ABSTRACTS

6th Northeast Onsite Wastewater Treatment Short Course & Equipment Exhibition - April 2-4, 2019

Clark, Mary | State of Vermont Department of Environmental Conservation
Barriers to Using Decentralized Wastewater Community Solutions: 2007 to 2018
Presented: Tuesday, April 2, 2019 | 10:30 am - 11:30 AM

In 2007, the U.S. E.P.A. funded a study that analyzed and identified the major factors keeping engineers, community leaders, and funding agencies from considering or implementing decentralized wastewater solutions in our small rural communities. The report identified the following four barriers as the most important ones to solve:

1) Consulting engineers preferred centralized solutions due to increased financial rewards;
2) Consulting engineers lack of knowledge of decentralized designs;
3) The lack of regulatory support for decentralized technologies; and
4) The lack of broad systems thinking as applied to decentralized solutions.

The report included a number of strategies to address these barriers. This presentation will seek to update our progress in the last eleven years in implementing the strategies and policy changes included in the report, along with identify some key barriers that continue to exist.

Zegel, Ken | Suffolk County Department of Health Services
Developing a County-Wide Road Map for the Restoration of Water Quality Through Wastewater Management
Presented: Tuesday, April 2, 2019 | 10:30 am - 11:30 AM

The Subwatersheds Wastewater Plan (SWP) will be used to establish first order nitrogen load reduction goals generated based upon the need to obtain water quality improvements for all of the County's surface water, drinking water, and groundwater resources. Although several similar studies have been completed to evaluate the sources and impact of nitrogen pollution to the major estuaries of the County, an integrated, holistic, evaluation that delineates all of the County's subwatersheds and provides a common platform of assumptions and boundary conditions has not been completed.

Execution of the SWP began with the establishment of a uniform and consistent set of subwatershed boundaries, development of receiving water residence times, and the generation of nitrogen loading rates through groundwater and surface water (hydrodynamic) analytical modeling. The modeling results were then keyed to baseline water quality for 191 individual surface waterbodies to establish tiered priority areas for wastewater management upgrades. Following the establishment of tiered priority areas, preliminary load reduction goals were developed using empirical data relationships, existing regulatory target guidelines, and other readily available data sources from related studies.

Finally, recommendations for wastewater management upgrades were than generated based upon the established priority ranks, ability to meet nitrogen load reduction goals, cost-benefit evaluation, and contemplated sanitary code modifications.

Jobin, Justin | Suffolk County Department of Health Services
Suffolk County New York's Reclaim Our Water Initiative
Presented: Tuesday, April 2, 2019 | 11:30 am - 12:30 pm

Water is the single most significant resource for which Suffolk County bears responsibility. In 2014, Suffolk County Executive Steve Bellone kicked off his Reclaim Our Water initiative by identifying water quality as his administration's highest priority. Since then, the County has participated in a four (4) State tour of Innovative and Alternative Onsite Wastewater Treatment Systems (I/A OWTS), adopted 2015's Comprehensive Water Resources Management Plan, initiated the Subwatersheds Wastewater Plan, piloted fourteen (14) I/A OWTS

technologies on forty (43) residential properties, adopted Article 19 of the sanitary code, and also amended Article 6 of the sanitary code for the first time since 1973. These efforts would not have been possible without the assistance of many stakeholders, most notably, New York State Department of Environmental Conservation (NYSDEC) and the Long Island Nitrogen Action Plan (LINAP). The Septic/Cesspool Upgrade Program Enterprise (SCUPE) is a DEC grant that enables Suffolk County to embark on these aggressive measures to battle nitrogen pollution.

Over 300,000 parcels are currently served by polluting cesspools and septic systems, but will never connect to a sewer system. Reversing degradation of water quality will depend on replacement of existing systems with new, individual Innovative and Alternative Onsite Wastewater Treatment Systems (I/A OWTS).

