Blazing a Path to Implement a "Hybrid" Approach to Reduce Excessive Nitrogen Discharges to the Town of Orleans' Ponds, Estuaries and Embayments

New England Water Environment Association Annual Conference & Exhibit

Session 2 – Watershed Management
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Agenda

- **What's Driving the Hybrid Approach?**
  - Approved CWMP
  - Consensus Plan
  - Stake holder Involvement
- **Hybrid Elements**
  - Traditional Technologies
  - Non-Traditional Technologies
  - Financial Model
  - Delivery Options

What's Driving the Hybrid Approach?

Approved CWMP

Consensus Plan

Stakeholder Involvement

Elements of Hybrid Approach

- **Collection, Treatment and Effluent Disposal**
- **Non-Traditional Technologies**
- **Septic Systems Only**

Wastewater Collection, Treatment and Effluent Disposal

Tri-Town Septage Treatment Facility

- 30 Years Old
- 45,000 GPD with Average of 30,000 per Year
- Decommissioning
- Demolition

Proposed Collection, Treatment and Effluent Disposal

- 2 Geographic Areas
- About 700 Properties
- 460,000 gpd (ADF)
- 65,000 lf of collection system
- 5 Pump Stations
- 3 Effluent Disposal Sites

Wastewater Collection, Treatment and Effluent Disposal

Collection System

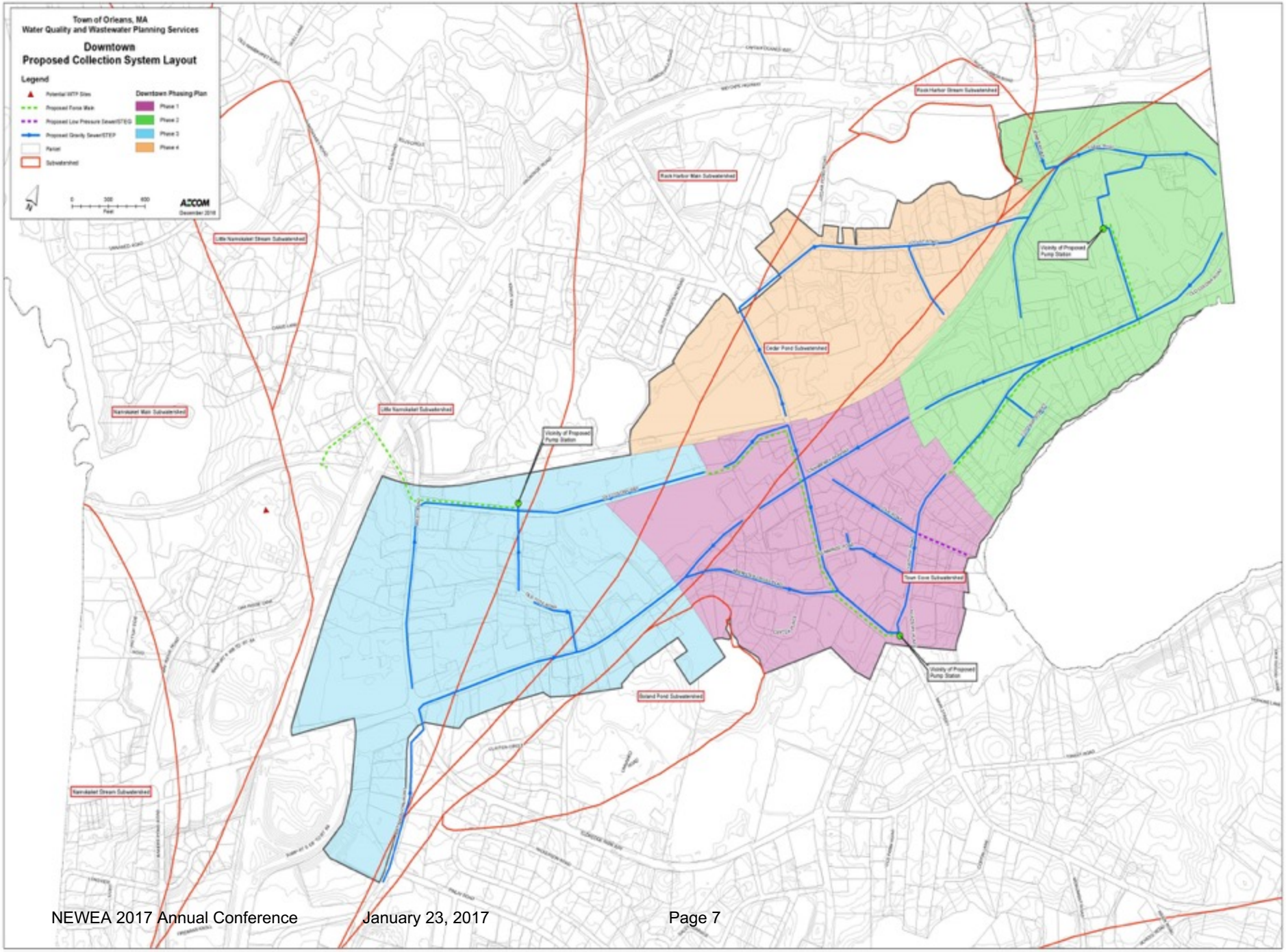
- Gravity Sewers
- Low Pressure Sewers
- Septic Tank Effluent Pumping
- Septic Tank Effluent Gravity
- Vacuum Sewers
- Hybrid

