Urban Tree Canopy Goals
In Washington, DC

Casey Trees Mission

To restore, enhance and protect the tree canopy of the Nation's Capital.

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Casey Trees Programs

- Education
  - Citizen Forester
  - Schools Programs
  - Internships
- Data Gathering & Analysis
  - GIS Mapping and Analysis
  - Inventory
  - Tree Map
- Tree Planting & Stewardship
  - Community Plantings
  - Request for Plantings (RFP)
  - Tree Stewardship
- Planning & Design
  - Policy and Design Input
  - Tree Space Design Research
  - BID, Developer and University Partnerships

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Outline

- Strategies for Re-Greening DC
- UTC Goals and DC Policies
- UTC Applied to Stormwater: Green Build-out Model
- Next Steps for UTC in DC

Strategies for Re-Greening

- Where to Start?
- 1999 report on the “Street Tree Crisis”
  - Street trees comprise 15% of the total tree cover
  - Street tree numbers down 25-30%
- Outdated street tree database system – no way to prioritize and track
- Solution: Inventory

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2002 Street Tree Inventory

- Summer 2002
- 106,000 trees,
  130,000 street tree spaces
- Citizen-based
  (over 500 participants)
- Spatial Data (GIS)
- Over 15 data fields
  including size, ID and health
- Partnership with DC Urban Forestry Administration

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Strategy for Planting

- Arbor Day 2003: Mayor, UFA & Casey Trees committed to fill 23,000 empty street tree spaces in 10 years!
- Casey Trees held 19 public meetings to prioritize planting locations
- Outreach Tool: Tree Map www.caseytrees.org/treemap

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Subsequent Inventories

2003
- NPS Monumental Core

2004
- UFORE (200 Plots)

2005
- DED Survey
- DCPS Schoolyard Inventory
- Ft Stanton Watershed

2006
- Big Tree Survey
- Casey Trees Plantings Survey

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Limitations of Inventories

- Data collection is time and resource intensive
- Lack of partners to maintain data
- “Forest for the trees”
- Difficult to monitor progress toward mission

Urban Tree Canopy Goals

- "Top down" approach to tree cover
- Assess present, possible and preferable
- Canopy – regardless of land use or jurisdiction
- Goals set in Annapolis, Baltimore, New York
- Incorporation in regional planning processes

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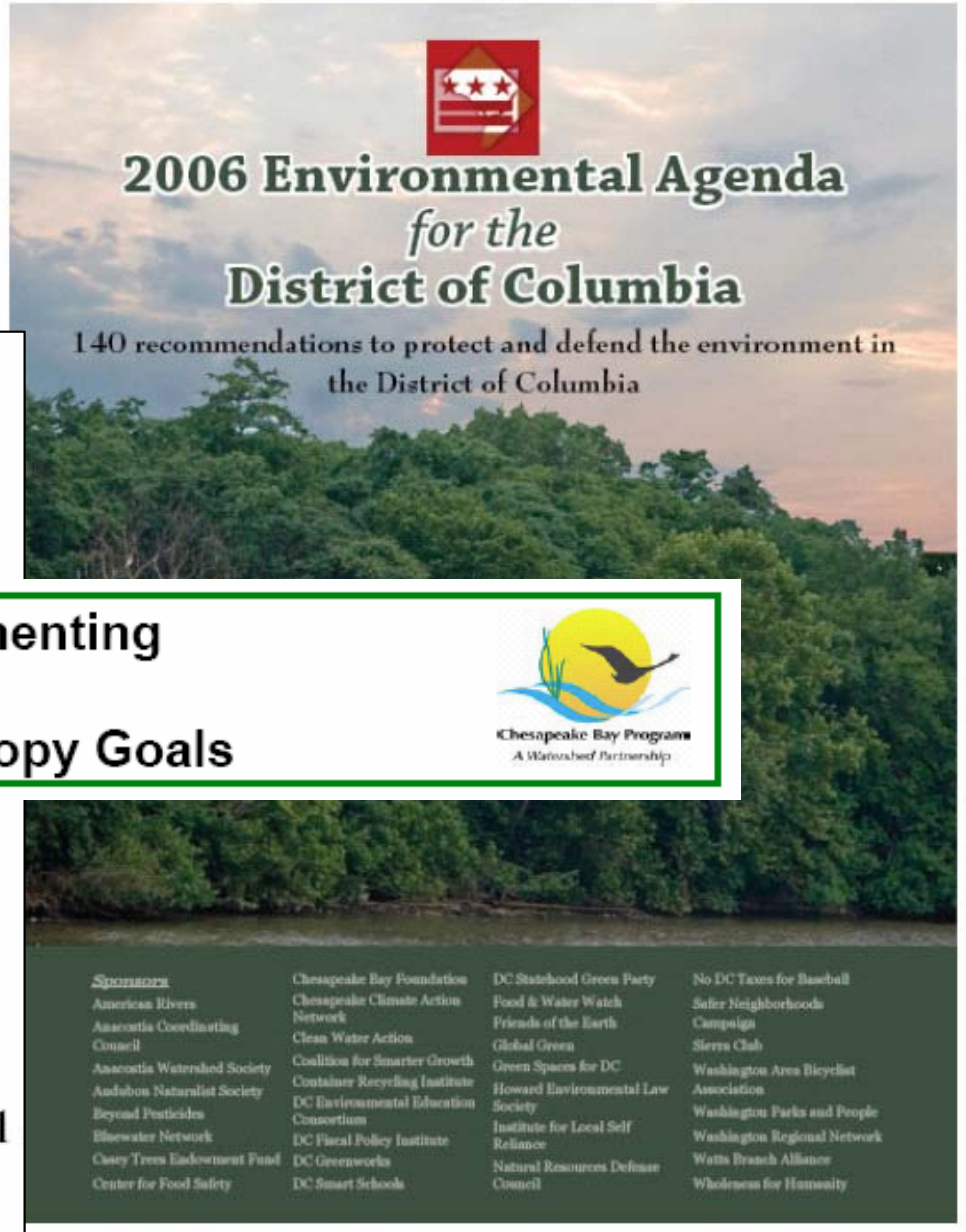
UTC in Policies

