



- ✓ Nitrex has had MassDEP Provisional use approval since 2006
- ✓ Nitrex has received site specific MassDEP Piloting Permit to achieve TN < 10 mg/L
- ✓ Permitted to Achieve TN < 10 mg/L in many states since 2007
- ✓ Permitted to Achieve TN < 2.5 mg/L in Utah
- ✓ Permitted to Achieve CA Title 22 Unrestricted nonpotable reuse
- ✓ US EPA & MASSTC recognized to achieve TN 2.4 mg/L
- ✓ Applications - single family, cluster/commercial, large flows -
 - ✓ 900,000 gpd National Engineering Excellence Awards Winning project
- ✓ 22 + years of proven performance - field validated by MASSTC, US EPA, States of Oregon, Montana & Florida and Suffolk County NY



Brian Baumgaertel, MASSTC—Presenter

Title: “Best Available Technology: Using I/A to Clean Up Our Watersheds”

Mr. Baumgaertel discussed the importance of considering watershed-specific needs, site specifications, and discharge limits when choosing the best I/A system to suit individual needs. He provided a list of the five best available I/A septic technologies⁸ currently being used in the region:⁹

1. [FujiClean](#): 11.4 mg/L TN. Used in Suffolk County, New York.
2. [Nitrex™](#): 2.5 mg/L TN. Provisional approval in Massachusetts; tested at MASSTC.
3. [NitROE™](#): 10.8 mg/L TN. Provisional approval in Massachusetts; tested at MASSTC
4. [Hydro-Action™](#): 10.6 mg/L TN. Used in Suffolk County, New York
5. [Non-Proprietary Soils-Based Systems \(Layer Cakes\)](#): Some designs able to get <10 mg/L TN.



Guidance for Federal Land Management in the Chesapeake Bay Watershed

Chapter 6. Decentralized Wastewater Treatment Systems

Guidance for Federal Land Management in the Chesapeake Bay Watershed

Table 6-2. Examples of biological N removal performance from the literature

Technology examples	TN removal efficiency (%)	Effluent TN (mg/L)
Suspended growth		
Aerobic units w/ pulse aeration	25%–61% ^a	37–60 ^a
Sequencing batch reactor	60% ^b	15.5 ^b
Attached growth		
Single-Pass Sand Filters (SPSF)	8%–50% ^c	30–60 ^c
Recirculating Sand/Gravel Filters (RSF)	15%–84% ^d	10–47 ^d
Multi-Pass Textile Filters (AdvanTex AX20)	64%–70% ^e	3–55 ^e
RSF w/ Anoxic Filter	40%–90% ^f	7–23 ^f
RSF w/ Anoxic Filter & external carbon source	74%–80% ^g	10–13 ^g
RUCK system	29%–54% ^h	18–53 ^h
NITREX	96%ⁱ	2.2ⁱ



**SUFFOLK COUNTY, NEW YORK
DEPARTMENT OF HEALTH SERVICES
OFFICE OF WASTEWATER MANAGEMENT**

**ALTERNATIVE ON-SITE SEWAGE DISPOSAL SYSTEMS
TASK IX-SUMMARY REPORT**

H2M Project No.: SCHS 09-01

Draft: August 2012

Final Draft: February 2013

Final: June 2013

Prepared by:
Holzmacher, McLendon & Murrell, P.C.
Division of Wastewater Engineering
175 Pinelawn Road, Suite 308
Melville, New York 11747



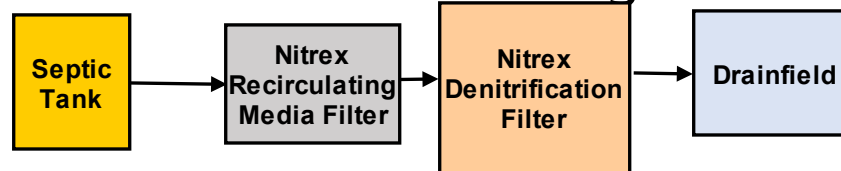
architects + engineers

No.	Site Name	Nitrex™ EFFLUENT TN (mg/l) Sampled by H2M - CDM		
		1st sampling	2nd sampling	Average
1	Eastham MA 40 unit subdivision	1.33	1.37	1.35
2	Mashpee MA 24 unit subdivision with 5,200 sf commercial	0.54	1.57	1.055
3	Harvard MA 2 family installation	0.63	1.4	1.015
4	Malibu CA 16,000 gpd Shopping Center restaurants & retail	1.58	1.28	1.43
5	St. Leonard, MD MA single family installation	2.3	3.68	2.99
Average all sites		1.28	1.86	1.57



