Optimizing Nitrogen Removal from Stormwater

EPA Region I has contracted with the University of New Hampshire Stormwater Center (UNHSC) to conduct a two-year research project to optimize nitrogen removal from stormwater treatment systems (best management practices (BMPs)). Stormwater management and nitrogen removal are top priorities for Region I because:

> ➢ Stormwater is a significant contributor to two-thirds of water quality impairments in the Northeastern United States, and nutrients (both phosphorus and nitrogen) are responsible for some the nation's most intractable water pollution problems, including loss of aquatic life and habitat, recreation, and shellfishing uses.

> ➢ Regionally, nitrogen is a key pollutant in water quality impairments of Long Island Sound (CT & NY), Narragansett Bay (RI & MA), Buzzards and Cape Cod Bays (MA) and Great Bay, (NH).

> ➢ EPA administers the NPDES Program and is responsible for issuing stormwater permits for the states of MA and NH, and needs data to assist stormwater dischargers (including stormwater permit holders and applicants) in designing appropriate treatment systems for *improved water quality*.

The study design includes both bench-scale and full-scale assessments of stormwater BMP total nitrogen (TN) removal using the existing infrastructure of the UNHSC research facility in Durham, NH[1]. During the first year (2011), UNHSC will conduct laboratory column studies on 1-3 different filter media selected from bioretention soil mix blends to optimize filter media composition.

Pending availability of funding for the second year, promising media blends will be used in field tests by installing two constructed BMPs, and testing those BMPs over the course of a year of precipitation events and weather. UNHSC will examine additional systems across the range of annual climate conditions during a 12 month period for a total of 20 events. UNHSC will assess BMP performance by collecting and analyzing water samples from the two systems with optimized designs, and from other BMPs at the UNHSC facility that show promise for nitrogen removal, potential for optimization, or widespread applicability.[2]

This nitrogen study will build on previous research from UNHSC used to support EPA Region 1's regionally-calibrated model (the Best Management Practice Decision Support System (BMPDSS)) developed for estimating stormwater BMP removal of total suspended solids (TSS), total phosphorus (TP), and zinc.[3] So far, the BMPDSS model results have been very useful in addressing BMP designs for stormwater discharges to freshwaters, where phosphorous is often the limiting nutrient. In 2010, a model interface tool was developed which makes BMP performance estimations easy and fast.[4]

The UNHSC nitrogen removal research results are important because nitrogen is usually the limiting nutrient in coastal stormwater issues, total nitrogen is more complex than TSS, TP and metals, and BMPs currently have mixed success at removing nitrogen from stormwater. The regional model can be adjusted for use in other geographic locations by changing the precipitation record input component.

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[1] http://ciceet.unh.edu/unh_stormwater_report_2007/performance_evaluation.php

[2] Analytical testing of water samples will include: total nitrogen (plus 4 analytes), total phosphate, total zinc, total petroleum hydrocarbons-diesel range, and total suspended solids (including particle size distribution). Real-time water quality parameters will include pH, dissolved oxygen, conductivity, temperature, turbidity, and flow. [Roseen, R. "Evaluation and Optimization of the Effectiveness of Stormwater control Measures for Nitrogen Removal", proposal submitted to EPA Region 1, 2010.]

[3] Tetra Tech 2008. *Stormwater Best Management Practices (BMP) Performance Analysis*, December 2008.
http://www.epa.gov/region1/npdes/stormwater/assets/pdfs/BMP-Performance-Analysis-Report.pdf

[4] Tetra Tech, 2010. *BMP Performance Extrapolation Tool (BMP-PET) for New England*, March 2010

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