Effluent Disposal

- Open Basins
- Subsurface
- Drip
- Wick Wells

Treatment

- Conventional Activated Sludge
- Sequencing Batch Reactor
- Integrated Fixed Film Activated Sludge
- Membrane Bioreactor
- Rotating Biological Contractor


Town of Orleans, MA
Water Quality and Wastewater Planning Services
Downtown
Proposed Collection System Layout
Legend
Downtown Phasing Plan
Phase 1
Phase 2
Phase 3
Phase 4
Parcel
Subwatershed
ACCOM
December 2016
Rock Harbor Stream Subwatershed
Rock Harbor Main Subwatershed
Little Namskaket Stream Subwatershed
Vicinity of Proposed Pump Station
Cedar Pond Subwatershed
Namskaket Main Subwatershed
Little Namskaket Subwatershed
Vicinity of Proposed Pump Station
Town Cove Subwatershed
Vicinity of Proposed Pump Station
Boland Pond Subwatershed
Namskaket Stream Subwatershed

NT Technology Demonstration Projects

- **Aquaculture**
- **Permeable Reactive Barriers (PRB)**
- **Nitrogen Reducing Barriers (NRB)**

NT Technology Demonstration Projects
Aquaculture

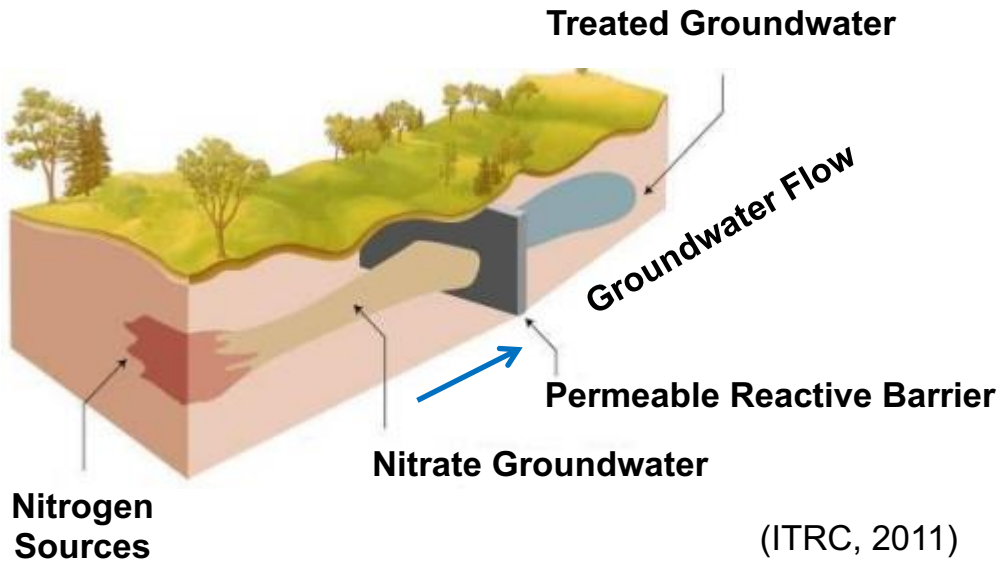
- **Lonnies Pond**
  - Plan, Design and Implement
  - Assess the feasibility of aquaculture
  - Determine biomass and optimal starting size

NT Technology Demonstration Projects Aquaculture (cont.)