for Nitrogen Removal

Process Flow Diagram



- **Very low energy use. No aeration. Treatment system cannot be shut off. Oxygen provided by spraying water over media.**
- **Can be completely gravity at sites with sufficient slope**
- **Sludge – very small amounts in large flow systems**
- **Electricity mainly for periodic pump use**
- **Professional Engineer Guaranteed to achieve TN < 10 mg/L, Averaging 3 mg/L**
- **Performance comparable / better than sewer systems**



O&M Requirements & Costs

- ✓ **Consistent performance with seasonal use – tested at MASSTC**
- ✓ **Min. Operator visits - 1 year, done with sampling**

- ✓ **Costs – Single family, 3-4 bedroom**
 - **Equipment costs \$18,000 - \$22,000**
 - **Installed costs with equipment \$30,000 +/-**
 - **O&M**
 - **Electricity \$ 50/yr**
 - **Total O&M Costs w/o sampling \$150/yr**

 - **Mass DEP required O&M sampling**
 - ✓ **Years 1 – 3 \$1,320**
 - ✓ **Year 4+ \$ 660**



Nitrogen Removal

Phosphorus removal option

Site	Period of Record	Average Influent Total P	Average Effluent Total P	Average %P Removal
MASSTC	2002 - 2003	5.70	0.40	93.0%
Residential - MA	2007 - 2019	5.8	0.18	97.0%
Residential - MA	2008 - 2019	6.66	0.05	99.3%
Residential - GA	2002	17.00	2.10	87.6%
Commercial Site -NY	2009 - 2012	16.8	1.6	90.5%

- **SCADA - Treatment system managed by a Programmable Logic Controller (PLC) with internet connection to Engineer + Operator**
- **Daily reports electronically issued on system wastewater flows and process unit status.**
- **Alarm conditions are instantaneously sent to the facility operator and engineer with identification of alarm cause**

PS-FE1

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-1	105.03	36.0	84	3780.97	1.25
P-2	105.00	36.0	84	3779.84	1.25
TOTALS	210.02		168	7560.85	

PS-AX1

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-5	360.43	56.0	99	20184.11	3.64
P-6	359.33	56.0	98	20122.38	3.67
TOTALS	719.76		197	40306.50	

PS-NF1

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-7	272.30	28.0	21	7624.27	12.97
P-8	278.25	28.0	20	7790.89	13.91
TOTALS	550.54		41	15415.16	

PS-AX2

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-3	205.99	62.0	103	12771.67	2.00
P-4	205.26	62.0	102	12725.88	2.01
TOTALS	411.25		205	25497.70	

PS-NF2

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-9	289.24	28.0	23	8098.81	12.58
P-10	244.26	28.0	22	6839.33	11.10
TOTALS	533.51		45	14938.14	

PS-DF1

PUMP #	RUN (MINS)	FLOW RATE (GPM)	# OF CYCLES	CALC FLOW (GPD)	TIME/CYC
P-11	62.31	66.0	6	4112.47	10.39
P-12	66.44	66.0	6	4384.73	11.07
TOTALS	128.75		7	8497.20	

NITREX STAGE 1 DAILY FLOW

SV #	FLOW (GPD)	SV OPEN (MIN)	SV RATE (SEC)	# OF CYCLES	CALC OPEN TIME
SV-NX1	7431.2	191.30	0.0	304	0.00
SV-NX2	7630.7	192.03	0.0	305	0.00
SV-NX3	7607.1	179.63	0.0	307	0.00
SV-NX4	0.0	0.00	0.0	0	0.00
SV-NX5	0.0	0.00	0.0	0	0.00
TOTALS	22668.9	562.96		916	0.00

NITREX STAGE 2 DAILY FLOW

SV#	FLOW (GPD)	SV OPEN (MIN)	SV RATE (SEC)	# OF CYCLES	CALC OPEN TIME
SV-NX6	26.8	273.99	0.0	423	0.00
SV-NX7	26.7	273.44	0.0	417	0.00
TOTALS	53.5	547.43		840	0.00

