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

Alternative Onsite Septic Systems

Where are we going and what will it be like when we get there ?

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Barnstable County Department of Health and Environment
Massachusetts Alternative Septic System Test Center

BCDHE
Barnstable County Department of Health and Environment
Promote - Protect - Support
90 YEARS OF SERVICE
1926 - 2016

MASSTC

Alternative onsite septic systems

What are they and how do they fit into the wastewater management plans in Barnstable County

Demonstration projects , the key to developing good information for wastewater managers

LaPine OR

Cape Cod

Demonstration Projects

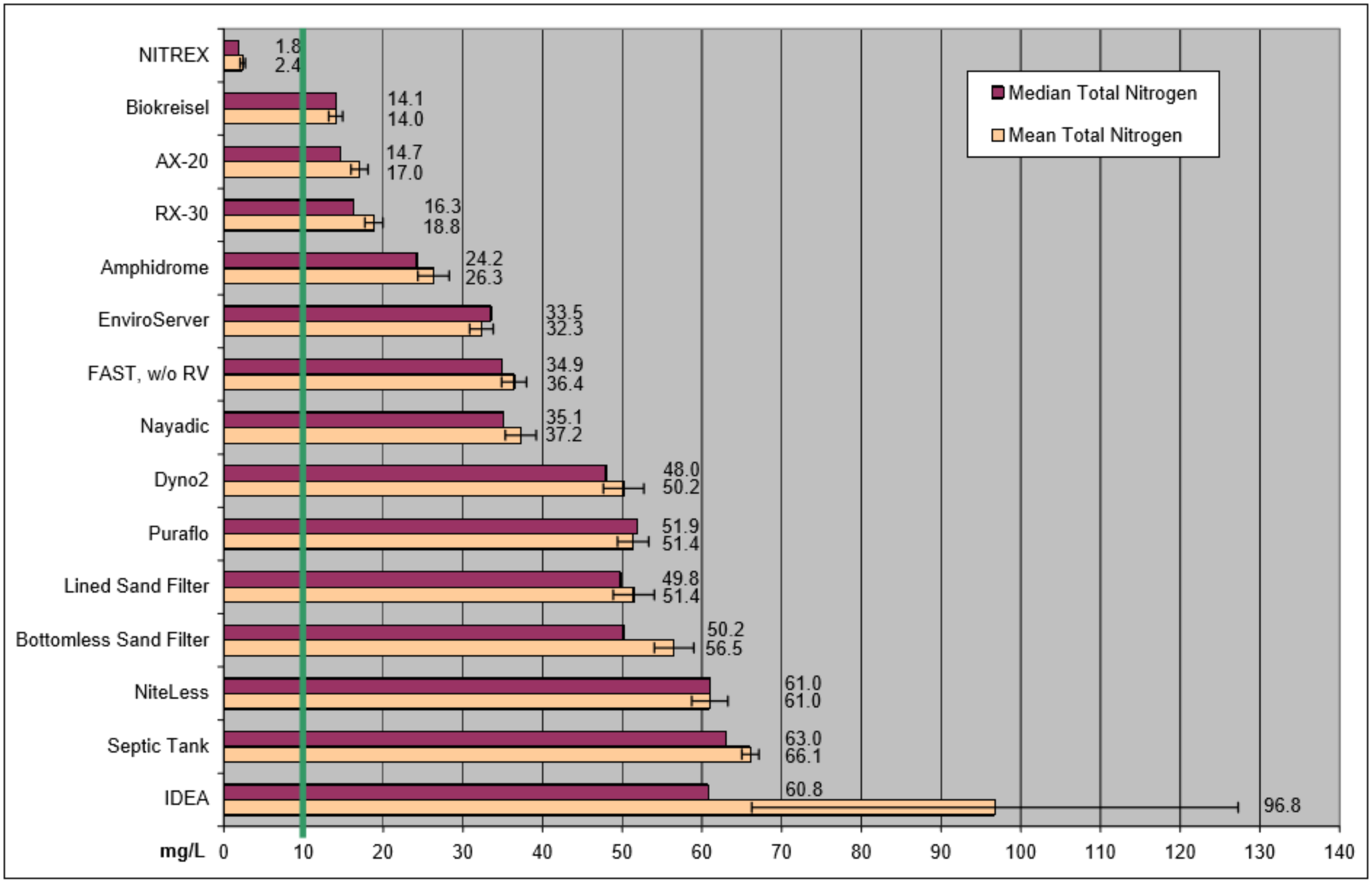
Pinelands NJ

Chesapeake Bay

Ventura, CA

Long Island

LaPine OR


Median Total Nitrogen
Mean Total Nitrogen
NITREX
1.8
2.4
Biokreisel
14.1
14.0
AX-20
14.7
17.0
RX-30
16.3
18.8
Amphidrome
24.2
26.3
EnviroServer
33.5
32.3
FAST, w/o RV
34.9
36.4
Nayadic
35.1
37.2
Dyno2
48.0
50.2
Puraflo
51.9
51.4
Lined Sand Filter
49.8
51.4
Bottomless Sand Filter
50.2
56.5
NiteLess
61.0
61.0
Septic Tank
63.0
66.1
IDEA
60.8
96.8
mg/L
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

Performance Summary of I/A OWTS Demonstrated in Suffolk County and Approved for Provisional Use

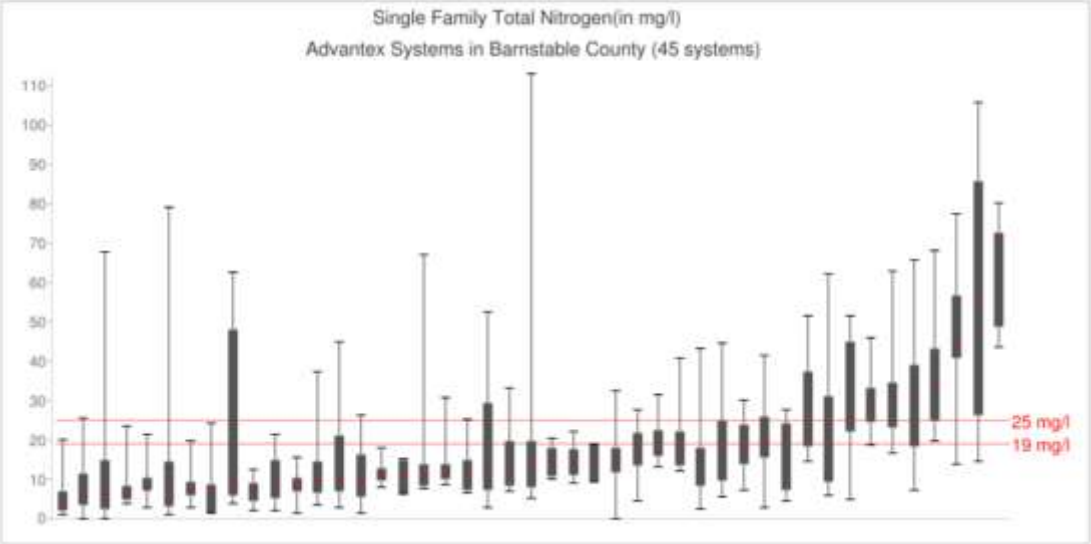
Technology	AVG (Mg/L)*	Provisional Approval
Hydro-Action AN Series	11.6 mg/L	Approved in September 2016
Norweco – Singulair TNT	18.3 mg/L	Approved in October 2016
Orenco Advantex – RT	18.8 mg/L	Approved in March 2017
Norweco – Hydro-Kinetic	17.4 mg/L	Approved in April 2017
Fuji Clean System	16.6 mg/L	Approved in January 2018
SeptiTech STAAR	13.6 mg/L	Approved in July 2018

*Standard is 19mg/L

The following technologies have successfully completed the field verification and designated as BAT Class I and are eligible to Bay Restoration Funds onsite sewage disposal system grant program:

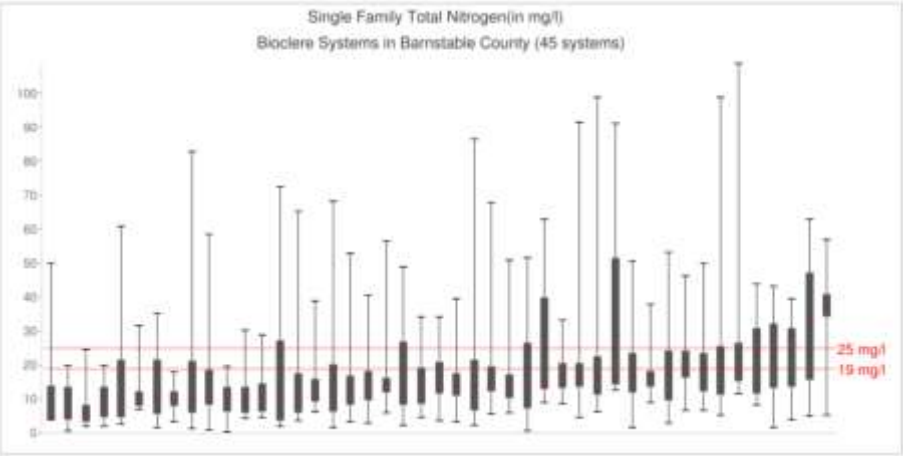
Model	Contact Information	Certifications	MDE Field Performance Analysis for Total Nitrogen
Advantex®-RT	**Manufacturer** Orenco Systems®, Inc. www.orenco.com/ **Local Distributor** **Eastern Region -** Service Energy Paul Hufschmidt – (302) 734-7433 phuffy@serviceenergy.com **Central, Southern, Western -** Atlantic Solutions Bob Johnson - 1 (877) 214-9283 bjohnson@septicsystems.net	Other 3rd Party	Mean % Reduction of TN: 76% Mean Effluent Concentration: 14 mg/l Data & Analysis
Advantex®-AX20	**Manufacturer** Orenco Systems®, Inc. www.orenco.com/ **Local Distributor** **Eastern Region -** Service Energy Paul Hufschmidt – (302) 734-7433 phuffy@serviceenergy.com **Central, Southern, Western -** Atlantic Solutions Bob Johnson - 1 (877) 214-9283 bjohnson@septicsystems.net	Other 3rd Party	Mean % Reduction of TN: 71% Mean Effluent Concentration: 17 mg/l Data & Analysis
SeptiTech®	**Manufacturer** SeptiTech, Inc. www.septitech.com **Local Distributors** **Eastern Region -** Gillespie & Sons Inc. Jim Gillespie - (410) 778-0900 jimg@gillespieandson.com **Central Region -** Bay Area Environmental Don Jones - (410) 836-9206 manager@jonespumpservice.com	ETV And NSF 245	Mean % Reduction of TN: 67% Mean Effluent Concentration: 20 mg/l Data & Analysis
Hydro-Action® - AN Series	**Manufacturer** Hydro-Action/AK Industries Inc. www.hydro-action.com **Regional Distributor-** Blue Water Environmental, LLC Mark O'Rourke – (240) 444-6401 Email: Mark@BWEnvironmental.com **Local Distributors** Central-Eastern Region- Sample Excavating Co. Inc. Mike Sample – (443) 807-8639 Email: Sample415@yahoo.com **Southern Region** -Outback Porta-Jon, Inc. Steve Willson – (410) 257-1600 Email: Willson05@comcast.net	NSF 245	Mean % Reduction of TN: 66% Mean Effluent Concentration: 20.3 mg/l

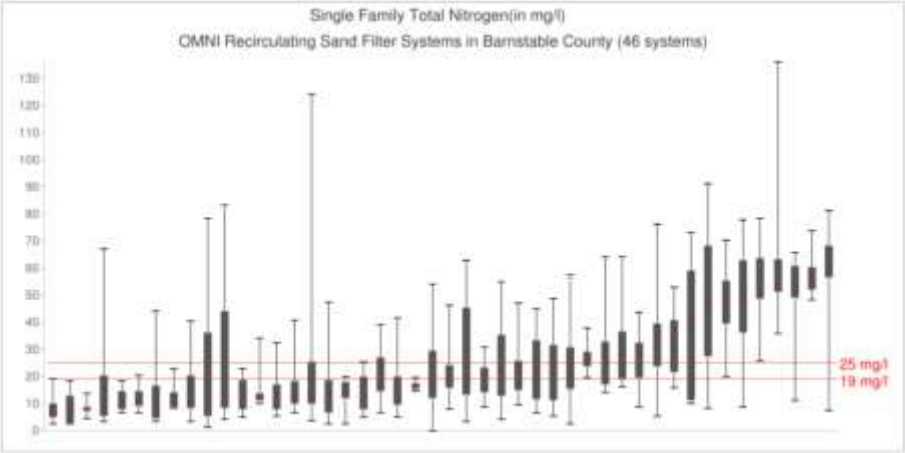
Chesapeake Bay



Mine your own data from Barnstable County Department of Health and Environment

https://septic.barnstablecountyhealth.org/charts/boxwhisker





- With each demonstration project, new technologies are discovered and tried and existing technologies are improved to meet the competition.

Where are these all leading for efforts on Massachusetts?

Why is it taking so long?

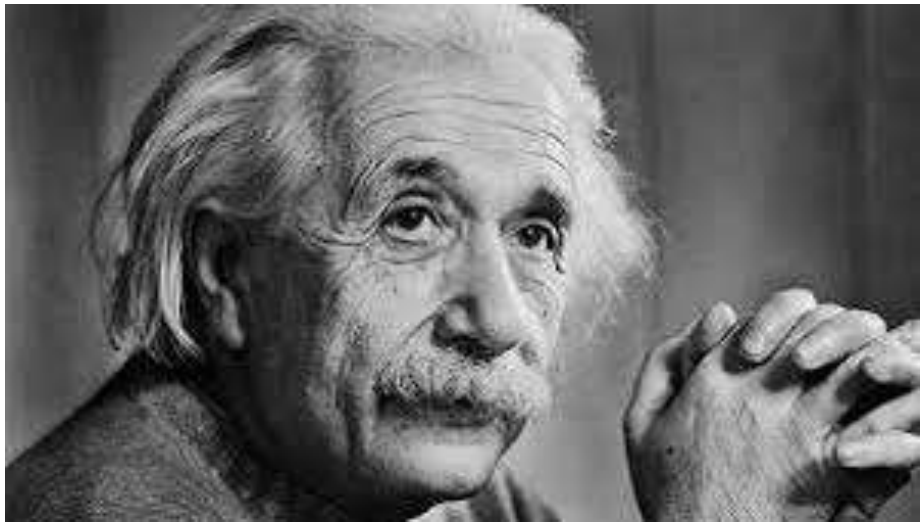
- **Determine the technologies having the best performance;**
- **Determine where they can provide cost savings compared to all other feasible alternatives such as sewering;**
- **Facilitate their implementation to address nutrient management issues.**

Changing gears

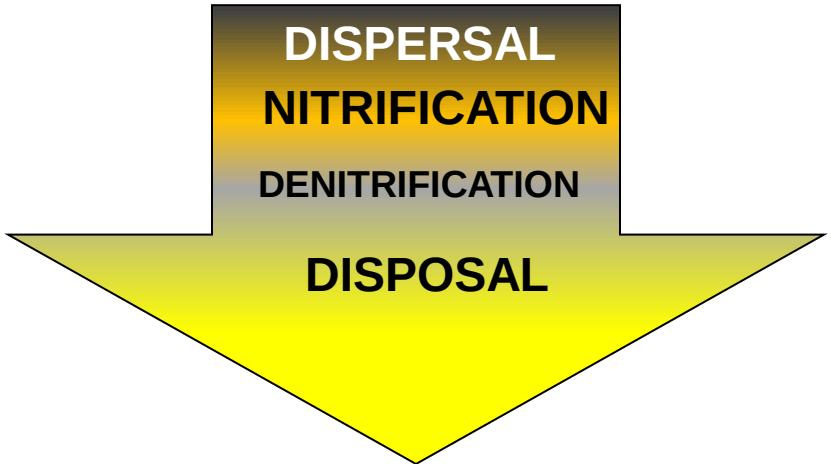
MASSTC experiments with non-proprietary technology

Guiding principle for present efforts

"Everything should be made as simple as possible, but not simpler"



keeping it Simple



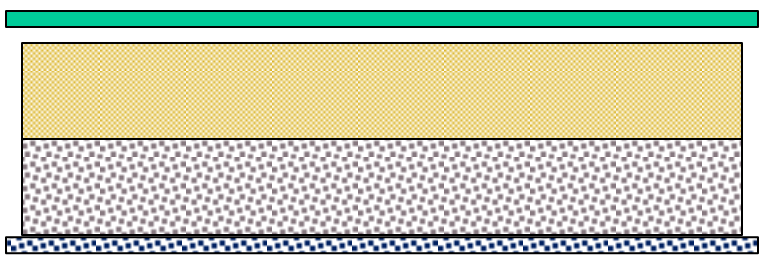
Acknowledgement of the Collaborative Effort

- Massachusetts Alternative Septic System Test Center
- Damann L. Anderson, P.E., a researcher of passive nitrogen removal systems for the State of Florida Onsite Sewage Nitrogen Reduction Study (FOSNRS);
- George Loomis, an onsite septic system specialist and published author from the University of Rhode Island;
- Dr. Will Robertson of the University of Waterloo;
- Jose Amador, a soil scientist at the University of Rhode Island;
- John Eliasson with the Wastewater Management Section of Washington State Department of Health's Division of Environmental Public Health
- More recently, researchers at Stony Brook University, NY

MASSTC

Layered System (aka. “layer cake”, “pancake system”, “that system the guys from Barnstable County plays with”.

- A soil absorption system in which a layer of sandy material mixed with sawdust, mulch or woodchips is positioned beneath a layer of clean fill sand for the purpose of achieving denitrification of percolating septic tank effluent.

