Preliminary Assessment of Nitrogen Treatment by a Dry Detention Basin and Retrofit Stormwater Wetland

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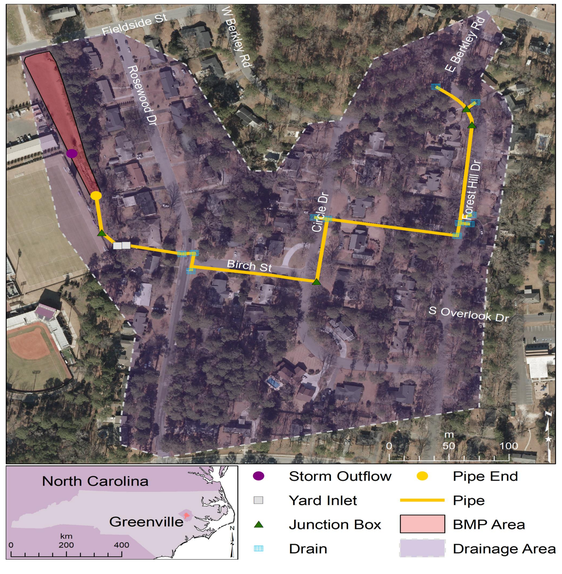
Abstract

Dry detention basins (DB) are designed to slow the delivery of urban runoff to streams. However, prior studies have shown that they are not very efficient at nitrogen removal, especially in comparison to stormwater wetlands. The purpose of this study was to compare the nitrogen removal efficiency of a dry basin that exhibited some wetland characteristics (wetland plants and organic accumulation in soil near inlet) before and after conversion to a stormwater wetland. Multiple inflow and outflow samples were collected during 8 storm events to determine event mean concentrations of TN entering and exiting the DB. After the conversion to a stormwater wetland, the event mean concentration of TN was determined at the inlet and outlet during 4 storms. The median concentration of TN exiting the DB was 21% lower relative to the inflow TN concentration, thus the DB was performing better relative to the 10% reduction expected based on State guidelines. Outflow from the wetland had a median TN concentration that was 46% lower relative to inflow concentrations. Most of the TN exiting the DB and wetland was in the dissolved form. More sampling is required to provide a more robust comparison of the TN treatment efficiency of the wetland and DB. This is an ongoing study.

Introduction

- A dry retention basin on the campus of East Carolina University receives drainage from a ~39-acre watershed
- Watershed mostly composed of residential development and has ~30% impervious surface
- Dry basin discharges to the Greenville stormwater conveyance system
- The stormwater conveyance discharge to Greens Mill Run, an impaired stream and tributary to the Tar River, which is nutrient-sensitive



Introduction

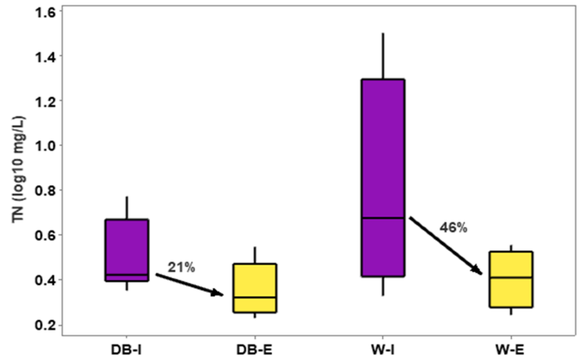
- Inflow to the dry basin occured via a 42" culvert, outflow was via an 8" diameter initial pipe with 10" diameter pipe as a second outflow
- Dense vegetation comprised of mostly *Typha* sp (cattails) was observed near the dry basin inlet
- A transition in vegetation & soil moisture occurs north of the outlet where grass is dominant, and the soil is drier due to higher elevation

Methods

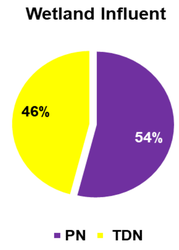
- The dry basin was converted to a stormwater wetland by removing the dense cattails and constructing deep pools near the inlet
- A new outlet structure was built on-site and designed to increase the hydraulic residence time of stormwater
- Wetland plants were installed in the deep pools and shallow water areas

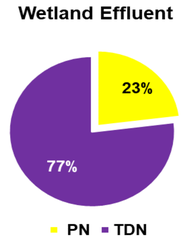
- Inflow and outflow samples were collected multiple times during storm events for the dry basin (n = 8) and wetland (n = 4)
- Samples were analyzed for total nitrogen (TN), which was comprised of particulate nitrogen and dissolved nitrogen
- Inflow concentrations of TN were compared to the outflow concentrations to determine if efficiency of the dry basin and wetland

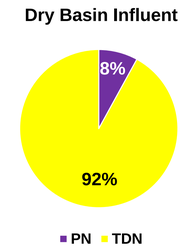
Results and Discussion

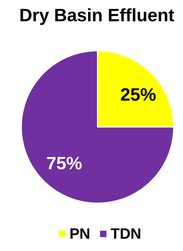


- Median concentrations of TN in dry basin outflow (2.1 mg/L) were 21% lower relative to inflow (2.65 mg/l)
- Median concentrations of wetland outflow (2.58 mg/L) were 46% lower relative to inflow (4.74 mg/L).
- The TN removal efficiency of the wetland was greater than the dry basin, but inflow and outflow TN concentrations were higher for the wetland.
- Additional sampling is being conducted so there were will be an equal number of storms capture for the dry basin and wetland.









- Outflow from the dry basin and wetland were mostly comprised of dissolved rather than particulate nitrogen. Inflow to the wetland was mostly dissolved nitrogen, while dry basin inflow was mostly particulate.

Acknowledgements

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