Green Infrastructure Working Group: Beneficial Use of Stormwater

April 10, 2015
Agenda

Arrivals & Introductions 11:00
Staff presentation 11:15
  Recap of WPO Phase 2
  National models
Retain stormwater on-site
  • How much stormwater to retain?
  • Redevelopment & high impervious cover
  • On-site best practices
Small group discussion 12:15
Large group summary & recap 1:15

Note: There will be short breaks both before and after the small group discussion
Challenges & Opportunities:
Connecting the Dots...

1. Can incorporate natural systems & rainwater storage in designs to offset water use, preserve quality of life
2. Practical methods & models have already been implemented in other cities

BUT...

Heat
Drought
Population
Urbanization

Rainfall
Surface &
Groundwater
Natural Land Cover
Recap of WPO Phase 2 Work

• 9 public stakeholder meetings in 2014 to discuss topics related to green stormwater infrastructure
  – How to optimize use of stormwater runoff volume (e.g., conservation & infiltration)
  – Reviewed best practices to incorporate into the Environmental Criteria Manual
  – Stakeholder conclusion: require beneficial retention and/or re-use on-site for new & re-development
  – Staff to expand research on national models
What Does Austin Do Now?

• **Water Quality Requirement**
  - Must capture and treat a portion of a site’s stormwater runoff (based on impervious cover)
  - Payment-in-lieu option in Urban Watersheds

• **Innovative Water Management**
  - 2010 amendment to the Landscape Ordinance
  - Must direct stormwater runoff to 50 percent of required landscape area
  - Option to protect undisturbed natural area instead

➤ Integration of two provisions not required
Two Overall National Models

1. Focus on infiltration and baseflow
   - Required to infiltrate amount equal to average annual recharge volume for an undeveloped site

2. Focus on keeping stormwater on-site
   - Keep stormwater runoff from leaving the site
   - Use a combination of infiltration, harvesting, reuse, evaporation, and/or evapotranspiration
   - Reduce the effective impervious cover

➢ Different approaches for redevelopment
1. Infiltration & Baseflow

- Pioneered by Massachusetts and Maryland
  - Also used by Connecticut, Vermont, New Jersey, Wisconsin
- Portion of water quality volume infiltrated on-site with structural or non-structural controls
- Based on Hydrologic Soil Group (HSG)
  - Multiply water quality volume by soil specific recharge factor for A, B, C, & D soils
  - Maryland: A = 0.38; B = 0.26; C = 0.13; D = 0.07
- Exceptions for pollution hotspots, karst, areas with shallow water table, redevelopment
2. Retain Stormwater On-Site

- Used by multiple jurisdictions across the country
  - New York, Washington D.C., West Virginia, Delaware, Tennessee, Kentucky, Minnesota, Montana, New Mexico, California
- Based on a certain size/frequency of storm event
- Same basic concept as requiring an effective impervious cover limit
  - How runoff from impervious cover is reduced to levels of runoff from an undeveloped site
- Exceptions for redevelopment, unique conditions
“the Cityscape as a Water Supply”

• LCRA: Current drought is the most severe in the history of the Highland Lakes (link)

• Austin Water Resource Planning Task Force
  – Cityscape can be designed and retrofitted to function as a water supply source (demand reduction)
  – Capture, store, & treat rainwater for beneficial use

• WPO Phase 2 Stakeholder support for same

• Given these challenges & goals, we need to focus on more than just infiltration & baseflow
  ➢ Retain stormwater on-site for beneficial use
Retain Stormwater On-Site: Questions to Answer

• How much stormwater to retain on-site?
• How to handle redevelopment and high levels of impervious cover?
• Are there best practices we would always want to see implemented on-site?
How much to retain?
National Benchmarking

- Percentile of rainfall events
  - Ranges from 80\textsuperscript{th} percentile to 95\textsuperscript{th} percentile (e.g., 90\% of rainfall events are less than one inch)
  - Equates to a required depth in inches (e.g., first inch of rainfall will be retained on site)
  - Retention volume is based on required depth, site area, and impervious cover
  - Some jurisdictions factor in runoff coefficients for different types of land covers on the site (e.g., impervious cover, disturbed pervious cover)
How much to retain?
National Benchmarking

• Other options for methodology
  – Percentage of average annual runoff volume
    (e.g., capture 80% of the annual runoff volume)
  – Match the runoff volume to undeveloped condition for a certain design storm
    (e.g., 1 year, 24 hour storm)
  – Set amount to retain on-site equivalent to the required water quality volume
How much to retain?
Data from Austin

- Austin percentiles for rainfall events (24-hour)
  - Austin’s water quality volume = “half-inch-plus”
    - Capture and treat first half inch of runoff plus an additional 1/10 inch of runoff for each 10 percent increase in impervious cover over 20 percent
    - Half-inch-plus captures about 94 percent of the average annual runoff volume

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Depth (inches)</th>
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<td>85</td>
<td>0.75</td>
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<tr>
<td>90</td>
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<tr>
<td>95</td>
<td>1.50</td>
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How much to retain?
Data from Austin

- Water Quality Volume (Half-Inch-Plus)
- 95th Percentile Rainfall Event
- 90th Percentile Rainfall Event
- 85th Percentile Rainfall Event
How much to retain?

