Mayor Kasim Reed

Building Green: Atlanta’s Green Infrastructure Approach

10/13/2017

SESWA 2017 Annual Conference

Presented by: Cory Rayburn
Presentation Outline

Overview of Atlanta’s Green Infrastructure Program

- What is Green Infrastructure?
- Why Green Infrastructure in Atlanta?
- What are the standards?

First four years of implementation

- Single Family and Small Commercial Design manuals
- Green Infrastructure Task Force

Addressing Neighborhood Flooding

- Historic 4th Ward – economic and social benefits
- Southeast Atlanta Green Infrastructure Initiative – combined sewer capacity relief
- Upper Proctor Creek Capacity Relief: Rodney Cook, Sr. Park in Historic Vine City
- Boone Blvd Green St
Background

City’s Department of Watershed Management
- Serves 1.2 million (450,000 night)

Consent Decree
- CSO – completed 2008
- SSO – extension granted 2027

2nd Highest W&S rates in the country

Stormwater Utility Fee
- Adopted in 1999
- Overturned - $7 million refunded
How Urbanization Causes Flooding

- Natural Ground Cover:
  - Evapotranspiration: 40%
  - 10% runoff
  - 25% shallow infiltration
  - 25% deep infiltration

- 10%-20% Impervious Surface:
  - Evapotranspiration: 38%
  - 20% runoff
  - 21% shallow infiltration
  - 21% deep infiltration

- 35%-50% Impervious Surface:
  - Evapotranspiration: 35%
  - 30% runoff
  - 20% shallow infiltration
  - 15% deep infiltration

- 75%-100% Impervious Surface:
  - Evapotranspiration: 30%
  - 55% runoff
  - 10% shallow infiltration
  - 5% deep infiltration
Problems of Urban Watersheds

‘Flashy’ stream hydrology causes in stream erosion and low base flow
What is Green Infrastructure?

Gray vs. Green

Slow, Infiltrate, and Clean Stormwater
What is Green Infrastructure?

An interconnected natural or engineered system that mimics undeveloped hydrologic functions

Capture the first 1.0” of rainfall

- Infiltration
- Evapotranspiration (uptake of water by plants + evaporation)
- Reuse through rainwater harvesting
Why use Green Infrastructure in Atlanta?

Environmental Protection
- Improves water quality
- Supports Mayor Reed’s sustainability initiatives

Compliance
- Complies with NPDES permit – Removing Barriers
- Prepares the City for potential changes in federal stormwater rules

Community
- Addresses drainage issues in redeveloping historic neighborhoods
- Maximizes infrastructure investments by further reducing combined sewer overflows and flooding
Amended Stormwater Ordinance

Added Green Infrastructure requirement for new and redevelopment projects

Process for success

- Technical Advisory Committee
- Robust stakeholder involvement
- ‘Give and take’ approach
- Outreach, education, and technical guidance documents

Unanimous Council approval in February 2013
What makes Atlanta unique?

Requires Green Infrastructure on single family infill and commercial development/redevelopment

- 1.0” Runoff Reduction Volume (RR$_v$)
- Mandatory versus voluntary*
- No direct financial incentives
- Low threshold for compliance

* Allows for fallback to 1.2” Water Quality (80% TSS reduction) upon showing 1.0” RR$_v$ is not possible on the given site – written rationale and separate approval required
Who has to do what?

Single family development (RR_v only)

- New or infill home construction
- Large additions (>1,000 ft²)
infill

historic
Who has to do what?

Single family development (RR_v only)
• New or infill home construction
• Large additions (>1,000 ft²)

Small commercial category (RRv only)
• 500 - 5,000 ft² added or replaced impervious surface

Commercial adding >5,000 ft²
• Full blown stormwater management plan and hydro study
• Rate Reduction up to 25-year storm
• 100-yr – no increase in peak discharge rate

All Commercial projects
• Infiltration tests, pre-submittal meeting, and site-specific O&M plan
The Pioneer Projects

Green Roof - Atlanta City Hall

Cistern & Green Roof - Southface

Bioretention - Adair Park

Bioretention - 14th St DWM office

Wet pond, wetlands bench, sewer capacity relief, urban reforestation - Historic Fourth Ward

