Mayor Kasim Reed

Building Green: Atlanta's Green Infrastructure Approach

10/13/2017

SESWA 2017 Annual Conference

Presented by: Cory Rayburn

CITY OF ATLANTA DEPARTMENT OF watershed management

Kishia L. Powell, Commissioner
Department of Watershed Management

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)

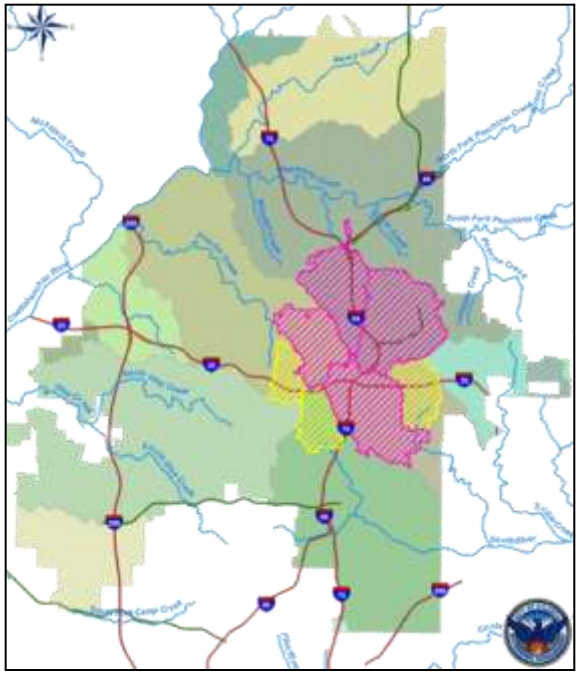
Consent Decree

- 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



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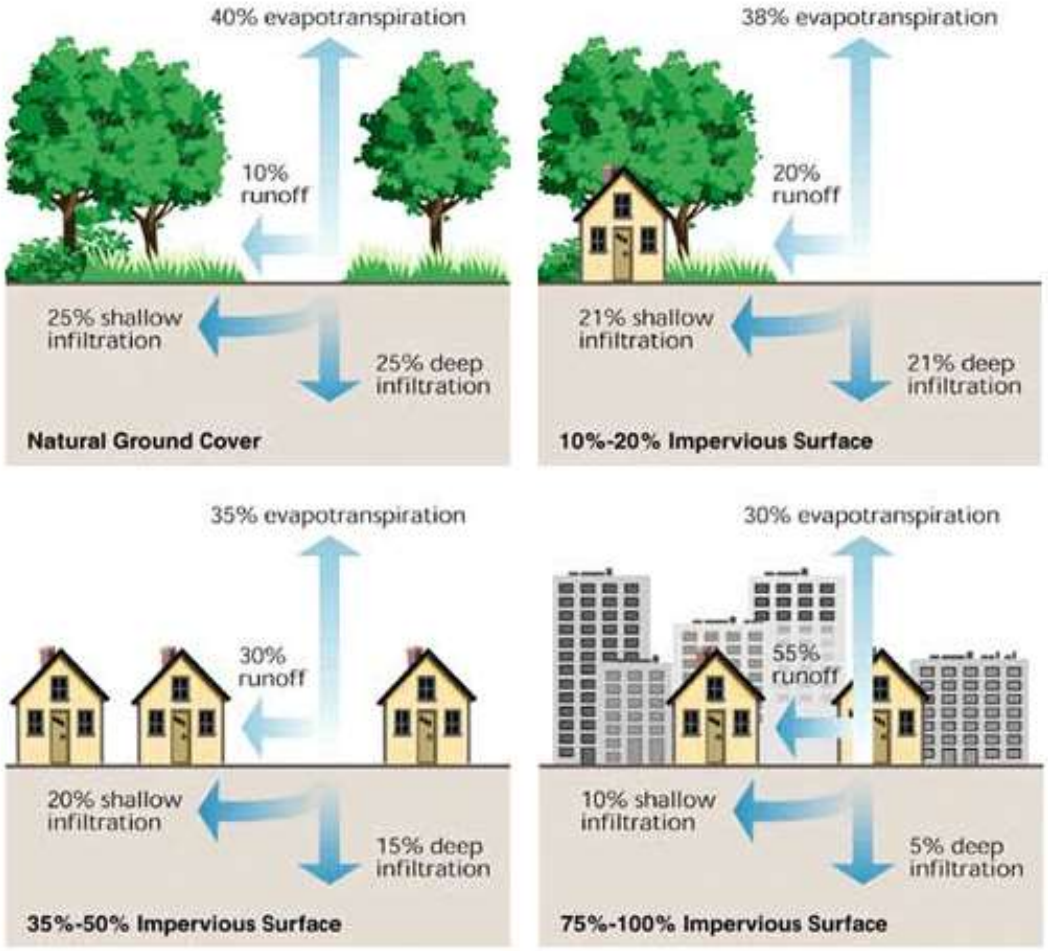
How Urbanization Causes Flooding



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Problems of Urban Watersheds

‘Flashy’ stream hydrology causes in stream erosion and low base flow

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What is Green Infrastructure?

Gray **vs.** **Green**

Slow, Infiltrate, and Clean Stormwater

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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

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Why use Green Infrastructure in Atlanta?

Environmental Protection

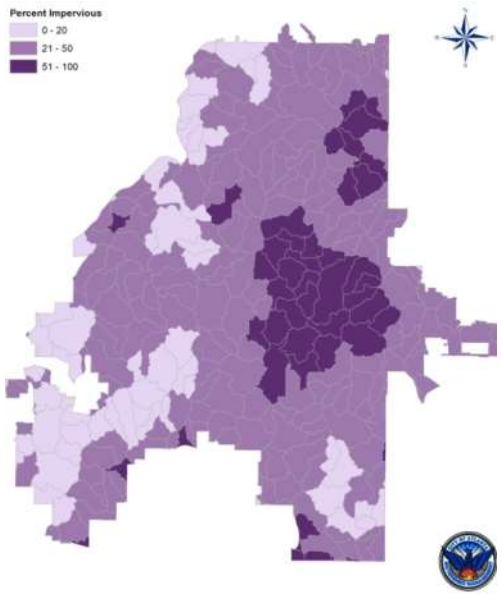
- Improves water quality
- Supports Mayor Reed's sustainability initiatives

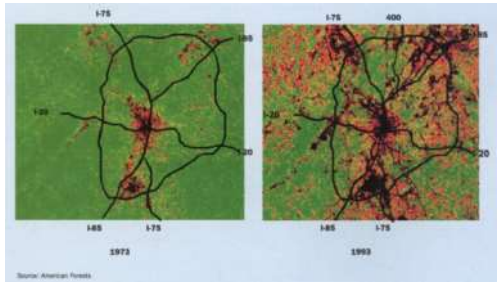
Compliance

- 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





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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

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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**

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Who has to do what?

Single family development (RR_v only)

- New or infill home construction
- Large additions (>1,000 ft^2)


infill
historic

Who has to do what?

Single family development (RR_v only)

- New or infill home construction
- Large additions (>1,000 ft^2)

Small commercial category (RRv only)

- 500 - 5,000 ft^2 added or replaced impervious surface

Commercial adding >5,000 ft^2

- 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

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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

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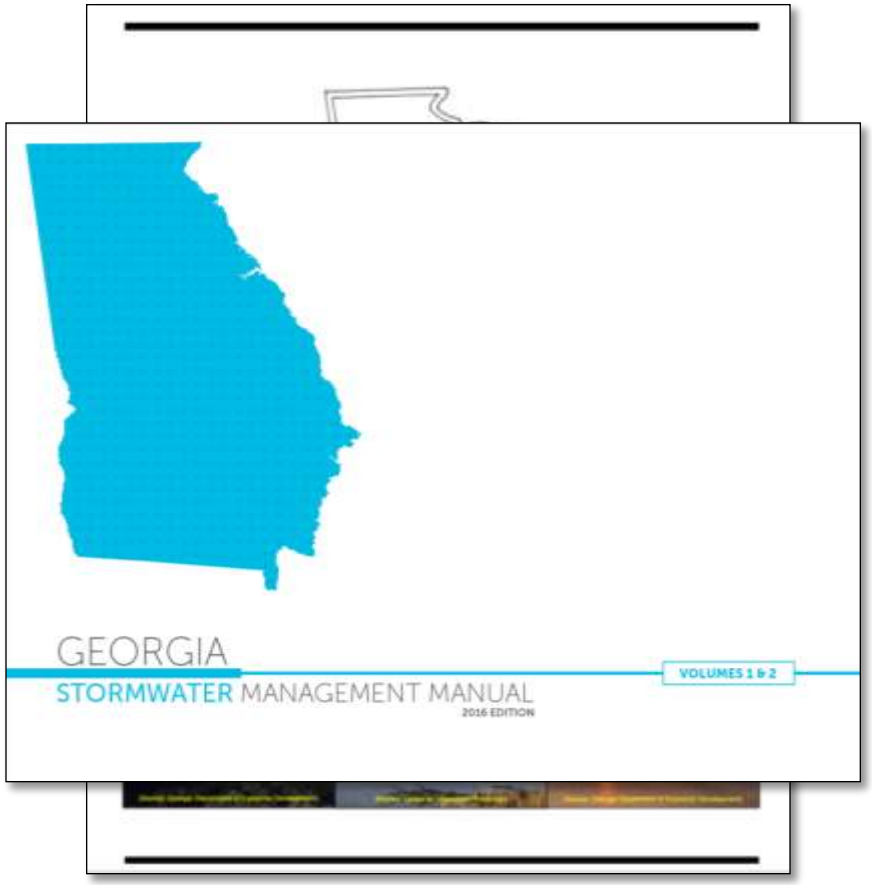
Stormwater Management Manual



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

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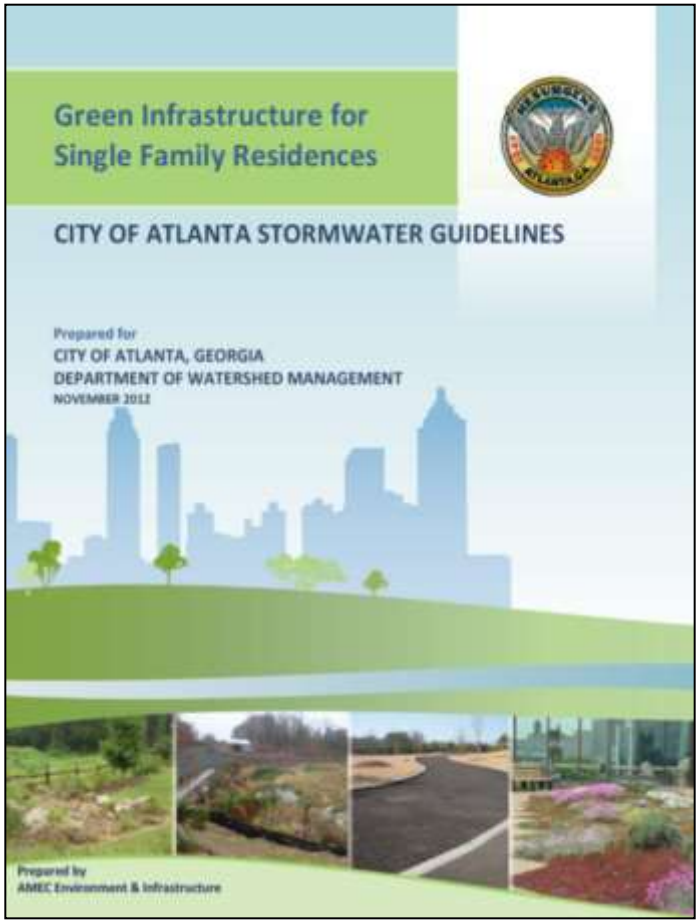
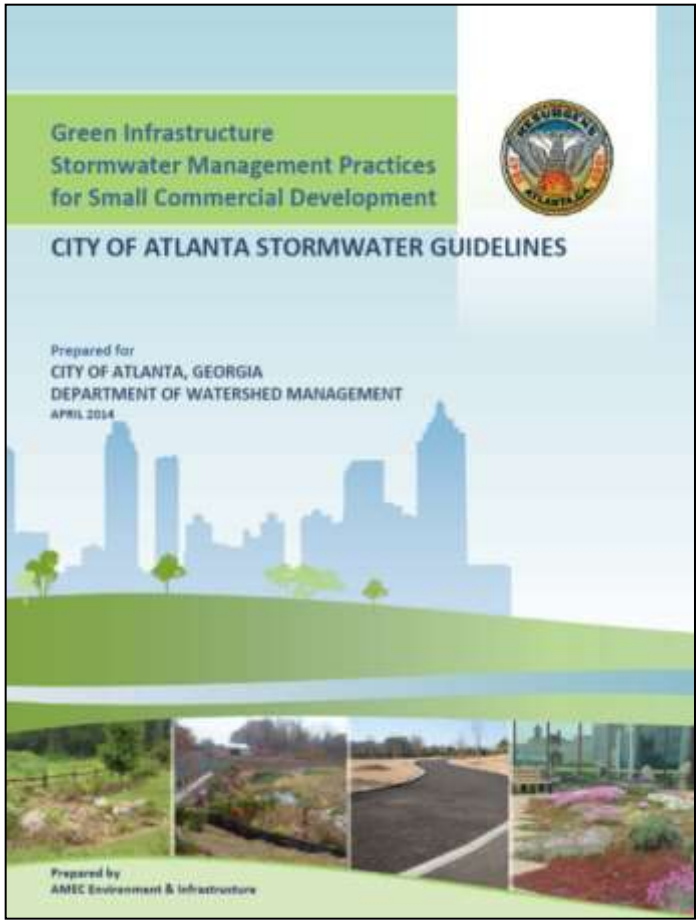
Simplified Design Approach





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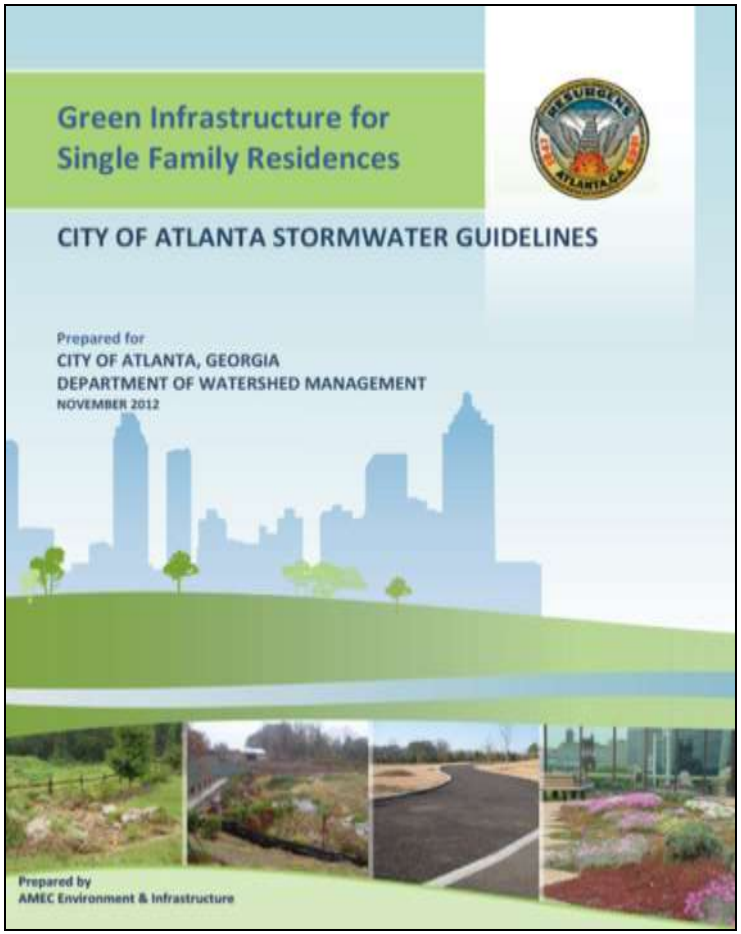
SFR Manual