The following are key program components of the Reclaim Our Water initiative:

- Liquid Waste Licensing
- Long Island Nitrogen Action Plan ("LINAP")
- Suffolk County Sanitary Code and Standards for Construction
- Suffolk County Septic Demonstration Programs
- Subwatersheds Wastewater Plan ("SWP")
- Septic Improvement Program ("SIP")

Heger, Sara | University of Minnesota
How are Reductions in Water Usage Impacting Our Septic Systems?
Presented: Tuesday, April 2, 2019 | 11:30 am - 12:30 pm

This presentation will focus on a study funded by the Water Research Foundation evaluating water use from over 23 utilities and over 1,000 homes showing a 23% reduction in water use since 1999. The primary sources for the reduction will be discussed along with implications with increased concentrations. Septic system design and operation considerations will be highlighted.

Clark, Amanda | State of Connecticut Department of Public Health
Heger, Sara | University of Minnesota
Murphy, John | MassDEP
State Funding Programs for Onsite Systems Panel
Presented: Tuesday, April 2, 2019 | 1:30 pm - 2:30 pm

Panelists will discuss the funding options available for the repair or replacement of failed onsite systems in Connecticut, Massachusetts and Minnesota.

Lombardo, Pio | Lombardo Associates, Inc.
Passive Wastewater Nitrogen Removal - Layer Cake / NRB / PNR vs 2 Stage Biofiltration
Presented: Tuesday, April 2, 2019 | 1:30 pm - 2:30 pm

Passive Wastewater Nitrogen Removal has become popular in the past few years as a low-cost, effective method for onsite wastewater nitrogen removal. The vertical treatment technique has been labeled "Layer Cake" by a Massachusetts researcher, Nitrogen Removing Biofilter (NRB) by Stony Brook University, and Passive Nitrogen Removal (PNR) and included in CT's onsite code. The State of Florida, after $5 million of research and more than nine years, has also been and is testing the layered approach in numerous applications. While the technique is alleged to be "new" by these researchers, they are all a variation on the technique developed by the University of Waterloo in 1995 and permitted in the State of Massachusetts in 2007.

The 2 Stage Biofiltration technique has been evaluated by the State of Florida, Barnstable County Dept. of Health, US EPA, numerous state and local agencies. The 2 stage biofiltration technique has been in use for more than fifteen years at numerous residential and commercial/institutional locations.

The presentation will:

1. Describe the history of the Passive Wastewater Nitrogen Removal Systems – both carbon and sulfur based
2. Describe the science of passive nitrogen removal
3. Compare the advantages and disadvantages/risks of the Layer Cake / NRB / PNR and 2 Stage Biofiltration in terms of:
    a. Capital and annual O&M costs
    b. Nitrogen removal performance
    c. Maintenance issues and monitoring requirements
    d. Long term reliability
    e. Life cycle costs

As the author has engineered and permitted both the vertical and 2 stage biofiltration techniques, attendees will learn from first-hand practical experience of the issues.

Belanger, Marie-Christine | Premier Tech Aqua
OWTS: How to Ensure Consistency between Certification and Field Results
Presented: Tuesday, April 2, 2019 | 2:30 pm - 3:30 pm

With the increasing use of advanced wastewater treatment systems, a few questions remain: are they performing as they are supposed to and as per manufacturers' claims? Is certification under controlled conditions enough to support those claims or should more extensive field performance demonstration be required?

Consistency of performance for certification should be a universal standard. The general disparity of field performance as compared to results obtained during certification led many stakeholders of the industry to evaluate how certification standards could be improved and adapted to ensure a better reciprocity between certification and field results. Over the last decades, we observed an important trend in standards and in different regulations (BNQ 3680-910 in Province of Quebec, BNQ 3680-600 in Canada, ANSI/NSF Standard 350, Z-55-3 Standard in Germany, etc.), to establish different treatment classes addressing protection of water resources in different sensitive areas and to certify treatment units per these classes' requirements.
We also observed that the more stringent and complex the standards are in different jurisdictions, the more the regulations adopt a combined approach in terms of performance demonstration, i.e. controlled (certification program) and uncontrolled (field testing) conditions. The primary principle underlying such a process is to demonstrate the general compliance of a system over time and actual usage and maintenance.