Bioswale - Klaus Building - GT campus
Recent Installs

Porous Concrete - Delia’s Chicken Sausage Stand

Bioswale - Edgewood Townhomes

Permeable Pavers - Urban Market on Howell Mill

Bioretention - Whitehall Terrace ROW

Permeable Pavers - 6th and Juniper

Permeable Pavers - Lakemoore Townhomes
Initially Adopted the Coastal Stormwater Supplement

- Provides design criteria and ‘credit’ system for green infrastructure
- Dependent on soil type

Includes Green Infrastructure / Runoff Reduction practices

- Does not address SFR or Small Commercial projects
Simplified Design Approach
SFR Manual

Green Infrastructure for Single Family Residences

CITY OF ATLANTA STORMWATER GUIDELINES

Prepared for
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT
NOVEMBER 2012

GI for Single Family Residences

• Provides a list of acceptable practices
• Reduces the need for complicated calculations
• Provides tear-off details and construction specification for each practice
• Simplifies the review and approval process
General Info & Tear-off Details
Easy-to-Use Sizing Tables

**Impervious Area Treated**

**Design Options**

**Sizing Charts**
- Options within practical range
- Accommodate actual rainfall and runoff data
- Allows for median infiltration duration
- Assumes 0.25-0.50 in/hr infiltration rate

### Practice Size

<table>
<thead>
<tr>
<th>Rooftop Area (square feet)</th>
<th>Depth of Gravel From Top of Pipe (inches)</th>
<th>Required Linear Feet of MFD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>100</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>500</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>1000</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>2000</td>
<td>120</td>
<td>95</td>
</tr>
<tr>
<td>3000</td>
<td>185</td>
<td>140</td>
</tr>
<tr>
<td>4000</td>
<td>245</td>
<td>190</td>
</tr>
<tr>
<td>5000</td>
<td>305</td>
<td>235</td>
</tr>
</tbody>
</table>

Modified French Drain Example
Small Commercial Manual

GI for Small Commercial

- For projects that add/replace between 500 and 5,000 ft\(^2\) of impervious surface
- Catered to small urban redevelopment and addition projects
- Supplement to CSS and Blue Book
- Provides clarification to specific issues
**Sizing Charts for each Practice**

### BIORETENTION TABLE A

<table>
<thead>
<tr>
<th>Bioretention Typical Dimensions (feet)</th>
<th>5x10</th>
<th>5x15</th>
<th>5x20</th>
<th>5x30</th>
<th>5x10</th>
<th>10x15</th>
<th>10x20</th>
<th>10x30</th>
<th>10x40</th>
<th>10x50</th>
<th>10x60</th>
<th>10x70</th>
<th>10x80</th>
<th>20x20</th>
<th>20x30</th>
<th>20x40</th>
<th>30x30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Storage Volumes (cubic feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Storage at 6&quot; Depth</td>
<td>25</td>
<td>38</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>Surface Storage at 9&quot; Depth</td>
<td>38</td>
<td>56</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td>375</td>
<td>450</td>
<td>525</td>
<td>600</td>
<td>600</td>
<td>675</td>
<td></td>
</tr>
<tr>
<td>Surface Storage at 12&quot; Depth</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>300</td>
<td>500</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BIORETENTION TABLE B**

<table>
<thead>
<tr>
<th>Bioretention Soil Storage Volumes for all Infiltration Rates (cubic feet)</th>
<th>100% RRv Credit by Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioretention Typical Dimensions (feet)</td>
<td>5x10</td>
</tr>
<tr>
<td>Surface Storage at 18&quot; Depth (cubic feet)</td>
<td>24</td>
</tr>
<tr>
<td>Soil Storage at 24&quot; Depth (cubic feet)</td>
<td>32</td>
</tr>
<tr>
<td>Soil Storage at 36&quot; Depth (cubic feet)</td>
<td>48</td>
</tr>
</tbody>
</table>

*note: table assumes a void ratio of 0.32*
Example Design

Example Site Information

Size = ½ acre
Existing Impervious Surface = 100%
Tested Soil Conditions = Infiltration rate 0.15 inch/hour (Type C)
Proposed building addition = 1,000 square feet
Pre-development pavement area impacted = 7,500 square feet
Proposed net impacted impervious change (see Table A-1 and Figure A-2) = 4,700 square feet