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

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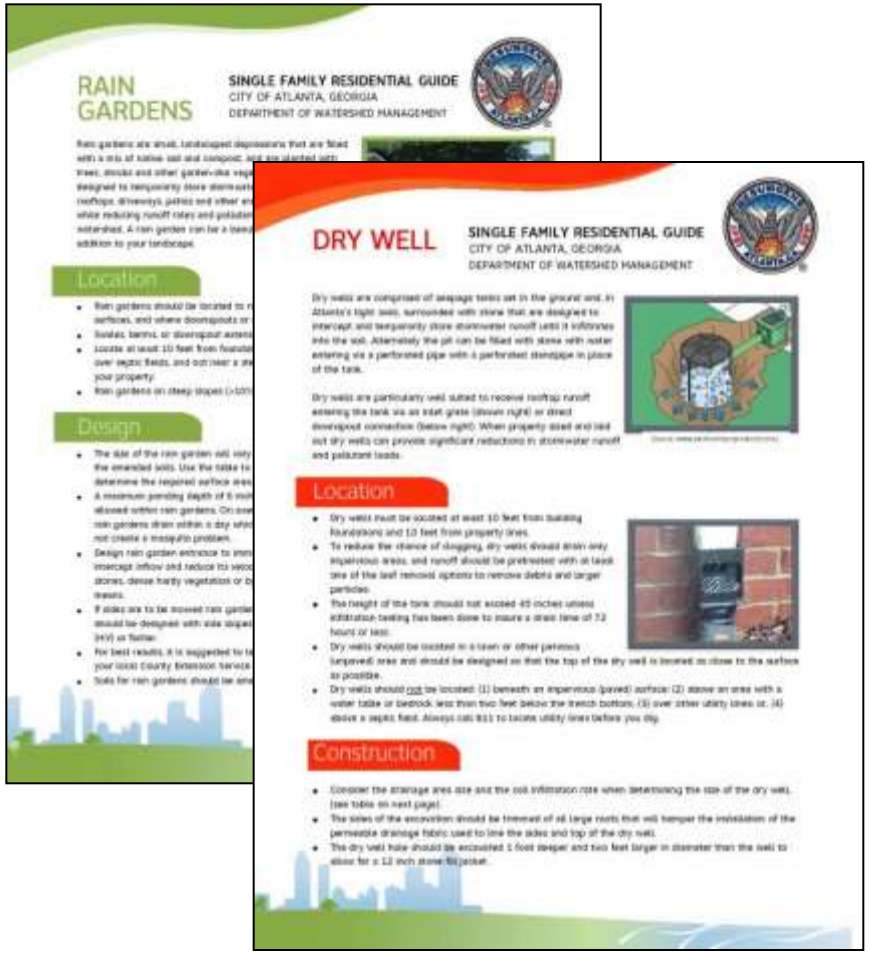
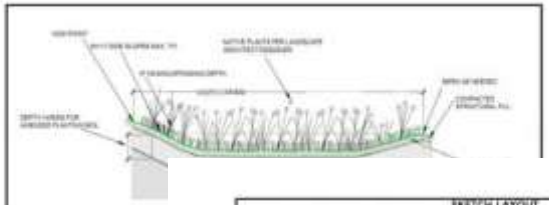
General Info & Tear-off Details





CONSTRUCTION STEPS:

1. Locate rain garden(s) wh
home. Locate at least 10
lines, not over septic fiel
2. Measure the area drainin
from the table on the ne
3. Optionally, perform infilt
underdrain will be neces
decreased 10% for every
4. Measure elevations and
garden, the overflow ele
higher than the overflow
be constructed on the d
rare for erosion control
5. Remove turf or other veg
compact soils in the bott
infiltration area.
6. Mix compost, topsoil, an
soil mix should be 1/3 c
7. Fill rain garden with the
surrounding surface. Ligh
rain garden should be sl
8. Build a berm at the dow
of the berm needs to be
9. Plant the rain garden usi
10. Mulch the surface of the
best choice is finely shre
11. Water all plants thoroug
needed to establish plan
12. During construction bulk
bried swale with a gentle
near the house is recom
water from the source to
13. Create an overflow at le

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SKETCH LAYOUT

PROVIDE PLAN VIEWS OF RAIN GARDEN AND HOUSE SHOWING DRAINAGE AREA DIRECTED TO RAIN GARDEN AND KEY DIMENSIONS AND OVERFLOW AREA RELATIVE TO PROPERTY LINE.

SIZING CALCULATION:

MEASURE CONTRIBUTING DRAINAGE AREA AND READ AREA FOR GIVEN MEDIA DEPTH.

CONTRIBUTING DRAINAGE AREA= _____ SQ FT
DEPTH OF SOIL MEDIA= _____ INCHES
AREA OF RAIN GARDEN= _____ SQ FT

MAINTENANCE:

1. IRRIGATE VEGETATION AS NEEDED IN FIRST SEASON
2. REMOVE WEEDS
3. REPLACE UNSUCCESSFUL PLANTINGS
4. REPLENISH MULCH
5. REPAIR ERODED AREAS
6. RAKE CLOGGED SURFACE TO RESTORE INFILTRATION
7. MONITOR RAIN GARDEN FOR APPROPRIATE DRAINAGE TIMES. IF GARDEN DOES NOT DRAIN AN UNDERDRAIN MAY BE NECESSARY

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ATTACH THIS TWO-PAGE SPECIFICATION TO HOUSE PLAN SUBMITTAL

RAIN GARDEN SPECIFICATIONS
PAGE 2 OF 2

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Easy-to-Use Sizing Tables

Impervious Area Treated

Design Options

Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	6	5	4	3
500	30	25	20	15
1000	60	45	40	35
2000	120	95	75	65
3000	185	140	115	100
4000	245	190	155	130
5000	305	235	195	165

Practice Size

Modified French Drain Example

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

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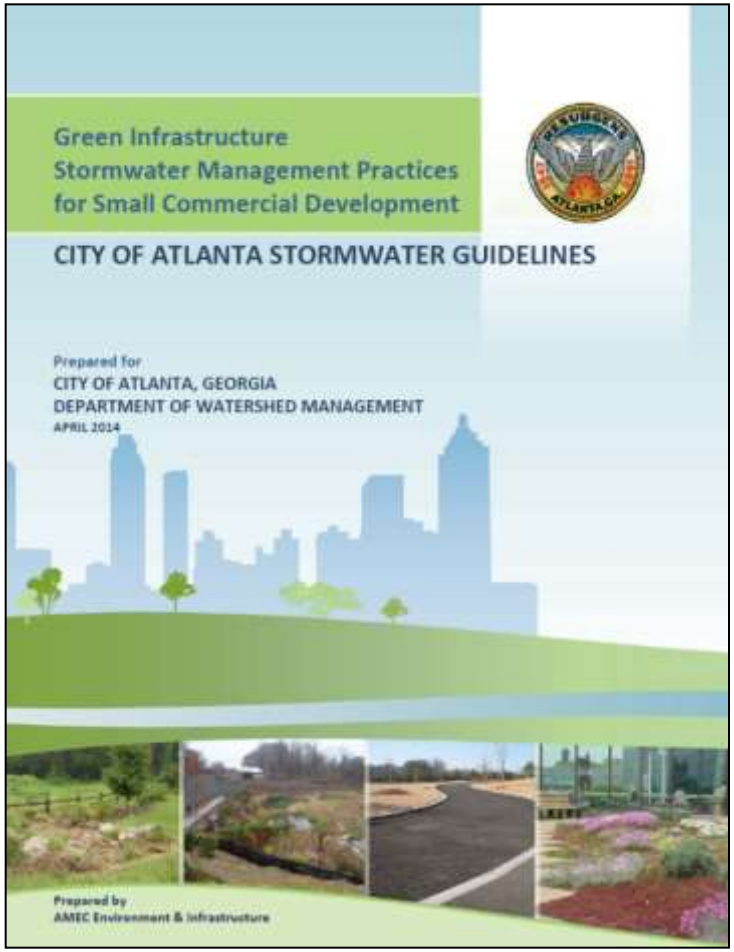
Small Commercial Manual



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

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Sizing Charts for each Practice

BIORETENTION TABLE A
Bioretention Surface Storage Volumes (cubic feet)

Bioretention Typical Dimensions (feet)	5x10	5x15	5x20	5x30	10x10	10x15	10x20	10x30	10x40	10x50	10x60	10x70	10x80	20x20	20x30	20x40	30x30
surface area (square feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900
Surface Storage at 6" Depth (cubic feet)	25	38	50	75	50	75	100	150	200	250	300	350	400	200	300	400	450
Surface Storage at 9" Depth (cubic feet)	38	56	75	113	75	113	150	225	300	375	450	525	600	300	450	600	675
Surface Storage at 12" Depth (cubic feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900

GI Practice 1

BIORETENTION TABLE B
Bioretention Soil Storage Volumes for all Infiltration Rates (cubic feet)
100% RRv Credit by Volume

Bioretention Typical Dimensions (feet)	5x10	5x15	5x20	5x30	10x10	10x15	10x20	10x30	10x40	10x50	10x60	10x70	10x80	20x20	20x30	20x40	30x30
surface area (square feet)	50	75	100	150	100	150	200	300	400	500	600	700	800	400	600	800	900
Soil Storage at 18" Depth (cubic feet)	24	36	48	72	48	72	96	144	192	240	288	336	384	192	288	384	432
Soil Storage at 24" Depth (cubic feet)	32	48	64	96	64	96	128	192	256	320	384	448	512	256	384	512	576
Soil Storage at 36" Depth (cubic feet)	48	72	96	144	96	144	192	288	384	480	576	672	768	384	576	768	864
note: table assumes a void ratio of 0.32																	

GI Practice 1

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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

	Site element	Area (square feet)
A	Building addition	1000
B1	Demolished pavement for island	- (500)
B2	Demolished pavement for island	- (900)
B3	Demolished pavement for green buffer	-(1800)
B4	Demolished pavement for green buffer	- (600)
C	Replaced Pavement	3,700
	Impacted Impervious Surface	**4,700**

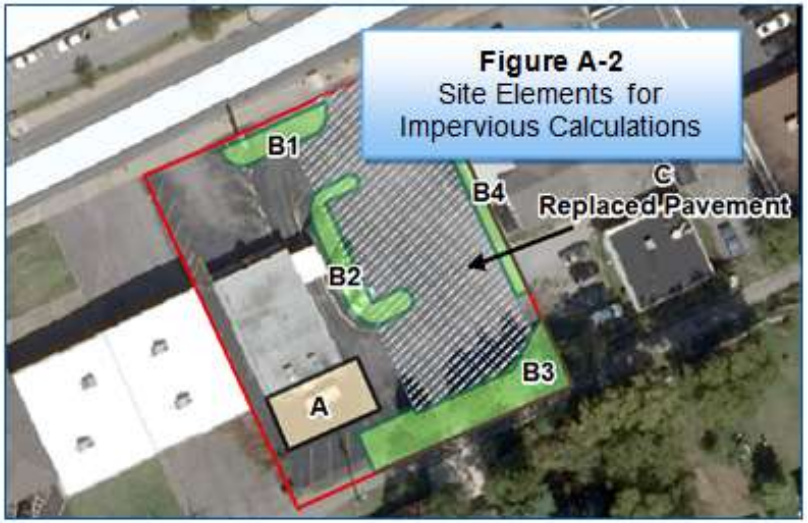
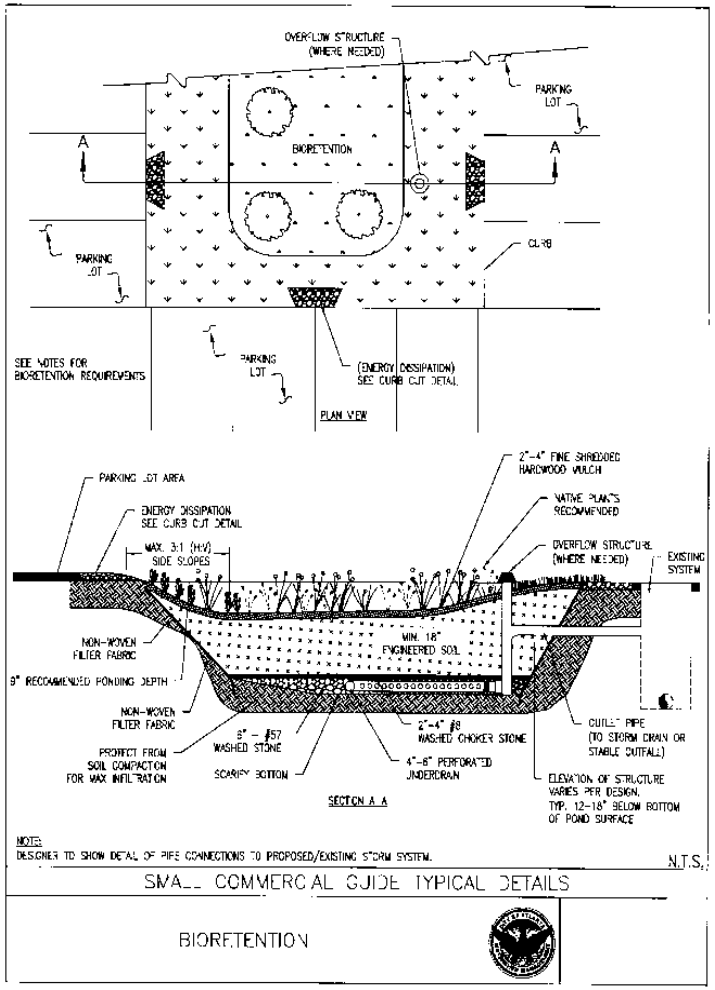


Figure A-2
Site Elements for Impervious Calculations

(Note: This manual applies because the net impacted impervious area is less than 5,000 square feet.)

