



TRB 2016 Summer Workshop | July 28, 2016

*Optimizing the Nutrient Removal
Performance of Stormwater BMP's
Within the Right-Of-Way*



Brian Lipscomb, PE



Optimizing the Nutrient Removal Performance of Stormwater BMP's Within the Right-Of-Way

- Introduction
 - Highway Stormwater Program (HSP)
 - NPDES
- Challenge
 - BMP's in a linear environment
- BMP Retrofits
 - R-4436EG (NC50 & NC98 Interchange)
 - Planned (I-40 & I-95 Interchange)
- Research
 - RP 2016-18
- Goals
- Q&A



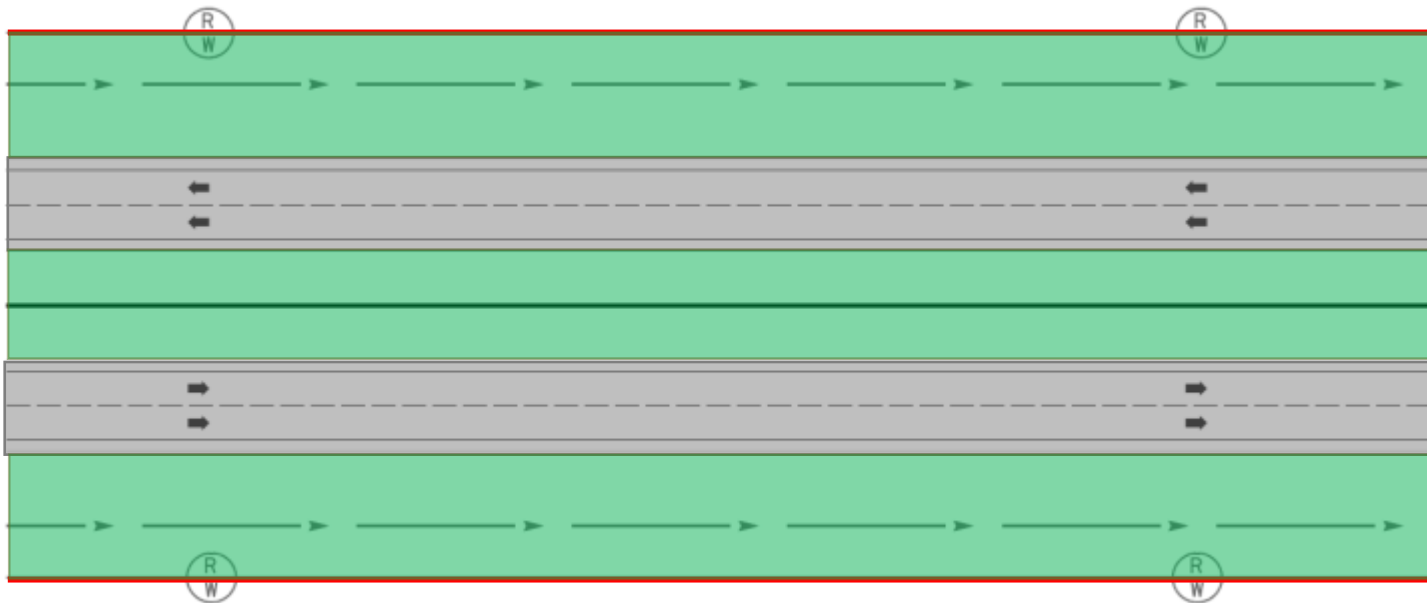
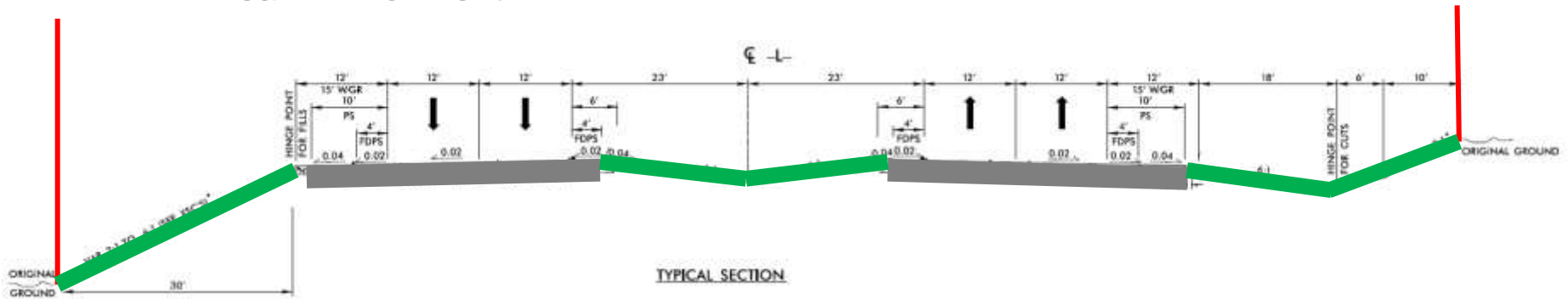
Highway Stormwater Program