An efficient approach to determine system compliance is to perform a systematic and regular independent random field performance audit on a limited number of installed systems. Annual random field audits have also been demonstrated to be an efficient indirect enforcement tool in many jurisdictions. Premier Tech Aqua wants to share its experience and knowledge acquired relative to what should be the determining factors and elements of a sound "controlled demonstration program" (certification) that will ensure consistency of results (certification and field results), control and management over time of field performance. Our experience is based on being approved in half of North America, and in 5 different European countries under tests protocols such as ANSI/NSF 40 & 245, BNQ 3680-910, CAN/BNQ 3680-600, EN 12566-3.

Miles, Randy | College of Agriculture, Food & Natural Resources
Importing Soil Material on Marginal Soil Treatment Area Footprints
Presented: Tuesday, April 2, 2019 | 2:30 pm - 3:30 pm

This presentation will focus on the very selective use of imported soil relative to soil properties, harvesting, handling, and placement at the site, on sites with very marginal soil resources for the soil treatment area. This prescriptive aspect was developed for renovation of existing systems at Table Rock Lake near Branson Missouri, in which there is no central sewer system with shallow, steeply sloping soils. This prescriptive method, used in concert with aeration treatment and drip dispersal, has been successful for residential and commercial applications in the Branson area. The prescription has been utilized in many other states since inception of the method.

Lentz, David | Infiltrator Water Technologies
Septic Tank Buoyancy Control 101
Presented: Tuesday, April 2, 2019 | 3:30 pm - 4:30 pm

An important consideration in the proper installation of a septic, pump, or holding tank is the risk of flotation due to the presence of groundwater. When a rigid object such as a septic, pump, or holding tank is partially or fully submerged in groundwater, an upward force is exerted on the object that is equal to the weight of the fluid that is displaced by the rigid object. Engineering controls, such as ballast systems, concrete pads, and helical anchors, can be applied to counteract upward buoyant forces, allowing for tank installations in areas where shallow groundwater conditions could cause a tank to float out of the ground. This presentation will include a discussion of Archimedes' principle, basic geotechnics of buried tanks, total and effective stress, uplift forces, buoyancy control function, and buoyancy control best practices.

Nelson, Mark | Horsley Witten Group, Inc.
Co-Presentor: Chris Miller
Development of an Alternative Onsite Treatment System Program to Meet the Nitrogen Reduction Goals of the Pleasant Bay Watershed Permit, Brewster, MA
Presented: Tuesday, April 2, 2019 | 3:30 pm - 4:30 pm

The Town of Brewster, MA recently entered into a Watershed Permit for Pleasant Bay, a nitrogen limited coastal estuary at the elbow of Cape Cod. This is the first multi-town, watershed-based permit issued by the Massachusetts Department of Environmental Protection. Brewster has partnered with the Towns of Orleans, Harwich and Chatham for its implementation over the next 20 years.

The permit authorizes a combination of traditional wastewater treatment and non-traditional strategies to achieve compliance with the Total Maximum Daily Load (TMDL) for Pleasant Bay. Brewster has already achieved half of its nitrogen reduction goal through changes in fertilizer practices at its two municipal golf courses. For the remainder, the town plans to develop and implement a program using alternative onsite septic systems to treat for nitrogen on individual properties. This program is currently under development and will be piloted between now and 2023.

This presentation will describe how Brewster is working to develop the program and determine the processes that will be used to select appropriate treatment technologies and finance, maintain and monitor individual systems throughout the life of the permit. It will also describe how the Town will manage future buildout within the program to insure long-term compliance with the TMDL..

