Nitrogen and phosphorus are often the limiting nutrients for marine and freshwater systems respectively. Additionally, stormwater often contains elevated levels of bacterial pathogens which can pollute the receiving water body, causing adverse health impacts on humans and wildlife that interact with the water body. The reduction of limiting nutrients and pathogens is a common primary target for stormwater best management practices (BMPs). Traditional BMPs, such as retention/detention treatment ponds require large footprints and may not be practical in ultra-urban environments where above ground space is limited. Upflow filters utilizing biosorption activated media (BAM) that can be placed underground offer a small footprint alternative. Additionally, BAM upflow filters can be installed at the discharge point of traditional stormwater ponds to provide further treatment.

Three different BAM mixtures in a bench scale upflow filter configuration were compared for the parameters of nitrogen, phosphorus, total coliform, E. coli, and heterotrophic plate count (HPC). Additionally, genetic testing was conducted using Polymerase Chain Reaction (PCR), in conjunction with a nitrogen mass balance, to determine if Anammox was a significant player in the nitrogen removal. The columns were run at both 22-minute and 220-minute Empty Bed Contact Time (EBCT).

All of the BAM mixtures analyzed removed nitrogen, phosphorus, and total coliform but BAM #1 was superior for all three parameters. During the 22-minute EBCT, BAM#1 achieved removal efficiencies of 49%, 23%, and 76% for total phosphorus, total nitrogen, and total coliform respectively. During the 220-minute EBCT, BAM#1 achieved removal efficiencies of 43%, 50%, and 96% for total phosphorus, total nitrogen, and total coliform respectively. All BAM mixtures experienced an increase in HPC. Additionally, PCR analysis confirmed the presence of Anammox in the biofilm and via mass balance it was determined that the biological nitrogen removal was due to endogenous denitrification and Anammox.

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Approved for distribution by Andrew A. Randall, Committee Chair, on October 14, 2019.

The public is welcome to attend.