Table A-1. Example Site Impervious Surface

<table>
<thead>
<tr>
<th>Site element</th>
<th>Area (square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A        Building addition</td>
<td>1000</td>
</tr>
<tr>
<td>B1       Demolished pavement for island</td>
<td>-(500)</td>
</tr>
<tr>
<td>B2       Demolished pavement for island</td>
<td>-(900)</td>
</tr>
<tr>
<td>B3       Demolished pavement for green buffer</td>
<td>-(1800)</td>
</tr>
<tr>
<td>B4       Demolished pavement for green buffer</td>
<td>-(600)</td>
</tr>
<tr>
<td>C        Replaced Pavement</td>
<td>3,700</td>
</tr>
<tr>
<td><strong>Impacted Impervious Surface</strong></td>
<td>4,700</td>
</tr>
</tbody>
</table>

(Note: This manual applies because the net impacted impervious area is less than 5,000 square feet.)
Retrofit examples: Landscape Islands
Example Landscape Plans

Example #1: Parking Island Bioretention Planting

Note: Planting areas shall be mulched with 4" minimum thickness double shredded hardwood.
Innovative designs included

Upturned “S” Underdrain

- Creates saturated zone, aids in denitrification, additional infiltration in poor draining soils
# Maintenance Checklists

**City of Atlanta, Georgia**

**Green Infrastructure Practices for Small Commercial Development**

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**Sample Bioretention Inspection and Maintenance Checklist**

<table>
<thead>
<tr>
<th>Item Inspected</th>
<th>Checked</th>
<th>Maintenance Needed</th>
<th>Inspection Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioretention and contributing areas clean of debris</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td>No standing water</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td>Litter, trash, etc. has been removed</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td><strong>VEGETATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No evidence of erosion</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td>Is plant composition still according to approved plans?</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td>No placement or growth of inappropriate plants</td>
<td>Y</td>
<td>Y</td>
<td>Monthly</td>
</tr>
<tr>
<td><strong>DEWATERING AND SEDIMENTATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioretention dewatering between storms</td>
<td>Y</td>
<td>Y</td>
<td>After Major Storms</td>
</tr>
<tr>
<td>No evidence of skimming water</td>
<td>Y</td>
<td>Y</td>
<td>After Major Storms</td>
</tr>
<tr>
<td>No evidence of surface clogging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OUTLETS/OVERFLOW SPILLWAY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good condition, no need for repair</td>
<td></td>
<td></td>
<td>Annualy and After Major Storms</td>
</tr>
<tr>
<td>No evidence of erosion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No evidence of any blockages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INTEGRITY OF BIORETENTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioretention has not been blocked or filled inappropriately</td>
<td>Y</td>
<td>Y</td>
<td>Annually</td>
</tr>
<tr>
<td>Multi layer to soil in place depth of at least 2”</td>
<td>Y</td>
<td>Y</td>
<td>Annually</td>
</tr>
<tr>
<td>Nuisance plants or weeds removed</td>
<td>Y</td>
<td>Y</td>
<td>Annually</td>
</tr>
</tbody>
</table>

---

**COMMENTS:**

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**OVERALL CONDITION OF FACILITY:**

In accordance with approved design plans? Y / N

In accordance with As Built plans? Y / N

Determination of as built:

Field Verified Dimension:

Maintenance required as detailed above? Y / N

Compliance with any other required conditions? Y / N

Comments:

---

Dates by which maintenance must be completed: ____ / ____ / ____

Dates by which outstanding information is required: ____ / ____ / ____

Inspector’s signature: __________________________

Engineer/Agent’s signature: __________________________

Engineer/Agent’s name printed: __________________________
Tracking Green Infrastructure with GIS

Permitted Sites Since Feb 2013
- 600+ Commercial
- 2,900+ Single Family Residential

GIS attributes contain:
- Owner
- Date of completion
- Copy of I&M agreement
- Inspections information
- Green infrastructure BMPs
- Detention BMPs
- Runoff Reduction Volumes
Updated MS4 Permits

Most Recent MS4 Permits

- Georgia DOT
- Phase I Medium

Includes Requirement to Adopt Runoff Reduction / Green Infrastructure Practices

- 3 year transition period
- Atlanta staff participated in both Blue Book update and proposed amendments to MS4 permits
Green Infrastructure can compete for space