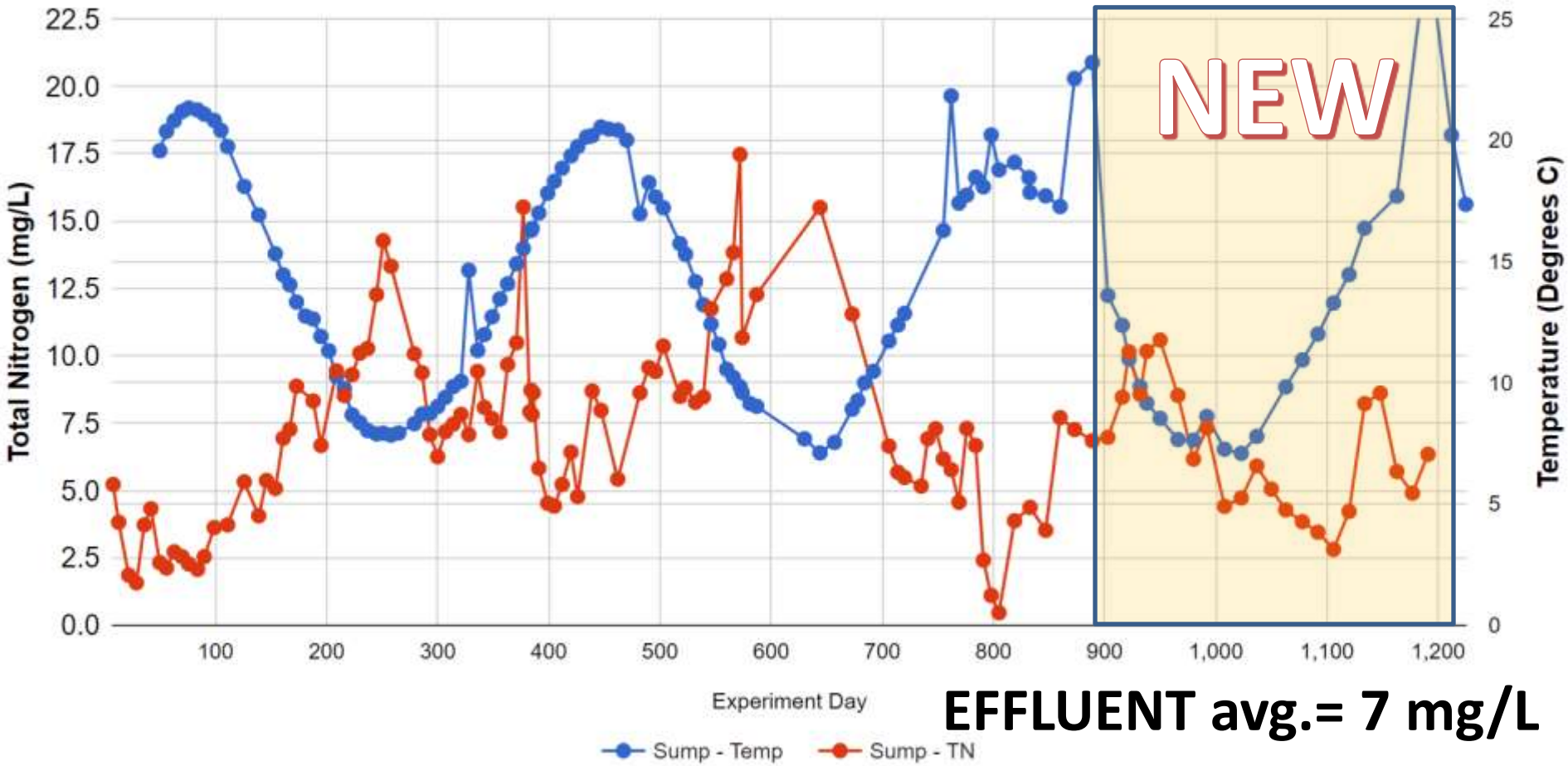


Brief Summary Past Studies at MASSTC

MASSTC

PRESENT

INFLUENT avg.= 44 mg/L

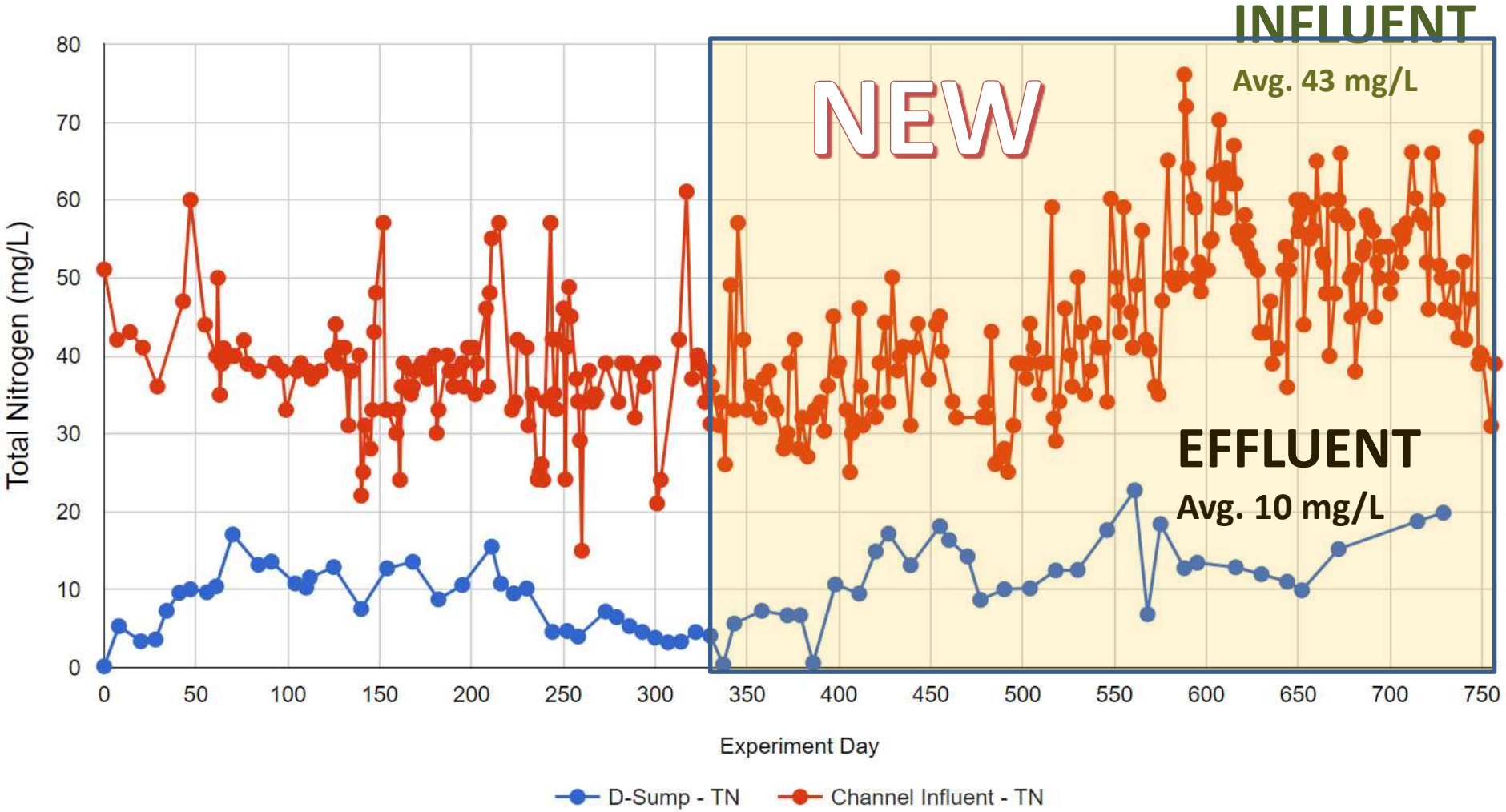


EFFLUENT avg.= 7 mg/L

84% removal

PRESENT

Simple layered system (no liner)



77% removal

What about the Real World ?

vs. Test Center Studies

Configurations installed generally were installed with a control portion for comparison.

