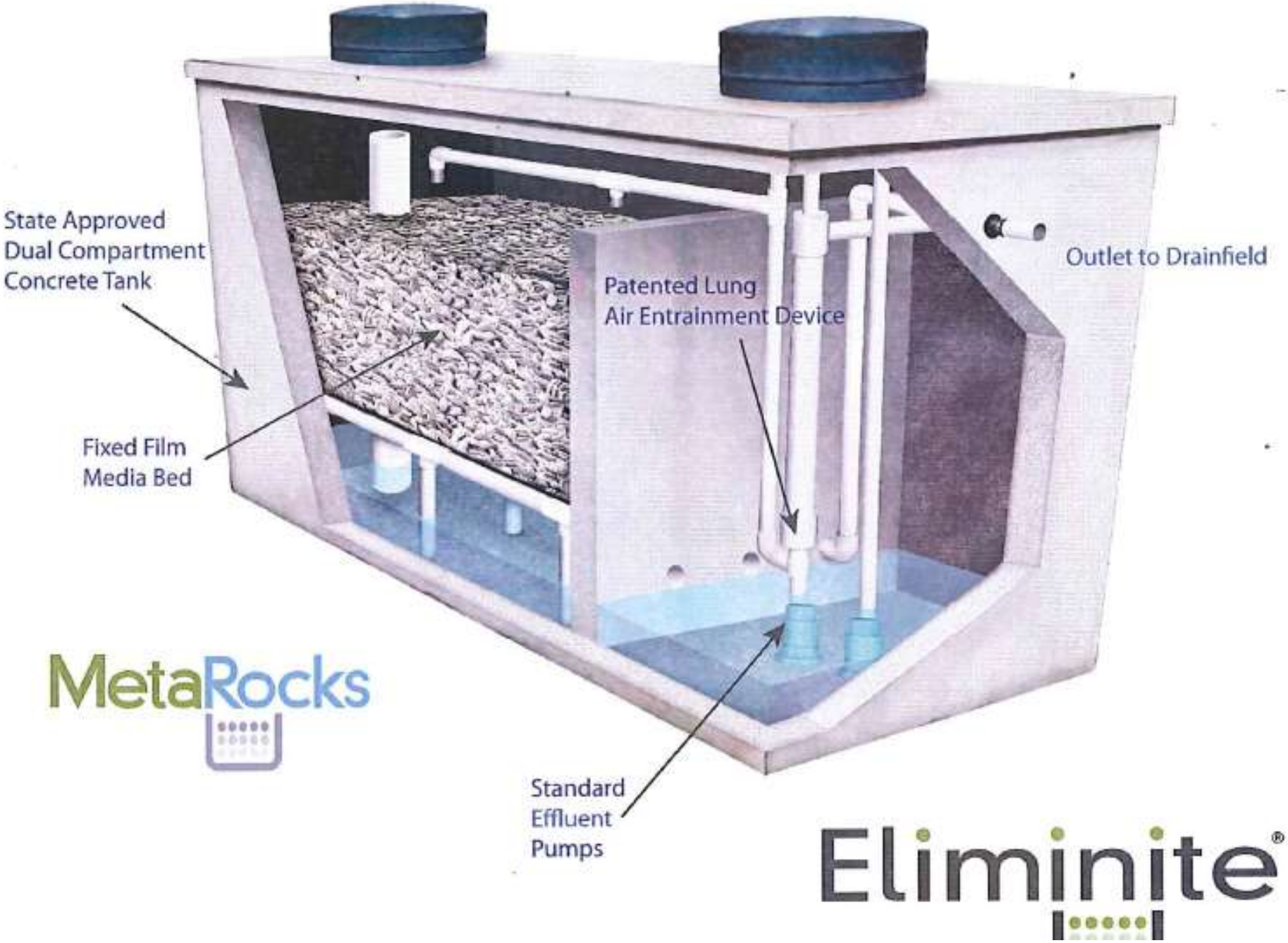

6.3
SHR.
6.3
5.9
20.4'
6.8
STEPS
4.5'
CONCRETE
GARAGE
LAWN
x6.5
5.9
19'
6.1
4'
BULK
HEAD
F.F.
8.58
EXISTING
HOUSE #2
F.F. 9.05
6.4
LANDSCAPE
BRICK WALK
1,000
GALLON
GRAY
WATER
TANK
4.8
CONC.
COVER
ENTRY
6.6
x8.0
OBS. PORT
T.H.
LAWN
5'
6.8
LANDSCAPE
6.7
x8.0
D-BOX
6.5
8.6'
BRICK WALK
LAWN
105'
90'±
6
PROPOSED
LANDSCAPE WALL
HEDGE
4.5
+ 5.6
5.3
2,000 GALLON
BLACK WATER TANK