Typical Details



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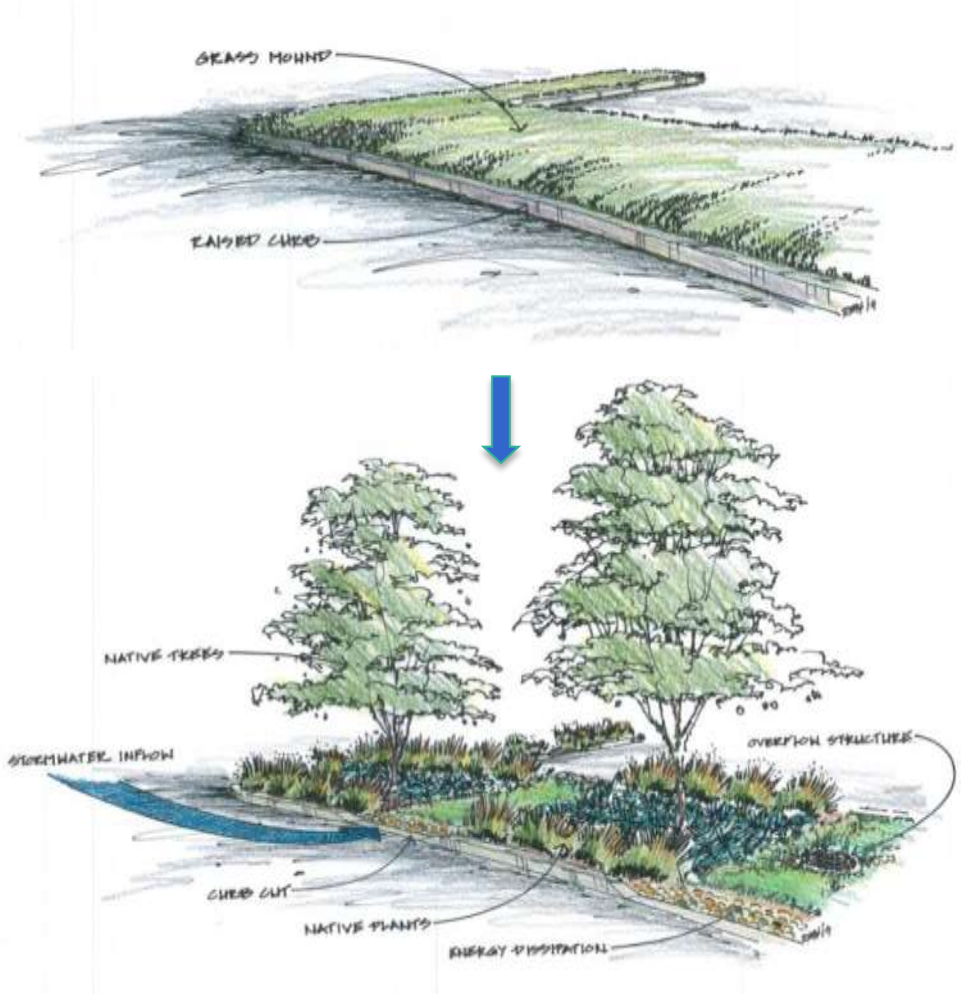
Retrofit examples: Landscape Islands



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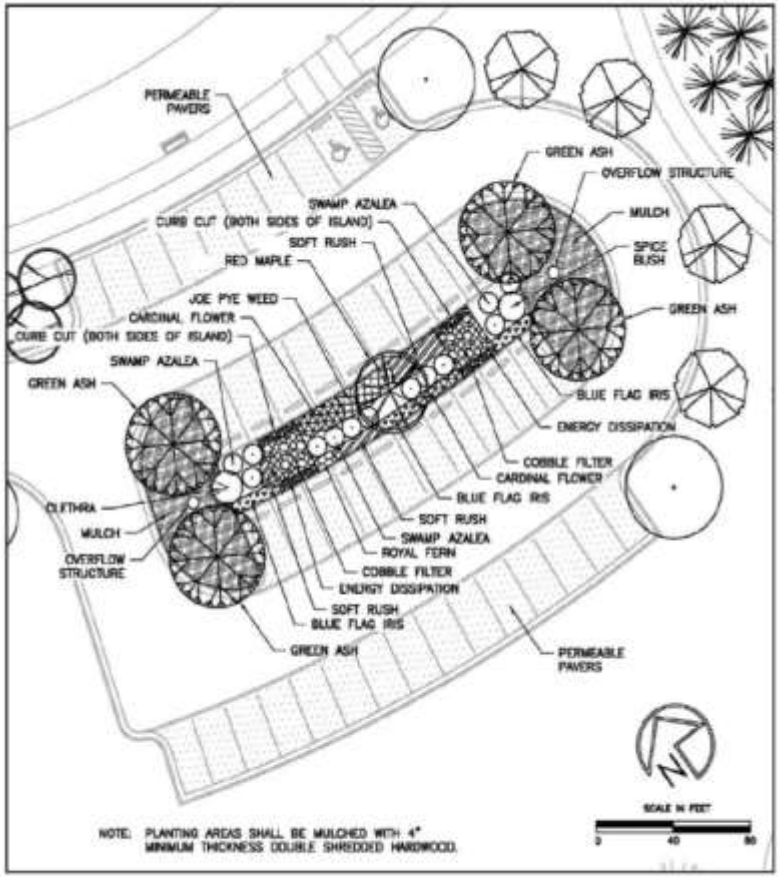
Example Landscape Plans



EXAMPLE #1: PARKING ISLAND BIORETENTION PLANTING

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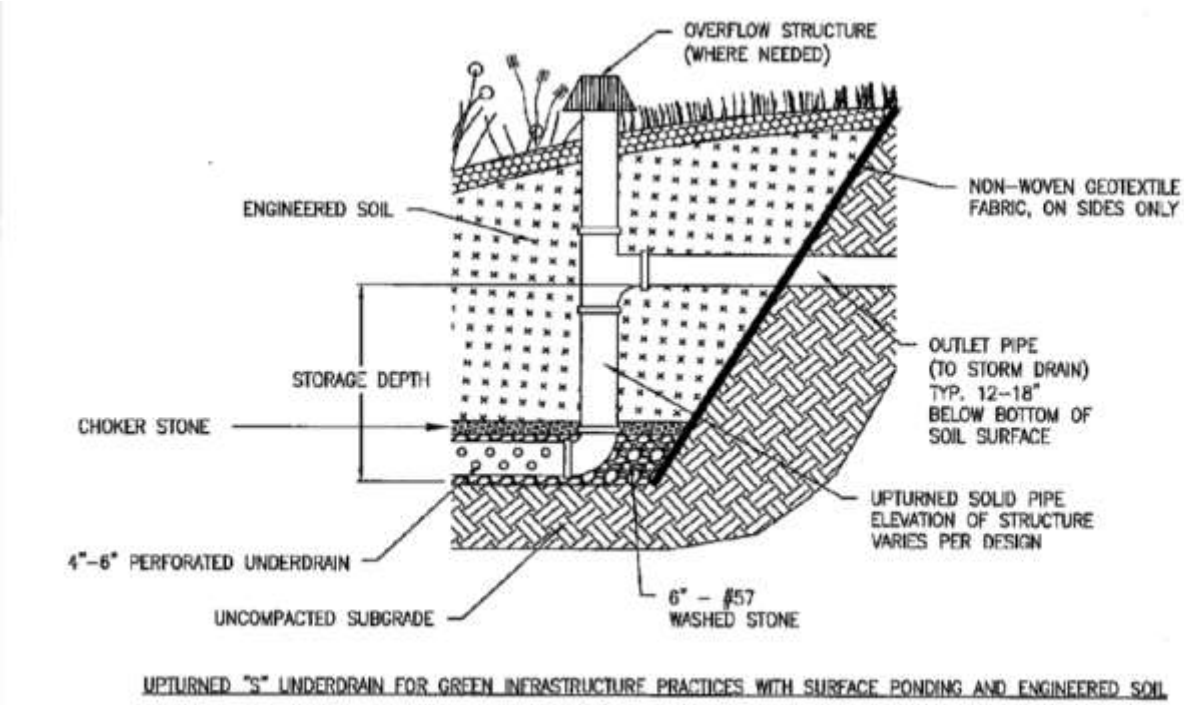
Innovative designs included



Upturned "S" Underdrain

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

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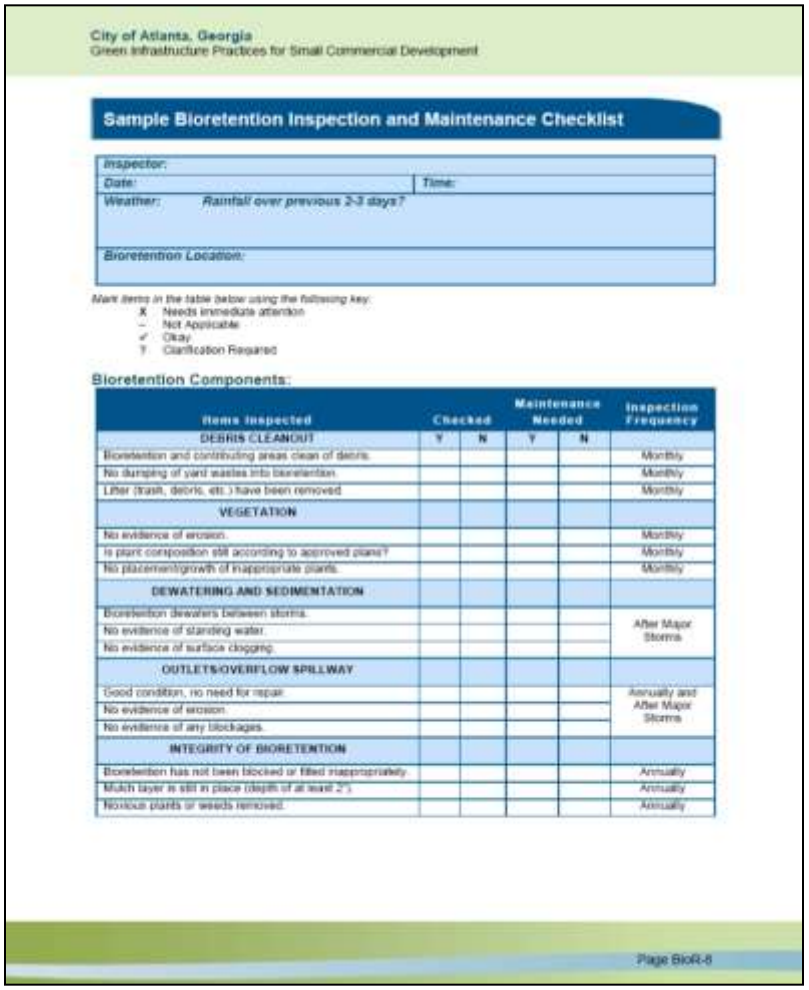
Maintenance Checklists



City of Atlanta, Georgia
Green Infrastructure Practices for Small Commercial Development

Sample Bioretention Inspection and Maintenance Checklist

Inspector:	
Date:	*Time:*
Weather: *Rainfall over previous 2-3 days?*	
Bioretention Location:	

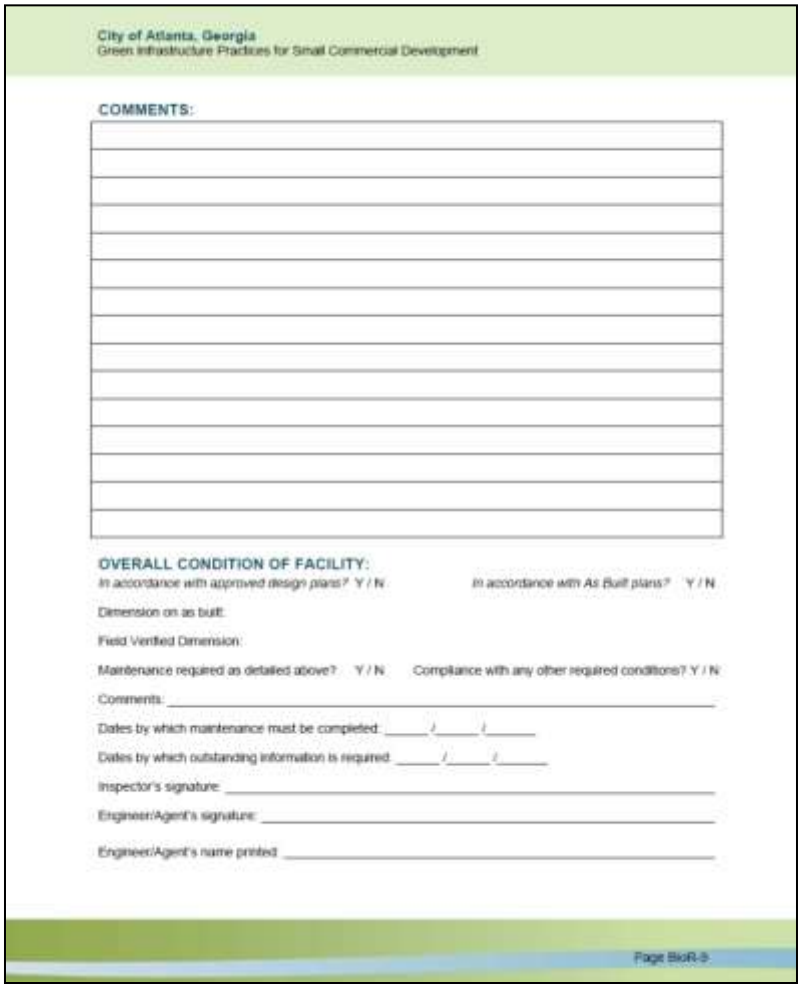
Mark items in the table below using the following key:

- X Needs immediate attention
- – Not Applicable
- ✓ Okay
- ? Clarification Required

Bioretention Components:

Items Inspected	Checked		Maintenance Needed		Inspection Frequency
	Y	N	Y	N	
DEBRIS CLEANOUT					
Bioretention and contributing areas clean of debris.					Monthly
No dumping of yard wastes into bioretention.					Monthly
Litter (trash, debris, etc.) have been removed.					Monthly
VEGETATION					
No evidence of erosion.					Monthly
Is plant composition still according to approved plans?					Monthly
No placement/growth of inappropriate plants.					Monthly
DEWATERING AND SEDIMENTATION					
Bioretention dewaters between storms.					After Major Storms
No evidence of standing water.					
No evidence of surface clogging.					
OUTLETS/OVERFLOW SPILLWAY					
Good condition, no need for repair.					Annually and After Major Storms
No evidence of erosion.					
No evidence of any blockages.					
INTEGRITY OF BIORETENTION					
Bioretention has not been blocked or filled inappropriately.					Annually
Mulch layer is still in place (depth of at least 2").					Annually
Noxious plants or weeds removed.					Annually

Page BioR-8



City of Atlanta, Georgia
Green Infrastructure Practices for Small Commercial Development

COMMENTS:

OVERALL CONDITION OF FACILITY:

In accordance with approved design plans? Y / N *In accordance with As Built plans?* Y / N