ADVANTEX STAGE 1 TOTALS

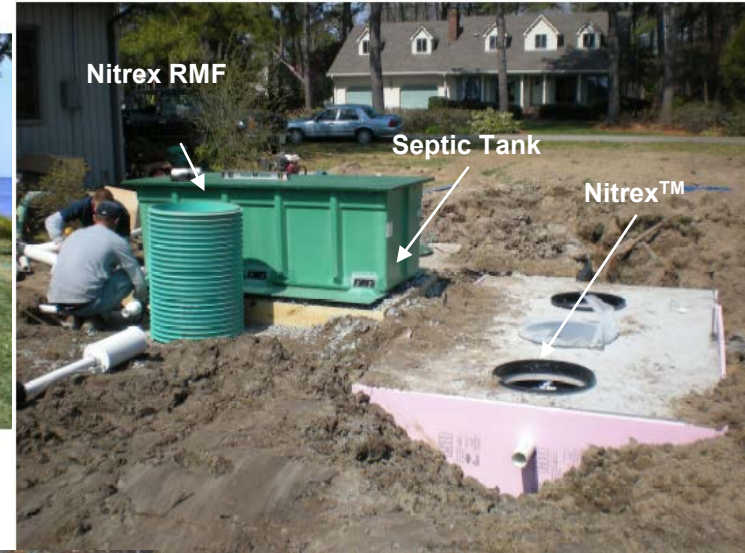
SV#	FLOW (GPD)	SV OPEN (MIN)	SV RATE (SEC)	# OF CYCLES	CALC OPEN TIME
SV-AX1	24035.6	362.57	0.0	196	0.00
SV-AX2	23840.2	363.71	0.0	197	0.00
TOTALS	47875.9	726.27		393	0.00

ADVANTEX 2 AND EFFLUENT

FM-AX2 TOTAL GPD	112732.5 GAL	EFFLUENT TOTAL GPD	7699.2 GAL
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Representative Installations - Single Family





Charlestown, Rhode Island



Project Description

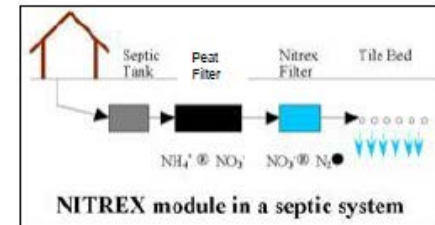
The Nitrex™ Denitrifying Filter was added to a Peat Filter Wastewater Treatment Systems as part of the EPA Green Hill Pond National On-Site Demonstration Project. The systems were monitored by the University of Rhode Island. Please note that the peat effluent was acidic due to the extremely low alkalinity of the water supply.

Project Application Data

- Location: Charlestown, Rhode Island
- Site Application: Residential Properties, weekend and seasonal use
- Installation Date: 2003

Design Profile

- Design Wastewater Flow: Two sites, each 330 gpd
- Wastewater Treatment Process:
Septic Tank – Single Pass Peat Filter – Nitrex™ - Drainfield



Nitrex™ Treatment Performance

Site - 15 LAM

Location	Peat Filter Effluent				Nitrex™ Filter Effluent		
	NO ₃ - N	BOD	TSS	pH	NO ₃ - N	BOD	TSS
Date	mg/l	mg/l	mg/l		mg/l	mg/l	mg/l
21-Aug-03	62	4	3	4.7	0	51	26
3-Dec-03	43	2	0	4.76	0	13	2.75
10-Jun-04	55	2	5.5	4.46	0	22	5.75
5-Aug-04	68	2	1	0	2.9	0.2	5
15-Dec-04	35	2	0	4.93	6.1	15	11
26-May-05	35	1	2	4.22	2.5	10	3
7-Jul-05	32	7	6.5	4.56	2.6	4.2	9
15-Dec-05	32	2	1	5.03	2.6	8.5	5
Average	45	2.8	2.4	4.08	2.1	15.4	8.4
Median	39	2.0	1.5	4.63	2.6	11.5	5.4
St. Dev	14	1.9	2.5	1.67	2.1	15.8	7.6