Woods, Erika | Barnstable County Department of Health and Environment
Efficacy of "Eco-Toilet" and I/A Technologies for the Reduction of Nutrient Inputs into Groundwater; A Falmouth, MA Technology Study
Presented: Wednesday, April 3, 2019 | 8:30 am - 9:30 am

Cape Cod is known for its sandy coastal beaches, marine estuaries and abundant freshwater lakes. Unfortunately, all of these natural treasures are in danger due to elevated levels of nutrients being discharged into the groundwater by onsite, subsurface sewage disposal systems. Towns are struggling to come up with affordable and effective ways to reduce the amount of nitrogen and phosphorus that is being discharged into the groundwater by homes and businesses across Cape Cod and the Islands.

The Town of Falmouth, as part of their Comprehensive Wastewater Treatment Plan, has opted to engage in multiple research projects to better understand the value, both financial and environmental, of promoting the use of Eco-toilets and other I/A technologies as a viable strategy for the reduction of these nutrients and as an alternative to centralized wastewater treatment. This presentation will describe and discuss the results of current participants in these programs with emphasis on both nutrient reduction and the overall cost of the technologies.

Jobin, Justin | Suffolk County Department of Health Services
Suffolk County's Septic Improvement Program
Presented: Wednesday, April 3, 2019 | 8:30 am - 9:30 am

The Suffolk County Septic Improvement Program (SIP) launched on July 3, 2017 at www.ReclaimOurWater.info. The Program provides homeowners looking to install new nitrogen reducing septic systems (known as I/A OWTS) with grants up to $11,000 to offset the increased costs of these new technologies. In addition, homeowners may apply to participate in a loan program administered by a third party lender to finance the remaining cost of the system. The County has enough funding to issue approximately 185 – 200 grants per year. Applications are accepted on a rolling basis and priority is given to high and medium density residential parcels located within the 0-25 year groundwater travel time or within 1,000 feet of enclosed waterbodies. Post-installation landscaping and irrigation restoration is the responsibility of the property owner.

Program Statistics as of October 8, 2018:
SCDHS started accepting applications July 3, 2017

- 1426 registrants
- 416 completed applications
- 285 issued grant certificates
- 94 total WWM Permit Applications
- 41 completed installations
- 57 applications currently approved or under review

Buchanan, John | UT Institute of Agriculture
Drip Distribution - Design, Installation and Service
Presented: Wednesday, April 3, 2019 | 9:30 am - 10:30 am

This session will focus on the basics of drip dispersal systems. Utilizing drip irrigation technologies, drip dispersal systems provide a uniform effluent application across the soil treatment area. This uniformity allows the effluent to be exposed to a greater volume of soil, resulting in a greater potential for renovation. This program will discuss the basics of how these systems are designed and installed, and then focus on the maintenance required for long-term service.

Heufelder, George | Barnstable County Department of Health and Environment
The Effectiveness of Layering a Sand-Sawdust Layer in a Soil Absorption System for the Removal of Nitrogen from Onsite Septic Systems in Northern Climates
Presented: Wednesday, April 3, 2019 | 9:30 am - 10:30 am

Following upon the work of the Florida Onsite Sewage Nitrogen Reduction Strategies (FOSNRS) studies—which sought, among other things, to incorporate lignocellulose into onsite septic systems for the reduction of nitrogen—the Massachusetts Alternative Septic System Test Center endeavored to both determine the applicability of those strategies in northern climates and simplify their applications to reduce costs.

Four systems of varying complexity were installed in the Test Center venue and six systems were installed in residences in the area. The results from each set of installations are first compared for the purpose of determining the effectiveness of a simplified layering approach and predicting their overall efficacy if broadly applied. Subsequently, data from systems with the simplest configurations are compared with two alternative configurations that have incrementally more complex features. The efficacy of these latter configurations is evaluated for the incremental increases in performance relative to the increased estimated costs. Data from the Test Center are used to better examine the variables affecting overall performance since the variables such as precipitation, temperature and true hydraulic loading rates are precisely measured in the Test Center venue.