Dimension on 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: _____

Page BioR-9

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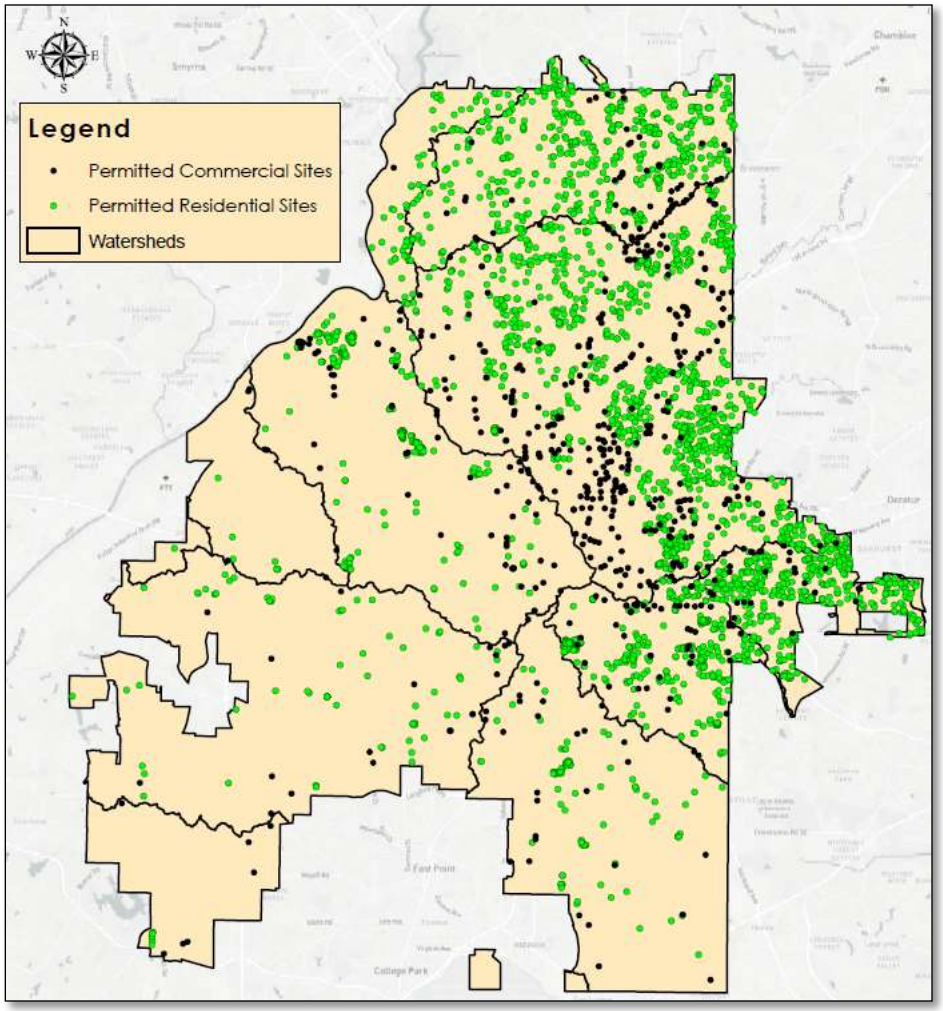
Tracking Green Infrastructure with GIS



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

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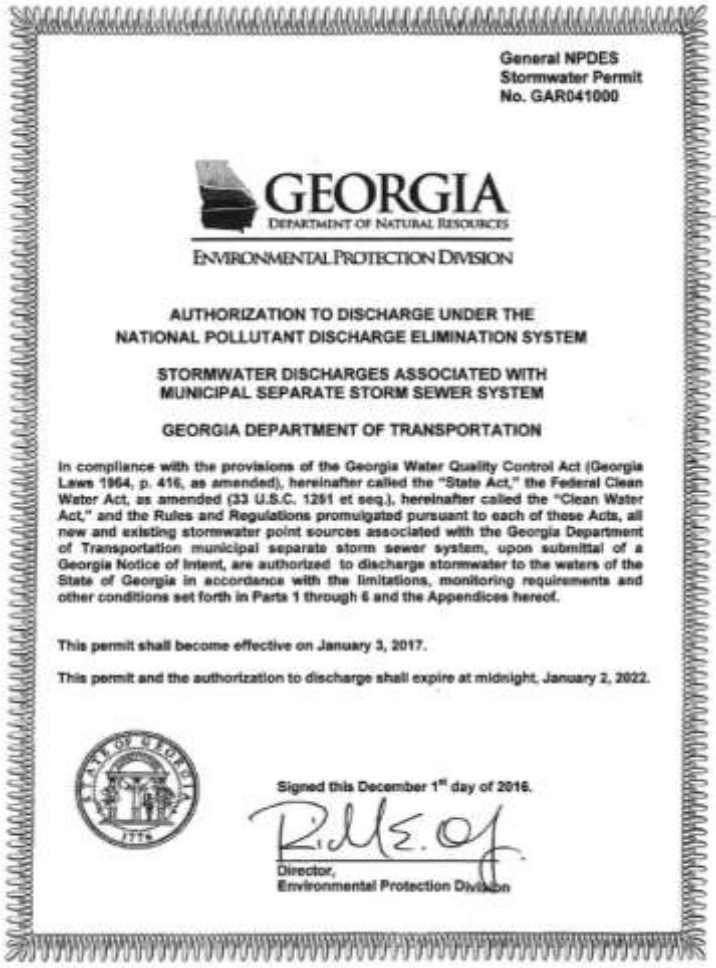
Updated MS4 Permits



General NPDES
Stormwater Permit
No. GAR041000

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

STORMWATER DISCHARGES ASSOCIATED WITH
MUNICIPAL SEPARATE STORM SEWER SYSTEM

GEORGIA DEPARTMENT OF TRANSPORTATION

In compliance with the provisions of the Georgia Water Quality Control Act (Georgia Laws 1964, p. 416, as amended), hereinafter called the "State Act," the Federal Clean Water Act, as amended (33 U.S.C. 1251 et seq.), hereinafter called the "Clean Water Act," and the Rules and Regulations promulgated pursuant to each of these Acts, all new and existing stormwater point sources associated with the Georgia Department of Transportation municipal separate storm sewer system, upon submittal of a Georgia Notice of Intent, are authorized to discharge stormwater to the waters of the State of Georgia in accordance with the limitations, monitoring requirements and other conditions set forth in Parts 1 through 6 and the Appendices hereof.

This permit shall become effective on January 3, 2017.

This permit and the authorization to discharge shall expire at midnight, January 2, 2022.

Signed this December 1st day of 2016.

Director,
Environmental Protection Division

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

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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

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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

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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

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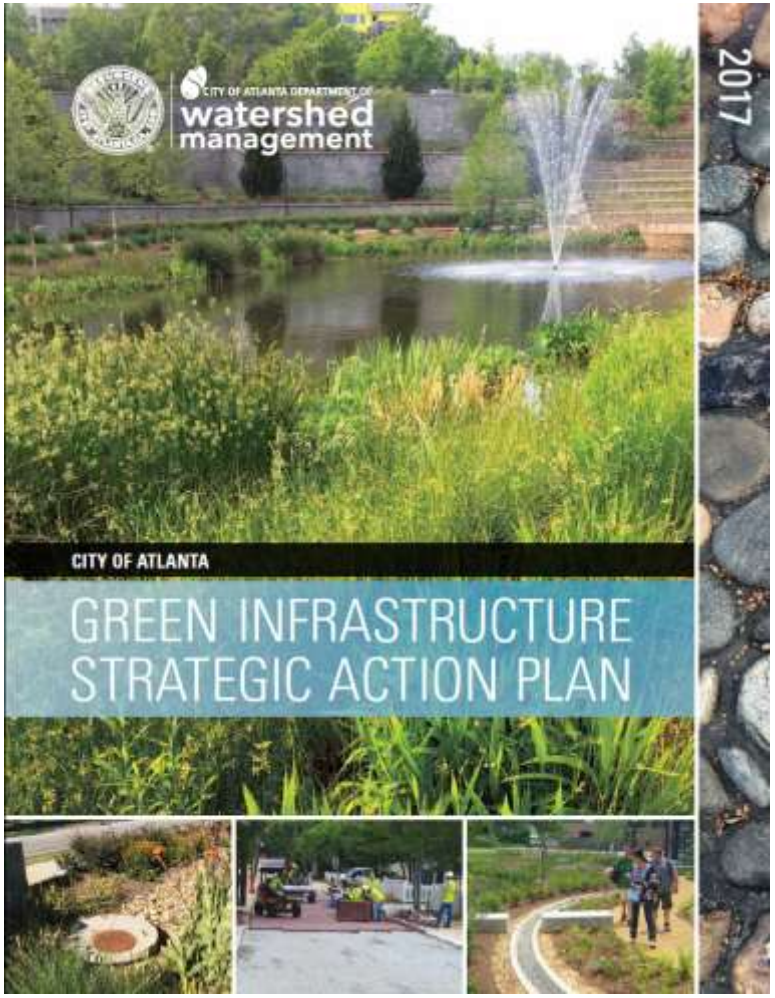
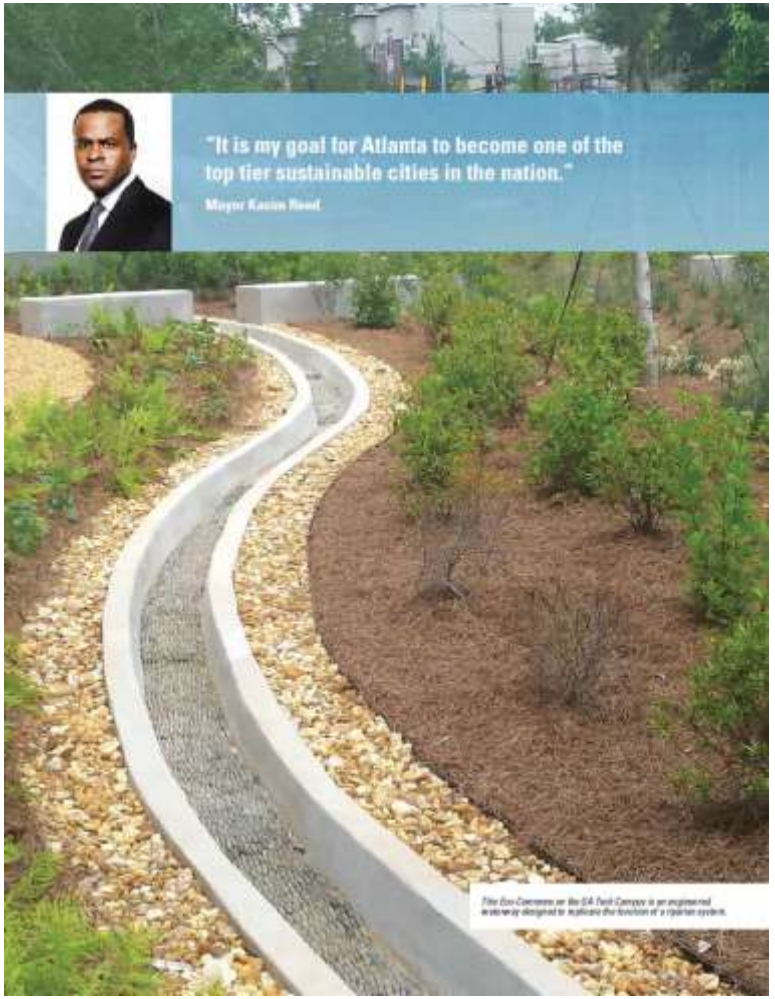
Strategic Action Plan





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Name that site!

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Historic 4th Ward Capacity Relief

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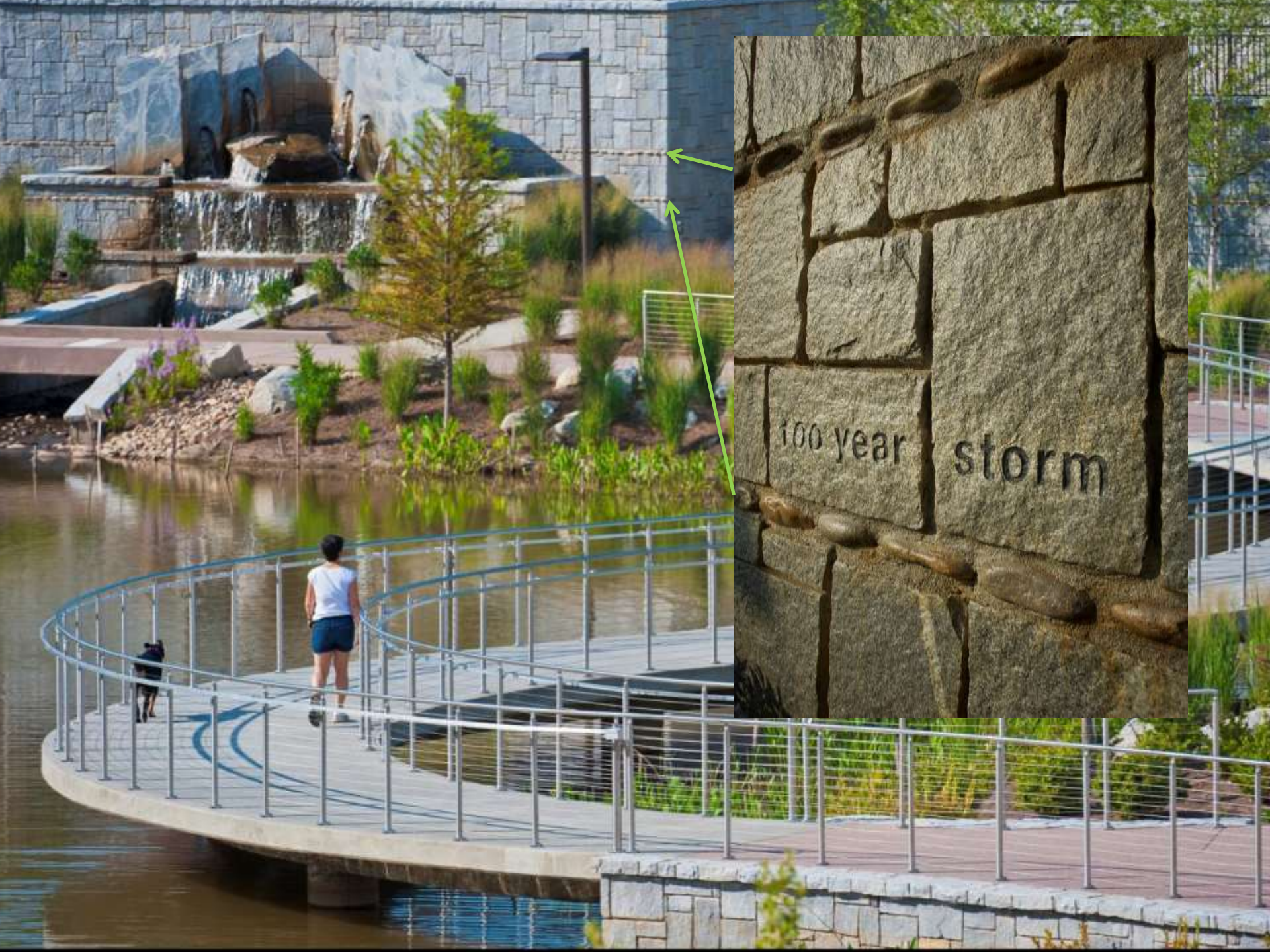
100 year
storm

