New Storm Water Control Measure Development: Case Studies and Challenges

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Low Impact Development:
is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features......(US EPA)

Ecological Restoration:
the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.
(Society for Ecological Restoration)

Ecological Engineering:
integrating ecology and engineering... design and construction of sustainable ecosystems... to integrate society with the natural environment for the benefit of both. (Howard Odum)

Novel Ecosystem:
ecosystem that has been heavily influenced by humans but is not under human management Nature (2009) 460: 450-453
Regenerative Stormwater Conveyances (RSCs)

-----Utilize a series of shallow aquatic pools, riffle/grade controls, native vegetation, and an underlying sand/wood chip substrate in degraded flowways (ecological restoration and ecological engineering)

-----intercept stormwater, and filter pollutants from the flow of stormwater in channels that have been incised and degraded by urban runoff (stormwater/LID and novel ecosystems).

Regenerative Stormwater Conveyance (RSC) History and Development

• Created as a remedy for highly eroded stormwater outfalls and conveyance channels

• Conceptualized in Maryland in 1990’s and early 2000’s

• Design development and refinement, water quantity/quality monitoring data was collected and analyzed

• Adoption as SCM in Maryland for nutrient reduction credit in 2014
Site Description

<table>
<thead>
<tr>
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<th>Contribution</th>
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<tbody>
<tr>
<td>2-ft Contours</td>
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<td>Watershed</td>
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<table>
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<th>Description</th>
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Alamance County

Hydrology
Storm Summary

• Monitored 43 inflow producing events between July 2013 and June 2014
• Max Rainfall Depth = 81 mm, 15 cm/hr
  – Inflow Volume = 660 m³, peak flow = 246 L/s
  – Outflow Volume = 235 m³, peak flow = 102 L/s

  **64% Volume Reduction**
  **58% Peak Flow Reduction**

  **Median Volume Reduction = 84%**
  **Median Peak Flow Reduction = 80%**

Alamance County

Water Quality
Storm Summary

• Monitored 20 water quality events between July 2013 and June 2014

• Inflow concentrations
  – TN: median = 2.40 mg/L, range = 1.59 to 9.96 mg/L
  – TP: median = 0.44 mg/L, range = 0.24 to 2.14 mg/L
  – TSS: median = 69.1 mg/L, range = 8.82 to 297 mg/L

• Outflow concentrations
  – TN: median = 1.76 mg/L, range = 1.05 to 3.85 mg/L
  – TP: median = 0.34 mg/L, range = 0.18 to 1.23 mg/L
  – TP: median = 11.56 mg/L, range = 7.57 to 68.5 mg/L
Sand Seepage Berms

• used to divert high flows from the conveyance channel to the floodplain, where it is temporarily stored

• much of the water seeps through the sand berm. by gravity flow, back to the channel

• It is filtered as the process proceeds

• Has been incorporated into stormwater and stream restoration designs in Maryland
Hydrographs during individual storms
WILELINOR

Red = upstream conveyance channel
Black = regenerative stream channel
Hydro-Modification

Source: Palmer and Filoso, 2009

Questions?