The authors conclude that, although the simple layering of a sand-sawdust layer has variable reductions of nitrogen from leachate beneath the soil absorption systems in response to season, the relatively low capital and operating costs make this strategy a relatively inexpensive, viable and sustainable strategy in areas where nitrogen is a concern and onsite septic systems are prevalent.

Bradley, Graham | Vermont Department of Environmental Conservation
Co-Presentor(s): Glenn Duffield; Vitaly Zlotnik
Groundwater Mounding Analysis for Onsite Wastewater Discharge: From Simple to Innovative
Presented: Wednesday, April 3, 2019 | 10:30 am - 11:30 am

Onsite soil-based wastewater systems rely on aerobic treatment in the unsaturated zone. The depth to the seasonal high water table is commonly determined using the presence of redoximorphic features or direct water level monitoring. However, the water table may rise when additional wastewater infiltration is applied, thus decreasing the unsaturated thickness and reducing the aerobic treatment capacity.

Prescriptive wastewater system designs assume groundwater mounding is negligible. The presence of low permeability soil or a high water table can make this assumption invalid, prohibit in-ground systems, and limit potential development. This has motivated the introduction of performance-based sand-mound wastewater system designs in Vermont. In some circumstances, the water table is allowed to rise into the mound fill, provided that a hydrogeological analysis has demonstrated 36 inches of unsaturated material remains beneath the leachfield and there is at least 6 inches to the induced water table at the edge of the fill.

This presentation reviews the theory and practice of groundwater mounding analysis, before examining the strengths and weaknesses of several different approaches from simple to innovative. For example, Darcy's Law may be applied to estimate the maximum water table rise at a sloping site, but it ignores recharge to the underlying saturated layer and cannot be used to calculate the reduction in groundwater mounding downslope. The Hantush (1967) method does account for groundwater flow in the saturated layer and estimates the reduction in groundwater mounding away from the leachfield. However, it is just valid for horizontal sites where the only hydraulic gradient is induced by the groundwater mounding itself. The presentation ends by describing a new solution that overcomes these limitations and calculates groundwater mounding in unconfined sloping aquifers (Zlotnik et al, 2017), and has been implemented in the AQTESOLV software (Duffield, 2008).

Miles, Randy | College of Agriculture, Food & Natural Resources
The Various Aspects of Treatment by the Soil in Onsite Wastewater Systems
Presented: Wednesday, April 3, 2019 | 10:30 am - 11:30 am

The presentation looks at fundamental soil properties with emphasis on chemical properties, and will address the treatment abilities for specific chemical constituents in the effluent stream. Soil chemical properties that have potential to ameliorate P, lower ammonia, decrease BOD, etc. will be presented.

Healy, Dennis | Infiltrator Water Technologies
Septic System Malfunction Studies and Analysis
Presented: Wednesday, April 3, 2019 | 12:30 pm - 1:30 pm

Septic system lifespan can vary due to a number of factors including system sizing, installation, water usage, wastewater strength, and other factors. The presentation will look into the function of each component in a septic system, field performance studies, and the inspection and diagnosis of malfunctioning systems. This will include studies on the rate of system malfunction across different regions and conditions, malfunction investigation basics, and system malfunction examples. The intention is to provide an overview on the rate at which onsite wastewater treatment systems malfunction and how to approach the investigation of these systems so a proper solution can be recommended.

Heindel, Craig | Waite-Heindel Environmental Management
Pilot Test of Nutrient Removal by Large-Scale Drip Dispersal of Tertiary-Treated Effluent, Southern Vermont
Presented: Wednesday, April 3, 2019 | 12:30 pm - 1:30 pm

A pilot test was conducted in 2016 to evaluate the nutrient removal capability of a proposed large-scale [80,000 gallons per day] drip dispersal field for tertiary-treated domestic wastewater for an expansion at Bromley Mountain Ski Resort in Peru, Vermont. The proposed dispersal area is a sand-and-gravel deposit with seasonal high water table depths of 20 to 25 feet. Groundwater beneath the dispersal area discharges into a small stream. The Vermont Indirect Discharge Rules [VT IDR] required field testing to confirm that in-stream concentrations of Total Dissolved Phosphorus [TDP] would not be increased by more than 0.001 mg/L, or of Nitrate [NO3] to above 2.0 mg/L.