Nature Influenced Design

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Aerating Fountain

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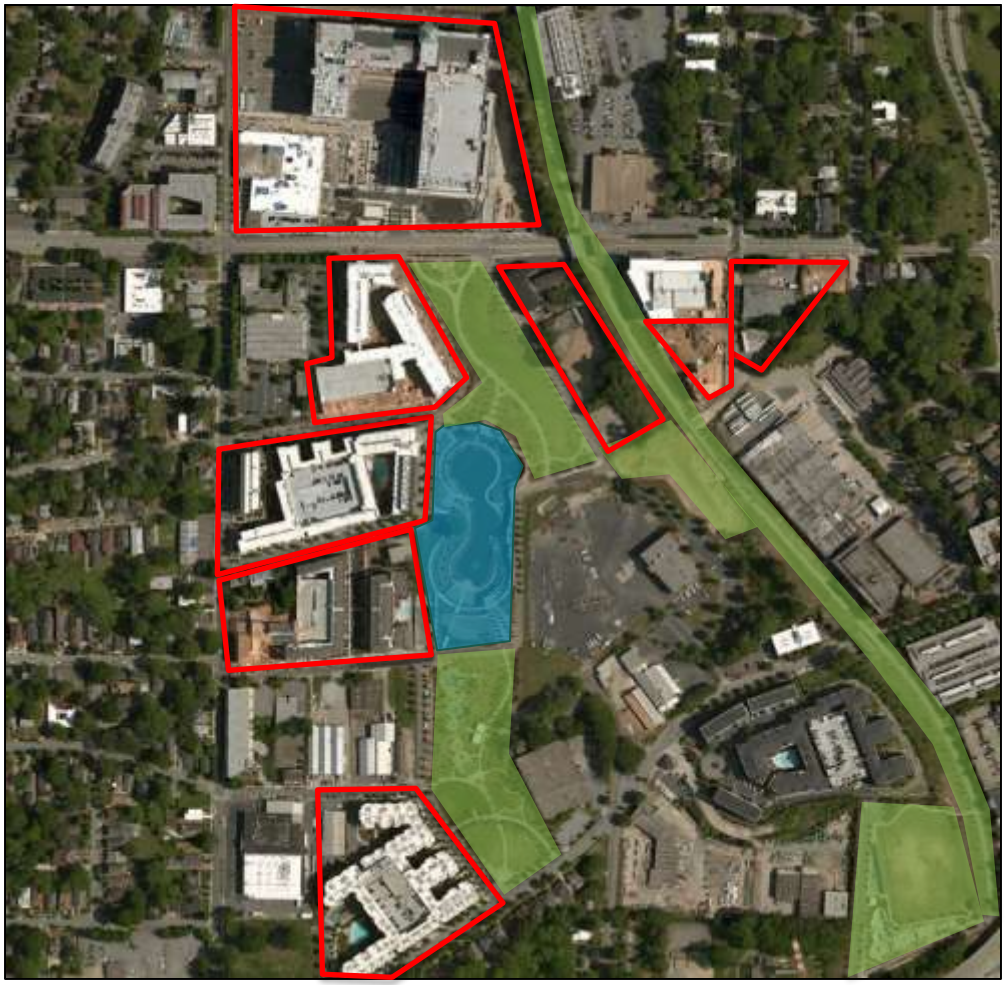
Which would you prefer?

Spurring Economic Development



$500M in Redevelopment

- Apartments
- Condos
- Ponce City Market

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Spurring Economic Development

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April 16, 2017 – 4” rain event

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Three days later…

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April 16, 2017 – 4” rain event

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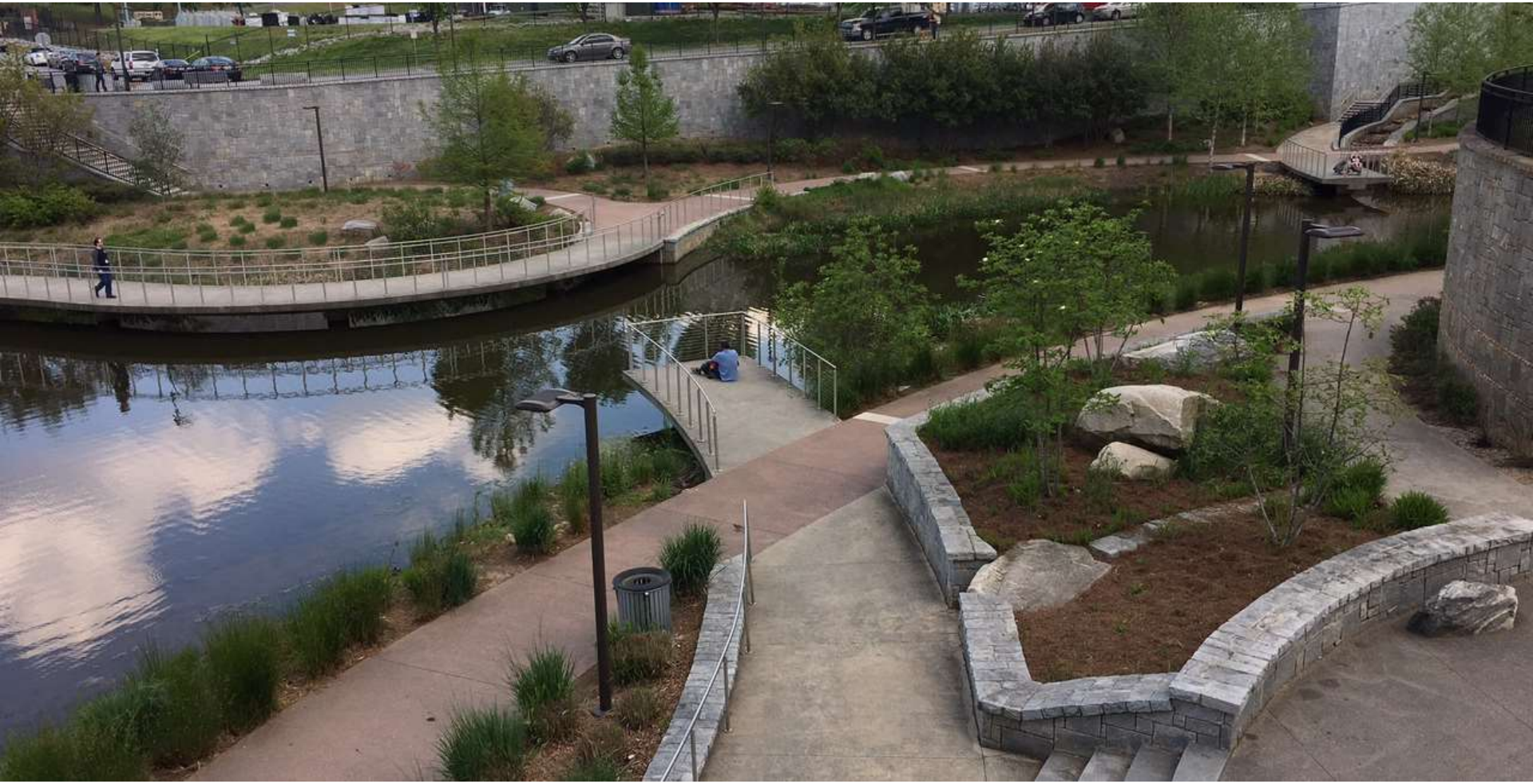
Three days later…



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Southeast Atlanta Green Infrastructure Initiative

Combined Sewer Capacity Relief

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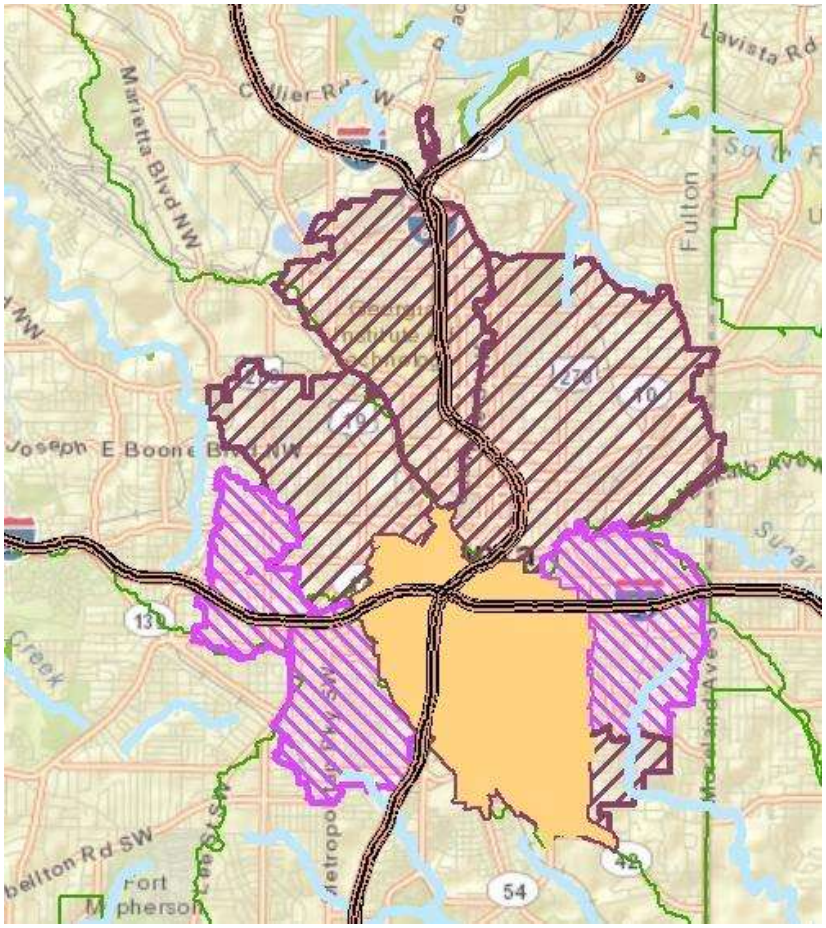
Custer CSO Basin Location



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

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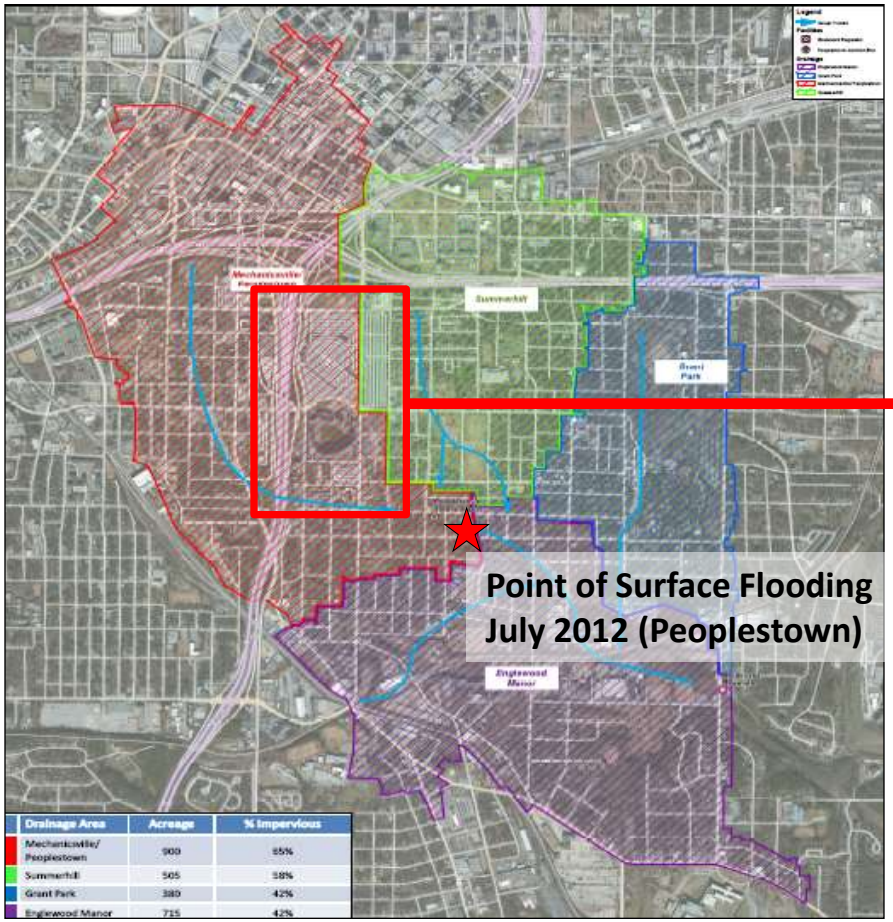
Contributing Conditions



Drainage Basin	Total Area (acres)	% Impervious	Impervious Area (acres)	Roadway Area (acres)
Mechanicsville / Peoplestown	900	65%	582	220
Summerhill	505	58%	293	110
Grant Park	380	42%	162	55
Englewood Manor	715	42%	301	62