Hoot System

Hoot



Eliminite

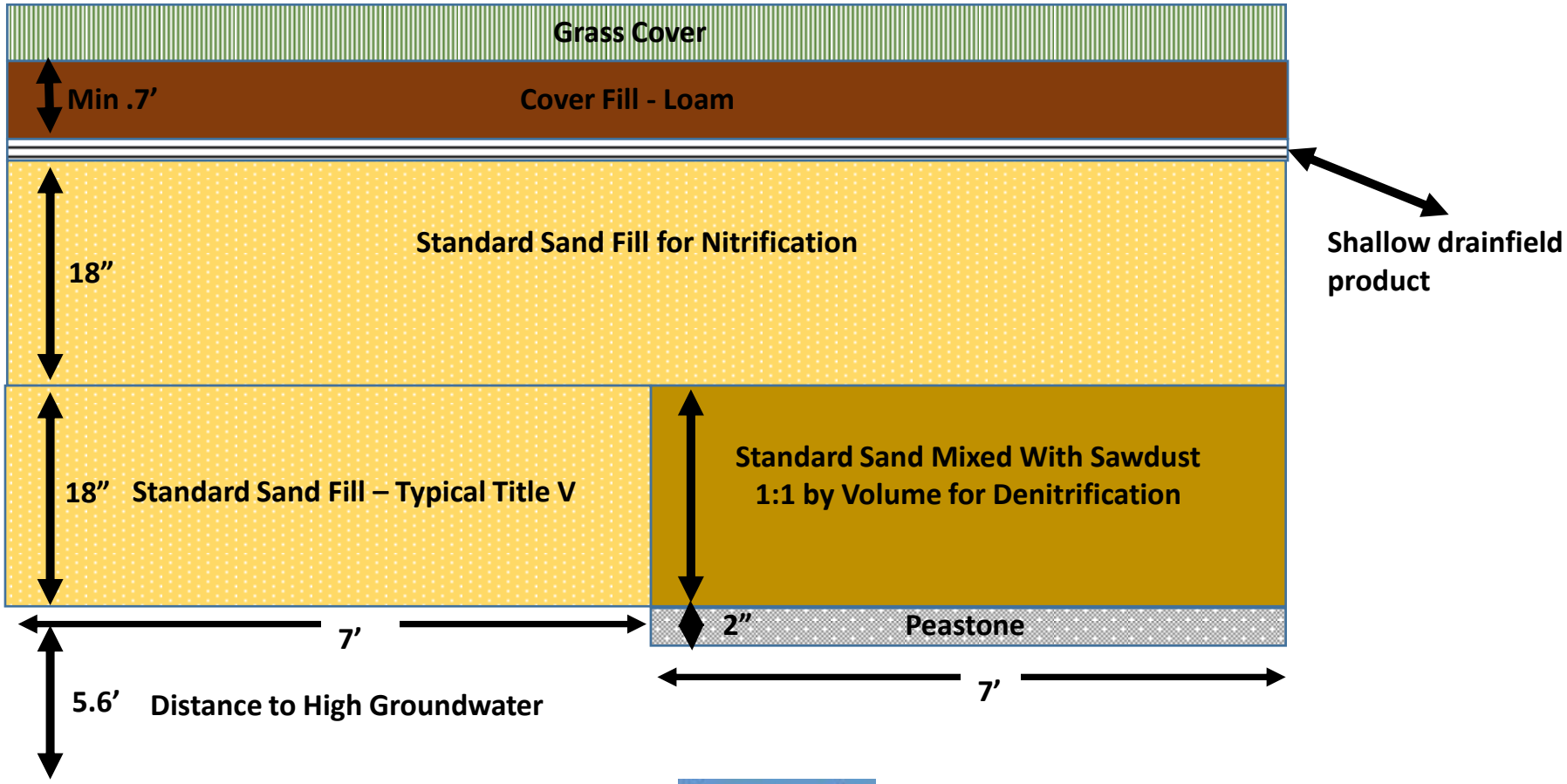


MetaRocks

Eliminite®

Layer Cake

Layer Cake Cross Section



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Fast & Perc-Rite

Fast

A. Blower and Housing

B. Control Panel

C. Air Line Piping

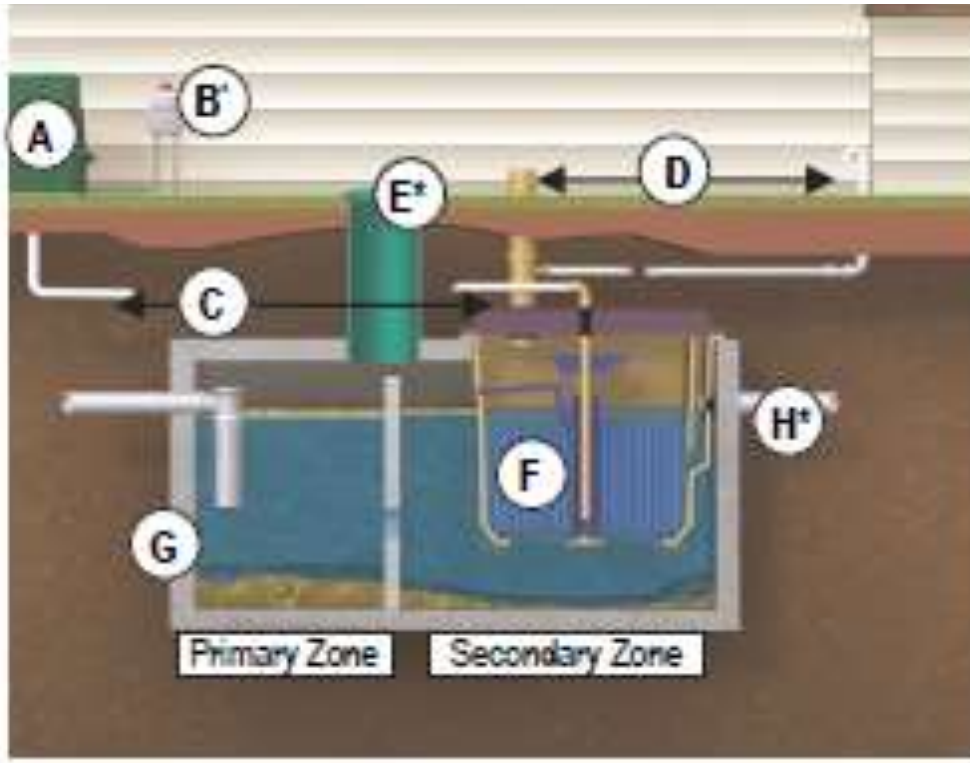