Site - 16 HAR

Location	Peat Filter Effluent				Nitrex™ Filter Effluent		
	NO ₃ - N	BOD	TSS	pH	NO ₃ - N	BOD	TSS
Date	mg/l	mg/l	mg/l		mg/l	mg/l	mg/l
21-Aug-03	50	12	24	5.32	0	100	25
10-Jun-04	53	9	9	4.08	0.4	24	14
5-Aug-04	120	5	9	0	0.1	23	4
7-Jul-05	3.4	43	6	5.9	ND	41	2
Average	57	17	12	3.83	0.2	47	11
Median	52	11	9	4.70	0.1	33	9
St. Dev	48	17	8	2.66	0.2	36	11

Environmental Engineers/ Consultants

LOMBARDO ASSOCIATES, INC.

188 Church Street

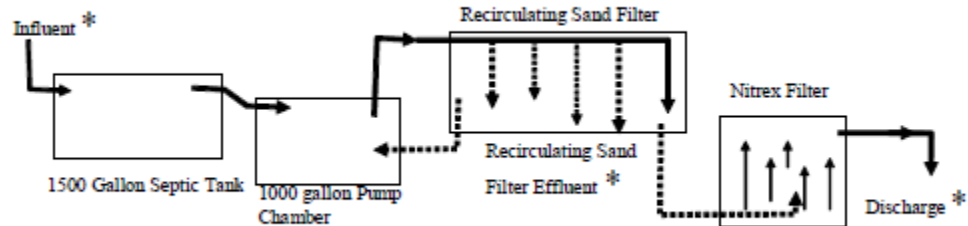
Newton, Massachusetts 02458

www.LombardoAssociates.com

Tel: 617-964-2924

Fax: 617-332-5477

Pio6@LombardoAssociates.com



“The Nitrex™ Filter effluent exhibited a mean TN of 5.4 mg/L (median=4.2 mg/L)”.

FINAL

Onsite Wastewater Technology Testing Report
Nitrogen Removal Performance



Massachusetts Alternative Septic System Test Center
Air Station Cape Cod, Massachusetts 02542
Telephone: 508-563-6757
MASSTC@cape.com

Massachusetts
Alternative
Septic
System
Test
Center

-- April 2008 --

Nitrex™ Filter

Technology Vendor

Lombardo Associates, Inc.



Representative Installations



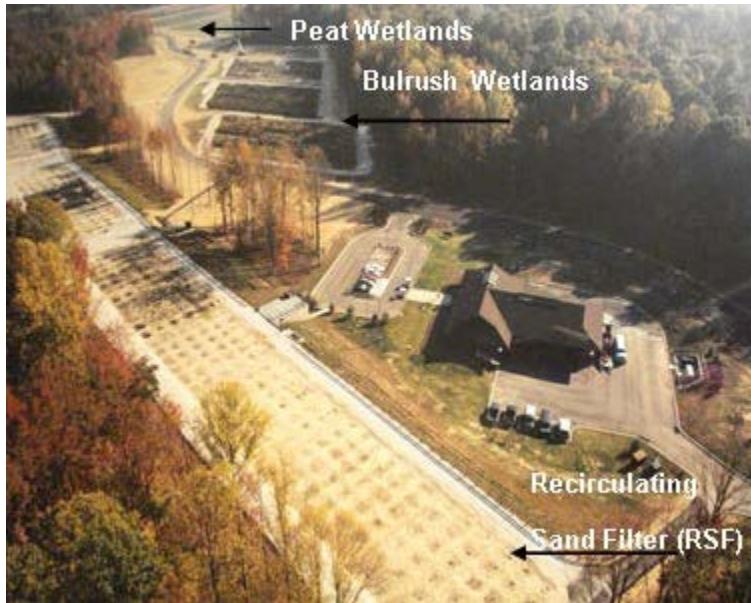


Representative Installations





Mayo MD
900,000 gpd Effluent TN 7 mg/L
Received Multiple National Engineering Excellence Awards



Bulrush Wetland





Questions / Discussion

Pio Lombardo, P.E.
Gary Rubenstein

Environmental Engineers/ Consultants

LOMBARDO ASSOCIATES, INC.

188 Church Street

Newton, Massachusetts 02458

www.LombardoAssociates.com

Tel: 617-964-2924

Fax: 617-332-5477

Pio@LombardoAssociates.com
