Infiltration Stormwater Control Measures

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Overview of Presentation

• NCDENR Infiltration Devices
• Infiltration and the SHWT
• Innovative infiltration systems
• Future look at infiltration
Infiltration Devices

- Infiltration trenches
- Infiltration basins

Adelphi Road, Maryland (Credit: Low Impact Development Center)

University of Minnesota
• ADVANTAGES

– Reduce frequency of flooding by reducing volume and through detention
– Groundwater recharge
– Maintain stream recharge
– Pollutant removal is generally good

• DISADVANTAGE

– Tend to clog if not maintained
– Requires relatively quick-draining soils (0.52 in/hr)
– Potential nasty pollutants: groundwater contamination?
Like all infiltration BMPs...
Infiltration trench

- Large crushed stone as storage media, or concrete vaults
- Pre-treatment
- Parking lot common
- 4” (typ) clean sand
- 1-2’ Undisturbed, unsaturated in-situ soil
- ~Level (0-0.05% grade)
- No outlet

Adapted from Schueler et al., 1992)
Infiltration basins are offline

- Flow splitting, only design storm goes to system
- No primary overflow structure
- Vegetated filter strip as emergency bypass
Infiltration trench

8’ max
Infiltration trench

Parking lot infiltration trench (Courtesy: EPA)

http://stormwater.files.wordpress.com/2007/05/infiltration-trench
Infiltration Basin

• Designed with bypass (unless they infiltrate exceptionally well)
• Shall not receive more than 2.0 acre-inches of runoff
• >0.52 in/hr *in-situ* infiltration rate
Infiltration Accreditation

- TSS – 85%
- Total Nitrogen – 30%
- Total Phosphorus – 35%
- Compare to wet pond...
  - 25% Nitrogen
  - 40% Phosphorus
- Big difference... Volume reduction
# Infiltration Devices

- From the NCDENR Stormwater BMP Manual (Ch. 16):

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Infiltration Devices

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Infiltration basin

- **BASIN BOTTOM**
  - 4” MIN. CLEAN SAND

- **2’ MIN.**
  - 4” MIN. CLEAN SAND
  - 1’ MIN. UNDISTURBED IN-SITU SOIL

- **SHWT**
Infiltration basin

- BASIN BOTTOM
- 4” MIN. CLEAN SAND
- 2’ MIN.
- SHWT
Infiltration basin

BASIN BOTTOM

4" MIN. CLEAN SAND

Local groundwater mound

Capillary fringe

SHWT
Infiltration basin

- Local groundwater mound
- 4" MIN. CLEAN SAND
- Capillary fringe
- SHWT
State Technical Review Workgroup: Why the 2-ft separation is staying

1. Existence of capillary fringe above the SHWT can reduce the depth of unsaturated soil zone to
2. Local water table mounding effects can prevent infiltration from occurring in time for the next storm
3. No evidence or precedent exists to suggest a smaller water table requirement will meet infiltration basin function.
Leaky Wet Retention Ponds as Infiltration Basins?

- NCSU Study in Fayetteville on HSG A Soils
- Can wet ponds be credited with ET and infiltration hydrologic fates?
- Potential future study of water table/pond interaction
Leaky Wet Retention Ponds as Infiltration Basins

Bingham Pond Fate of Inflow

- 0.4–1.9 inches per day
- 100% volume reduction in Sept, Oct 2013!
Innovative Infiltration: Market at Colonnade (Raleigh, NC)

Why is this innovative.....?

Underground infiltration gallery
Innovative Infiltration:
*Market at Colonnade (Raleigh, NC)*
Innovative Infiltration: 
*Market at Colonnade (Raleigh, NC)*

(not to scale)
Innovative Infiltration:
*Market at Colonnade (Raleigh, NC)*

Median Runoff Volume

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</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>50</td>
</tr>
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<td>0</td>
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- **Conventional Development**
  - Inflow: 150 m$^3$
  - Outflow: 100 m$^3$

- **LID**
  - Inflow: 200 m$^3$
  - Outflow: 10 m$^3$

Includes rainwater harvesting,

[www.bae.ncsu.edu/stormwater](http://www.bae.ncsu.edu/stormwater)
Innovative Infiltration:  
*Dune Infiltration System (Kure Beach, NC)*

- Reduce outfall discharge to ocean
- Use dunes as a sand filter
- Reduces exposure of swimmers to harmful bacteria
Innovative Infiltration:

Dune Infiltration System (Kure Beach, NC)

- 0.25 m (0.83 ft) Ø PVC CLEANOUT
- DISTRIBUTION PIPE INPUT
- STAGE MEASUREMENT WELL
- 0.45 - 0.75 m (1.5 - 2.5 ft)

- 26 STORMCHAMBERS™ (ONE 12 CHAMBER BANK AND ONE 14 CHAMBER BANK)
- DUNE SURFACE
- STAGE MEASUREMENT WELL

- 0.25 m (0.83 ft) Ø PVC CLEANOUT
- DISTRIBUTION PIPE INPUT
- 0.6 m (2.0 ft)

- SEDIMENTRAP™ TOP OF TRAP INSTALLED Flush with gravel layer
- NYLON MESH ON TOP OF GRAVEL LAYER

- THE DIS CONSISTS OF TWO, INDEPENDENT BANKS OF CHAMBERS. A PARTIAL VIEW OF ONE BANK IS SHOWN HERE

- GRAVEL LAYER
  0.15 TO 0.3 m (0.5 TO 1.0 ft) THICK UNDER CHAMBERS
  EXTENDS 0.6 m (2.0 ft) OUTWARDS FROM CHAMBERS
  0.3 m (1.0 ft) ON SIDES OF CHAMBERS
Diverted 80% of the stormwater away from the beach (roughly 3.8 million gallons in the first year)

Most importantly - GW concentrations similar to control at dune beach interface (6 MPN/100 mL)
Infiltration in the Future

• Small-scale, distributed system benefits:
  – Cumulatively cheaper long-term cost
  – Reduced local mounding

• More use due to now due to hydrologic match accounting

Bellingham, WA
Summary

• Infiltration devices are one of many devices used to be compliant with state stormwater standards
• ...but ALSO count as an LID practice! (Volume reduction)
• For the time being, still recommend at least 2-foot separation to SHWT
• Many innovative ways to create infiltration devices
• Benefits of smaller scale systems
• Future leniency?