Data from Austin
Redevelopment and High Impervious Cover

- Can be challenging to retain stormwater on-site for highly impervious sites
- Other jurisdictions offer a wide variety of alternative standards
  - Reductions in required volume
  - Payment-in-lieu options
  - Complete exemption
Example: 80% Impervious Cover Site

Conventional Sand Filter
2.3% of Site Area
4 feet deep

**Assumes half-inch-plus capture depth and criteria manual design standards**
Example: 80% Impervious Cover Site

Rain gardens = 9.2% site area
Moderate infiltration rate

Rain gardens = 18.3% site area
Slower infiltration rate

**Assumes half-inch-plus capture depth and criteria manual design standards**
Example: 80% Impervious Cover Site

- Porous pavement on 60% of parking lot
- Rain gardens for remaining 40%
- Green roof and 7,500 gal. cistern
  - Extra cistern for long-term storage
- Rain garden for remaining 50% of roof

**Assumes half-inch-plus capture depth and criteria manual design standards**
Rain garden size by percent IC:

Moderate infiltration rate

**Assumes half-inch-plus capture depth and criteria manual design standards**
Rain garden size by percent IC:

Slower infiltration rate

**Assumes half-inch-plus capture depth and criteria manual design standards**
Washington, D.C.

- Requires 1.2 inches (90th percentile event) to be retained on-site for new development
- Reduces to 0.8 inches (80th percentile event) for “major substantial improvement activity”
- Where on-site retention proves infeasible, may reduce volume retained on-site by up to 50%
  - Achieve off-site through payment-in-lieu to D.C. or through purchase of credits from market
Tennessee

- Requires 1 inch to be retained on-site
- Incentive standards allow a site to reduce the 1 inch standard by 10%, up to a maximum of 50% (0.5 inches always retained)
  - Redevelopment projects
  - Brownfield redevelopment
  - High density (>7 units per acre)
  - Vertical density (Floor-to-Area Ratio of 2:1 or >18 units/acre)
  - Mixed use and transit oriented development

- W. Virginia: similar program (0.2” reduction each)
Required Best Practices?

• Regardless of the retention requirement, are there best practices we would always want to see implemented on-site?
  – Disconnected downspouts
  – Recessed landscape islands
  – Prevent compaction of pervious areas
  – Green stormwater controls
Disconnected Downspouts

- Must discharge to landscaping or rainwater cisterns
- Must design to avoid erosion and drainage problems
- Requirement included in Colony Park Design Guidelines
Recessed Landscape Islands

- Parking lot islands must be designed to accept and infiltrate stormwater
- Requirement in New Orleans Code
- Must design to avoid erosion, drainage, and tree protection problems
Prevent Compaction of Pervious Areas

• Improve construction sequencing for parking lots
• Fence off islands from construction vehicles or remove compacted fill before planting
Green Stormwater Controls

• Require portion of water quality volume to be treated using green stormwater controls
  – Part of Transit-Oriented Development (TOD) and Planned United Development (PUD) ordinances
• Require water quality ponds be designed for shallow depths (e.g., 1 foot or less)
• Departure from current practice with sedimentation-sand filter as default control
• Exceptions for special cases (e.g., topography)
CVS Example

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<th>Category</th>
<th>CVS Cost</th>
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<td>Water Quality Control</td>
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<td>Storm Drainage</td>
<td>$30,702</td>
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<td>Landscaping</td>
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<td><strong>Total</strong></td>
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Small Group Discussion

- How much stormwater to retain on-site?
- How to handle redevelopment and high levels of impervious cover?
- Are there best practices we would always want to see implemented on-site?
- Identify and discuss key considerations if more stormwater is integrated on site.
  - For example: maintenance, inspections, plant selection, retention time, existing trees, soils
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<td>Kickoff</td>
<td>Jan. 30</td>
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<td>Land Cover &amp; Natural Function</td>
<td>Feb. 20</td>
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<td>Integrate Nature into the City</td>
<td>Mar. 13</td>
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<td><strong>Beneficial Use of Stormwater</strong></td>
<td>Apr. 10</td>
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<td>Stormwater Options for Redevelopment &amp; Infill</td>
<td>May 15</td>
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<td>Integration of Green Elements</td>
<td>June 5</td>
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<td>Wrap-Up</td>
<td>June 26</td>
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