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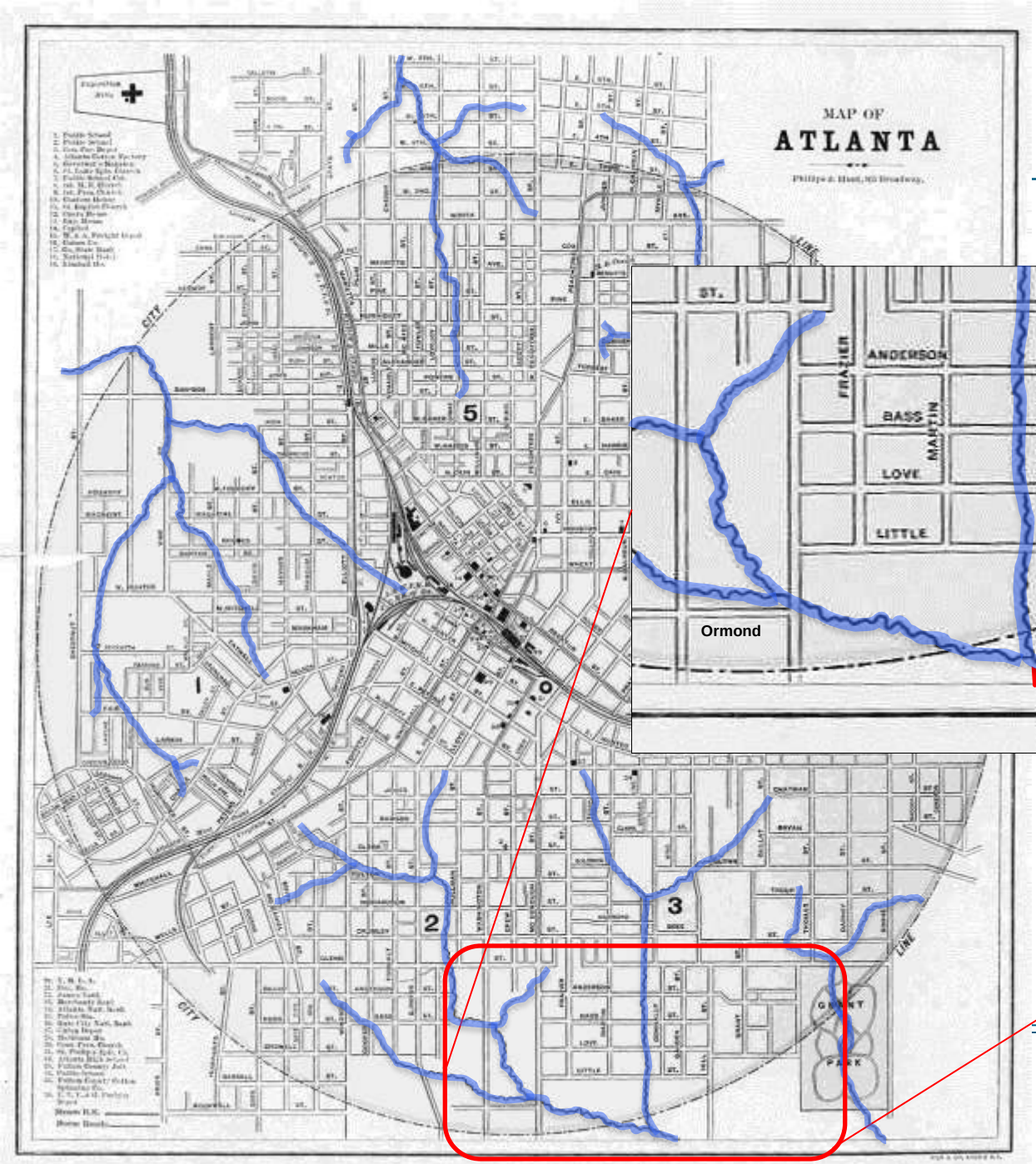
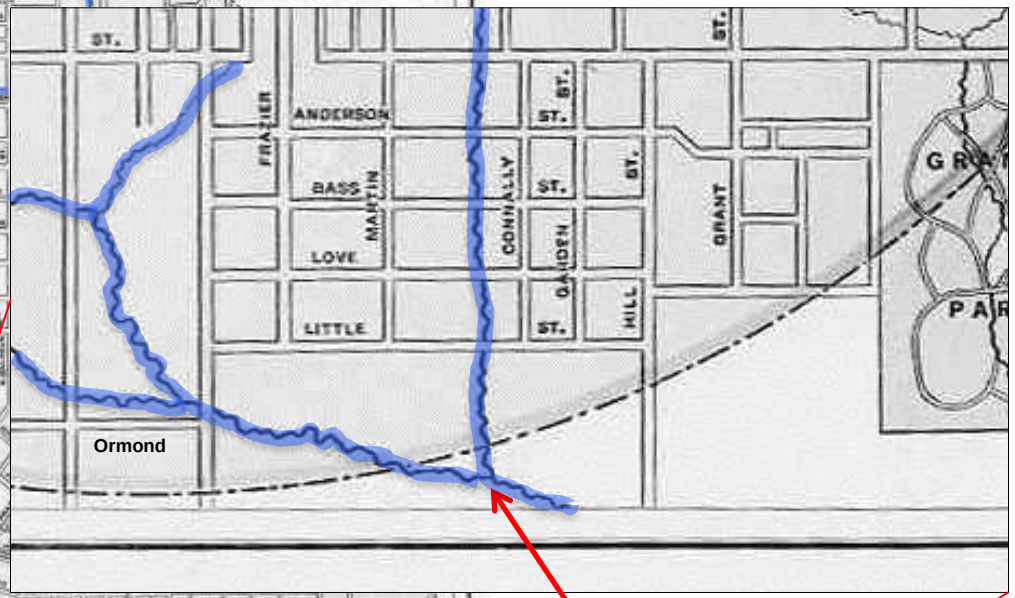
Historical Perspective

Map of Atlanta

1886





Peoplestown Junction Box Location

Back to Back Rain Events

Rank	Date	Recurrence Level
1	7/9/2012	10-25 year
2	8/31/2006	5-10 year
3	7/11/2012	2-5 year
4	9/29/2009	2-5 year
5	7/3/2012	2-5 year
6	5/5/2003	2-5 year
7	7/20/2011	2 year
8	8/20/2000	2 year
9	6/3/2001	2 year
10	8/28/2009	2 year

Peoplestown Flooding

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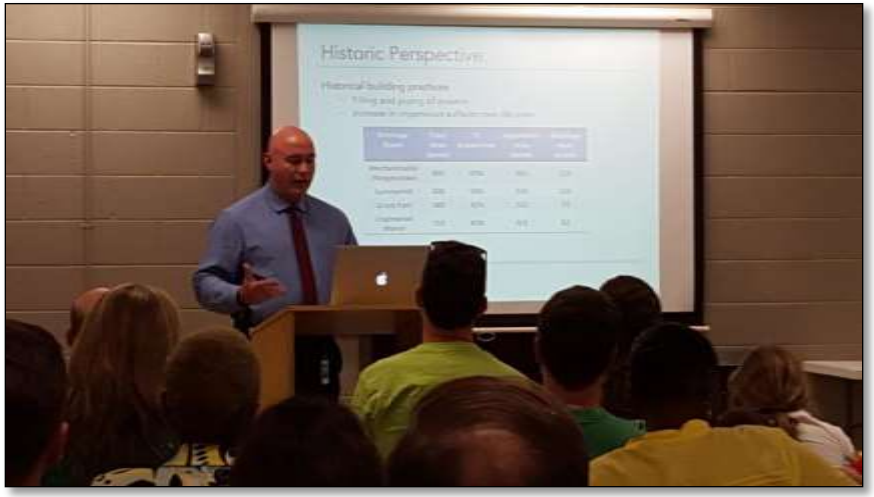
Community Engagement



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Phase 1 Projects- Completed

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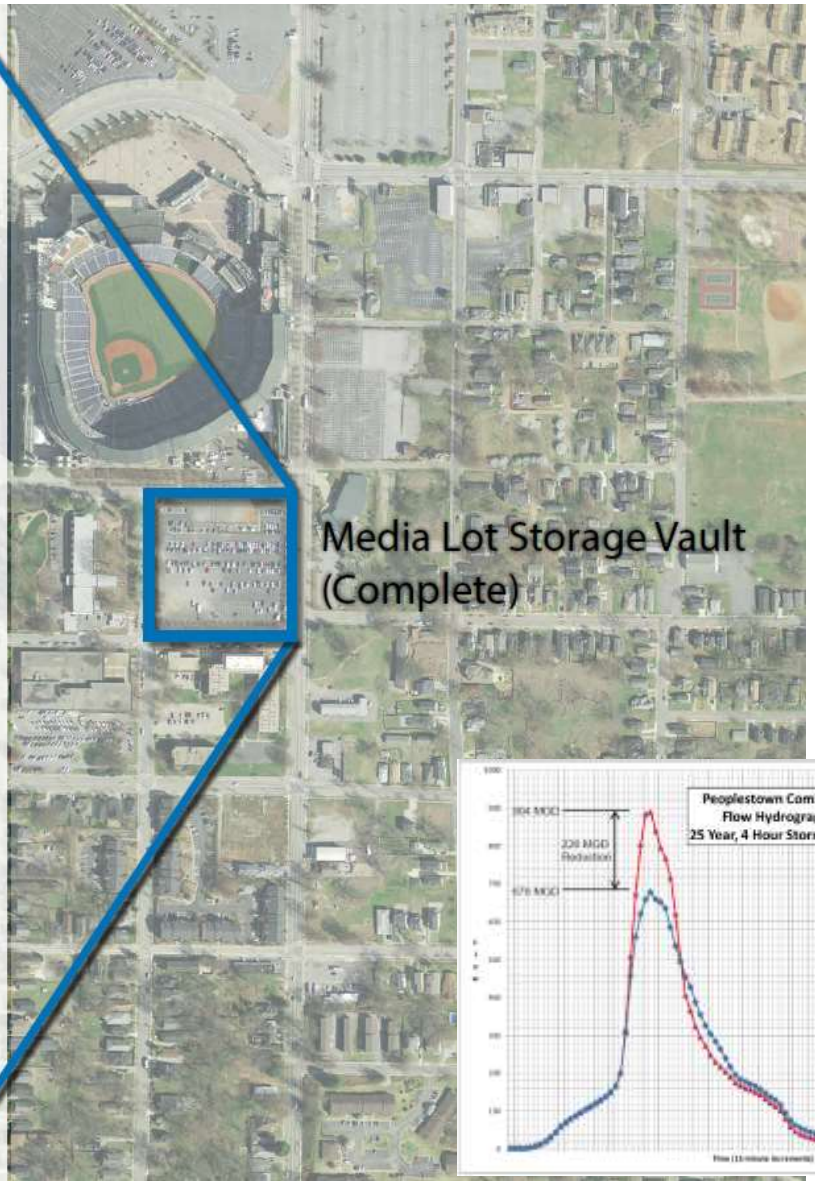
Phase 2: Gray Solution

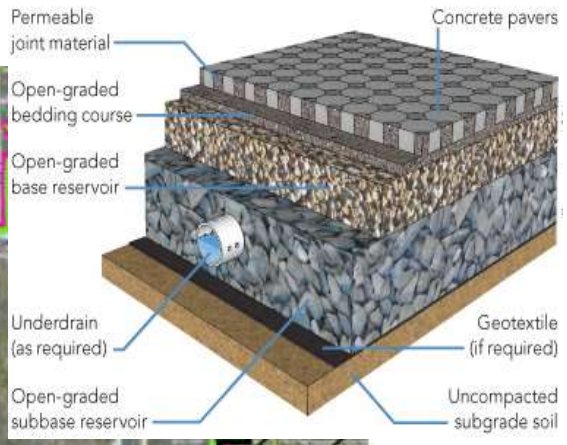

During Construction


View Inside Vault

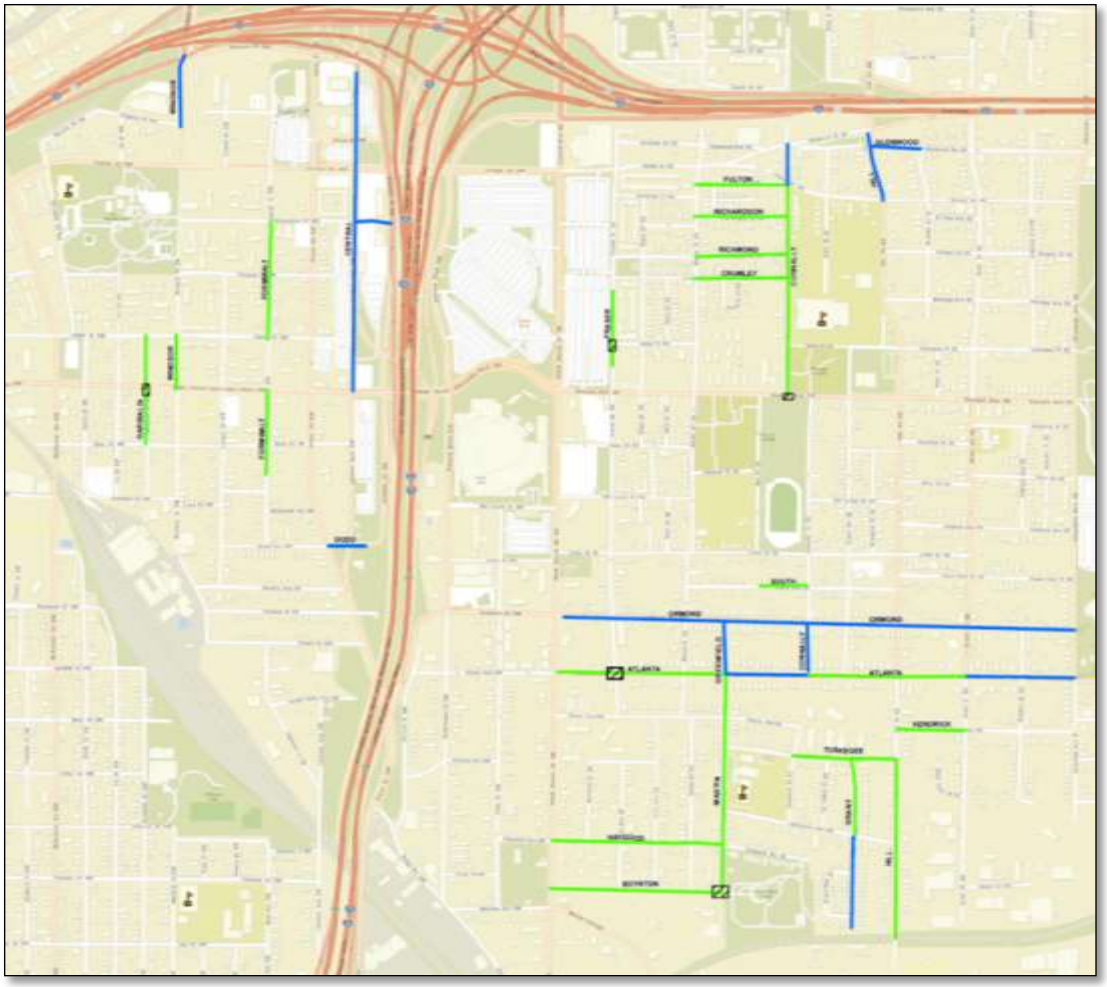


Phase 2: Permeable Roadways

- **4+ miles of Permeable Pavers**



Updated Map



Legend

- Schools
- Gateway Intersections

Pavers Status

- Proposed Streets to Compensate for Removed streets
- Completed
- Originally Proposed
- Removed from Project
- Currently Under Construction

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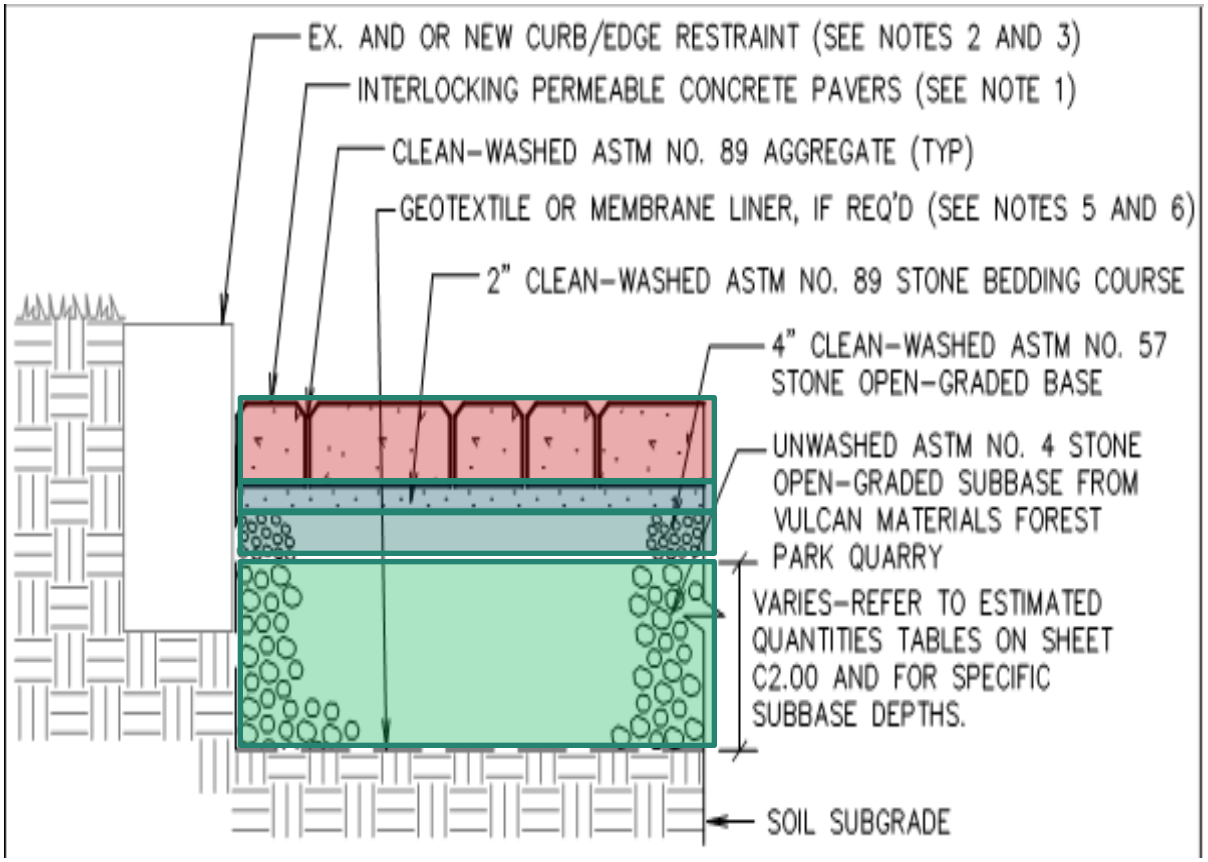
Permeable Paver System