- Co-managed by the Hydraulics Unit and the Roadside Environmental Unit
 - Comply with the NPDES Permit (NCS000250)
 - 4th Term (10/1/2015 - 9/30/2020)
- My primary responsibilities
 - BMP Retrofit Program
 - Post Construction Stormwater Program (PCSP)
 - BMP Toolbox
 - Driven by:
 - Field Experience (BMP Retrofit Program)
 - New Research
 - New Technology



The Challenge

- Available land for BMPs
 - Linear Environment



Solution

- Typical Swale section
 - Good for treatment
 - Limited greatly by flow characteristics (flow, velocity etc.)
 - Little to no volume reduction



What Can We
Do To Optimize
Performance?

Solution

- Research project with **NCSU-BAE**
 - Part of the research included incorporating checkdams

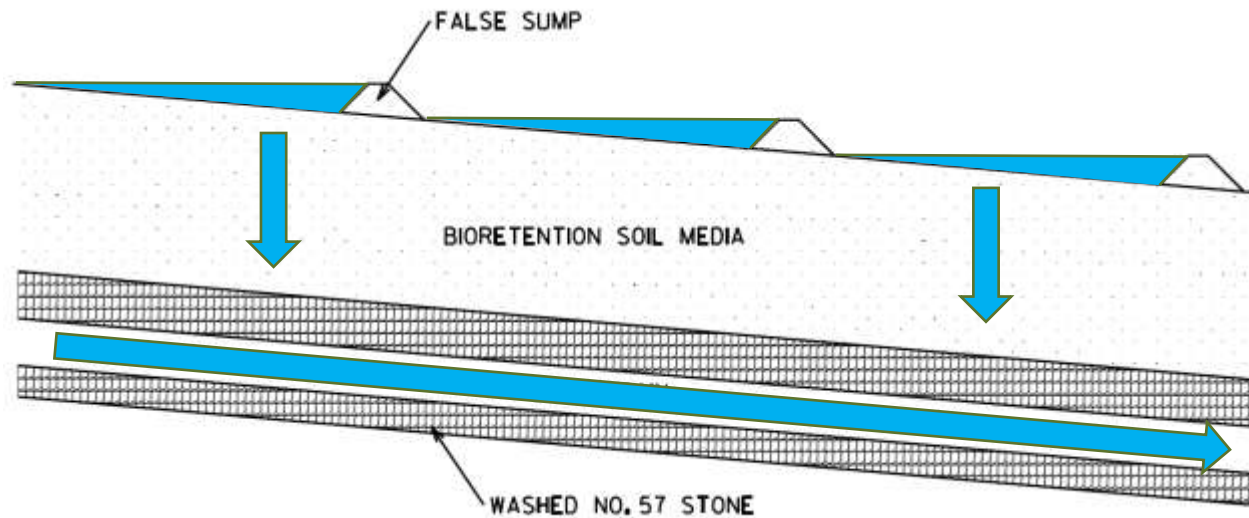
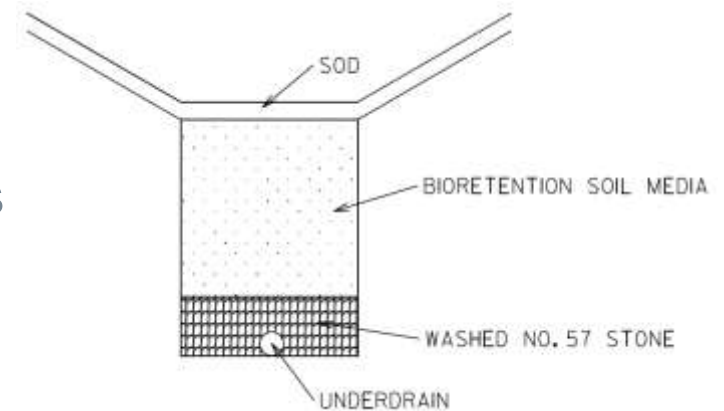