D. Vent(s) and Observation Port

E. Access

F. FAST® Unit

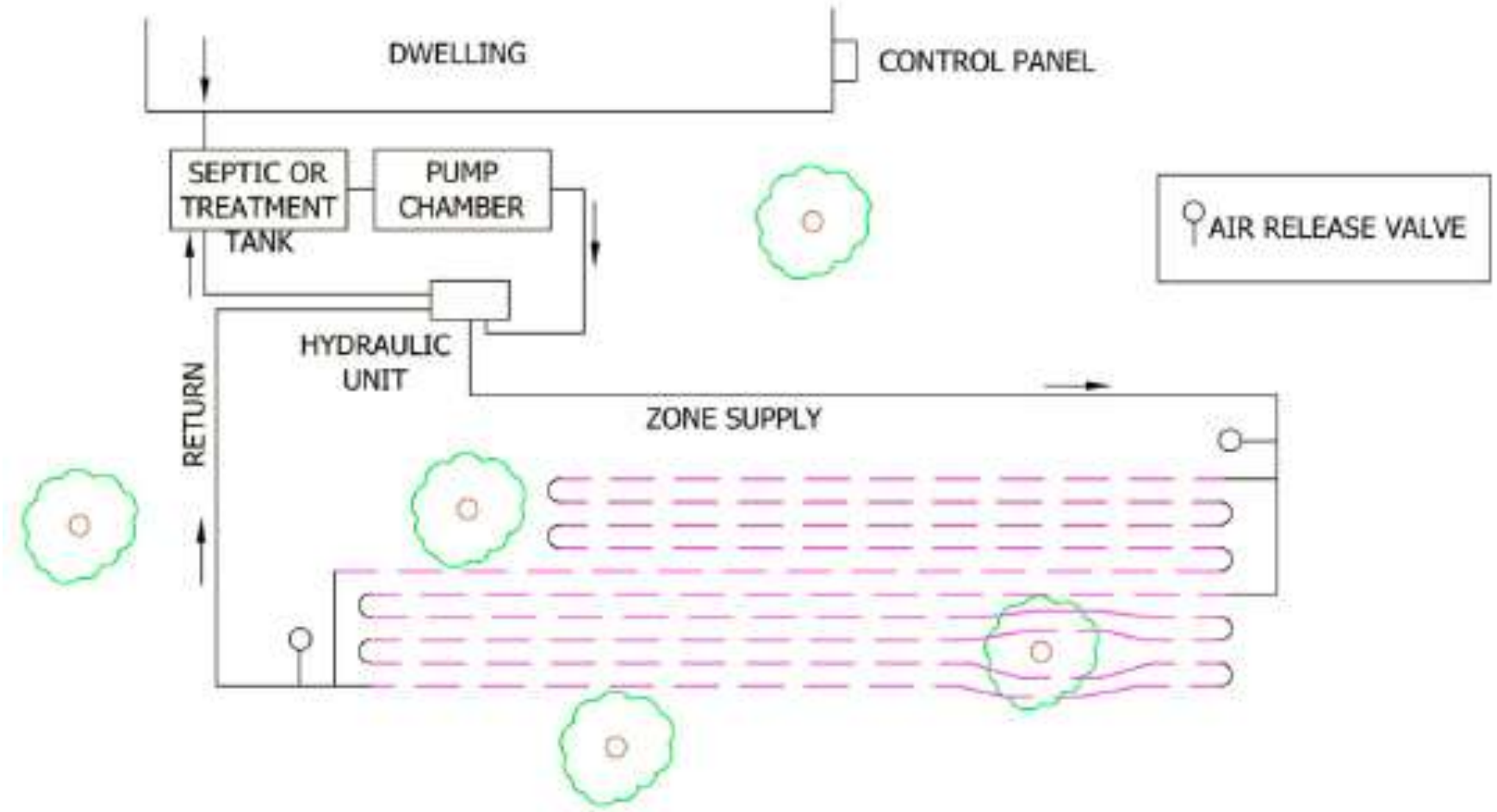
G. Tank

H. Outlet to Drain field



Perc-Rite

Perc-Rite Drip Dispersal



TYPICAL ZONE LAYOUT DETAIL

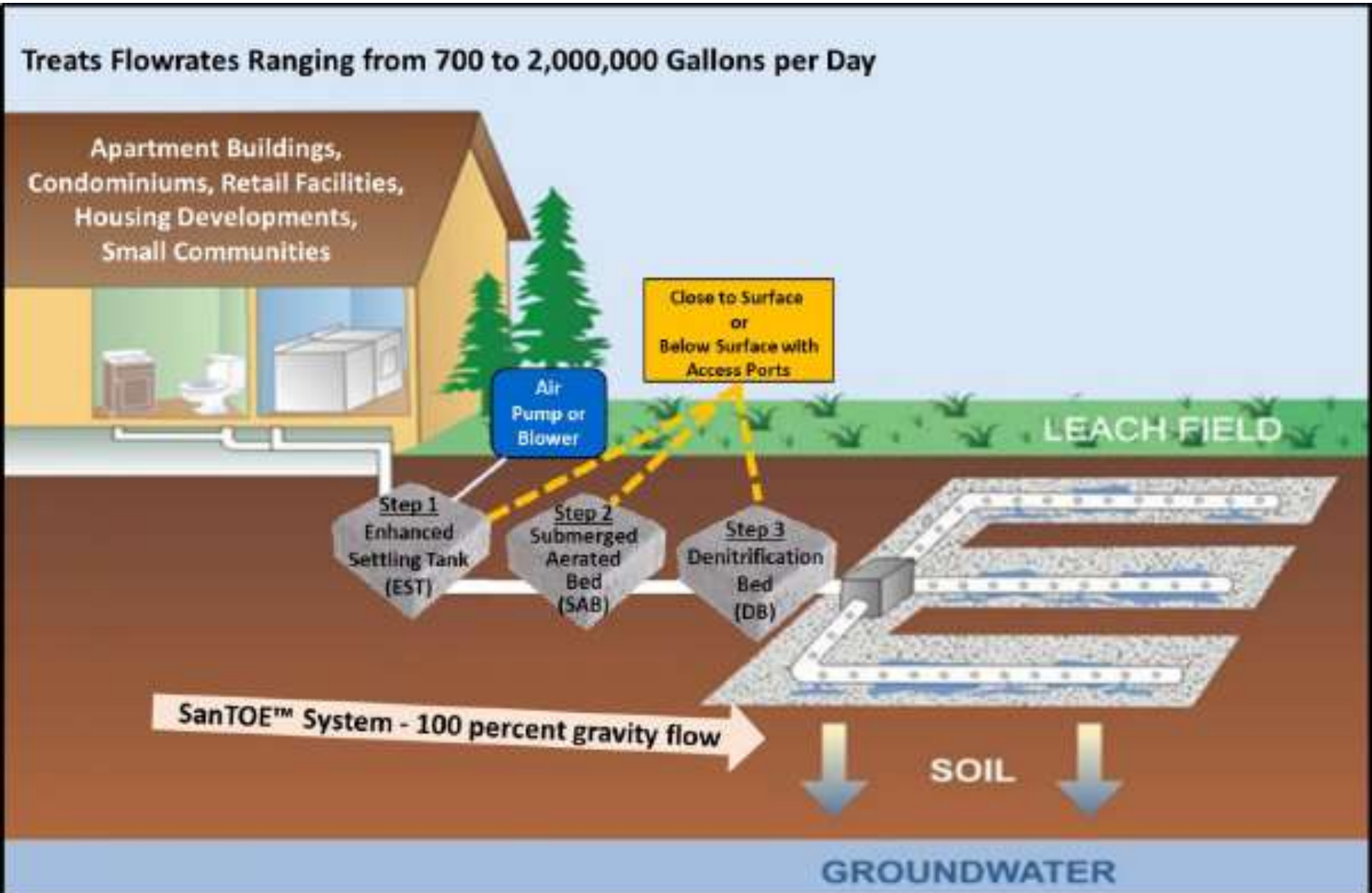
NOT TO SCALE


NitROE

NitROE


House Vent
A NitROE™ Tank is a Supplement to an Existing Title 5 Septic System for Significant Total Nitrogen Reduction
Air Pump
Sampling Ports at Surface
NitROE™ Tank
Septic Tank
Aeration Chamber
Wood Chip Chamber
Leachfield / Drainfield
Effluent Absorption
100 percent gravity flow
Groundwater
10

SanTOE


Treats Flowrates Ranging from 700 to 2,000,000 Gallons per Day
Apartment Buildings, Condominiums, Retail Facilities, Housing Developments, Small Communities
Close to Surface or Below Surface with Access Ports
Air Pump or Blower
LEACH FIELD
Step 1 Enhanced Settling Tank (EST)
Step 2 Submerged Aerated Bed (SAB)
Step 3 Denitrification Bed (DB)
SanTOE™ System - 100 percent gravity flow
SOIL
GROUNDWATER