A 2,515 sq.ft. pilot drip dispersal field was installed, and test effluent was applied at 2.0 gpd/sq.ft. for 119 days. The test effluent was secondary-treated domestic wastewater from the ski area's existing WWTP, diluted four-fold with well water and spiked with Bromide as a tracer. An induced groundwater mound of 2.9 ft. in height was observed for the final 60 days of the test. TDP, NO3 and Bromide concentrations stabilized after 108 days. Final nutrient concentrations in downgradient groundwater showed a 99.4% reduction of TDP [from 1.9 mg/L in effluent, to 0.012 mg/L in groundwater], and an increase of 0.34 mg/L in Nitrate [from 0.86 mg/L in effluent, to 1.2 mg/L in groundwater]. Mass-balance calculations for the receiving stream using these final groundwater concentrations were applied at the proposed 80,000-gpd dispersal rate, mixed with the estimated Low Median Monthly Streamflow. These calculations predict that VT IDR in-stream nutrient limits will be met. As of October 2018, the project is in the detailed engineering-design phase.

Fritts, Tom | Residential Sewage Treatment Company
Choosing the Correct System for the Site
Presented: Wednesday, April 3, 2019 | 1:30 pm - 2:30 pm

The onsite industry is growing and with that growth comes more and more choices for treatment systems, from the primary treatment component to the soil treatment area. We will review many of these systems from the "Onsite

Cafe Menu" ranging from the most basic septic tank and gravity to advanced treatment and pressure dosed systems.

Amador, Jose | University of Rhode Island
Nitrogen Loading from Onsite Wastewater Treatment Systems in the Greater Narragansett Bay Watershed: Magnitude and Reduction Strategies
Presented: Wednesday, April 3, 2019 | 1:30 pm - 2:30 pm

Advanced OWTS are used instead of conventional OWTS to lower nitrogen (N) inputs to coastal ecosystems and groundwater sources used for drinking. Knowledge of the N load from OWTS helps identify drivers of excess N and develop strategies to lower N inputs. We used wastewater flow and effluent total N (TN) concentration to determine the mass N load from 42 advanced N removal OWTS technologies and 5 conventional OWTS within the Rhode Island side of the Greater Narragansett Bay watershed. The median N load (g N/system/day) followed the order: conventional systems (31.1) > AX-20 (10.8) > FAST (10.1) > SeptiTech (9.6), and was positively correlated with flow. Results of a Monte Carlo simulation estimated the N load from the current distribution of conventional and advanced systems (105,833 systems total; Current Scenario) to the watershed at 1,217,539 kg N/year. Compared to the Worse Case scenario (100% conventional OWTS), advanced OWTS currently prevent 53,898 kg N/year from entering the watershed. The per capita N load (kg N/capita/year) from OWTS under the Current Scenario is 4.68, and 1.47 for a local wastewater treatment plant (WTP) with biological N removal (BNR). Replacing 5,150 conventional OWTS yearly with the most effective OWTS technology would result in a per capita N load from OWTS equivalent to that for a WTP with BNR after ~15 years, with a yearly cost of $174.24 per additional kilogram of N removed. Increasing the proportion of advanced OWTS that achieve the final effluent standard of 19 mg TN/L—through monitoring and recursive adjustment—would reduce the time and cost necessary to achieve parity with the WTP.