Creativity with site layout
• Upfront coordination between Civil, LA, and Architect

Dual purpose practices:
• permeable pavement
• landscape islands → bioretention
• green roof
• underground detention/infiltration systems

Able to meet tree planting and runoff reduction requirements with one practice
Infiltration Practices in Atlanta

Soils analysis required for all commercial sites
  • Infiltration rates, high water table, bedrock, contaminated soils

Compaction of Silt and Clay soils
  • Loosening compacted soils on redevelopment sites
  • Prevent compaction during construction
  • Innovative designs (upturned underdrain) to encourage surface drainage and promote infiltration in clay soils

Erosion control
  • Phasing installation to prevent sedimentation issues
  • Installation of appropriate BMPs
Erosion Control and Phasing
Green Infrastructure Task Force

City staff plus partners
• Watershed, Public Works, Parks & Recreation, Mayor’s Office of Resilience, Planning and Community Development, Aviation
• Atlanta Beltline, The Conservation Fund, American Rivers, Invest Atlanta, Chattahoochee Riverkeeper, etc.

Task Force Origins and Goals
• Began through a Peer Exchange trip (2012) to Philadelphia
• Create ‘Best-in-Class’ program
• Focus on CIPs and processes
• Recently published Strategic Action Plan
Strategic Action Plan
Name that site!
Historic 4th Ward Capacity Relief
Historic Fourth Ward Park

Opened 2011. Combined Sewer Capacity relief
Aerating Fountain
Which would you prefer?
Spurring Economic Development

$500M in Redevelopment

- Apartments
- Condos
- Ponce City Market
Spurring Economic Development
April 16, 2017 – 4” rain event
Three days later...
April 16, 2017 – 4” rain event
Three days later…
Southeast Atlanta Green Infrastructure Initiative

Combined Sewer Capacity Relief
Custer CSO Basin Location

- Heart of Atlanta
- Highly impervious
- Piped Streams
- Repeated Flooding
Contributing Conditions

Point of Surface Flooding
July 2012 (Peoplestown)

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>Acres</th>
<th>% Impervious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanicsville / Peoplestown</td>
<td>900</td>
<td>65%</td>
</tr>
<tr>
<td>Summerhill</td>
<td>505</td>
<td>58%</td>
</tr>
<tr>
<td>Grant Park</td>
<td>380</td>
<td>42%</td>
</tr>
<tr>
<td>Englewood Manor</td>
<td>715</td>
<td>42%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drainage Basin</th>
<th>Total Area (acres)</th>
<th>% Impervious</th>
<th>Impervious Area (acres)</th>
<th>Roadway Area (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanicville / Peoplestown</td>
<td>900</td>
<td>65%</td>
<td>582</td>
<td>220</td>
</tr>
<tr>
<td>Summerhill</td>
<td>505</td>
<td>58%</td>
<td>293</td>
<td>110</td>
</tr>
<tr>
<td>Grant Park</td>
<td>380</td>
<td>42%</td>
<td>162</td>
<td>55</td>
</tr>
<tr>
<td>Englewood Manor</td>
<td>715</td>
<td>42%</td>
<td>301</td>
<td>62</td>
</tr>
</tbody>
</table>
Historical Perspective

Map of Atlanta

1886

Peoplestown Junction Box Location
# Back to Back Rain Events

<table>
<thead>
<tr>
<th>Rank</th>
<th>Date</th>
<th>Recurrence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/9/2012</td>
<td>10-25 year</td>
</tr>
<tr>
<td>2</td>
<td>8/31/2006</td>
<td>5-10 year</td>
</tr>
<tr>
<td>3</td>
<td>7/11/2012</td>
<td>2-5 year</td>
</tr>
<tr>
<td>4</td>
<td>9/29/2009</td>
<td>2-5 year</td>
</tr>
<tr>
<td>5</td>
<td>7/3/2012</td>
<td>2-5 year</td>
</tr>
<tr>
<td>6</td>
<td>5/5/2003</td>
<td>2-5 year</td>
</tr>
<tr>
<td>7</td>
<td>7/20/2011</td>
<td>2 year</td>
</tr>
<tr>
<td>8</td>
<td>8/20/2000</td>
<td>2 year</td>
</tr>
<tr>
<td>9</td>
<td>6/3/2001</td>
<td>2 year</td>
</tr>
<tr>
<td>10</td>
<td>8/28/2009</td>
<td>2 year</td>
</tr>
</tbody>
</table>
Peopletown Flooding
Community Engagement
Phase 1 Projects- Completed
Phase 2: Gray Solution

