City of Atlanta

Department of Watershed Management

Stormwater Management

Margaret E. Tanner, P.E.
Deputy Commissioner
Office of Watershed Protection

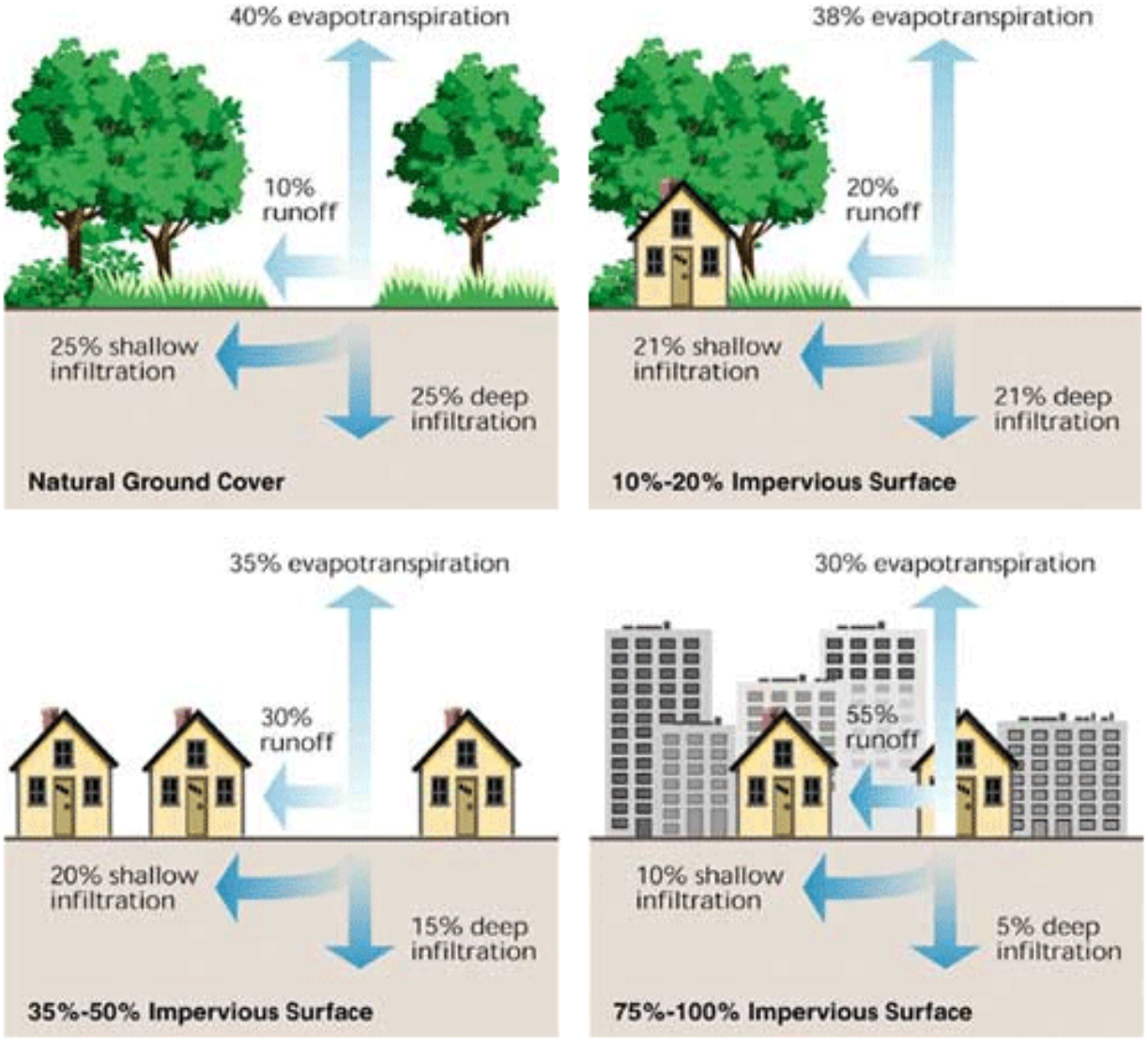
Buckhead Council of Neighborhoods
July 11, 2013

> *"It is my goal for Atlanta to become one of the top tier sustainable cities in the nation"*
>
> - Mayor Kasim Reed





Problems of Urban Watersheds

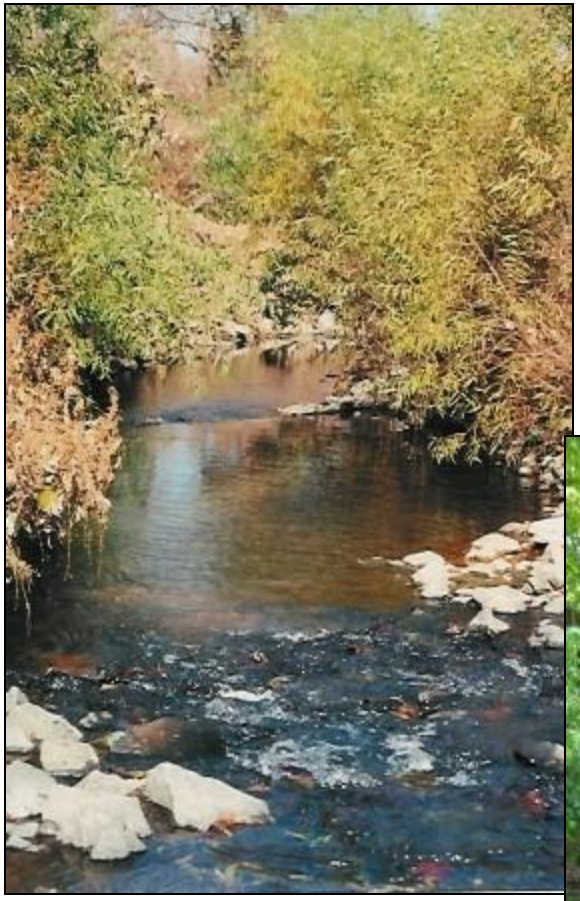


Problems of Urban Watersheds

"Flashy" stream hydrology causes erosion and low base flow

Problem: Stream Pollution

Goal: Clean Healthy Streams



What is Green Infrastructure?