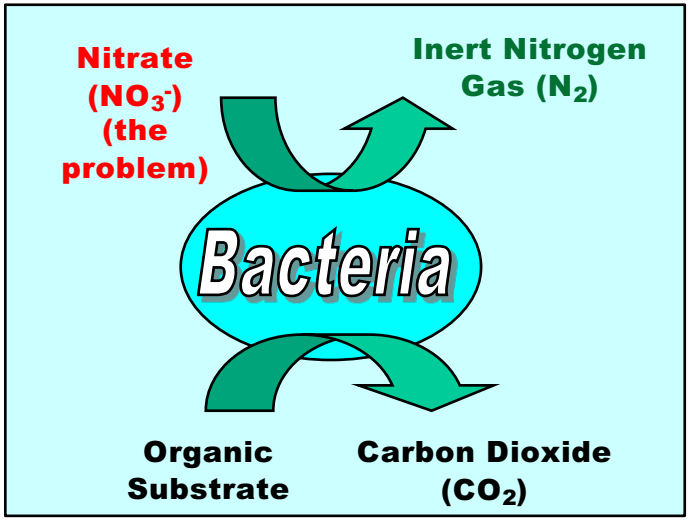
- **Kent's Point Oyster Bed Propagation**
  - Plan, Design and Implement Oyster Bed Propagation
  - Assess the feasibility of aquaculture
- **Enhanced Aquaculture in Pleasant Bay and Town Cove**
  - Build on previous experience with growers to enhance shellfish production through private aquaculture in Pleasant Bay
  - Assess the feasibility of increasing private aquaculture in Town Cove
- **Town Cove Project**
  - Establish a baseline quahog population
  - Determine appropriate numbers of additional quahogs to be planted for water quality benefits

NT Technology Demonstration Projects
Permeable Reactive Barriers (PRB)

- **A PRB consists of a zone of reactive material installed in the path of a plume (e.g. nitrate)**



(ITRC, 2011)



- **Naturally-occurring bacteria to convert nitrate to inert nitrogen gas (N_2)**
- **Requires Anoxic Conditions**

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NT Technology Demonstration Projects
Permeable Reactive Barriers - Eldredge Park