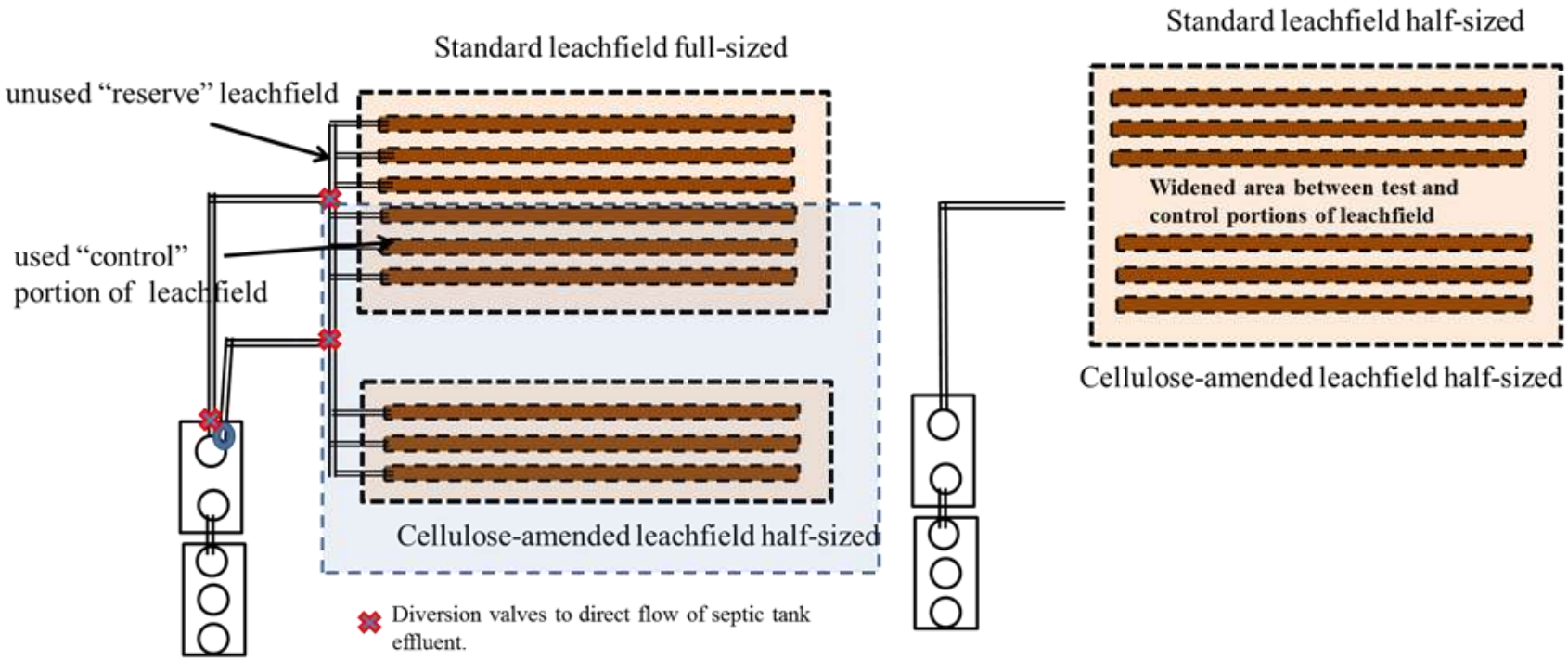
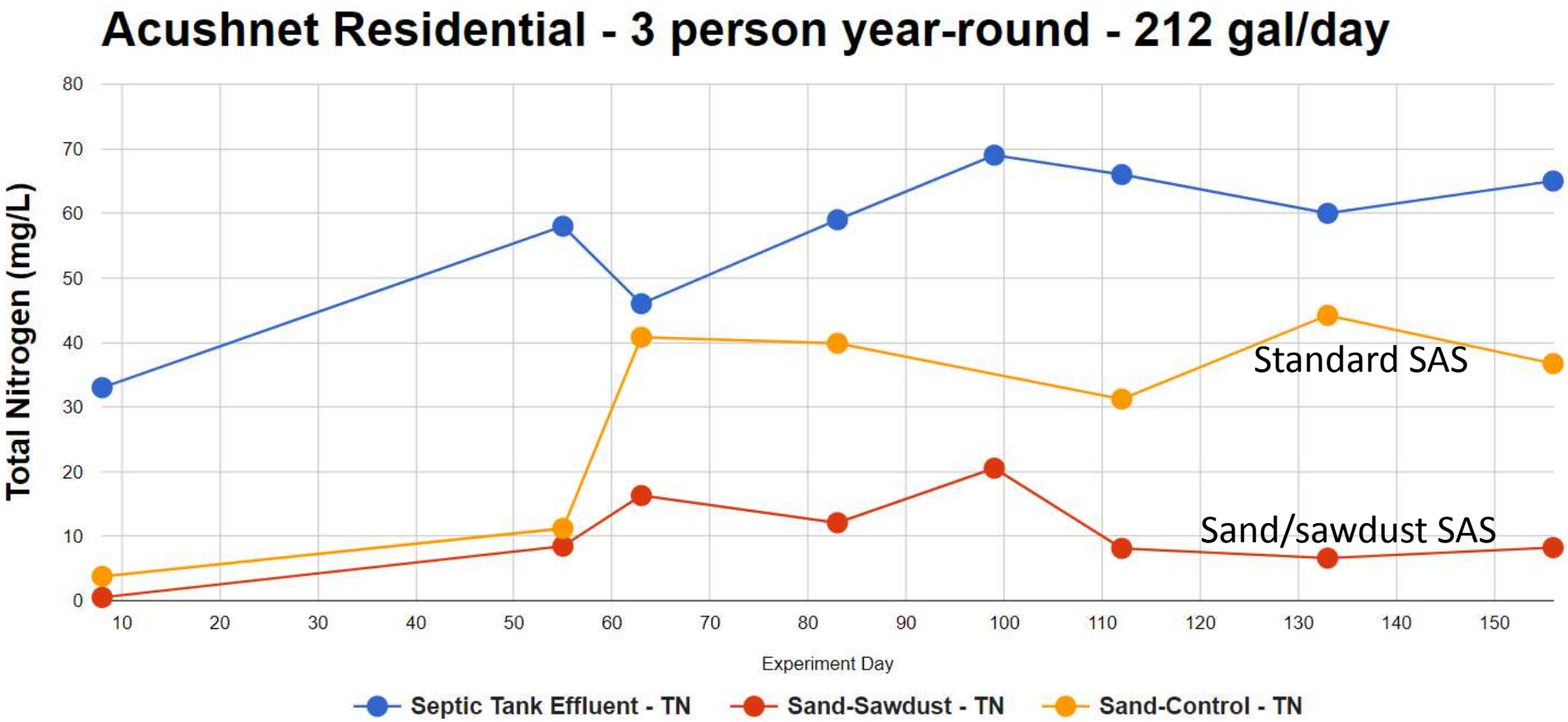
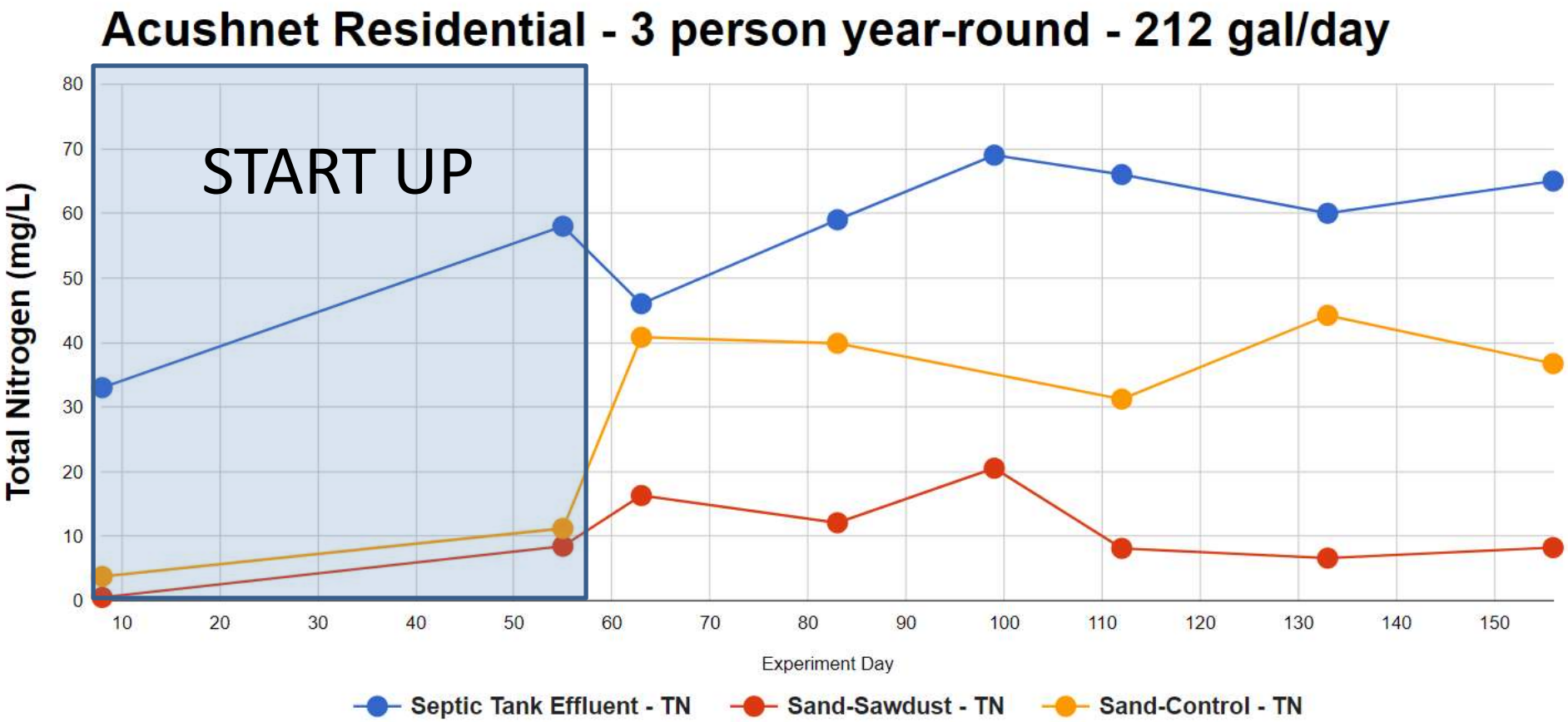


