Performance Analysis of Two Relatively Small Capacity Urban Retrofit Stormwater Controls

University of New Hampshire Stormwater Center – July 2015

Submitted to EPA Region 1

Executive Summary

This study introduces data on an innovative bioretention design with a water treatment residual (WTR) admixture filter media and an internal storage reservoir and an undersized linear subsurface gravel wetland with an internal storage reservoir sized to optimize both phosphorus and nitrogen removal. In this study systems retrofitted into existing developed areas were sized at less than the water quality volume (undersized systems). The bioretention system was constructed in the town of Durham, NH in summer 2011 and the subsurface gravel wetland system constructed in a linear drainage right of way in a residential neighborhood of Durham, NH in the fall of 2013. Data are being used by EPA Region 1 to calibrate and verify SCM models for developing long-term cumulative performance estimates for these SCM for design capacities ranging from small to large.

Sediment and metal removals for both undersized systems were high with median removal efficiencies (RE) in the Subsurface Gravel Wetland (SGW) system (SGWSC#1) of 75% for both Total Suspended Solids (TSS) and Total Zinc (TZn). The Durham Bioretention (Durham Bio) (IBSC#2) recorded median RE of 86% for TSS and TZn. Total Phosphorus (TP) RE were higher than conventional Bioretention systems with the SGW system achieving a median RE of 53% and the Durham Bio achieving a median RE of 40% for TP. Orthophosphate (OrP), the most bioavailable form of phosphorus, was generally reduced in the SGW system, with median RE of 53% and effluent concentrations consistently below 0.06 mg/L. The Durham Bio system did achieved moderate reductions of OrP concentrations with median RE of 38% and effluent concentrations consistently below 0.02 mg/L. Both systems reduced total nitrogen by approximately 20% (23% for SGW and 21% for Durham Bio) with median effluent concentrations of 1.4 mg/L. Reduction in nitrate was limited to storms that were at or below the design storm event in the SGW only, median effluent concentrations for the SGW and Durham Bio were 0.3 mg/L and 0.2 mg/L, respectively.

Performance for all pollutants with the exception of dissolved nitrogen species approached performance expectations for conventionally sized systems despite being “undersized” by 90% for the SGW and by 70% for the Durham Bio as compared to conventional sizing methods.