- An interconnected natural or engineered system that mimics undeveloped hydrologic functions
- Capture the first 1.0” of rainfall and infiltrate, evapotranspire (uptake of water by plants), or reuse the runoff with rainwater harvesting
  - Reduces volume of runoff **AND** removes pollutants
  - Every land surface can act as stormwater
  - Reduces amount of detention volume required





What is Green Infrastructure?

Gray vs. Green

Slow, Infiltrate, and Clean Stormwater

Why Green Infrastructure?

- **Addresses stormwater at its source**
- **Flood protection** - increases capacity in our Combined/Separate storm sewers and creeks
- **Promotes sustainability** - alleviates the impacts of urban heat islands, reduces energy demand, improves air quality, and increases carbon sequestration
- **Potential cost savings**
- **Enhances aesthetics of community**





Examples of Green Infrastructure

- Soil Restoration
- Site Reforestation
- Green Roofs
- Permeable Pavements
- Undisturbed Pervious Areas (greenspace)
- Vegetated Filter Strips
- Downspout Disconnection
- Rain Gardens
- Stormwater Planters
- Dry wells
- Rainwater Harvesting
- Bioretention
- Infiltration Practices
- Dry Swales
- Grass Channels

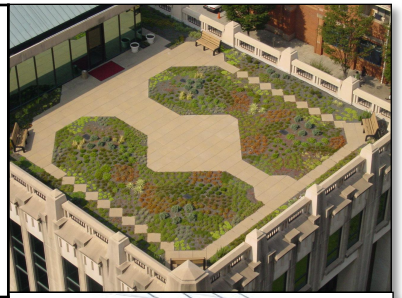




Green Infrastructure Practices

Green Roof

Atlanta City Hall

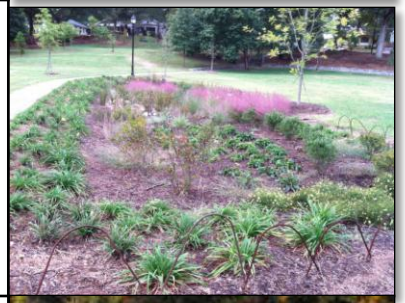


Rainwater Harvesting Cistern

Southface Energy Institute

Rain Garden

Adair Park



Pervious Paving

English Park

Bioswale

Fernbank Museum Parking Lot

Stormwater Planters

Juniper Street (planned)

Pervious Concrete

Felder Street

Stormwater Bump-outs

Whitehall Terrace

Post-Development Stormwater Management Ordinance





Atlanta's Post Development Stormwater Management Ordinance

- Adopted in 2013
- Requires the use of Green Infrastructure Stormwater Management
  - Adds a water quality treatment component
- Adds requirements for single family residential
- Requires maintenance of existing community and privately owned detention ponds
- Requires a pre-plan submittal consultation meeting





Applicability - Commercial

- **NEW DEVELOPMENT -** A site that has not been previously developed
  - Adds any impervious surface, or
  - Disturbs more than 1.0 acres of land
- **REDEVELOPMENT**
  - Adds or replaces more than 500 ft^2 of impervious surface,
- **DEMOLITION**
  - leaves in place more than 500 ft^2 of impervious surface (i.e. slab)
  - Not required if a permit for redevelopment has been submitted





Applicability - Single Family Residential

- Construction of a new home, tear down & rebuild, & large additions (>1,000 square feet) of impervious surface
- Required to capture and treat first 1.0” of rainfall **ONLY** (no detention requirements)
- Does not apply to:
  - Second story additions
  - Renovations
  - Replacing driveways





Why use GI on SFR lots?

- Existing drainage problems in neighborhoods
- Redevelopment often maximizes building footprints
- No stormwater management required previously
- Compounded effects on downstream property owners
  - Increased flooding
  - Increased Erosion & Sedimentation
  - Incised streams





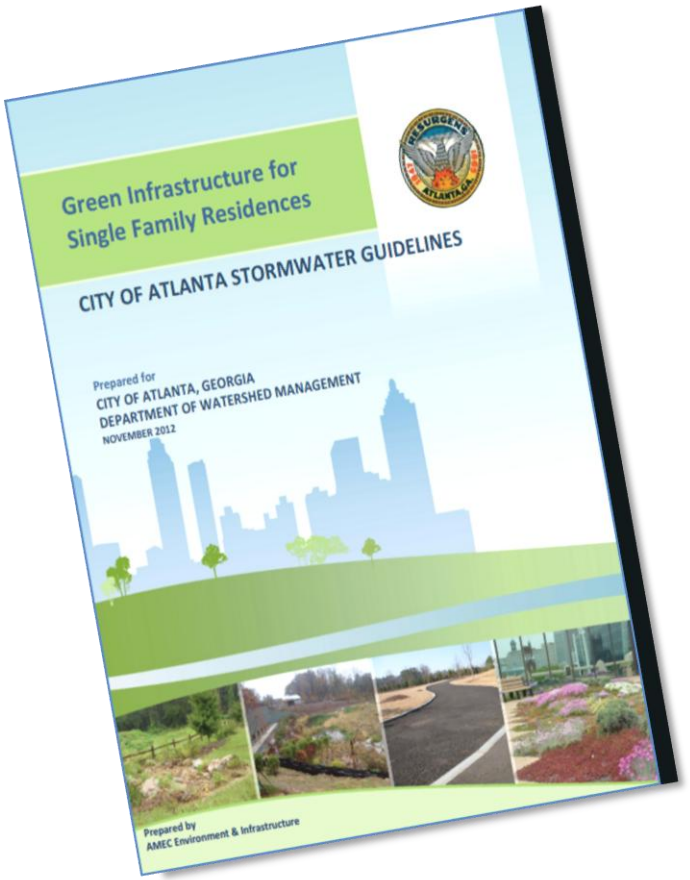
Guidance Document

- *COA Stormwater Guidelines: Green Infrastructure for Single Family Residences*
  - Provides a list of acceptable GI Practices
  - Reduces the need for complicated calculations
  - Provides tear-off details and construction specification for each practice
  - Simplifies the review and approval process