The paver system is made up of the following components:

- **#4 Stone**
- **#57 Stone**
- **#89 Stone**
- **LLDPE 40 Mil Liner**
- **Permeable Pavers**

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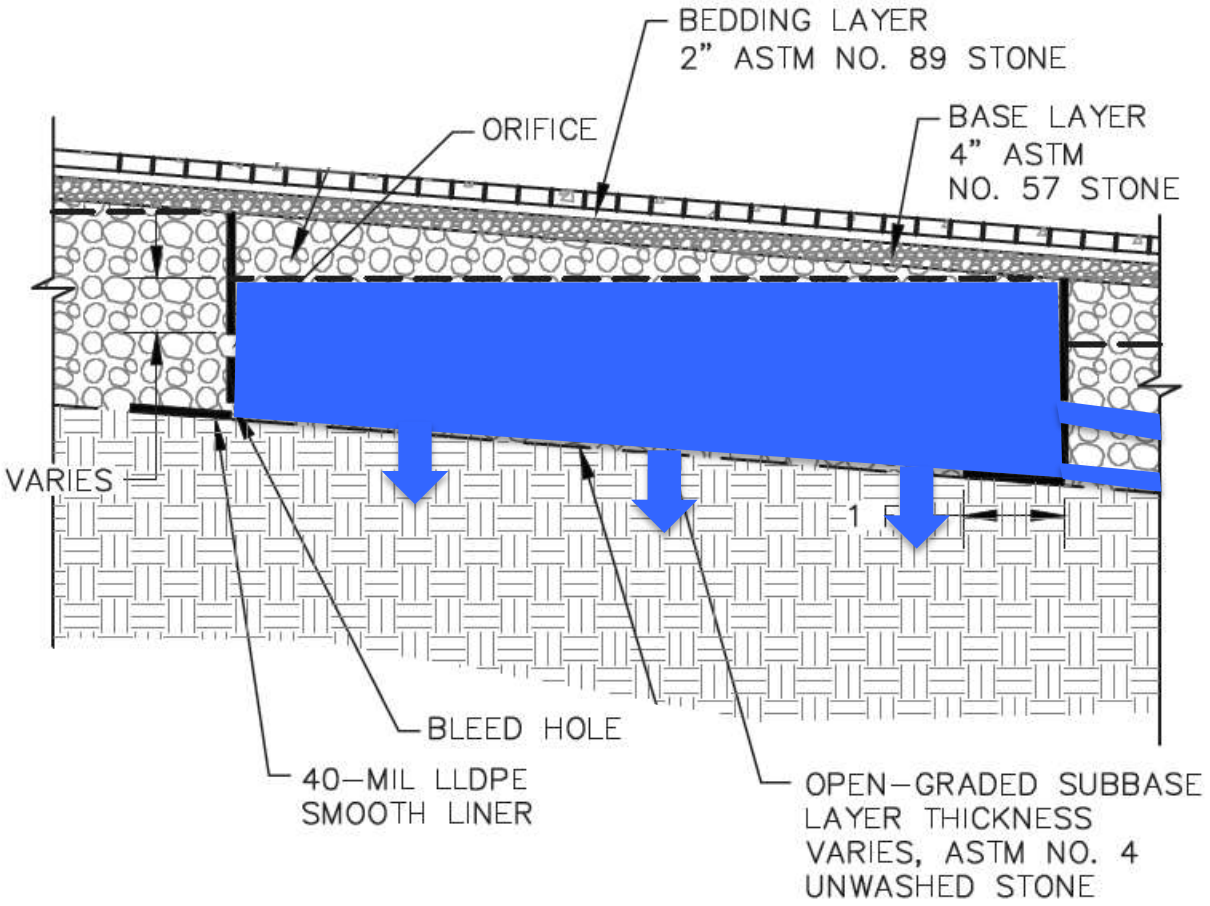
Unique Design Considerations



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Construction Sequence

- **Excavation, aggregate reservoir, paver installation**

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Completed Streets

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Rodney Cook, Sr. Park in Historic Vine City

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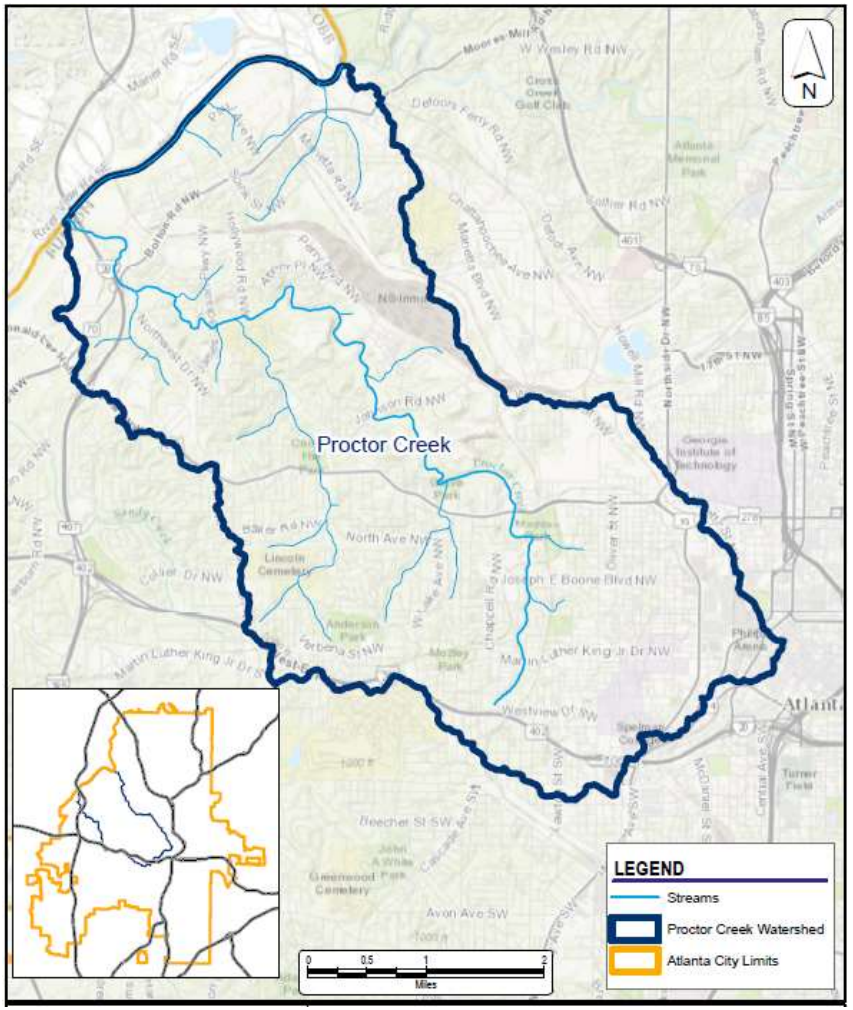
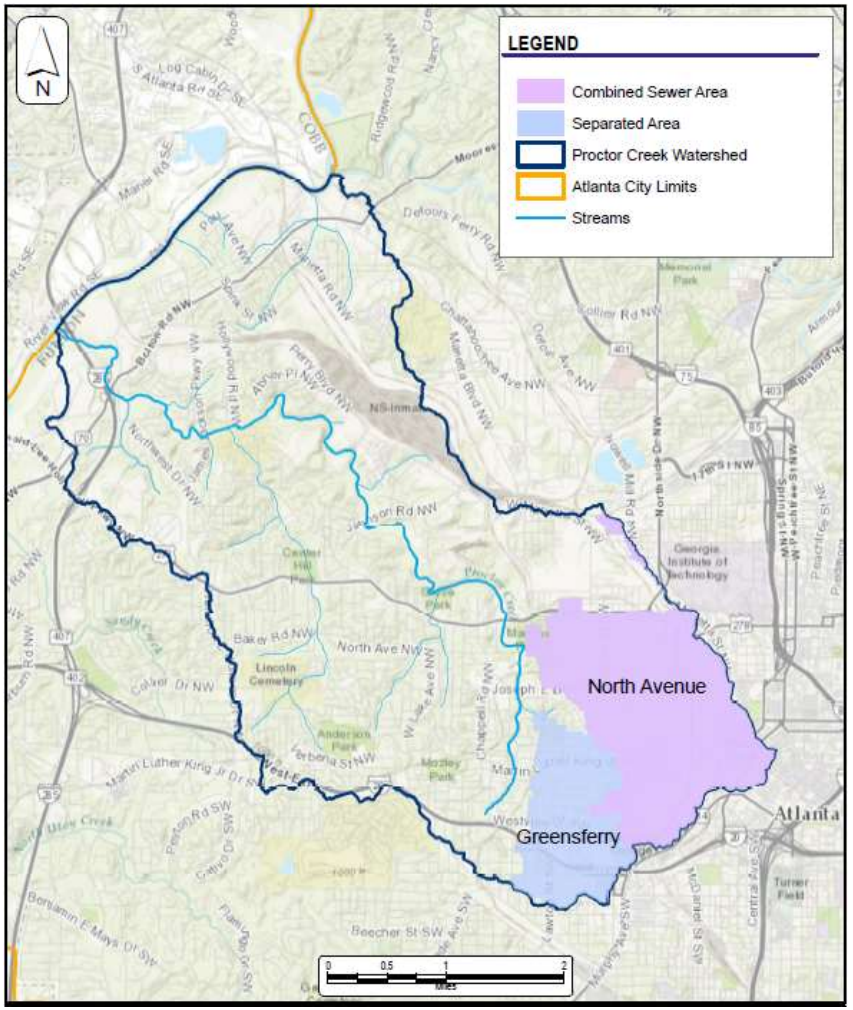
Proctor Creek Watershed - UWFP





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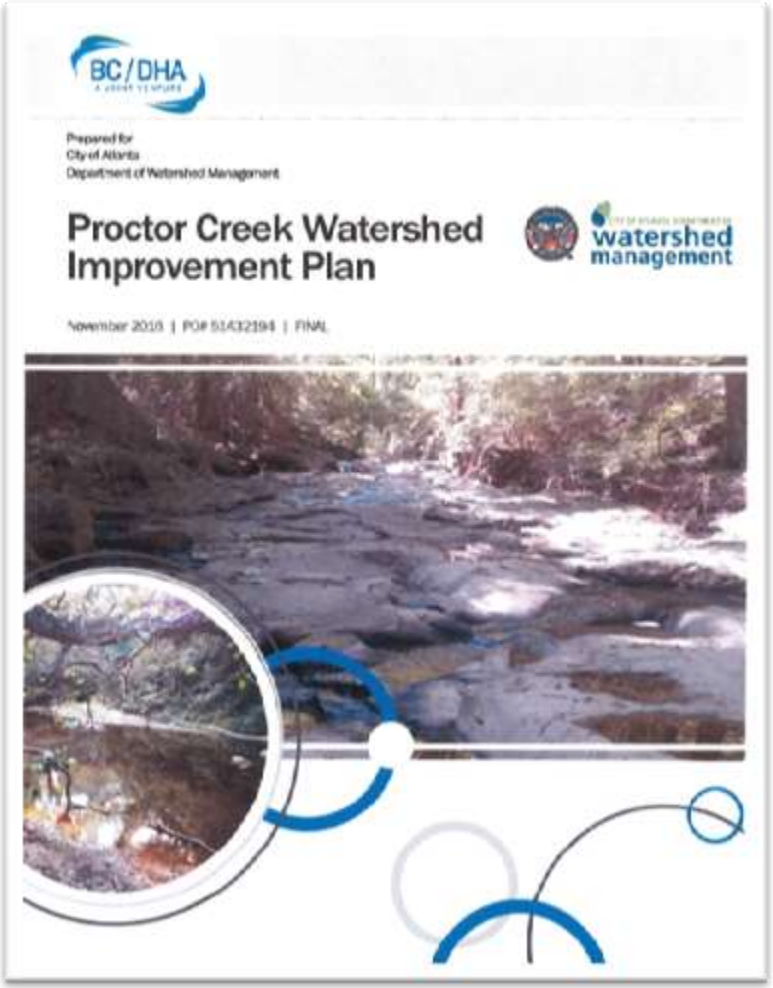
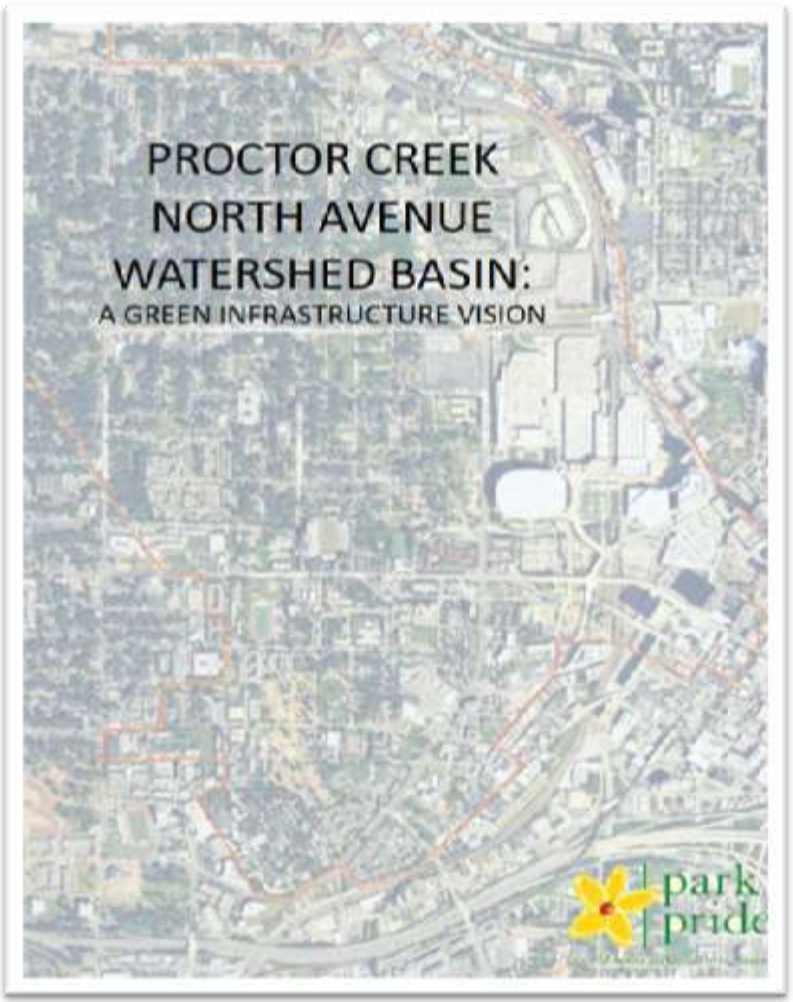
Basin wide planning efforts