Jobin, Justin | Suffolk County Department of Health Services
Suffolk County New York's I/A OWTS Demonstration Program and Performance Evaluation
Presented: Wednesday, April 3, 2019 | 3:00 pm - 4:00 pm

In 2014 and 2016, Suffolk County offered an I/A OWTS Demonstration Program, whereby a Vendor installs, tests and maintains systems at no cost or at a reduced cost to Property Owner(s). This program is based on a similar program in Rhode Island were 58 I/A OWTS were installed, evaluated over a 10-year period to provide a means for industry training, performance evaluations, and provide data for the development of I/A OWTS regulations. During the two (2) phases of this demonstration program, over 14 technologies were installed at over 43 private residences in Suffolk County New York.

Systems being tested as part of a Demonstration Program were subject to a streamlined approval process where the Department has approved a technology for Provisional Use if 75% of the units installed have a combined total average effluent TN of 19 mg/L or less for at least 6 months of composite sampling.

The Demonstration Program proved to be an exceptional tool to assess the design, operation, maintenance, installation, and overall ability of an I/A OWTS technology to meet nitrogen reduction objectives in Suffolk County. The dual purpose framework of the program also included a means for accelerated construction of programmatic infrastructure and validation of its and local institutional ability to review, approve, install and operate I/A OWTS systems.

As part of this approach, Suffolk County dedicated significant staff resources to work with manufacturers, who also committed to terms of an intensive cooperative program, including:

- industry training (designers, installers, O&M contractors)
- regulatory training (procedures/standards to review/approve, and inspect)

- cooperative process optimization; i.e., vendors working with Suffolk to optimize systems (recirculation rates, oxygen supply, etc.) given local influent strength, venting configurations, etc.
- demonstration of systems to design professionals, non-governmental organizations (NGOs), civics, local governments, etc.

Cox, Alissa | University of Rhode Island
Co-Presentor(s): Bianca Ross; Sara Wigginton
Onsite wastewater treatment systems in southern New England: Nitrogen removal performance, greenhouse gas emissions and climate change woes
Presented: Wednesday, April 3, 2019 | 3:00 pm - 4:00 pm

Nitrogen (N) pollution from onsite wastewater treatment systems (OWTS) is of particular concern in coastal environments, as it can lead to degraded drinking water resources and compromised ecological health. Our research in southern New England focuses on N in residential wastewater treated by both proprietary advanced N-removal technologies and non-proprietary N-removal drainfield designs. Our findings indicate that some N-removal technologies and designs are performing as intended, resulting in final effluent total N concentrations below 19 mg/L, whereas others are not meeting this regionally-established standard.

Because previous research indicates that OWTS technology can be a source of greenhouse gas (GHG) emissions, we also explore our systems' relative GHG contributions to the atmosphere. To complicate matters, coastal OWTS also face climate change-related threats in the form of rising groundwater tables and intensifying storm events. Our findings indicate that coastal communities face rising groundwater tables, especially in the near-shore areas, which means that drainfield performance is becoming compromised. We have modeled storm events with and without sea level rise, and worst-case scenarios indicate that as many as 6000 septic systems could be affected by major storm events in southern Rhode Island. These findings may help inform policy related to performance monitoring and designing systems in a way that accounts for climate change over the next several decades.

Theroux, Maggie | US EPA Region 1
Advanced Septic System Nitrogen Sensor Challenge: Background and Update
Presented: Wednesday, April 3, 2019 | 4:00 pm - 4:30 pm

Nitrogen loads from conventional residential Onsite Wastewater Treatment Systems cause critical water quality problems in the northeastern U.S. and elsewhere. There are many commercially available advanced septic systems designed to reduce the amount of nitrogen leaving a system. However, there are currently no commercially available nitrogen sensor packages that can be used in conjunction with an advanced septic system to measure its performance in real-time. A number of northeastern states and local governments have expressed interest and support for the development of such a sensor, that would be low-cost and could monitor and optimize the performance of an advanced septic system. A nitrogen sensor installed in an advanced system, and the resulting real-time performance data, would provide assurance to state and local governments, as well as homeowner and manufacturers, that systems are performing as intended during their service life. The Advanced Septic System Nitrogen Sensor Challenge was created to spur the development of a low-cost nitrogen sensor package that can measure and monitor the performance of an advanced septic system. The Challenge began in January 2017 with an on-paper "ideation" phase and is currently in its second phase: "development and testing". Thus far two sensors have been tested and at least two more will have been tested by the time of this conference. The purpose of this presentation will be to (1) give a brief background on the Challenge and present results thus far, (2) discuss how the development of a sensor will benefit industry, regulators, and homeowners, (3) describe our proposed next steps.