SFR Guidance Document



- Overview of Requirements
- Design of BMPs
- Infiltration Testing
- Plant List
- Mainly for Builders
- Can also be used by homeowners to address drainage problems on existing lots

SFR Guidance Document

RAIN GARDENS

SINGLE FAMILY RESIDENTIAL GUIDE
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT

Rain gardens are small, landscaped depressions that are filled with a mix of native soil and compost, and are planted with trees, shrubs and other garden-like vegetation. They are designed to temporarily store stormwater runoff from rooftops, driveways, patios and other areas around your home while reducing runoff rates and pollutant loads in your local watershed. A rain garden can be a beautiful and functional addition to your landscape.

Location

- Rain gardens should be located to receive the maximum amount of stormwater runoff from impervious surfaces, and where downspouts or driveway runoff can enter garden flowing away from the home.
- Swales, berms, or downspout extensions may be helpful to route runoff to the rain garden.
- Locate at least 10 feet from foundations, not within the public right of way, away from utility lines, not over septic fields, and not near a steep bluff edge. Call 811 before you dig to locate the utility lines on your property.
- Rain gardens on steep slopes (>10%) may require an alternative design with terracing.

Design

- The size of the rain garden will vary depending on the impervious surface draining to it and the depth of the amended soils. Use the table to determine the required surface area.
- A maximum ponding depth of 6 inches is allowed within rain gardens. On average, rain gardens drain within a day which will not create a mosquito problem.
- Design rain garden entrance to immediately intercept inflow and reduce its velocity with stones, dense hardy vegetation or by other means.
- If sides are to be mowed rain gardens should be designed with side slopes of 3:1 (H:V) or flatter.
- For best results, it is suggested to test your soil characteristics as you would for a garden, or contact your local County Extension Service for help www.caes.uga.edu/extension/fulton.
- Soils for rain gardens should be amended native soils containing: 2/3 native soils and 1/3 compost.

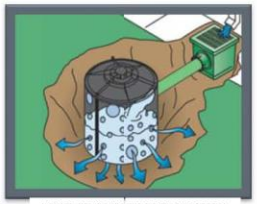
Contributing Drainage Area (square feet)	Depth of Amended Soil (inches)			
	18	24	30	36
	Area of Rain Garden (square feet)			
100	6.6	5.7	5.1	4.6
500	35	30	25	23
1000	65	60	50	45
2000	135	115	100	90
3000	200	170	150	140
4000	260	230	200	185
5000	330	290	255	230

DRY WELL

SINGLE FAMILY RESIDENTIAL GUIDE
CITY OF ATLANTA, GEORGIA
DEPARTMENT OF WATERSHED MANAGEMENT

Dry wells are comprised of seepage tanks set in the ground and, in Atlanta's tight soils, surrounded with stone that are designed to intercept and temporarily store stormwater runoff until it infiltrates into the soil. Alternately the pit can be filled with stone with water entering via a perforated pipe with a perforated standpipe in place of the tank.

Dry wells are particularly well suited to receive rooftop runoff entering the tank via an inlet grate (shown right) or direct downspout connection (below right). When properly sized and laid out dry wells can provide significant reductions in stormwater runoff and pollutant loads.



Source: www.earthcontactproducts.com/

Location

- Dry wells must be located at least 10 feet from building foundations and 10 feet from property lines.
- To reduce the chance of clogging, dry wells should drain only impervious areas, and runoff should be pretreated with at least one of the leaf removal options to remove debris and larger particles.
- The height of the tank should not exceed 45 inches unless infiltration testing has been done to insure a drain time of 72 hours or less.
- Dry wells should be located in a lawn or other pervious (unpaved) area and should be designed so that the top of the dry well is located as close to the surface as possible.
- Dry wells should not be located: (1) beneath an impervious (paved) surface; (2) above an area with a water table or bedrock less than two feet below the trench bottom; (3) over other utility lines; or, (4) above a septic field. Always call 811 to locate utility lines before you dig.

Construction

- Consider the drainage area size and the soil infiltration rate when determining the size of the dry well, (see table on next page).
- The sides of the excavation should be trimmed of all large roots that will hamper the installation of the permeable drainage fabric used to line the sides and top of the dry well.
- The dry well hole should be excavated 1 foot deeper and two feet larger in diameter than the well to allow for a 12 inch stone fill jacket.