During Construction

View Inside Vault

Media Lot Storage Vault (Complete)

Peoplestown Combined Flow Hydrograph
25 Year, 4 Hour Storm Event
Phase 2: Permeable Roadways

- 4+ miles of Permeable Pavers
Updated Map
Permeable Paver System

The paver system is made up of the following components:

- #4 Stone
- #57 Stone
- #89 Stone
- LLDPE 40 Mil Liner
- Permeable Pavers
Unique Design Considerations

- Steep slopes
- Impermeable liner check dams used

Diagram:
- Bedding layer: 2” ASTM No. 89 Stone
- Base layer: 4” ASTM No. 57 Stone
- Orifice
- Bleed hole
- 40-mil LLDPE Smooth Liner
- Open-graded subbase layer thickness varies, ASTM No. 4 unwashed stone
Construction Sequence

- Excavation, aggregate reservoir, paver installation
Completed Streets
Basin wide planning efforts
Neighborhoods

English Avenue and Vine City

- Steep decline in population over past 30 yrs
- Highest crime rates (twice the City of Atlanta average)
- Lowest occupancy rates
- Repeated flooding
- Fewest acres of planned greenspace
- 41% of households living below the poverty line (57% of children)
- 20% houses vacant
- 40% foreclosure rate
Upper Proctor Creek Capacity Relief

History

- 2002 storm event caused catastrophic flooding in the Vine City neighborhood
- Over 60 homes were purchased by the City as a result
- Combined sewer basin
- Opportunity for multiple partnerships to resolve flooding concerns and restore community health
Rodney Cook, Sr. Park in Historic Vine City

16 acre site

- Provides 9+ million gallons of capacity relief, preventing localized flooding throughout the community
- Redirects surface runoff away from the combined sewer system
- Innovative stormwater management practices

Courtesy of HDR, Inc.
Rodney Cook, Sr. Park in Historic Vine City

DWM Components of the Project

- 9+ MG stormwater wet pond with littoral shelf and created wetlands
- Green Infrastructure including bioretention, stormwater planters, rainwater harvesting cisterns, and soil restoration
- Rerouted combined sewer trunkline (96”)
- Aerating water features
- New sidewalks and roadway improvements
- Separated storm drain pipelines
Rodney Cook, Sr. Park in Historic Vine City

Phased Combined Sewer Separation

- Phase A (Green) 73 acres drainage
- Phase B (Purple) 36 acres drainage
- Phase C (Blue) 41 acres drainage
- Ultimate Drainage 150 acres
- Eliminates combined sewer spills up to the 100-year storm event
Partnerships

Department of Watershed Management (DWM)
• Pond design and construction, limited combined sewer separation, green infrastructure, soil remediation

Trust for Public Land (TPL)
• Park design and construction in coordination w/ Department of Parks and Recreation and DWM

National Monuments Foundation (NMF)
• Design and construct 16 statues of historical and civil rights leaders throughout the park

Adjacent projects
• Boone Blvd Green Street (DWM), PATH, Boone Park West
City of Atlanta's DWM Background

Addressing Neighborhood Flooding

• Southeast
Boone Blvd Green Street
Boone Blvd Green Street

- Beltline
- Lowery Blvd

Project Extent
Before and After

Leveraging Funding and Partnerships

- Invest Atlanta $1M Grant for streetscape improvements
- Renew Atlanta $1.1M
- EPD 319(h) Grant $387K
- Total $8.9M
In Summary...

- Utilizing green infrastructure as a tool to address historic drainage issues and water quality is possible, practical, and can spur economic growth
- Coordinating w/ other City Departments and developing partnerships is vital
- Providing a robust outreach and education program and developing relevant guidance documents aids in transition
- Leading by example is key
Mayor’s Commitment

“It is my goal for Atlanta to become one of the top tier sustainable cities in the nation”

-Mayor Kasim Reed