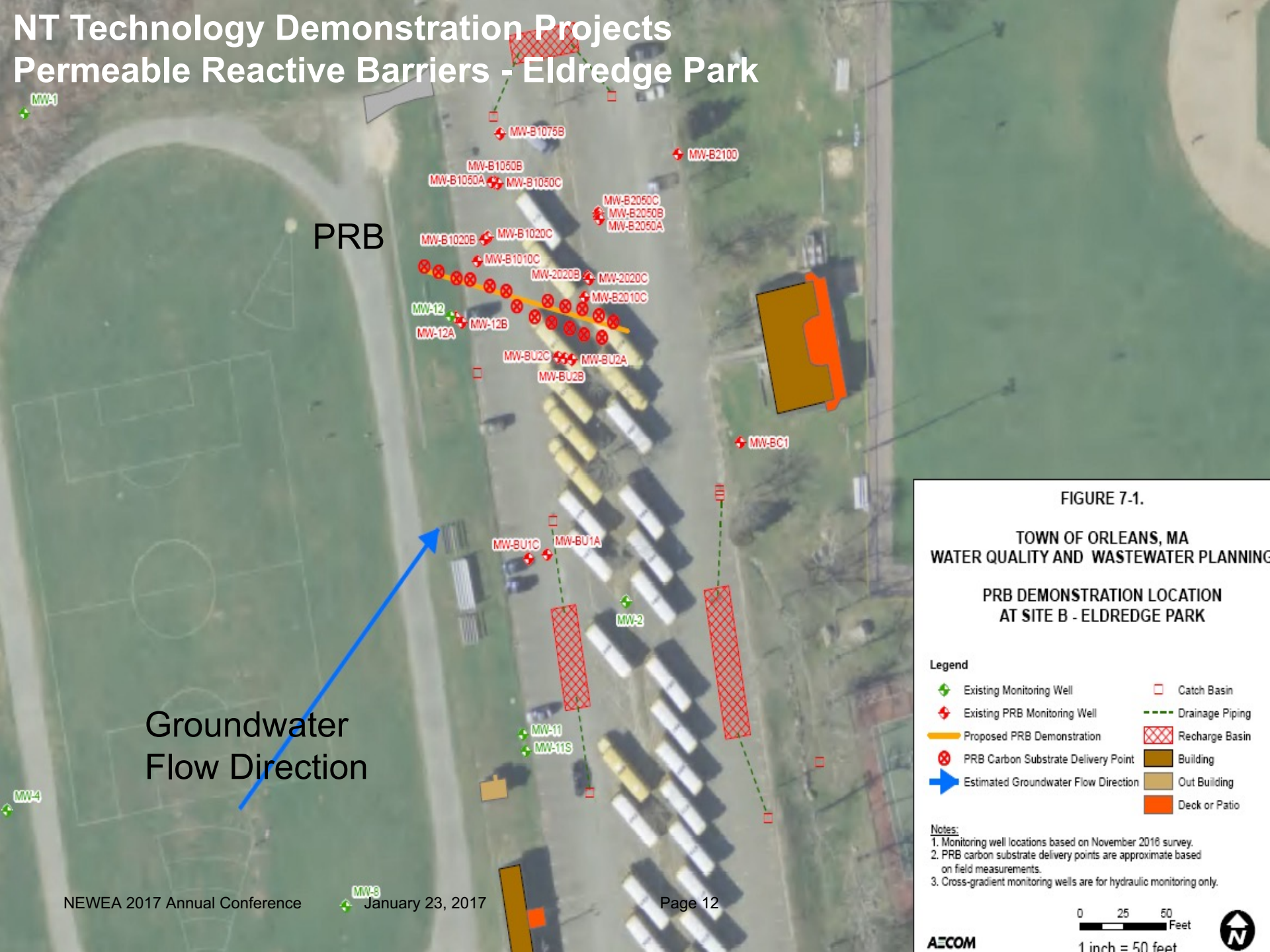

FIGURE 7-1.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

PRB DEMONSTRATION LOCATION
AT SITE B - ELDREDGE PARK

Legend

- Existing Monitoring Well
- Existing PRB Monitoring Well
- Proposed PRB Demonstration
- PRB Carbon Substrate Delivery Point
- Estimated Groundwater Flow Direction
- Catch Basin
- Drainage Piping
- Recharge Basin
- Building
- Out Building
- Deck or Patio

Notes:
1. Monitoring well locations based on November 2016 survey.
2. PRB carbon substrate delivery points are approximate based on field measurements.
3. Cross-gradient monitoring wells are for hydraulic monitoring only.

0 25 50 Feet
1 inch = 50 feet

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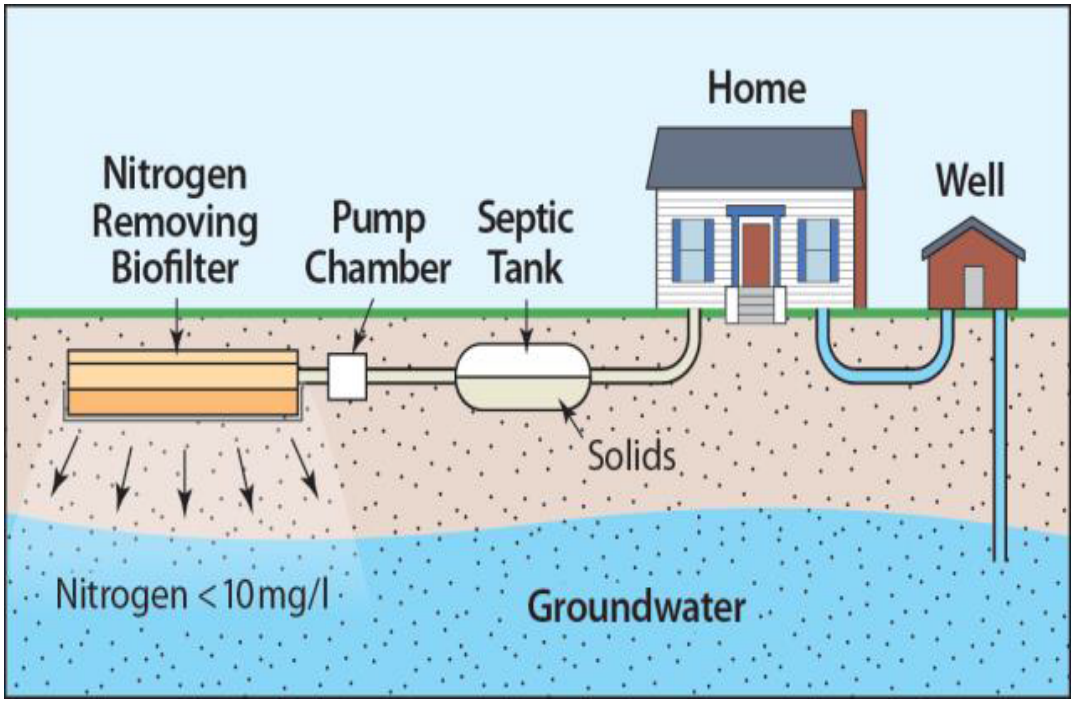
NT Technology Demonstration Projects
Nitrogen Removing Biofilter (NRB)