General Sizing Tables

Design Options

Impervious Area Treated

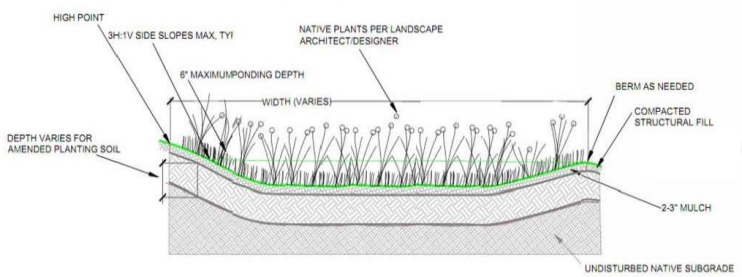
Rooftop Area (square feet)	Depth of Gravel From Top of Pipe (inches)			
	18	24	30	36
	Required Linear Feet of MFD			
100	6	5	4	3
500	30	25	20	15
1000	60	45	40	35
2000	120	95	75	65
3000	185	140	115	100
4000	245	190	155	130
5000	305	235	195	165

Practice Size

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

Modified French Drain Example

Tear Off Detail Sheets



CONSTRUCTION STEPS:

1. Locate rain garden(s) where downspouts or driveway runoff can enter garden flowing away from the home. Locate at least 10 feet from foundations, not within the public right of way, away from utility lines, not over septic fields, and not near a steep bluff edge.
2. Measure the area draining to the planned garden and determine required rain garden surface area from the table on the next page and your planned excavation depth.
3. Optionally, perform infiltration test according to Appendix A. If the rate is less than 0.25 in/hr an underdrain will be necessary. If the rate is more than 0.50 in/hr the size of the garden may be decreased 10% for every 0.50 in/hr infiltration rate increase above 0.50 in/hr.
4. Measure elevations and stake out the garden to the required dimensions insuring positive flow into garden, the overflow elevation allows for six inches of ponding, and the perimeter of the garden is higher than the overflow point. If the garden is on a gentle slope a berm at least two feet wide can be constructed on the downhill side and/or the garden can be dug into the hillside taking greater care for erosion control at the garden inlet(s).
5. Remove turf or other vegetation in the area of the rain garden. Excavate garden being careful not to compact soils in the bottom of the garden. Level bottom of garden as much as possible to maximize infiltration area.
6. Mix compost, topsoil, and some of the excavated subsoil together to make the 'amended soil'. The soil mix should be 1/3 compost, 2/3 native soil (topsoil and subsoil combined).
7. Fill rain garden with the amended soil, leaving the surface eight inches below your highest surrounding surface. Eight inches allows for 6 inches ponding and 2" of mulch. The surface of the rain garden should be as close to level as possible.
8. Build a berm at the downhill edge and sides of the rain garden with the remaining subsoil. The top of the berm needs to be level, and set at the maximum ponding elevation.
9. Plant the rain garden using a selection of plants from elsewhere in this manual.
10. Mulch the surface of the rain garden with two to three inches of non-floating organic mulch. The best choice is finely shredded hardwood mulch. Pinestraw is also an option.
11. Water all plants thoroughly. As in any new garden or flower bed, regular watering will likely be needed to establish plants during the first growing season.
12. During construction build the inlet feature as a pipe directly connected to a downspout or use a rock lined swale with a gentle slope. Use of an impermeable liner under the rocks at the end of the swale near the house is recommended to keep water from soaking in at that point. Test the drainage of water from the source to the garden prior to finishing.
13. Create an overflow at least 10 feet from your property edge and insure it is protected from erosion.

CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT	NAME/ADDRESS:	RAIN GARDEN SPECIFICATIONS PAGE 1 OF 2

November 2012

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:

Contributing Drainage Area (square feet)	Depth of Amended Soil (inches)			
	18	24	30	36
	Area of Rain Garden (square feet)			
100	6.6	5.7	5.1	4.6
500	35	30	25	23
1000	65	60	50	45
2000	135	115	100	90
3000	200	170	150	140
4000	260	230	200	185
5000	330	290	255	230

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

CITY OF ATLANTA DEPARTMENT OF WATERSHED MANAGEMENT	ATTACH THIS TWO-PAGE SPECIFICATION TO HOUSE PLAN SUBMITTAL	RAIN GARDEN SPECIFICATIONS PAGE 2 OF 2

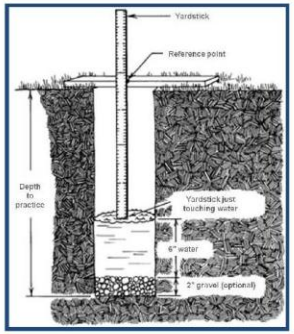
November 2012

Appendices

APPENDIX A

Testing Infiltration: the Simple Approach

It is assumed that an infiltration rate of 0.25 to 0.50 inches per hour exists on residential sites. The sizing criteria are set for this rate. However, if the soils have a higher infiltration rate the size of the features could be reduced. At the discretion of the property owner the following infiltration test can be conducted, and if it returns a higher infiltration ate than 0.50 inches per hour suitable reductions in the size of the infiltration-based facilities can be made. See each practice for the adjustment procedure.



Source: modified from www.ag.ndsu

Infiltration features (rain gardens, dry wells, permeable paver gravel layers) should reliably drain within the recommended time limit. Here is how to test if your soils can handle this type of feature.

1. Locate the approximate center of the area where you expect to build your feature.
2. Dig an access pit down to the bottom of the amended soils or gravel layer in the feature.
3. At that elevation dig a narrow test hole at least eight inches deep. You can optionally place 2" of course gravel in the bottom. The test hole can be excavated with small excavation equipment or by hand using a spade shovel or post-hole digger.
4. If you run into a hard layer that cannot be penetrated with a shovel or, you come across water in the whole, stop. Infiltration features should not be sited over impenetrable rock surfaces or over high water tables, so your site is inappropriate.
5. Place a flat board across the hole to serve as a measuring point (see figure).
6. Fill the hole with water to a depth of six inches. Measure from the flat board to the water surface. Record the exact time you stop filling the hole and the height of the water every 10 minutes for fast draining soils for a minimum of one hour or every 30 minutes for slow draining soils for a minimum of two hours.
7. Refill the hole again and repeat step 5 twice more. The third test will give you the best measure of how quickly your soil absorbs water when it is fully saturated.
8. If on the third test the water is dropping at least ½" per hour the soil will work for the infiltration features.