Figure A **Figure B**

System 1


Acushnet Residential - 3 person year-round - 212 gal/day
Total Nitrogen (mg/L)
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Experiment Day
Standard SAS
Sand/sawdust SAS
Septic Tank Effluent - TN
Sand-Sawdust - TN
Sand-Control - TN

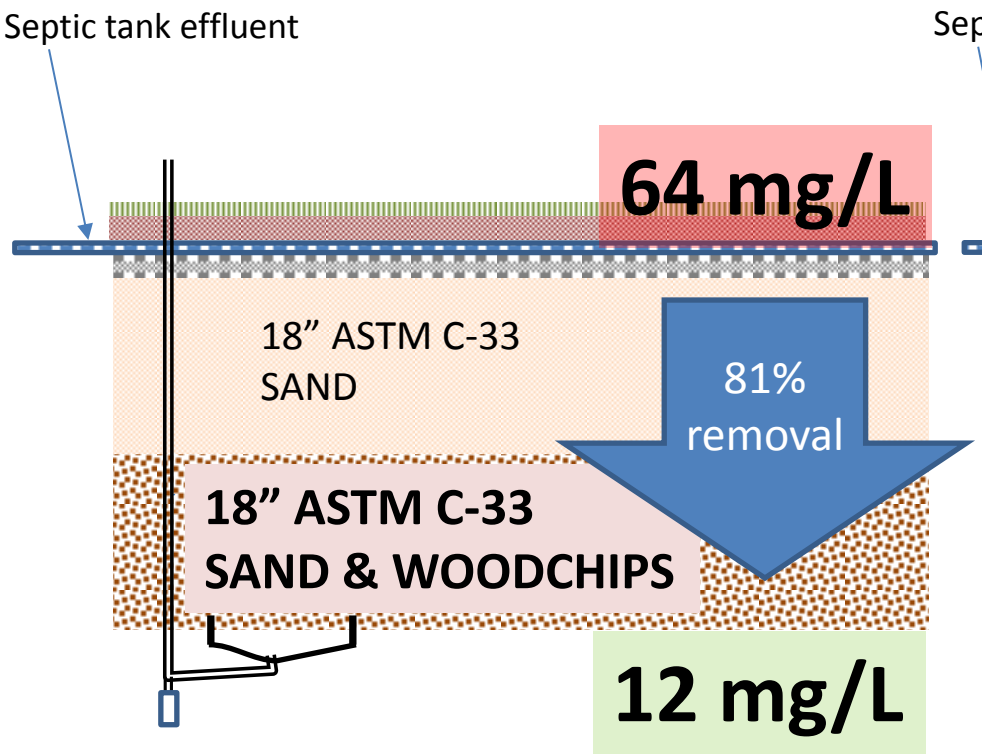
System 1


Acushnet Residential - 3 person year-round - 212 gal/day
START UP
Total Nitrogen (mg/L)
0
10
20
30
40
50
60
70
80
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Experiment Day
Septic Tank Effluent - TN
Sand-Sawdust - TN
Sand-Control - TN

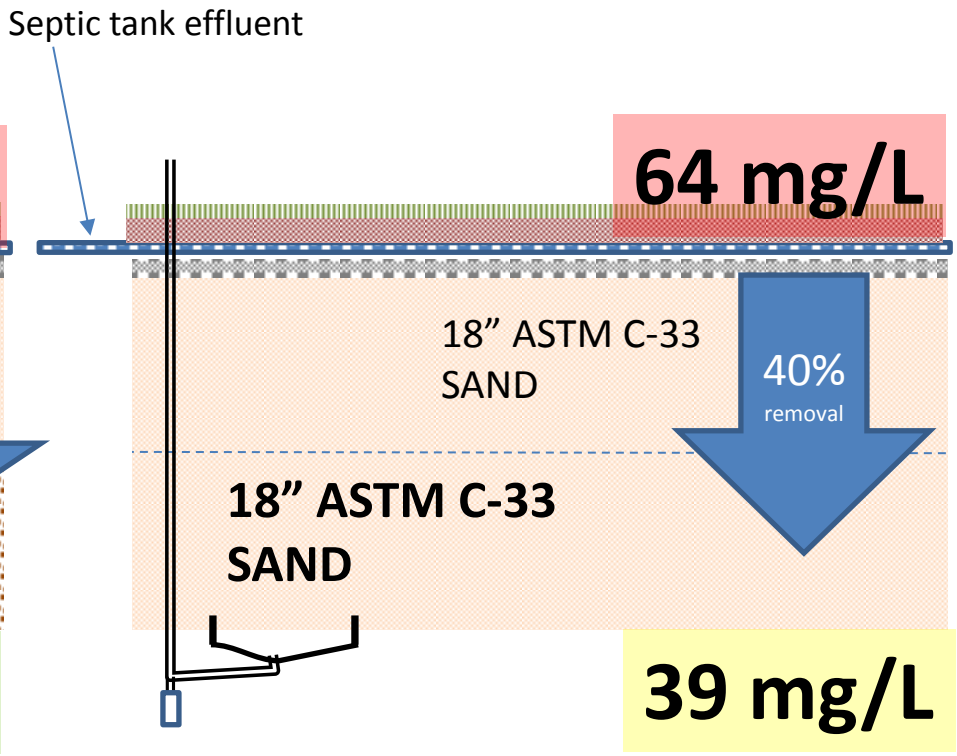
System 1

Acushnet Residence

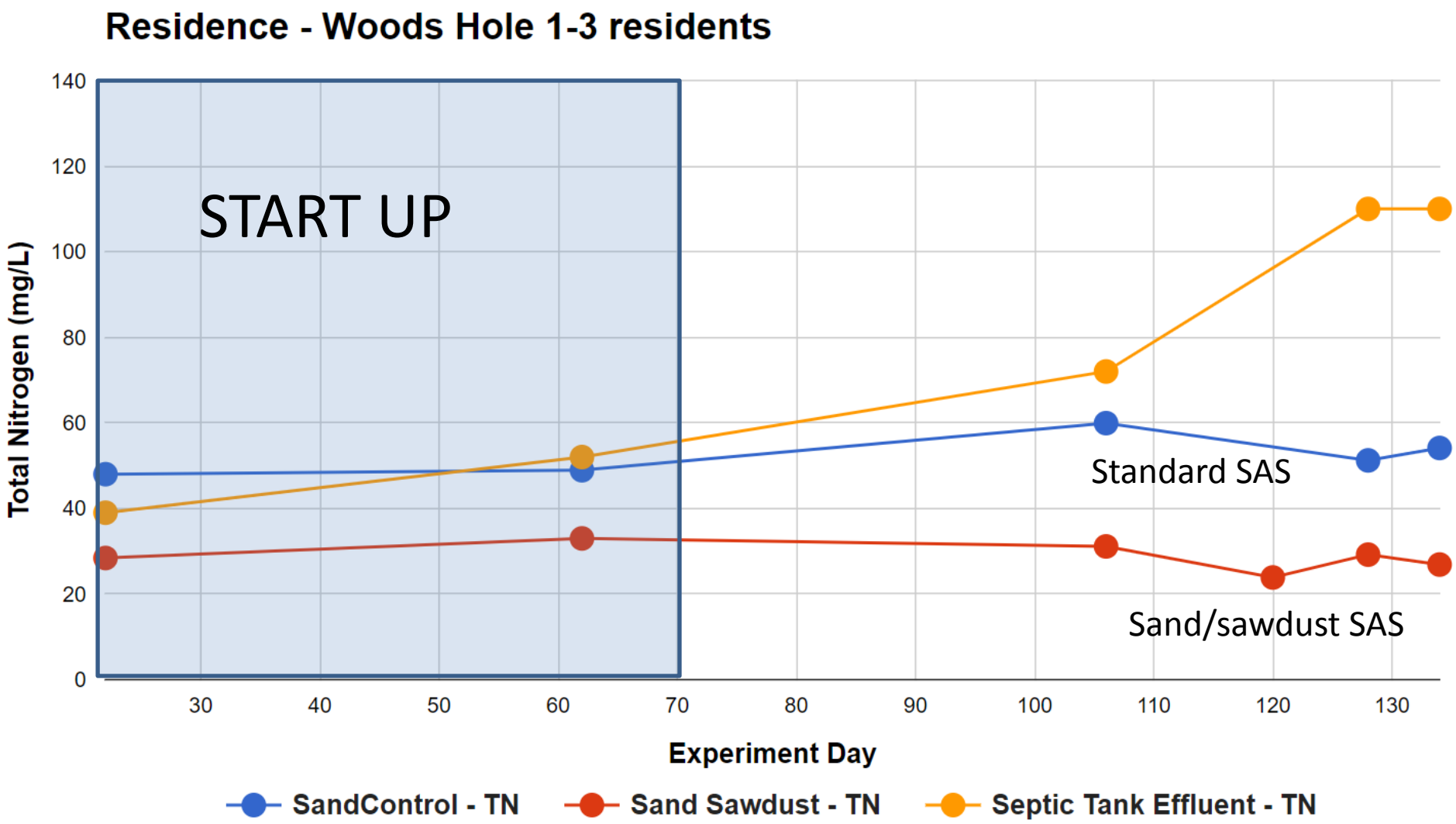
Treated Portion of Soil Absorption System