- **Mixed Results**
 - No significant difference in pollutant concentration
 - Didn't measure volume at coastal site
 - Volume important to determine actual Pollutant Load
- **Theory: Should see volume reduction in highly permeable soils.**

Solution

- Bio-swale

- Incorporate highly permeable soils
 - Infiltration capability
 - Filtration
- False Sumps
 - Encourage shallow ponding thus volume capture
 - Benefits over check dams
 - Clear Recovery Zone
 - Mowable



BMP Retrofits

NC 50 & NC 98 Interchange in Wake County, NC

- Falls Lake Watershed
- Piedmont Site - Clay Soils



R-4436EG Stormwater BMP Retrofits

BMP Retrofits

NC 50 & NC 98 Interchange in Wake County, NC

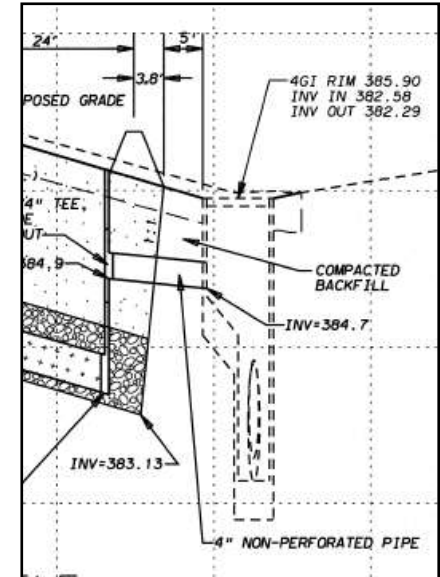
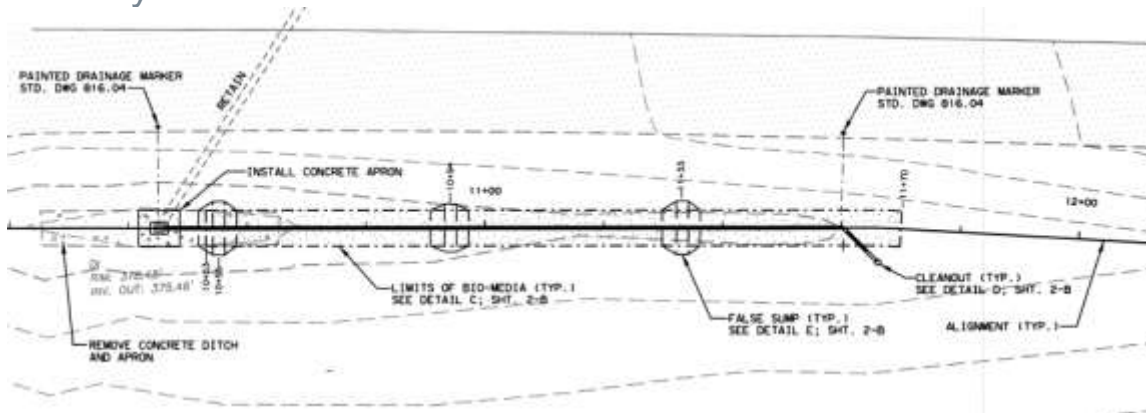
- Existing Conditions
 - Concrete lined ditch conveyance
 - Incised and Eroded Outlets and Downstream Conveyances