Source: www.learntogrow.com

APPENDIX B

Recommended Plants

Plants for rain gardens and other vegetated stormwater practices must be able to tolerate both wet and dry conditions. This list, while not exhaustive, includes many plants that will tolerate conditions in rain gardens. The plants in this list do have different preferences for both moisture and light, as shown in the columns labeled 'Moisture' and 'Sun'. Additionally, the majority of these plants are native to Georgia and thus contribute the added benefit of providing habitat and food for native pollinators and wildlife. Those plants that are not native to Georgia are marked with an asterisk (*).

Key
Height: Typical height range for mature plants
Moisture: The amount of soil moisture that plants will tolerate is defined as follows:

- **W** (Wet) —Frequently saturated soils
- **M** (Moist) —Moist soils that are periodically inundated.
- **D** (Dry) — Areas not flooded after rains and frequently dry between rains. Plants designated 'D' will tolerate drought conditions

Sun: the amount of sunlight that plants require is defined as follows:

- **F** (Full) Direct sunlight for at least 6 hours per day
- **P** (Partial shade)—Direct sunlight for 3-6 hours per day, or lightly filtered light all day
- **S** (Shade)—Less than 3 hours of direct sunlight per day, or heavily filtered light all day

	Botanical Name	Common Name	Height	Moisture	Sun
Small Trees	Acer floridanum	Southern Sugar Maple	20'-25'	M	F/P/S
	Amelanchier arboria	Serviceberry	15'-25'	WM/D	F/P
	Cercis canadensis	Redbud	20'-30'	M	F/P
	Chionanthus virginicus	Fringe Tree	12'-20'	M	F/P
	Cornus florida	Flowering Dogwood	15'-30'	M/D	F/P
	Hamamelis virginiana	Witchhazel	15'-30'	WM	P/S
	Ilex decidua	Possumhaw	15'-25'	M/D	F/P
	Ilex vomitoria	Yaupon Holly	20'-25'	M/D	F/P
	Lagerstroemia indica *	Crape Myrtle *	15'-50'	M/D	F/P
	Magnolia virginiana	Sweetbay Magnolia	10'-30'	WM	F/P
	Magnolia x soulangeana *	Saucer Magnolia *	15'-25'	M	F/P
	Vitex agnus-castus *	Chaste Tree *	15'-20'	M/D	F/P

	Botanical Name	Common Name	Height	Moisture	Sun
Med.-LargeTrees	Acer rubrum	Red Maple	60'-90'	WM/D	F/P
	Betula nigra	River Birch	40'-70'	WM	F/P
	Carpinus caroliniana	Musclewood	30'-50'	WM	F/P
	Crataegus phaenopyrum	Washington Hawthorne	25'-30'	WM/D	F/P
	Fraxinux pennsylvanica	Green Ash	50'-70'	WM/D	F
	Ilex opaca	American Holly	30'-60'	M/D	F/P
	Magnolia grandiflora	Southern Magnolia	40'-80'	M/D	F/P
	Magnolia macrophylla	Bigleaf Magnolia	30'-40'	M	F/P
	Nyssa sylvatica	Black Gum	35'-70'	WM/D	F/P
	Platanus occidentalis	American Sycamore	75'-100'	WM	F
	Quecus lyrata	Overcup Oak	35'-50'	M/D	F
	Quercus bicolor	Swamp White Oak	50'-60'	WM/D	F/P
	Quercus phellos	Willow Oak	60'-80'	WM/D	F/P
	Salix babylonica *	Weeping Willow *	30'-50'	WM	F
	Taxodium distichum	Bald Cypress	50'-100'	WM/D	F/P

* denotes plants not native to Georgia

Past Projects

City Hall Green Roof

Built 2003. Demonstration Project

Historic Fourth Ward Park

Opened 2011. Combined Sewer Capacity relief

Fire Station #16 Rain Garden

Built 2012. Demonstration. EPA, EPD, COA, UGA, WAWA

Current Projects

McDaniel Branch Stream Restoration and Constructed Wetlands

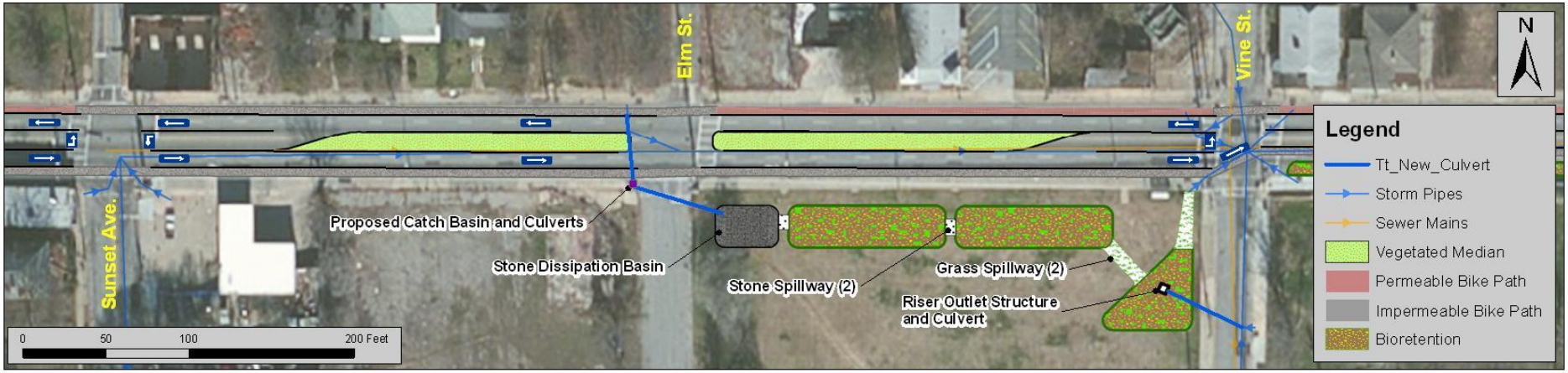
Water Quality Project. US Corps of Engineers and EPA 319 Funding.