Un-Treated (Control) Portion of Soil Absorption System

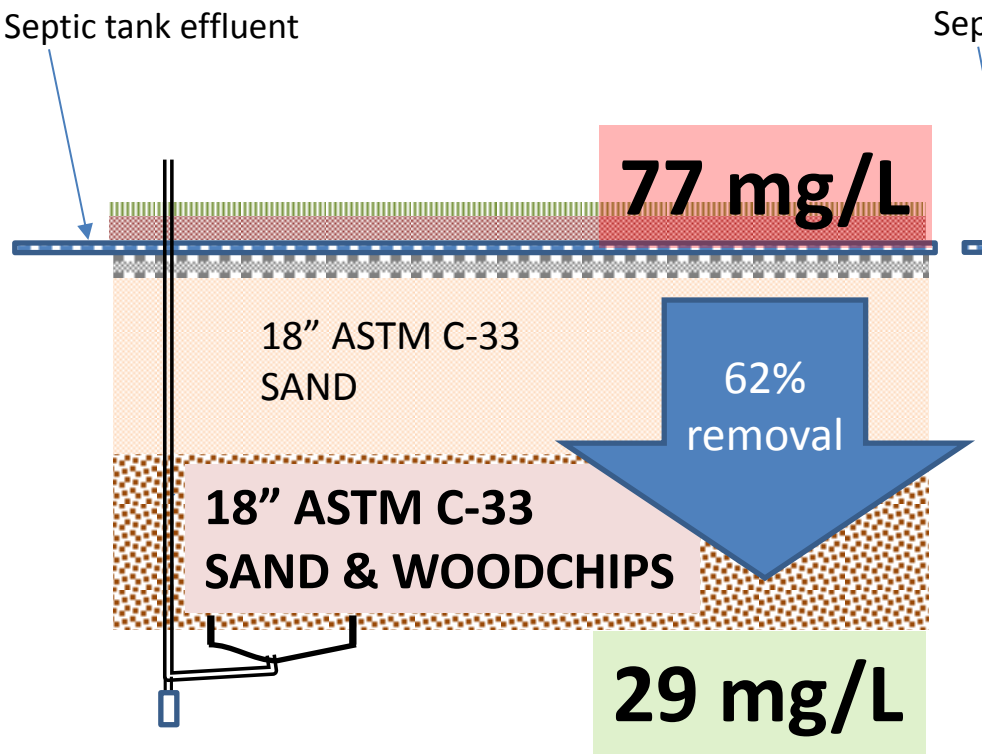


System 2

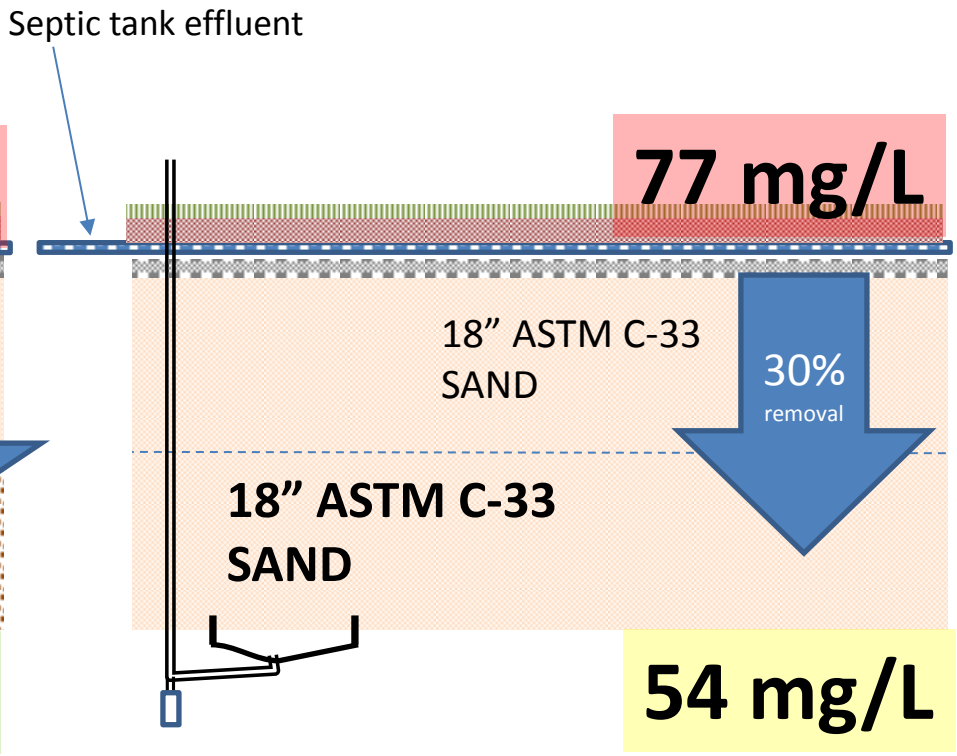

Residence - Woods Hole 1-3 residents
START UP
Standard SAS
Sand/sawdust SAS
Total Nitrogen (mg/L)
0
20
40
60
80
100
120
140
30
40
50
60
70
80
90
100
110
120
130
Experiment Day
SandControl - TN
Sand Sawdust - TN
Septic Tank Effluent - TN

System 2 Woods Hole Residence

Treated Portion of Soil Absorption System

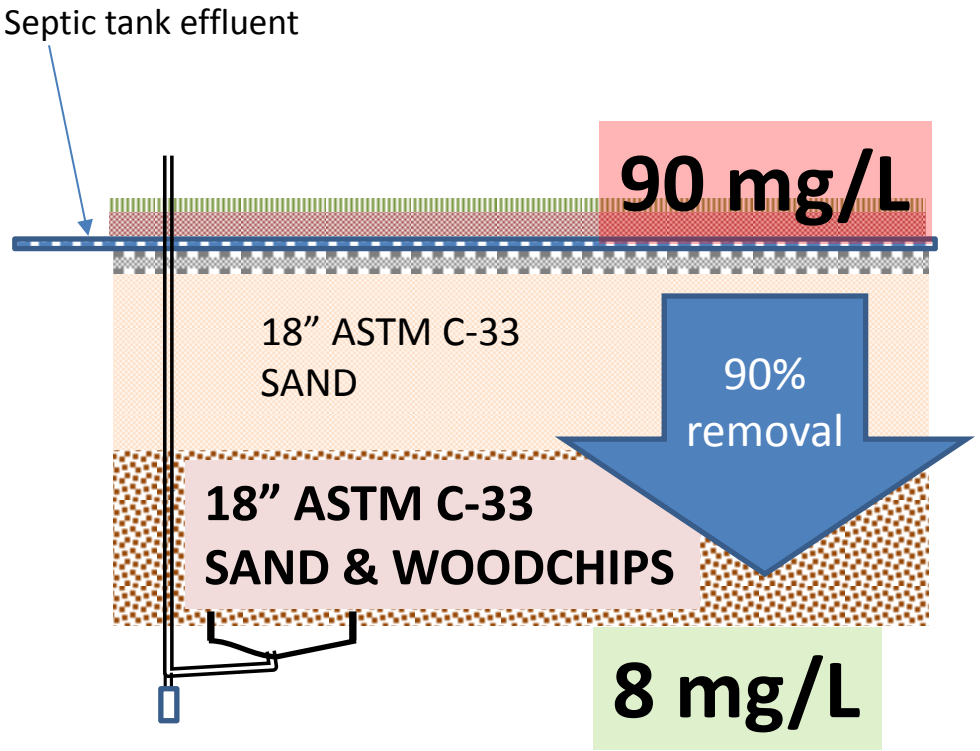


Un-Treated (Control) Portion of Soil Absorption System



System 3 West Falmouth Harbor (seasonal)

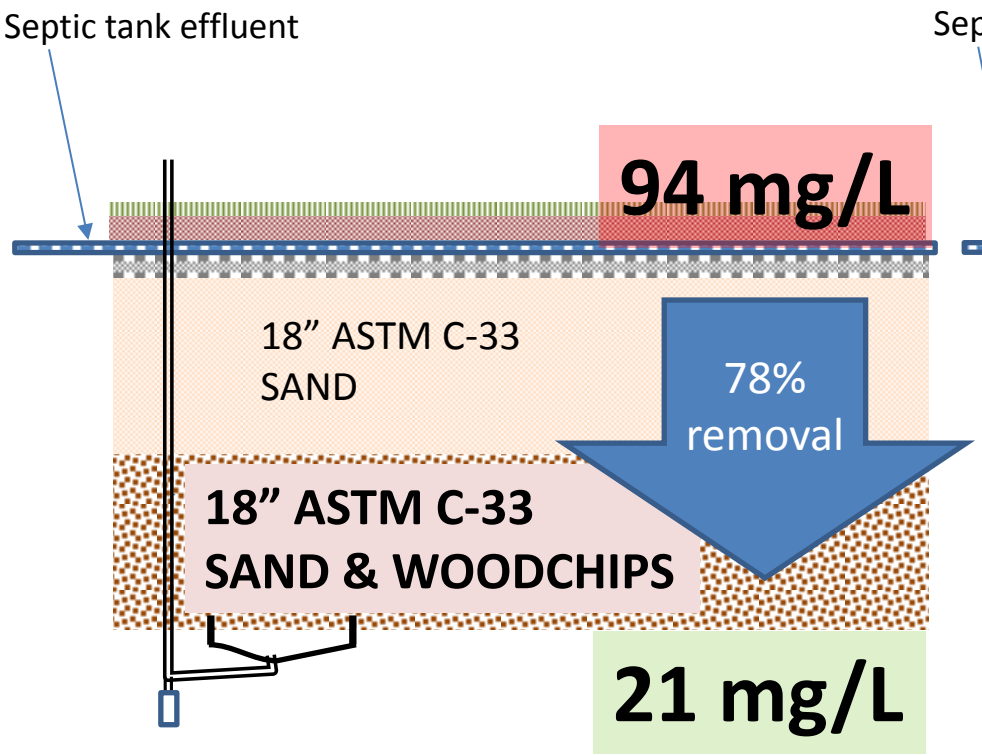
Treated Portion of Soil Absorption System