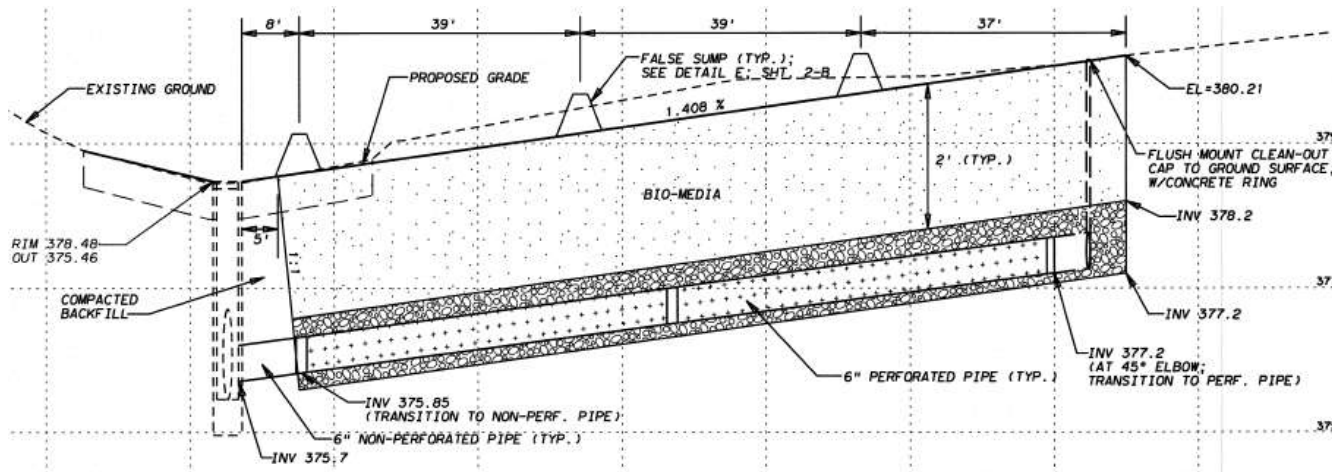
BMP Retrofits

NC 50 & NC 98 Interchange in Wake County, NC

- 7 Bio-Swales (2 w/ Internal Water Storage (IWS))
- 2 Swales
- 2 Dry Detention



With IWS
(Upturned Underdrain)



No IWS
(Traditional Underdrain)

BMP Retrofits

NC 50 & NC 98 Interchange in Wake County, NC



BMP Retrofits

I-40 & I-95 Interchange in Johnston County, NC

- Representative of Coastal Site
- Sandy Soils



BMP Retrofits

I-40 & I-95 Interchange in Johnston County, NC

- Existing Loops have Curb & Gutter
 - Runoff doesn't get any treatment
- Proposed new Catch Basins that outlet to new Bio-Swales
 - Treatment through vegetation, sedimentation and filtration



Research

RP 2016-18 'Swale Optimization Study'

- 'Lab' tests at NCSU – SECREP
 - 6 Bio-Swales constructed
 - 3 lengths
 - 2 slopes
 - With and without check dams/false sumps
 - Controlled Pollutant Concentrations
 - Controlled Flow Rates
- Field Tests & Verification
 - NC 50 & NC 98
 - I-40 & I-95