Juniper St. ‘Green Street’ Improvements

In Permitting. Included in Streetscape Improvements. Midtown Alliance funded

Boone Blvd

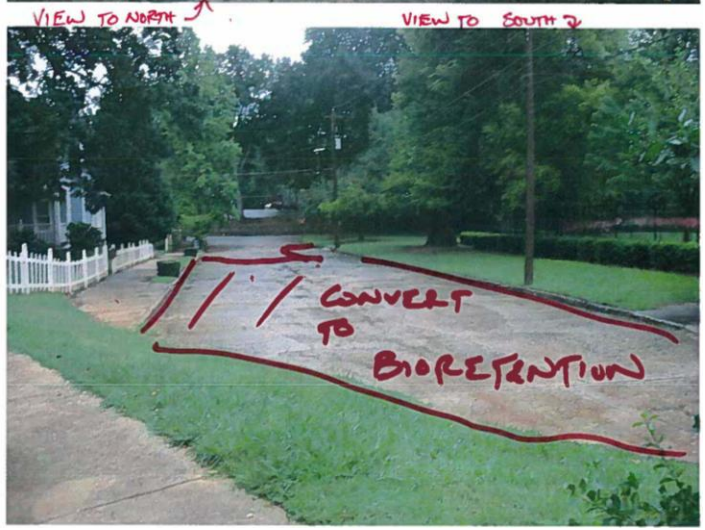
‘Green Street’



Demonstration Project: EPA Technical Assistant Grant

South East Atlanta Green Infrastructure Initiative

South East Atlanta Green Infrastructure Initiative



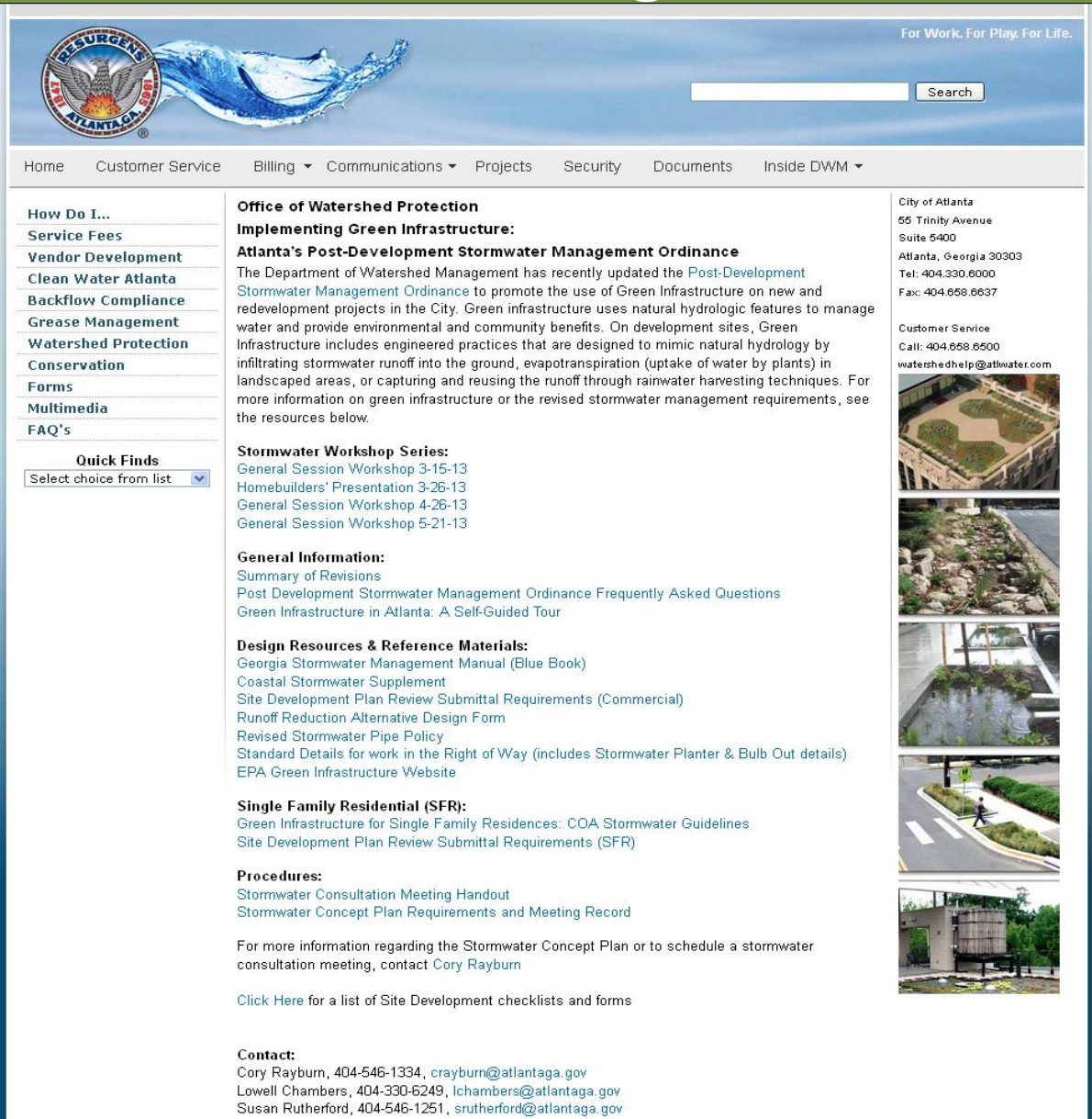
Combined Sewer Capacity Relief

South East Atlanta Green Infrastructure Initiative

Atlanta Fulton County Stadium Stormwater Pond
FIGURE NO. 1 - November 2012

Combined Sewer Capacity Relief

For more information: www.AtlantaWatershed.org/GreenInfrastructure



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Office of Watershed Protection