Rhodes, Evelyn | Yale School of Forestry and Environmental Studies
Prevalence of Surfactants in Advanced Technology Onsite Wastewater Treatment Systems
Presented: Wednesday, April 3, 2019 | 4:30 pm - 5:00 pm

The ability of advanced technology (AT) onsite wastewater treatment systems (OWTSs) to remove potentially hazardous organic water contaminants (OWCs) from household wastewater is not yet well understood. Surfactants, the components of many soaps and detergents, are a class of OWC that is not targeted during onsite wastewater treatment and may have deleterious effects on aquatic organisms and ecosystems. Using liquid chromatography and refraction index detection (LCRI), the prevalence of surfactants in the wastewater of homes in Charlestown, RI was assessed. Effluent samples from homes inhabited both seasonally and year-round using five different AT OWTSs were collected. These AT systems were each designed to improve nitrogen removal during treatment to prevent eutrophication in downstream marine ecosystems. Samples were transported on ice from the field to Yale's Center of Green Chemistry and Engineering lab where solid phase extraction (SPE) was performed to prepare them for injection and analysis. Basic and acidic compounds were eluted and injected separately to improve detection sensitivity for all compounds. A solvent gradient was used to prolong the interaction of surfactants on the C18 reverse-phase column. Preliminary evaluation of the effluent collected in June and July 2018 showed minimal contamination from common household OWCs. Further analysis will be conducted to determine the presence of surfactants. This study will enhance understanding about the capacity of OWTSs to remove surfactants and potentially inform future system innovation and improvement.

Smith, Daniel | AET Tech
Nitrogen Removal from Wastewater by Ion Exchange Sorption & Regeneration
Presented: Wednesday, April 3, 2019 | 4:00 pm - 5:00 pm

Anaerobic Ion Exchange (AN-IX) coupled with in situ media regeneration is a developing technology to remove nitrogen from wastewater at single-family homes. AN-IX is a multi-chamber module with hydraulically interconnected chambers that include an upflow anaerobic solids blanket chamber followed by ion exchange chambers that capture ammonium ions (NH_4^+). Ion exchange chambers contain granular porous ion exchange media in the form of Nv-Na, a natural highly crystalline zeolite produced by St. Cloud Mining with major mineral components of SiO_2 (65.5%), Al_2O_3 (10.8%), K_2O (3.7%), Na_2O (3.4%), CaO (0.84%), and Fe_2O_3 (0.79%).

AN-IX operates without power and requires little if any daily maintenance. Nitrogen removal in AN-IX does not rely on microbial nitrification and denitrification, which greatly simplifies design and operation. AN-IX nitrogen removal is effective at low temperature and the process is suitable for discontinuous use and seasonal occupancy. As a tank-based process, AN-IX is not affected by rising groundwater table elevations. AN-IX has been field verified in prototype testing in Florida and Maryland, where Total Nitrogen removal exceeded 95%. Monitoring and modeling of NH_4^+ breakthrough shown that nitrogen removal by AN-IX is a tractable process that is amenable to rational process design. Pilot verification of AN-IX at single family homes will verify process effectiveness and reliability. Methods are currently being developed to enable at-site zeolite regeneration within short time frames, which will significantly lower the life cycle cost of nitrogen removal. AN-IX provides a reliable, compact and low maintenance nitrogen removal system that is highly appropriate to the needs of individual homes. The development of systems to remove captured NH_4^+ from media in short time frames will enable at site media regeneration and lower life cycle costs. The flexibility and modularity of AN-IX can stimulate local-scale recycling of nitrogen and water.