

LINAP September Newsletter

Long Island Nitrogen Action Plan (LINAP) – Monthly Newsletter NYS Center for Clean Water Technology Update

In this month's issue we highlight the initiatives lead by the team at the NYS Center for Clean Water Technology (CCWT).

- Nitrogen Removing Biofilters
- NYS Wastewater Research and Innovation Facility
- Shinnecock Indian Nation Septic System Upgrades
- Nitrogen Sensor
- Bulkhead Permeable Reactive Barrier at Hampton Bays

Nitrogen Removing Biofilters

The [Center for Clean Water Technology](#) (CCWT) is continuing to develop non-proprietary, onsite wastewater treatment systems for residential and commercial use that reduce nitrogen to below 10 mg/L. The CCWT currently has three variations of for [Nitrogen Removing Biofilters](#) (NRBs) that are adaptable to site constraints, depth to groundwater and degree of desired nitrogen removal.

The CCWT (the 'Center') was recently granted pilot status by Suffolk County Department of Health Services for permitting two of its three designs for NRBs. The two designs being piloted are the unlined and lined NRBs. Eight installations of unlined NRBs have been installed to meet the minimum requirements for the pilot evaluation to attain provisional status for this design. The eight installation of the lined NRBs are expected to be completed in the fall. The Center expects its third NRB design, a sand bed coupled to a box filled with woodchips, will complete experimental phase testing by year end.

NRBs remove nitrogen and other pollutants from wastewater by nitrification in a sand bed followed by denitrification in an anoxic (oxygen free) sand/woodchip biofilter. Woodchips provide a source of carbon which converts nitrates to nitrogen gas that is then safely released into the atmosphere. Lined systems keep the woodchips completely saturated whereas unlined systems expose woodchips to repeated wet/dry cycles. The Center has monitored such systems in-ground for five years and believes continuous saturation results in improved denitrification in lined NRBs compared to unlined NRBs but at a higher cost of installation.

During and following the COVID pandemic, the Center has observed higher nitrogen (TKN) in septic influent in its Suffolk County installations. In spite of the higher nitrogen loading, the Center's systems continue to achieve much lower nitrogen in final effluent than required by Article 19.



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NYS Wastewater Research and Innovation Facility

Experiments at the Center's Wastewater Research and Innovation Facility (WRIF) are ongoing with the aim of continually improving the design of the Center's wastewater treatment technology. Raw wastewater from a Suffolk County Department of Public Works' sewage pumping station is used to test design concepts and modifications to improve treatment designs.

At the WRIF, there is ongoing testing of next generation (Nex Gen) NRBs including NRB2.0 and NRB4.0, both of which aim to reduce the size of the systems. NRB2.0 is using recirculating features to shrink the size of the treatment system and package it into a box unit which can be inexpensively delivered onsite. NRB4.0 downsizes a process adopted from municipal wastewater treatment facilities which cycles between nitrification and denitrification to promote denitrification. Another experiment at the WRIF is assessing the benefits of using biochar additions to the NRB's sand bed to enhance nitrification of wastewater ammonia.

Early in 2021 the Center completed an experiment which tested the removal of contaminants of emerging concern (such as some pharmaceuticals and personal care products) using variations of the NRB process technology. This paper is expected to be published in an engineering journal shortly.

The Center is presently expanding its operations at the WRIF, which includes installing systems at the facility for testing of experimental designs. In addition to its own pilot projects, the Center anticipates working with commercial partners to test systems intended for introduction in Suffolk County.



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Shinnecock Indian Nation Septic System Upgrades

The Center continues to collaborate with U.S. Indian Health Services (IHS) to install NRBs at the Shinnecock Nation in Southampton. These installations include both unlined NRBs, woodchip box NRBs and several experimental systems using woodchip biofilters on a gravity-only basis. Installations at the reservation enable the Center to increase the number of in-ground replicates of each design which allows the Center to build a more comprehensive database, tracing system performance for these designs. Also, IHS has been creative and flexible in testing innovative designs especially in connection with gravity based solutions.

Nitrogen Sensor

A nitrogen sensor was developed by SUNY Stony Brook University faculty member Dr. Qing Zhu which simultaneously measures nitrate and ammonia in wastewater and final treated effluent. The sensor design has recently completed an ISO (International Organization for Standardization) field verification test sponsored by the EPA and assessed by global engineering consultants VerifiGlobal and Battelle. There are plans for the nitrogen sensors to be used in Suffolk County through a partnership with The Nature Conservancy, to monitor innovative/alternative on-site treatment systems. Also, the Center and Dr. Zhu are now exploring different avenues for commercialization of the sensor.

Bulkhead Permeable Reactive Barrier at Hampton Bays

Funded by the [Community Preservation Fund](#) and the Town of Southampton the first full-scale bulkhead [Permeable Reactive Barrier](#) (PRB) was installed in 2020 in Hampton Bays. The project is a collaborative effort between the [Cornell Cooperative Extension Marine Program](#) (CCE) and the Center for Clean Water Technology. The 100 feet wide and 10 feet deep woodchip-based subsurface barrier intercepts nitrogen polluted groundwater flowing towards Shinnecock Bay and provides conditions conducive to microbial mediated denitrification. The PRB is expected to remove more than 1.5 metric tons of nitrogen over the next 20 years.

Groundwater nitrogen removing technologies will be critical to reduce eutrophication of Long Island’s coastal waters, because even if all septic systems on Long Island would be replaced innovative/alternative onsite wastewater treatment systems within the next few years, nitrogen that has accumulated in Long Island’s aquifer over the past decades will continue to seep into our coastal bays in coming decades. Permeable reactive barriers have the potential to be a promising approach to deal with this “legacy nitrogen.”



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