Implementing Green Infrastructure:

Atlanta's Post-Development Stormwater Management Ordinance

The Department of Watershed Management has recently updated the Post-Development Stormwater Management Ordinance to promote the use of Green Infrastructure on new and redevelopment projects in the City. Green infrastructure uses natural hydrologic features to manage water and provide environmental and community benefits. On development sites, Green Infrastructure includes engineered practices that are designed to mimic natural hydrology by infiltrating stormwater runoff into the ground, evapotranspiration (uptake of water by plants) in landscaped areas, or capturing and reusing the runoff through rainwater harvesting techniques. For more information on green infrastructure or the revised stormwater management requirements, see the resources below.

Stormwater Workshop Series:
General Session Workshop 3-15-13
Homebuilders' Presentation 3-26-13
General Session Workshop 4-26-13
General Session Workshop 5-21-13

General Information:
Summary of Revisions
Post Development Stormwater Management Ordinance Frequently Asked Questions
Green Infrastructure in Atlanta: A Self-Guided Tour

Design Resources & Reference Materials:
Georgia Stormwater Management Manual (Blue Book)
Coastal Stormwater Supplement
Site Development Plan Review Submittal Requirements (Commercial)
Runoff Reduction Alternative Design Form
Revised Stormwater Pipe Policy
Standard Details for work in the Right of Way (includes Stormwater Planter & Bulb Out details)
EPA Green Infrastructure Website

Single Family Residential (SFR):
Green Infrastructure for Single Family Residences: COA Stormwater Guidelines
Site Development Plan Review Submittal Requirements (SFR)

Procedures:
Stormwater Consultation Meeting Handout
Stormwater Concept Plan Requirements and Meeting Record

For more information regarding the Stormwater Concept Plan or to schedule a stormwater consultation meeting, contact Cory Rayburn

Click Here for a list of Site Development checklists and forms

Contact:
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Lowell Chambers, 404-330-6249, lchambers@atlantaga.gov
Susan Rutherford, 404-546-1251, srutherford@atlantaga.gov

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Atlanta, Georgia 30303
Tel: 404.330.6000
Fax: 404.658.6637

Customer Service
Call: 404.658.6500
watershedhelp@atlwater.com

Floodplain Ordinance





Modification to the Floodplain Ordinance

- **Definitions**
  - Historically modified floodplain
    - Combined sewer system areas
  - Traditional riverine floodplain
    - Daylighted streams





Tabular Summary of Most Substantial Proposed Changes

	Historically Modified Floodplain	Traditional Riverine Floodplain
New Structures	* May be built 2-ft above high water mark or 3-ft above base flood elevation * Fill allowed only if (1) no increase in flood elevation; (2) no adverse impacts to adjacent properties; and (3) no net loss of flood storage volume.	Must continue to remain 15-ft horizontally away and 2-ft above base flood elevation.
Existing Structures	* Substantially damaged structures may be elevated 3-ft above base flood elevation. * May be flood protected if not substantially damaged or substantial improvement.	* Same as Historically Modified FP.
Ancillary Structures	* Permitted if designed and constructed to minimize and mitigate impact	* Same as Historically Modified FP