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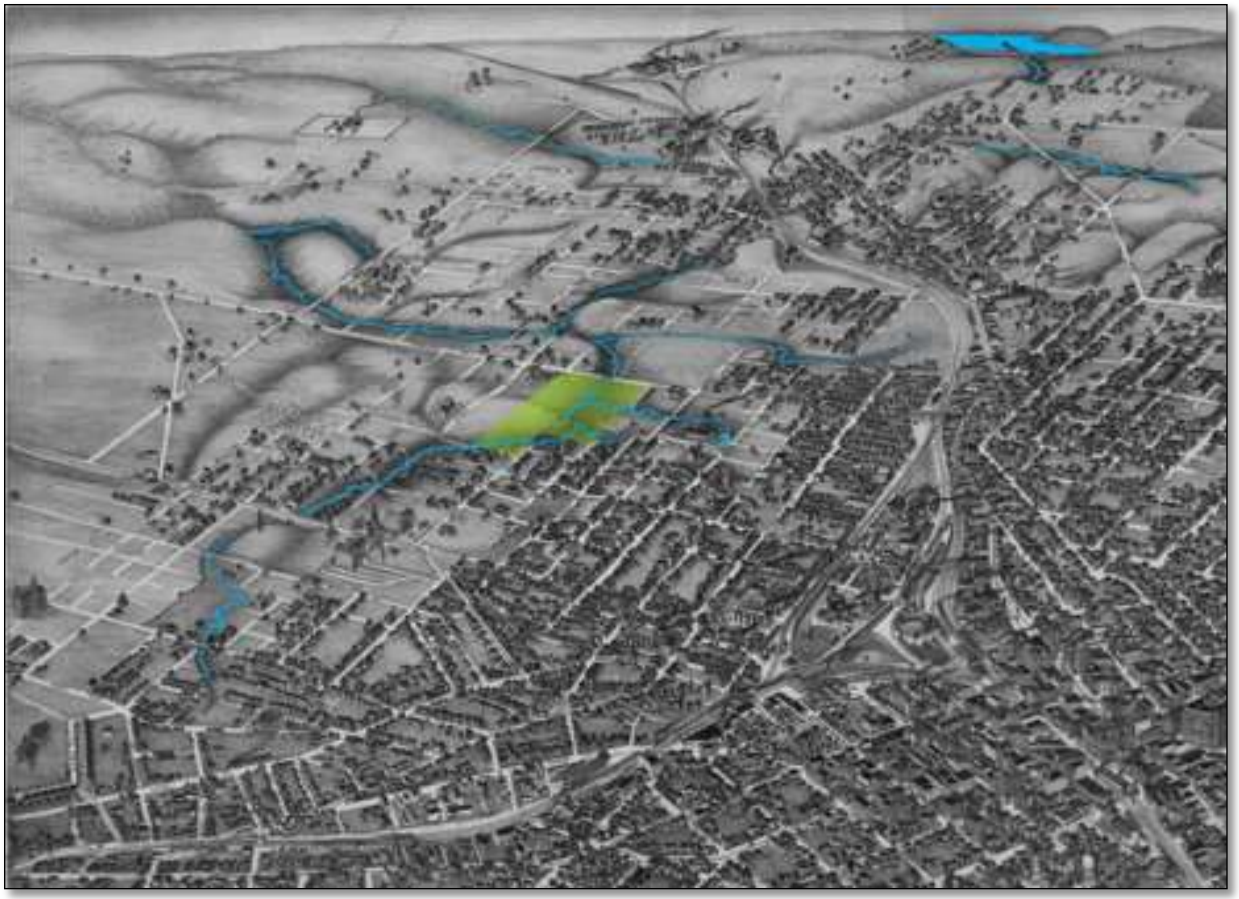
Neighborhoods

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

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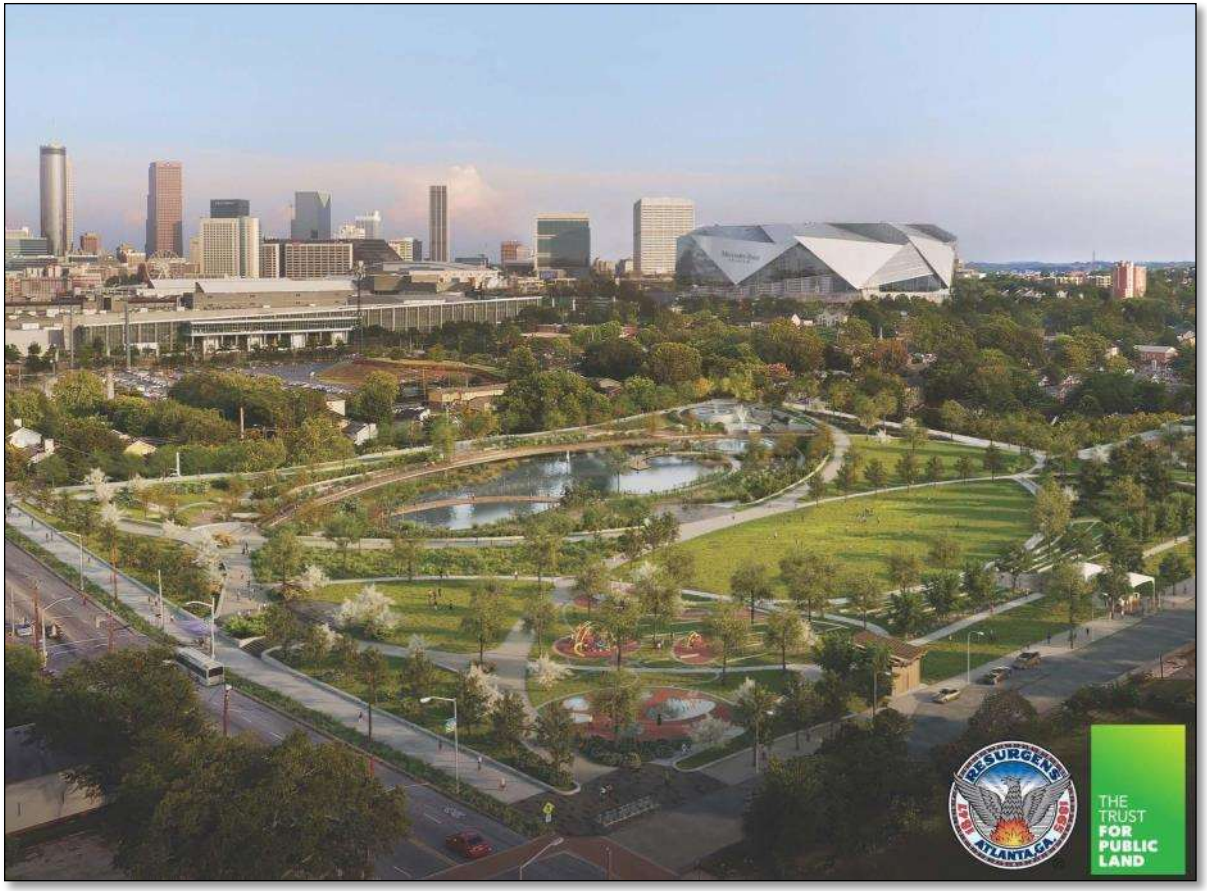
Rodney Cook, Sr. Park in Historic Vine City



Courtesy of HDR, Inc.

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

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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

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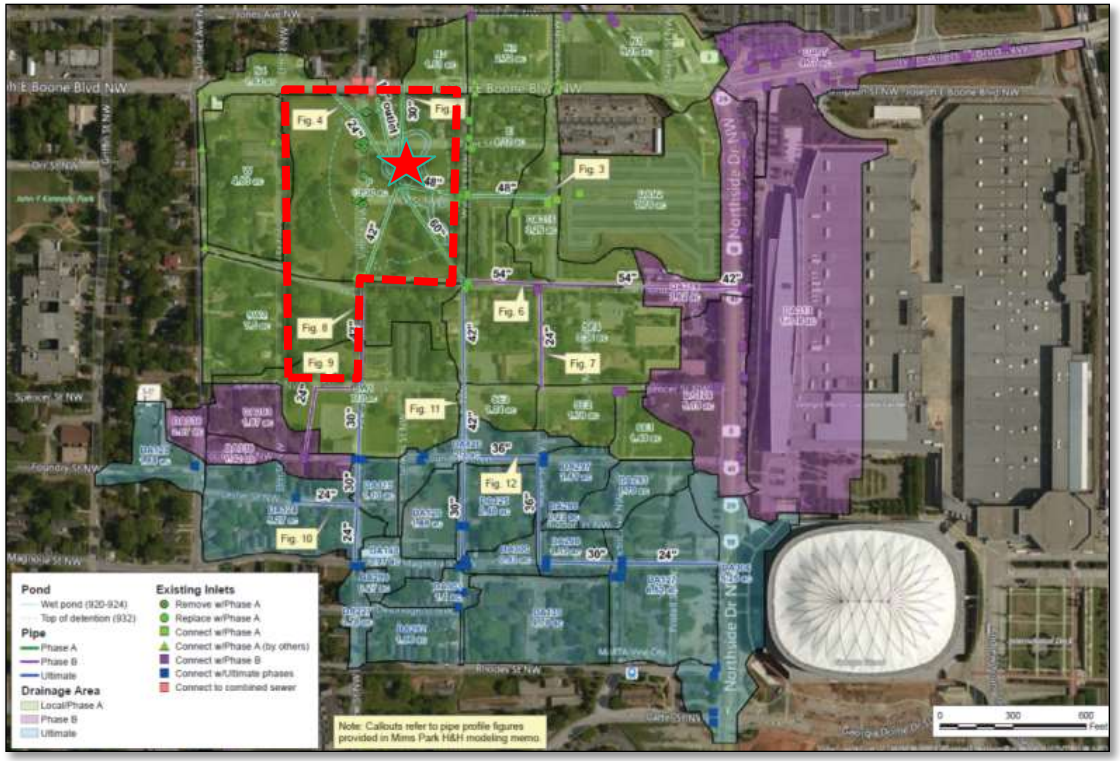
Rodney Cook, Sr. Park in Historic Vine City



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

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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

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Boone Blvd Green Street

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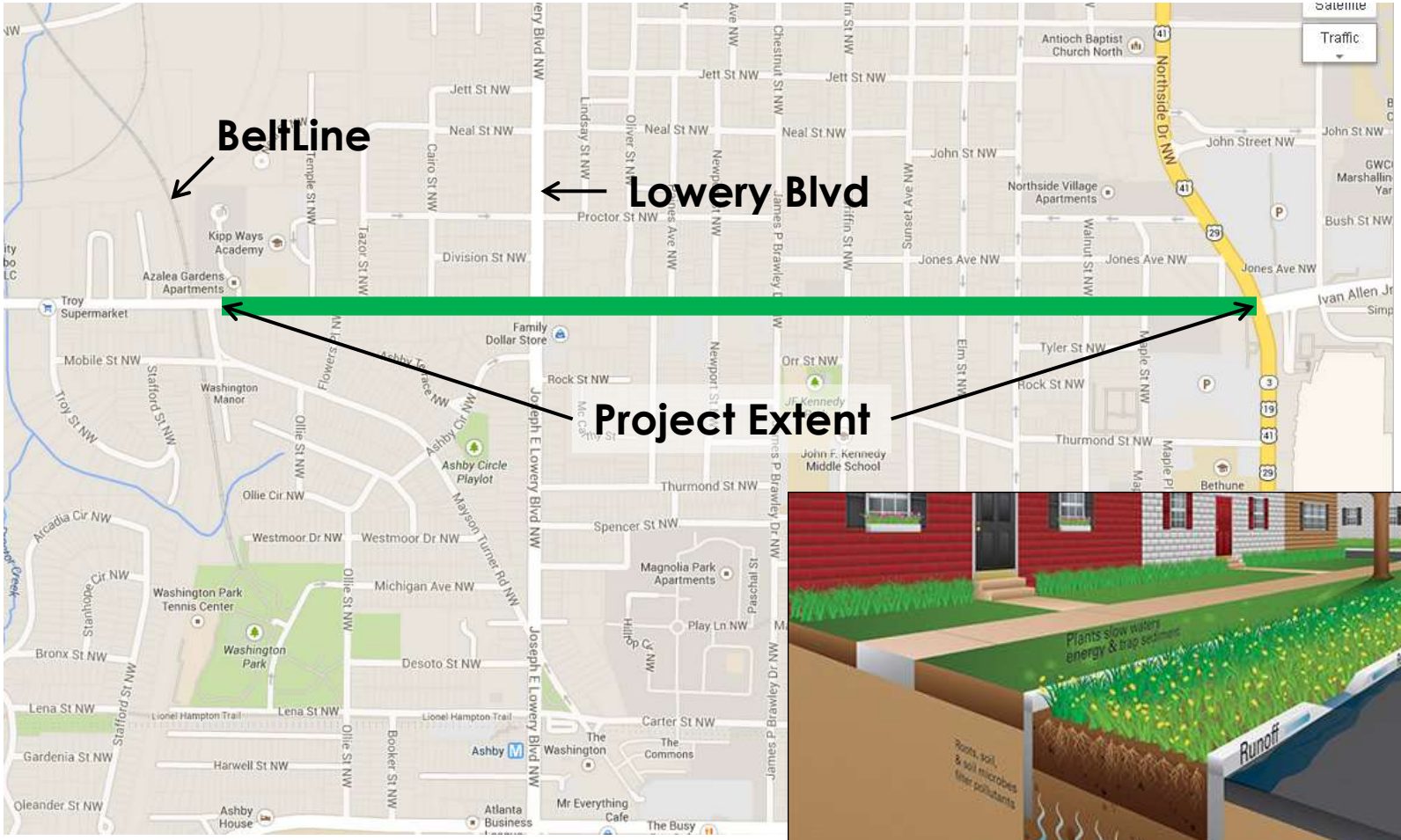
Boone Blvd Green Street



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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

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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**

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Mayor's Commitment

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

-Mayor Kasim Reed

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Questions?

www.AtlantaWatershed.org/GreenInfrastructure

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