Implementation Costs

ITEM	AVERAGE COST	COST RANGE
Equipment (denitrification tanks)	$8,437	$4,146-$10,625
Engineering	$2,620	$606-$4,200
Installation (adding a nitrogen-reducing system to an existing Title 5 system)	$11,096	$10,600-$15,350
Installation (full upgrade from a cesspool)	$20,675	$17,720-$25,600
Landscaping	$2,142.97	VARIABLE

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Monitoring Results

- Nitrogen-reduction goal of at least 67%
- Phase I & II median total nitrogen-reduction - 76%
  - Blackwaters – 59%
  - Eliminites – 78%
  - Hoots – 81%
  - Layer Cake – 90%
  - Fast – 43%

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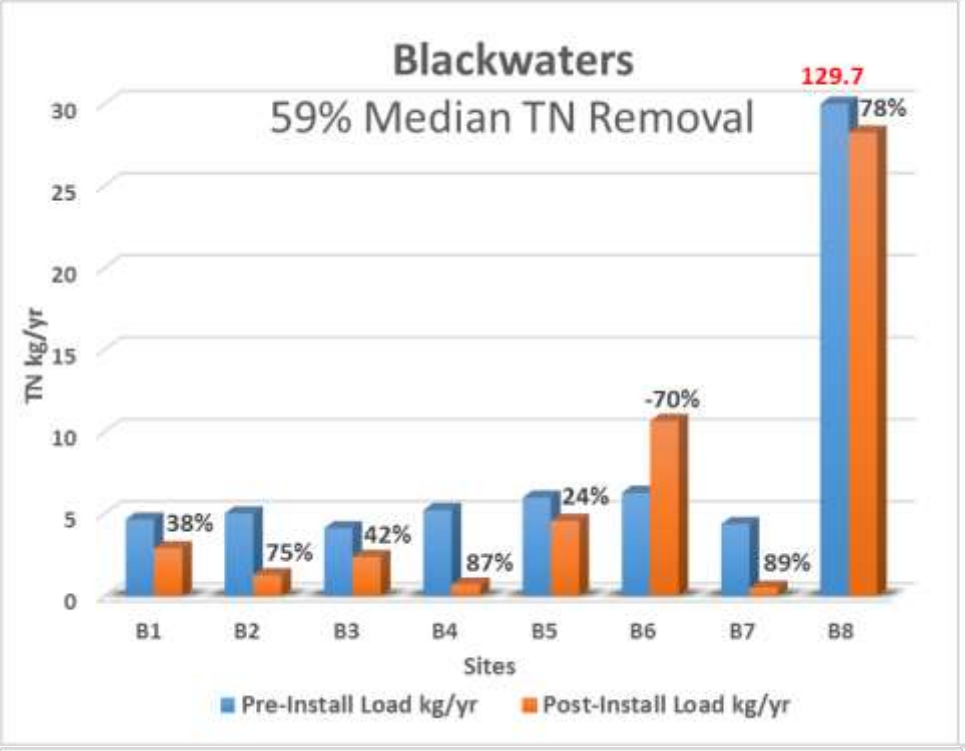
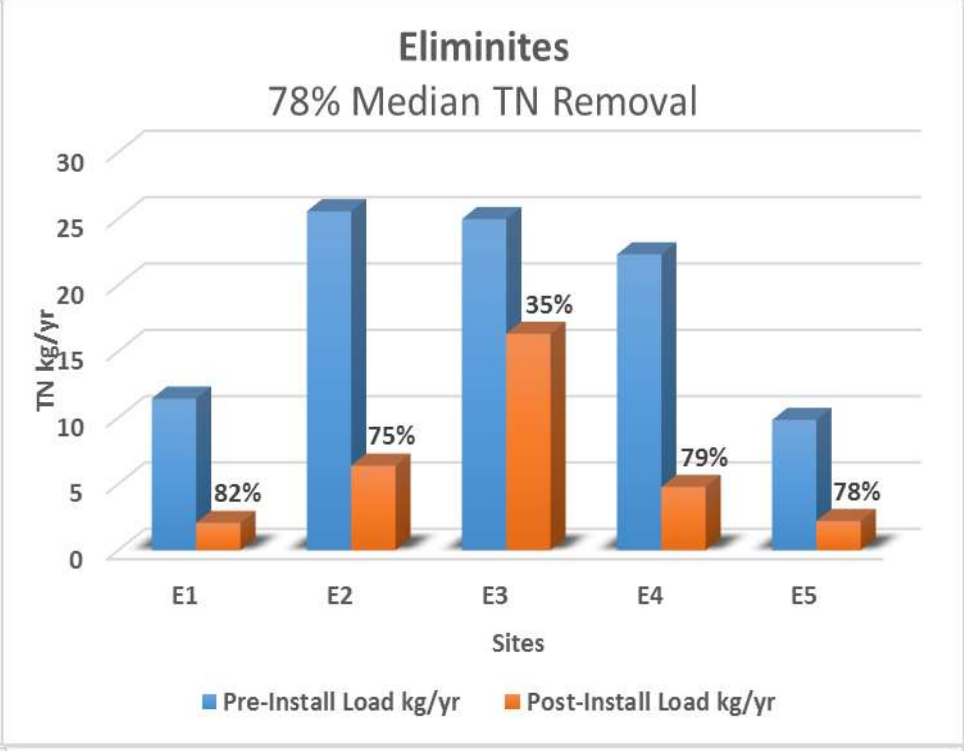
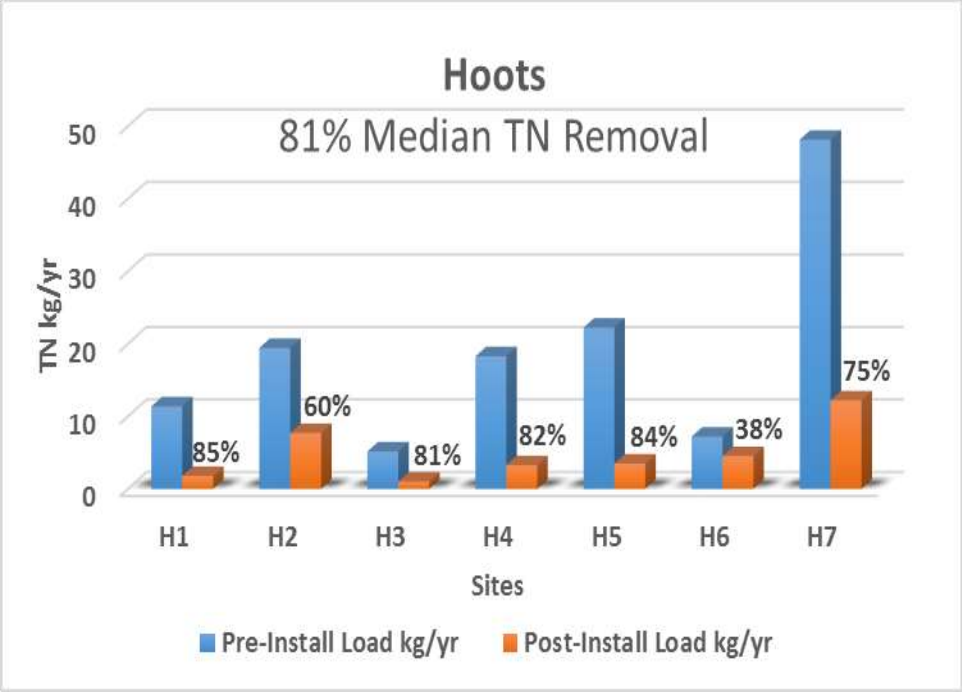
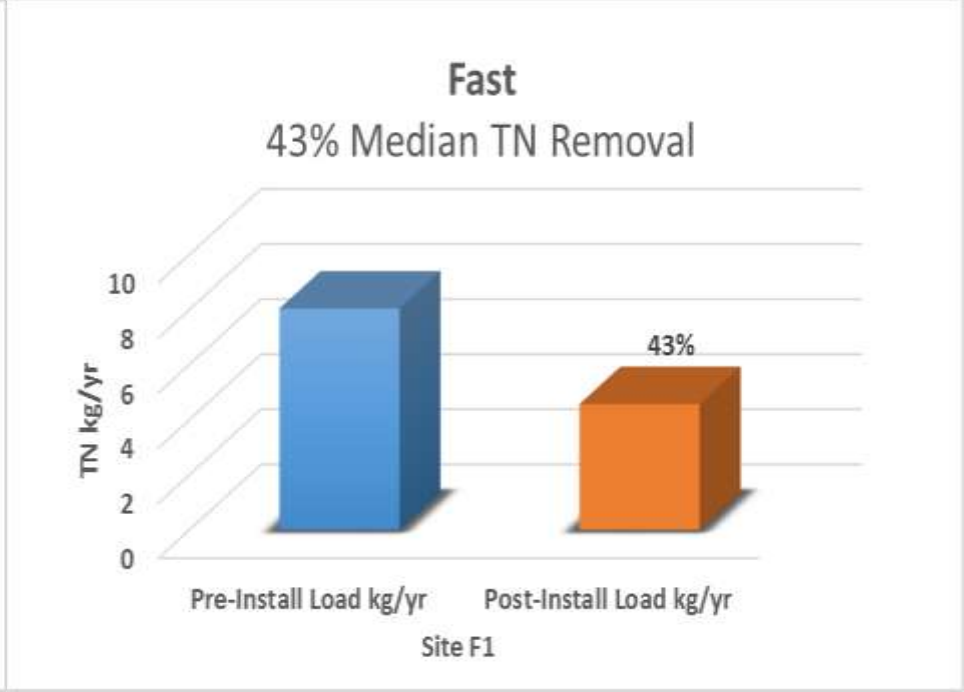