- **Technology to Address Nitrogen at the Individual Lot**
- **Testing Ongoing at County Test Center**
- **$15,000 to $18,000 per System**
- **Monitoring for 5 Years**
- **Potentially Applicable Where Other Technologies are not Practical**



Conceptual schematic of Nitrogen Removing Biofilter (NRB). Source: The New York State Center for Clean Water Technology, June 2016

Program Costs and Cost Allocation

Elements of the Program	Major Cost Components	Users
Collection, Treatment and Effluent Disposal	Capital	Sewered Areas
Non-Traditional Technologies	Annual Operation and Maintenance	Non-Traditional Technology Areas
Adaptive Management	Replacement	Septic Systems Only Areas
	Monitoring	

Financial Plan

- Developed Detailed Model with Functionality
- Running Scenarios Using Federal, State, or Regional Funding Options
- Producing Best “Reasonably Optimistic” Scenario – Outlining Assumptions and Priorities
- Completing Affordability Study Based on EPA, State and Local Metrics

Financial Plan Scenarios

Component Description	A	B	C	D	E	F	G
100% Capital Cost on Tax Rate	X	X	X	X	X	X	X
100% O/M/R/R on User Charge	X	X	X	X	X	X	X
4% Conventional Financing	X	X					
20 Year Borrowing	X	X	X	X	X		
90% Grant/Loan Forgiveness		X					
2% SRF Financing			X				
0% SRF Financing				X	X	X	X
25% Grant/Loan Forgiveness					X	X	X
30 Year Borrowing						X	X
D/B/O Savings							X
Local Options Tax							X
Septage Revenue							X

Delivery Options

- **Types**
  - Design-Bid-Build
  - Design-Build (DB) and Design-Build-Operate (DBO)
  - Public Provide Partnership (P3)
- **Evaluation of Options**
  - Costs and Risks
  - Evaluation of Prospective Bidder Pool
  - Eligibility for SRF Financing
  - Inflation and Cost Escalation Protections
  - Phasing Implementation
  - Contract Default Provisions
  - Delivery (Design and Construction) Schedules
  - Administrative Services (e.g. Management, Billing)
  - Asset Management Provisions and Protections

Summary

- Town Dedicated to Finalizing the Report to Meet Water Quality, Financial and Management Challenges
- The Hybrid Approach Blends the Proven Use of Sewers and the Innovative Use of Non-Traditional Technologies
- Town Using Water Quality Data, Financial Model and Stakeholder Input to Develop/Implement an Effective and Affordable Plan

Project Team

- Orleans Water Quality Advisory Panel
- Water Resources Associates
- School for Marine Science and Technology
- Watershed Groups
- AECOM Technical Services, Inc.
- Biohabitats, Inc.
- Coastal Engineering
- FinePoint Associates
- MT Environmental Restoration
- Science Wares, Inc.
- The Abrahams Group
- Subsurface, Laboratory, etc.

Thank You

Questions

New England Water Environment Association

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