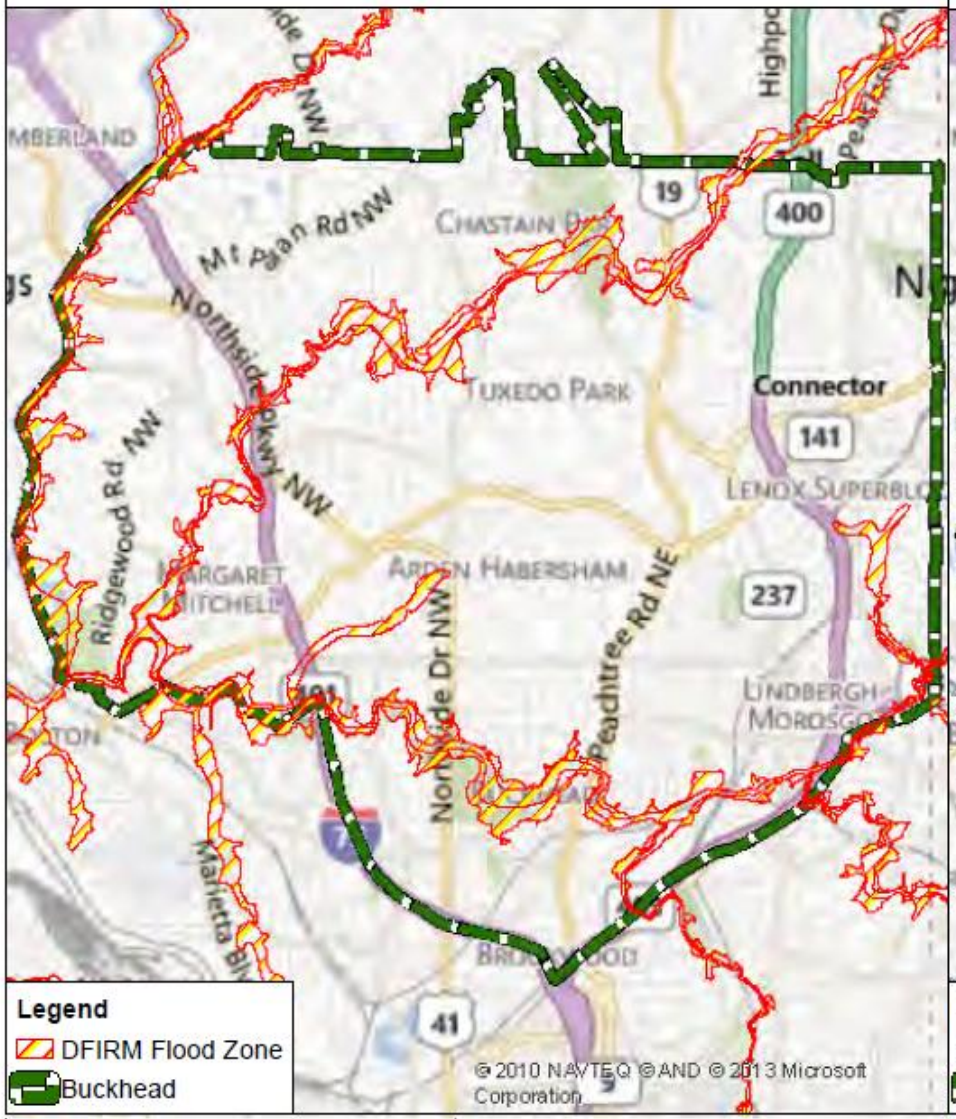
Revised FEMA FIRMs



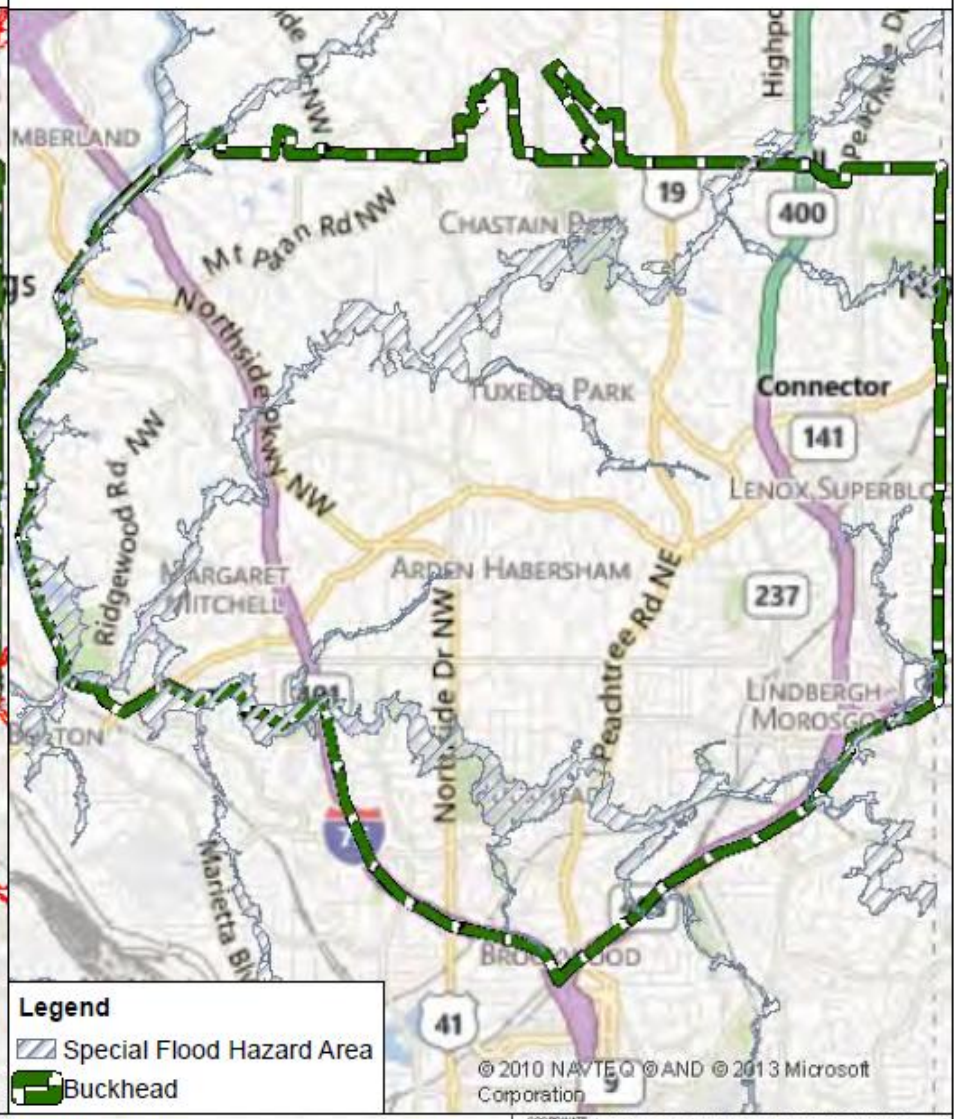


Buckhead Flood Map

Previous Flood Zones



Current Flood Zones



City of Atlanta
Department of Watershed Management

COORDINATE SYSTEM	NAD 1983 STATE PLANE GEORGIA WEST
MAP UNITS	U.S. SURVEY FEET
DATE	7/11/2013
AUTHOR	DWM GIS
TICKET #	<request number>
MAP SCALE	1:84,000 1 in = 7,000 ft

COMMENTS:

Community Impacts

- The revised floodplain maps are effective on September 18, 2013
- The City's Floodplain Officer signs a form to qualify homeowners (property was placed in a higher flood risk area) to receive two years of insurance (extension) at a preferred risk rate (Preferred Risk Policy)
- The City of Atlanta is applying for the Community Rating System (CRS). CRS is an incentive program that allows the residents of participating community to receive discounts on flood insurance premiums





Questions?

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