Blackwaters
59% Median TN Removal
TN kg/yr
30
25
20
15
10
5
0
129.7
78%
-70%
38%
75%
42%
87%
24%
89%
B1
B2
B3
B4
B5
B6
B7
B8
Sites
Pre-Install Load kg/yr
Post-Install Load kg/yr


Eliminites
78% Median TN Removal
TN kg/yr
30
25
20
15
10
5
0
82%
75%
35%
79%
78%
E1
E2
E3
E4
E5
Sites
Pre-Install Load kg/yr
Post-Install Load kg/yr


Hoots
81% Median TN Removal
TN kg/yr
50
40
30
20
10
0
85%
60%
81%
82%
84%
38%
75%
H1
H2
H3
H4
H5
H6
H7
Sites
Pre-Install Load kg/yr
Post-Install Load kg/yr


Fast
43% Median TN Removal
TN kg/yr
10
8
6
4
2
0
43%
Pre-Install Load kg/yr
Post-Install Load kg/yr
Site F1

Operation, Maintenance, & Monitoring Costs

System	O & M	Monitoring
Blackwater	$400	$52/month
Eliminite (pilot)	$1,000	$117/month
Fast	$250	$52/month
Hoot	$600	$52/month
NitROE (pilot)	$1,000	$117/month
Per-Rite	$250	$52/month

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Keys to Success

- Collaboration
- Funding
- Neighborhood Advocacy
- Results

Lessons Learned

- West Falmouth homeowners care about water quality & want to participate in restoration
- Neighborhood outreach is critical to success
- Cost, not technology, is the main concern for homeowners
- Upgrading on-site septic systems is not a one-size-fits-all project
- Disruption during installation can be minimized & systems can fit nicely into existing landscaping

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Next Steps

- Complete Phase II in Spring 2019
- Status report on WFHSSR Project Phase II
- Continue operating, maintaining, sampling & dialing-in systems
- Work with Town of Falmouth to develop local nitrogen reduction regulations
- Just the beginning

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WEST FALMOUTH NITROGEN-REDUCING SEPTIC SYSTEM DEMONSTRATIONPROJECT

https://www.savebuzzardsbay.org/wp-content/uploads/2017/07/West-Falmouth-Nitrogen-Reducing-Septic-System-Demonstration-Project-May-2017-status-report.pdf

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