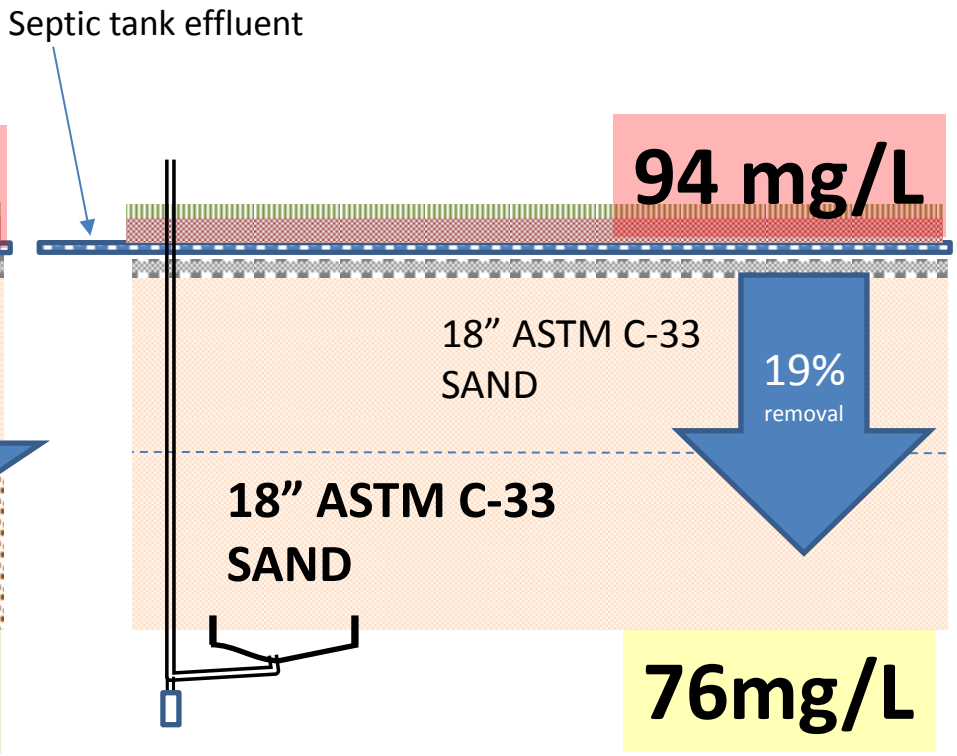
Un-Treated (Control) Portion of Soil Absorption System not installed at this location

System 4 West Falmouth Harbor (seasonal)

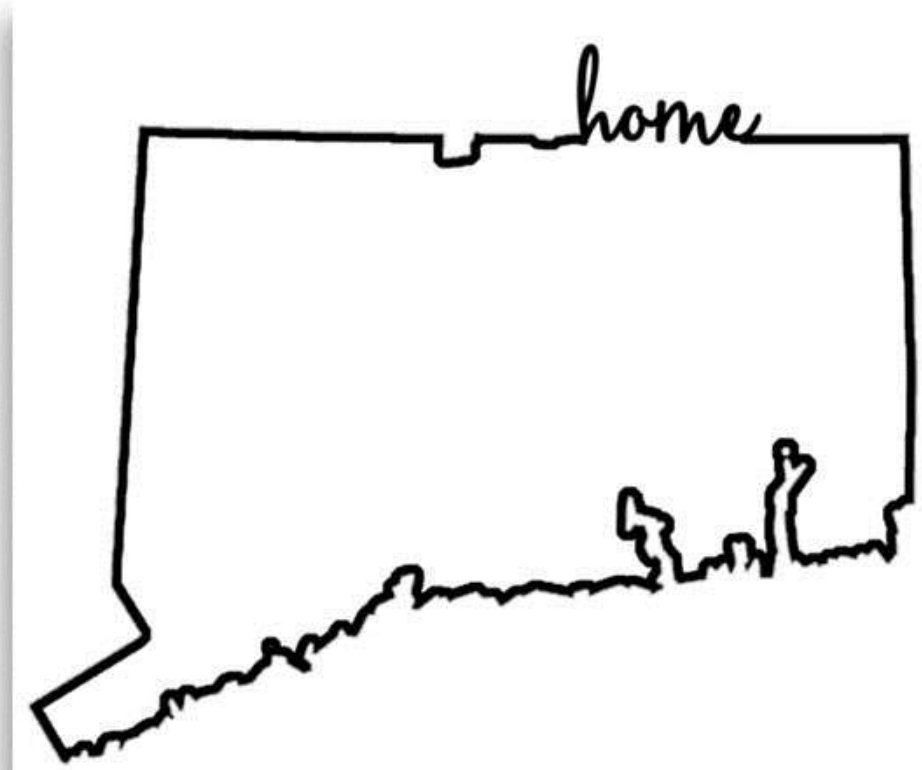
Treated Portion of Soil Absorption System



Un-Treated (Control) Portion of Soil Absorption System



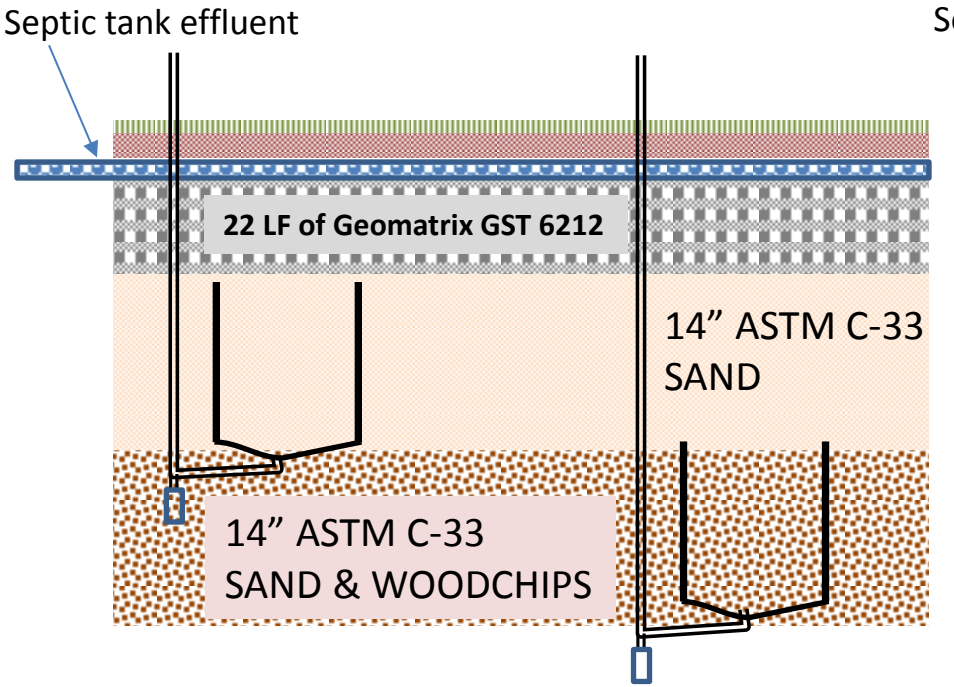
The Connecticut Experiment



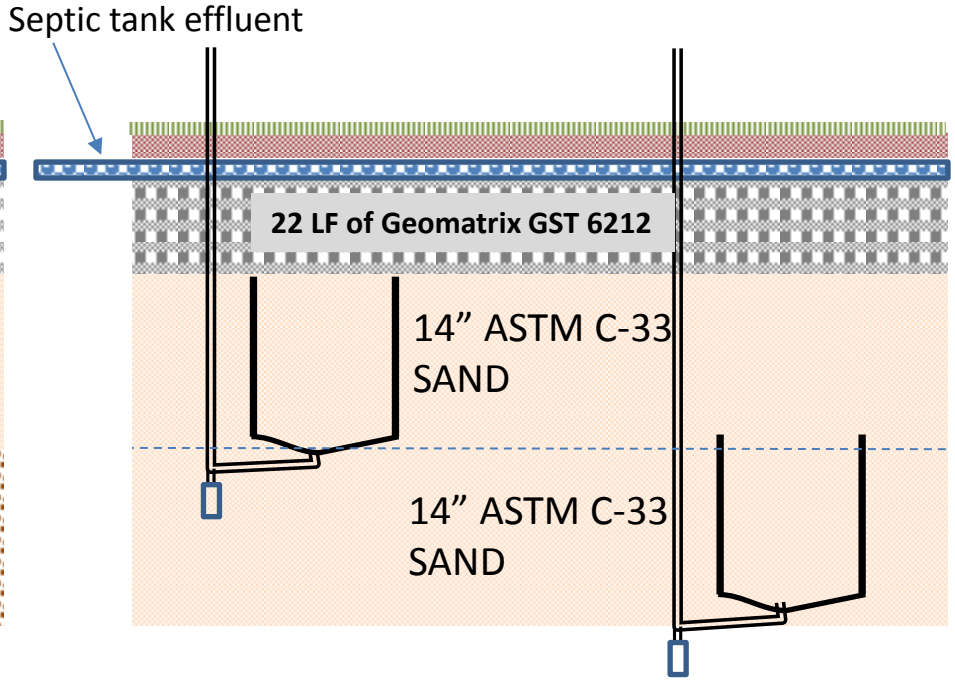
- DPW Garage
- Expected high nitrogen concentration
- Close to seasonal high groundwater

