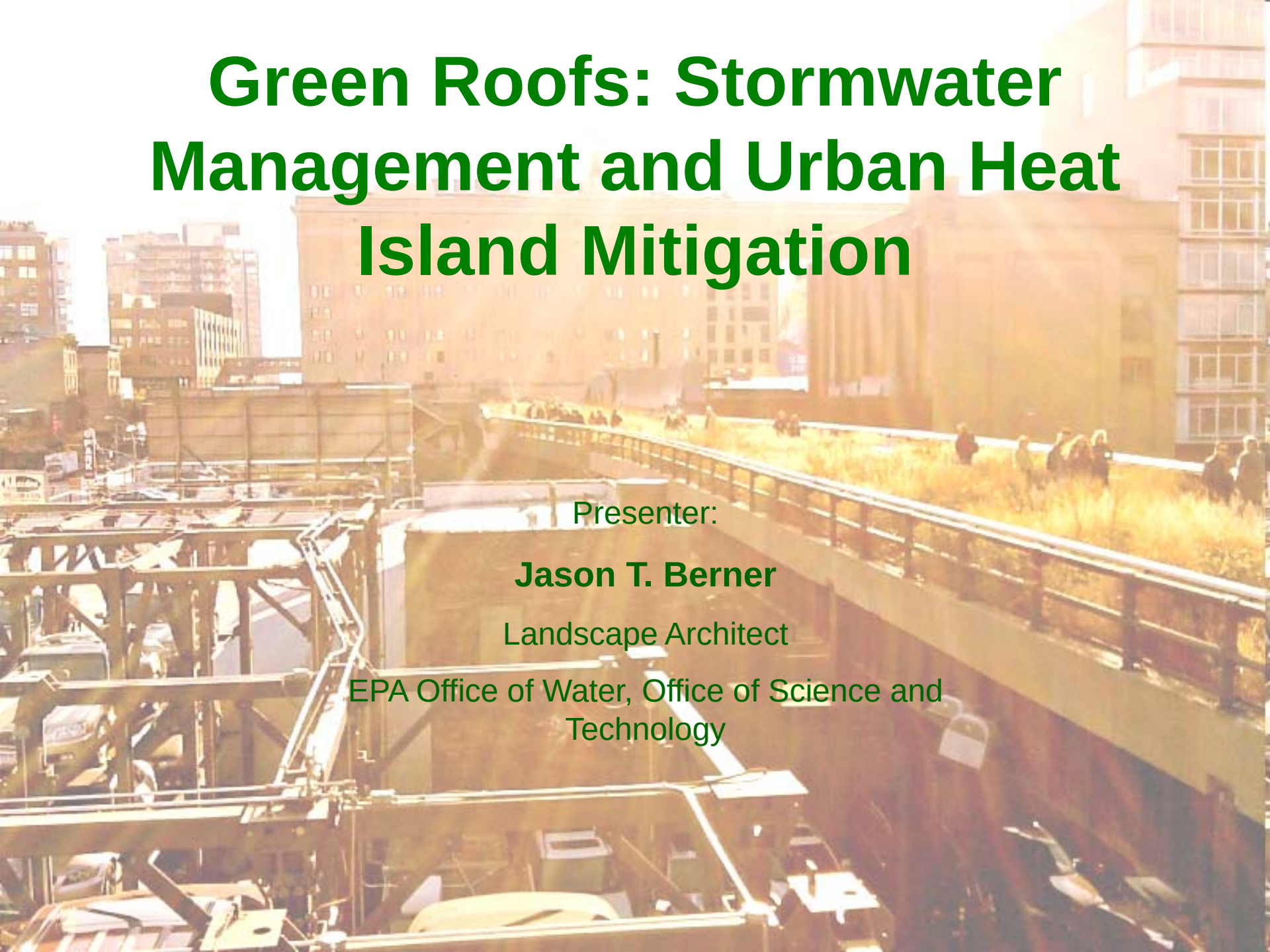
Green Roofs: Stormwater Management and Urban Heat Island Mitigation