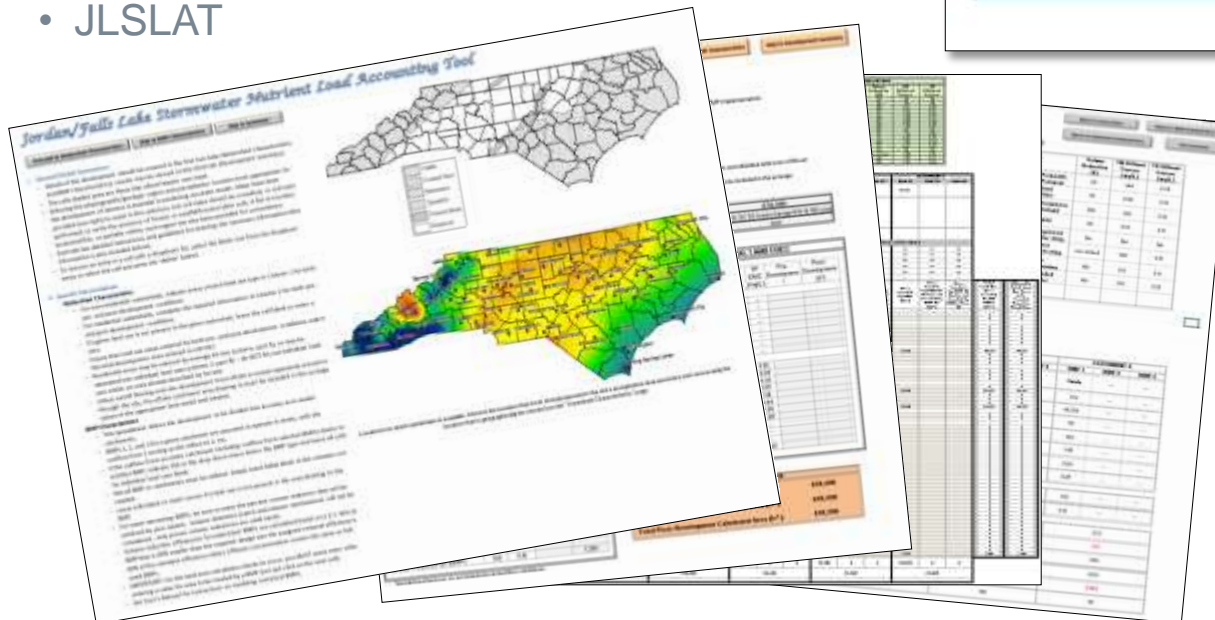
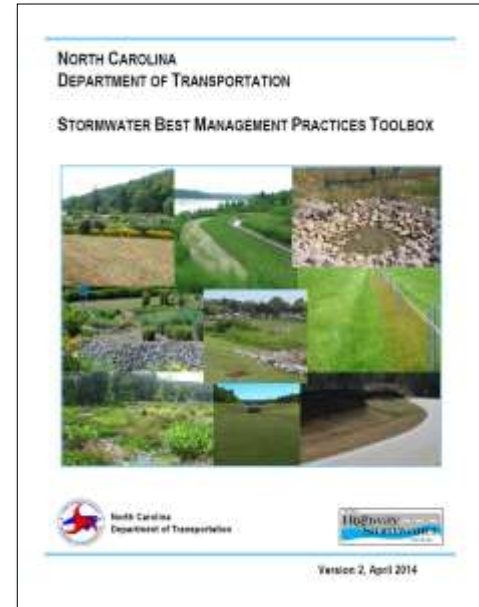
Goals

Toolbox Chapter – Design Guidance

- Length of Bio-swale
- Slope
- Depth media
- Flows

Means for Crediting

- JLSLAT



Questions?



Brian S. Lipscomb, PE

Hydraulics Unit, Highway Stormwater Program
NC Department of Transportation

919-707-6735

blipscomb@ncdot.gov

1590 Mail Service Center
Raleigh, NC 27699-1590