Town DPW Garage

Treated Portion of Soil Absorption System



Un-Treated (Control) Portion of Soil Absorption System



Town DPW Garage

Un-Treated (Control) Portion of Soil Absorption System

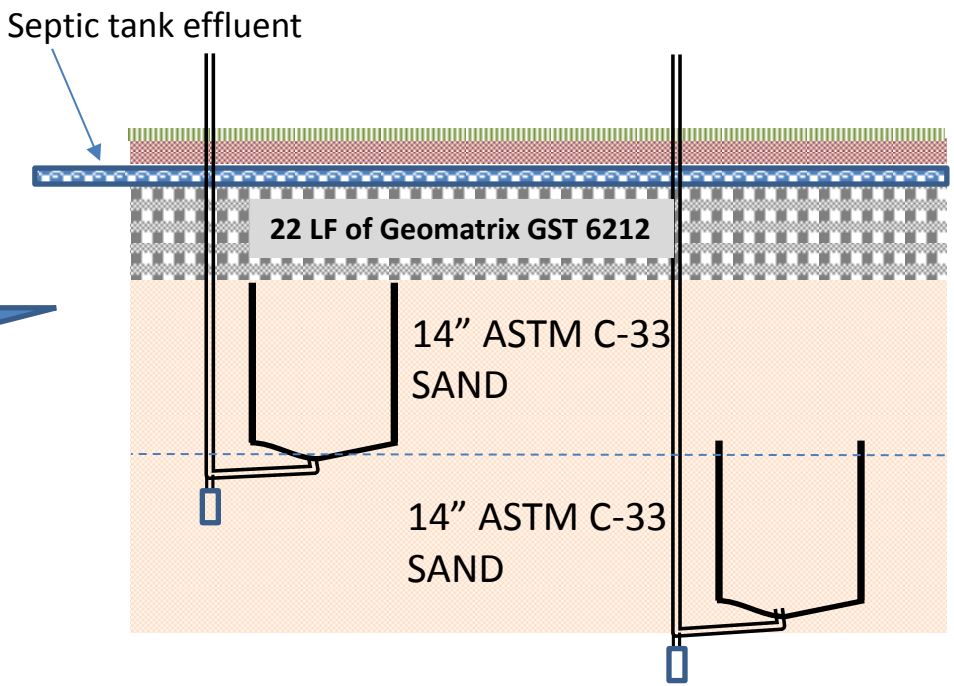
~ 260 mg/L TN

TN

257 mg/L TN

TN

98.5 mg/L TN



~ 62% Reduction in TN

Town DPW Garage

Treated Portion of Soil Absorption System

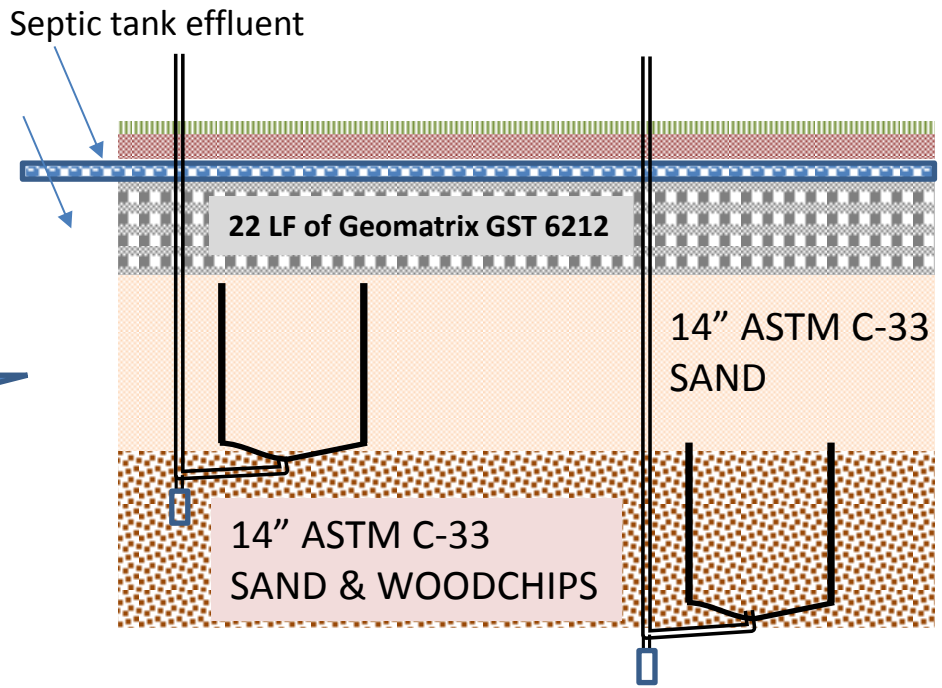
~ 260 mg/L TN

TN

248 mg/L TN

TN

56.5 mg/L TN



~ 78% Reduction in TN

Town DPW Garage

Treated Portion of Soil Absorption System

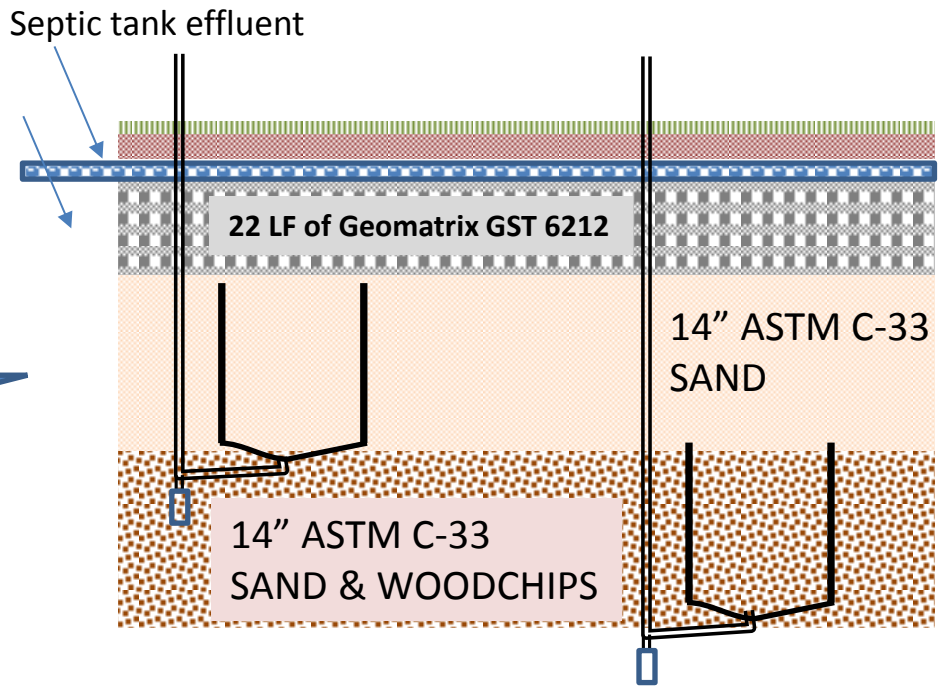
~ 260 mg/L TN

TN

248 mg/L TN

TN

56.5 mg/L TN



~ 78% Reduction in TN

Conclusions

- **Simple layering of an organic material like cellulose may offer a simple, sustainable and relatively inexpensive way to achieve nitrogen removal from onsite septic systems.**
- **Research in this area should continue to determine all the factors controlling the performance of the systems.**

Remaining Questions

- **Is it worth it $$$$?**
- **How long will the carbon last?**
- **What are all the possible negative impacts?**
- **Do they outweigh the positive impacts?**

Some final thoughts

- **Shallow drainfields used in these systems enhance removal of contaminants of emerging concern.**
- **Recent research suggests that wood-based denitrification may also reduce endocrine disrupting compounds.**

Ligninolytic enzymes: Versatile biocatalysts for the elimination of endocrine-disrupting chemicals in wastewater.
Ayodeji O. Falade Leonard V. Mabinya Anthony I. Okoh Uchechukwu U. Nwodo
First published: 17 October 2018 https://doi.org/10.1002/mbo3.722

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Questions?