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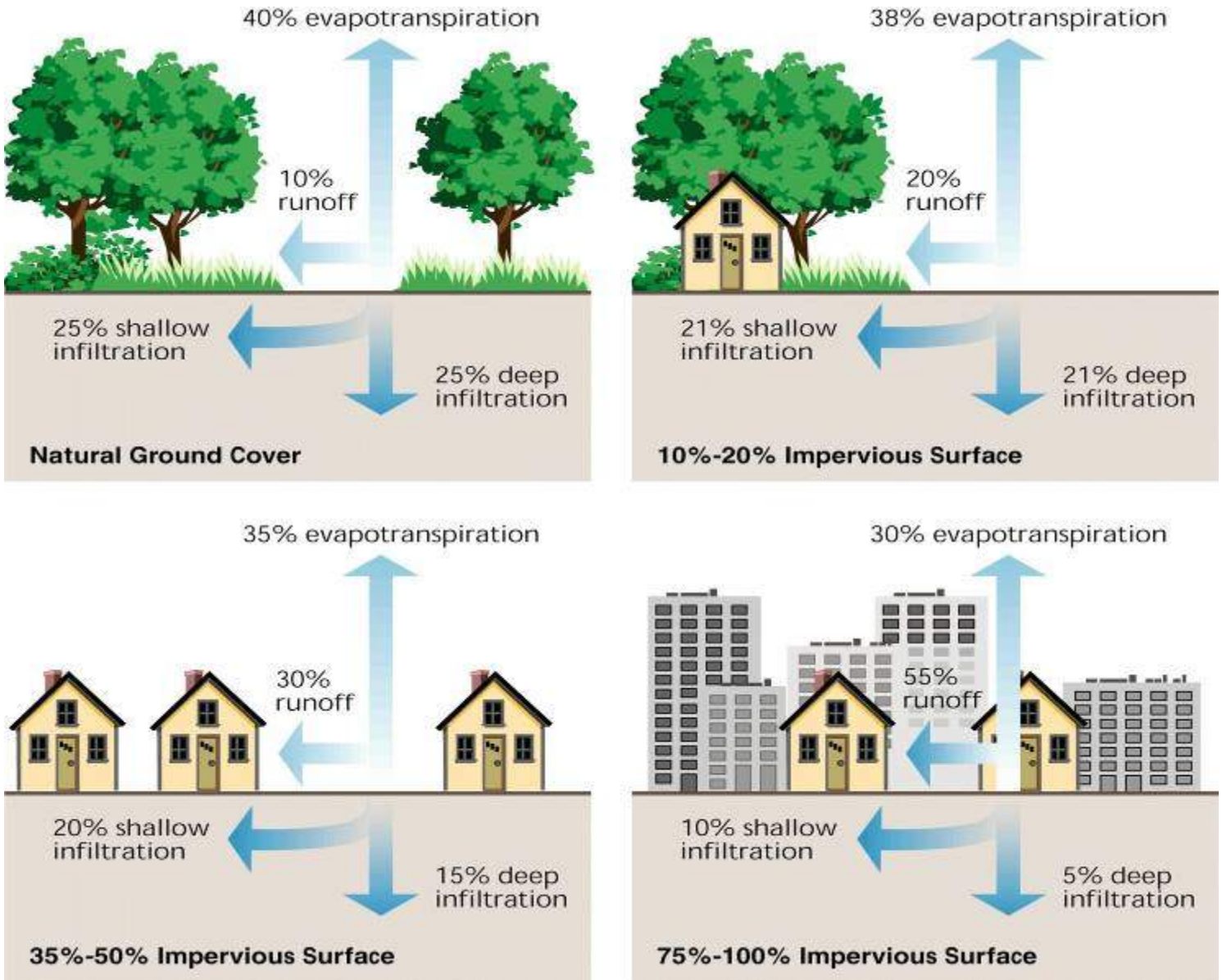
- **National Stormwater Team member**
- Environmental Impacts & Benefits Assessments
- Water Quality Modeling
- Urban Planning and Policy Analysis

Outline

1) Urban Stormwater Water Quality Impacts
2) Overview of Green Roofs
3) Stormwater Related Benefits of Green Roofs
4) Examples Applications of Green Roofs for Stormwater Mitigation
5) Tools and Resources for Green Roofs

Water Quantity Impacts: Changes in Land-Water Linkages



Green Roof Overview

- Enhances or restores natural hydrologic cycle (evapotranspiration, retention, minimizes runoff)
- Vegetation and storage media used for stormwater retention
  - Small storm events (less than .25 to .5 inches) in Washington, DC metro area
- Reduces outside building temperatures

Sources: American Society of Landscape Architects (ASLA) (2010) & D. Sample (2010)

Types of Green Roofs

- **Extensive:** light vegetation, sedums and grasses
- **Intensive:** medium size vegetation, including shrubs and small woody plants

Hybrid green roof

Intensive green roof

Source: ASLA (2010): http://www.asla.org/ContentDetail.aspx?id=25420

Applications of Green Roofs

- New Development
- Redevelopment
- Retrofits
- Commercial, Residential, Industrial, and Institutional Building Types

New Development, Commercial Building, Washington, DC

Benefits of Green Roofs

- Increases on site retention of stormwater, decreases total volume and flow to municipal stormwater systems
- Overall reduction in nutrient loadings (Nitrogen & Phosphorus)
- Enhancement of local site biodiversity
- Increases stakeholder awareness of local site stormwater management

Benefits of Green Roofs

- Increase aesthetic appeal and property value of property
- Minimal maintenance costs
- Less replacements than conventional roofs
- Possible tax incentives, stormwater utility fees

Examples of Green Roofs

- **American Society of Landscape Architects (ASLA) Green Roof**, Washington, DC (Commercial Building Retrofit)
- Monitored stormwater runoff reduction and temperature reductions
  - Retention of 76.7 % of 11.83 inches rain during 1st data collection period (Summer – Fall)

Source: ASLA (2010): http://www.asla.org/ContentDetail.aspx?id=25362 & http://www.asla.org/ContentDetail.aspx?id=25420

Examples of Green Roofs

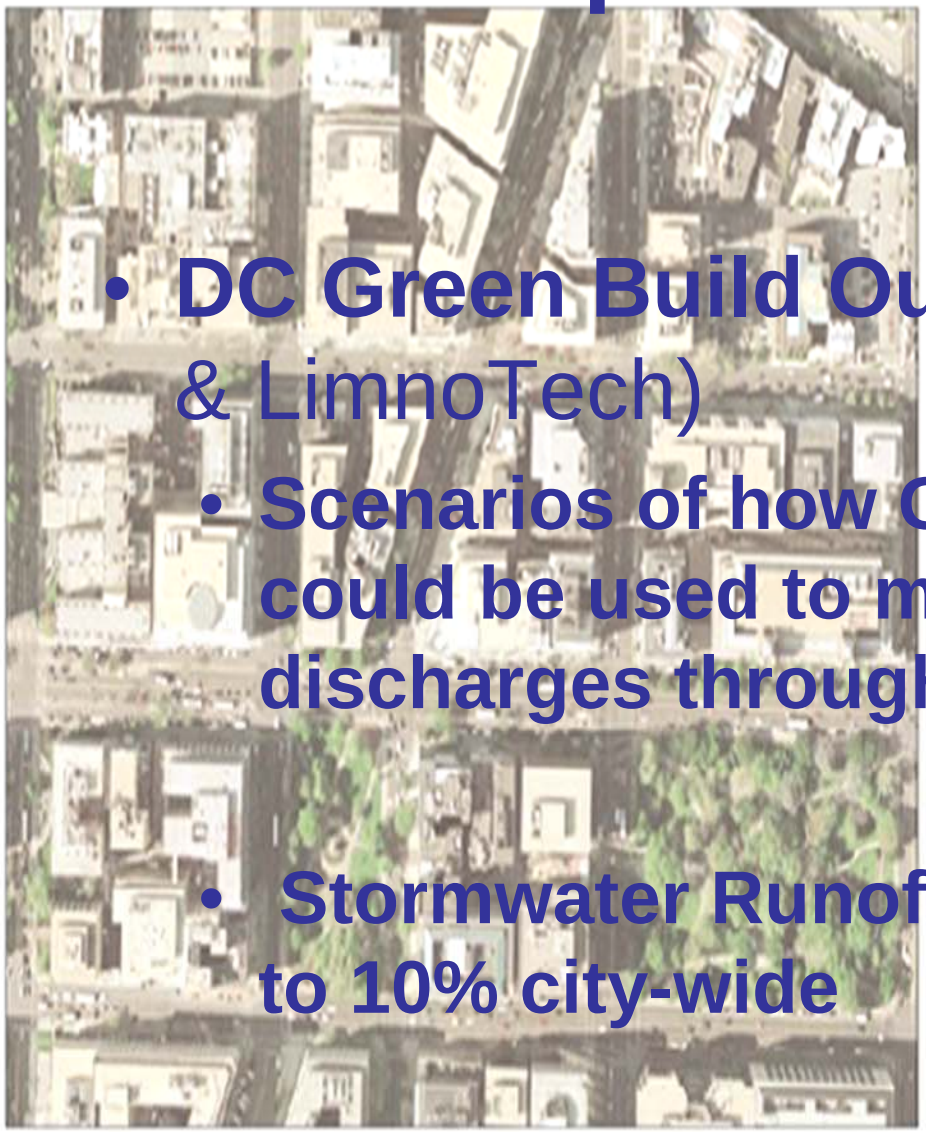
- City Hall, Chicago, IL (institutional retrofit)
- Planted in 2000, with over 150 species of plants (extensive and intensive)
- Green Roof able to retain 75% of 1 inch rain event

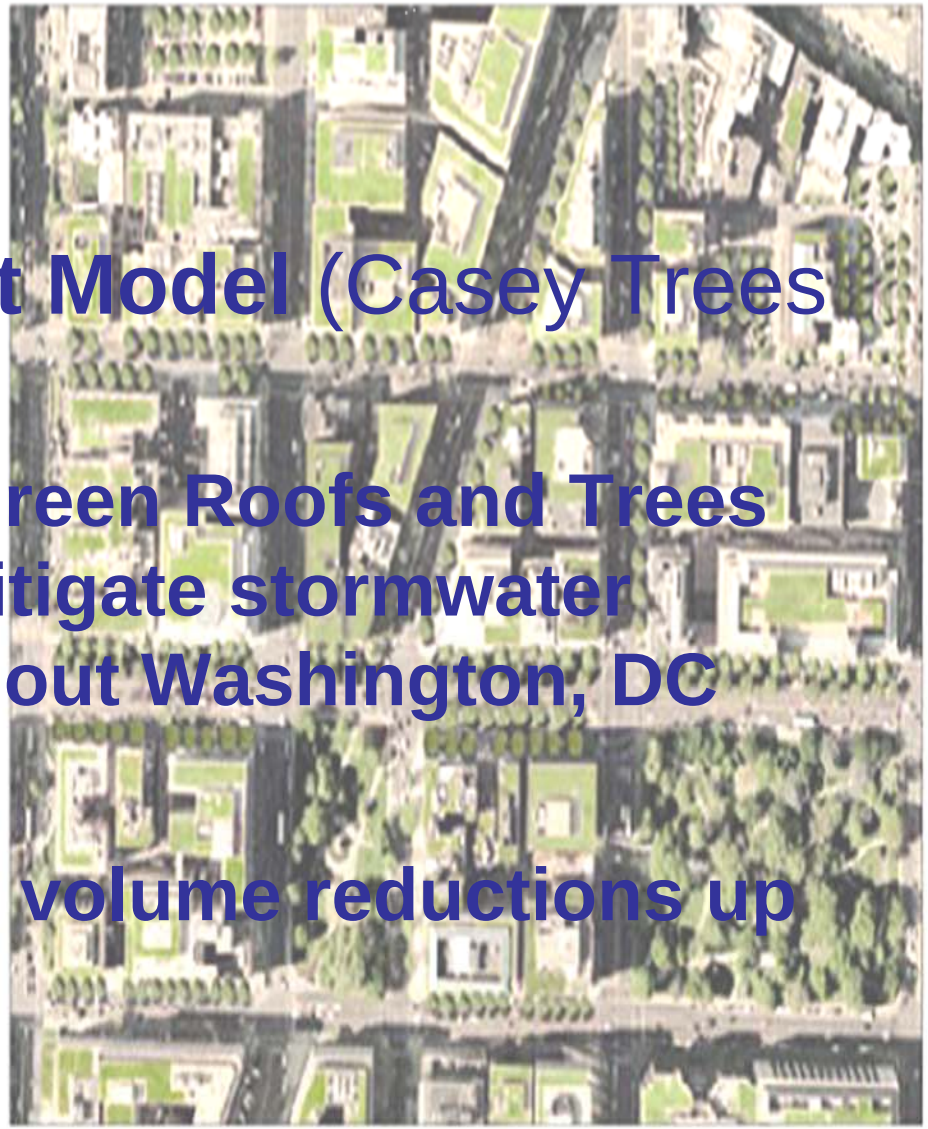
Sources: City of Chicago (2010):

http://www.cityofchicago.org/city/en/depts/doe/supp_info/chicago_s_city_hallrooftopgarden.html & Wild New Jersey (2008):
http://wildnewjersey.tv/2009/05/28/wild-new-jersey-exclusive-green-roof-offers-native-habitat-at-dodge-office-on-morristown.aspx

Examples of Green Roofs

- **DC Green Build Out Model** (Casey Trees & LimnoTech)
  - **Scenarios of how Green Roofs and Trees could be used to mitigate stormwater discharges throughout Washington, DC**
  - **Stormwater Runoff volume reductions up to 10% city-wide**





Source: Casey Trees (2008): http://www.caseytrees.org/planning/greener-development/gbo/index.php

Tools & Resources for Green Roofs

- **Websites:**
  - **Green Roofs for Healthy Cities (green roof industry association website):**
    - http://www.greenroofs.org/
  - **EPA Green Infrastructure Technologies and Approaches**
    - http://cfpub.epa.gov/npdes/greeninfrastructure/technology.cfm
  - **EPA Stormwater Menu of BMPs**
    http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Tools & Resources for Green Roofs

- **Design Tools**
  - **<u>EPA Models:</u>**
    - **SWMM (stormwater management model)**
    - **SUSTAIN (System for Urban Stormwater Treatment and Analysis Integration Model): GIS-based with SWMM**
  - **<u>Stormwater Calculators:</u>**
    - **Green Values National Stormwater Management Calculator (Center for Neighborhood Technology)**
    - **Virginia Runoff Reduction Method (BMP design spreadsheet, VA Dept. Conservation & Recreation)**

Thank You, Questions??

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Source: Clean Air Through Green Roofs (2008): http://cleanerairforcities.blogspot.com/2009/08/green-roofs-do-require-maintenance.html