Summary: Guidelines for Implementing the Chesapeake Bay Program's Urban and Community Tree Canopy Goals

Chesapeake Bay Program
A Watershed Partnership

Proceedings from the Chesapeake Bay Scientific and Technical Advisory Committee's Urban Tree Canopy Workshop



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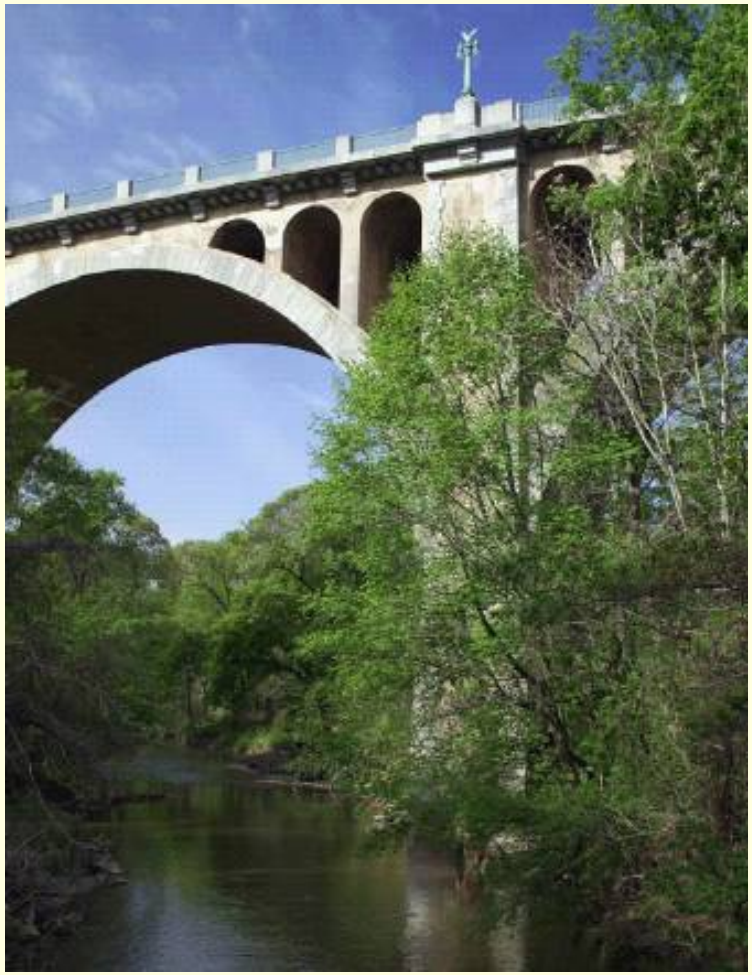
DC Comp Plan, Adopted Dec 2006

Environment Protection Element

Action E-1.1-F: Urban Tree Canopy Goals

Determine the extent of the District's tree canopy at a sufficient level of detail to establish **tree canopy goals** for neighborhoods across the city.



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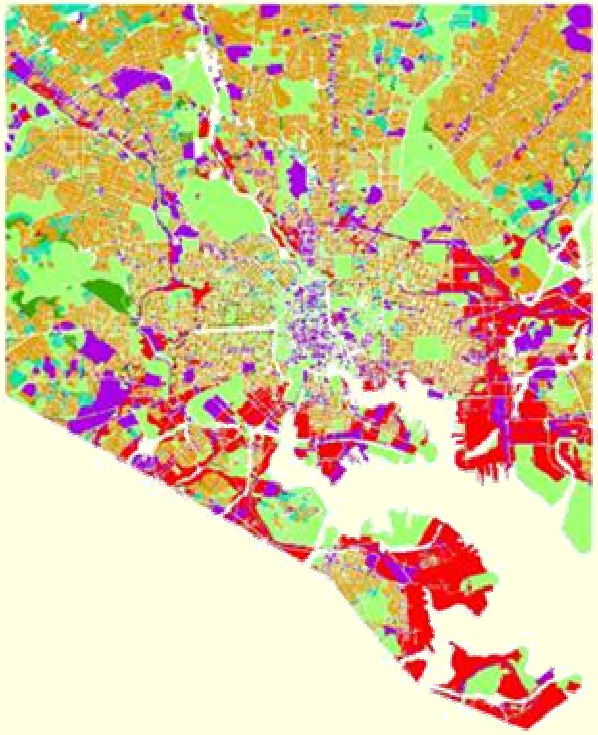
UTC Approach

Parcel Land Use



Total Possible

Relative Possible

- Commercial
- Commercial Condo
- Commercial Residential
- Exempt
- Exempt Commercial
- Industrial
- Apartments
- Residential
- Residential Commercial
- Residential Condo

Low — Med — High

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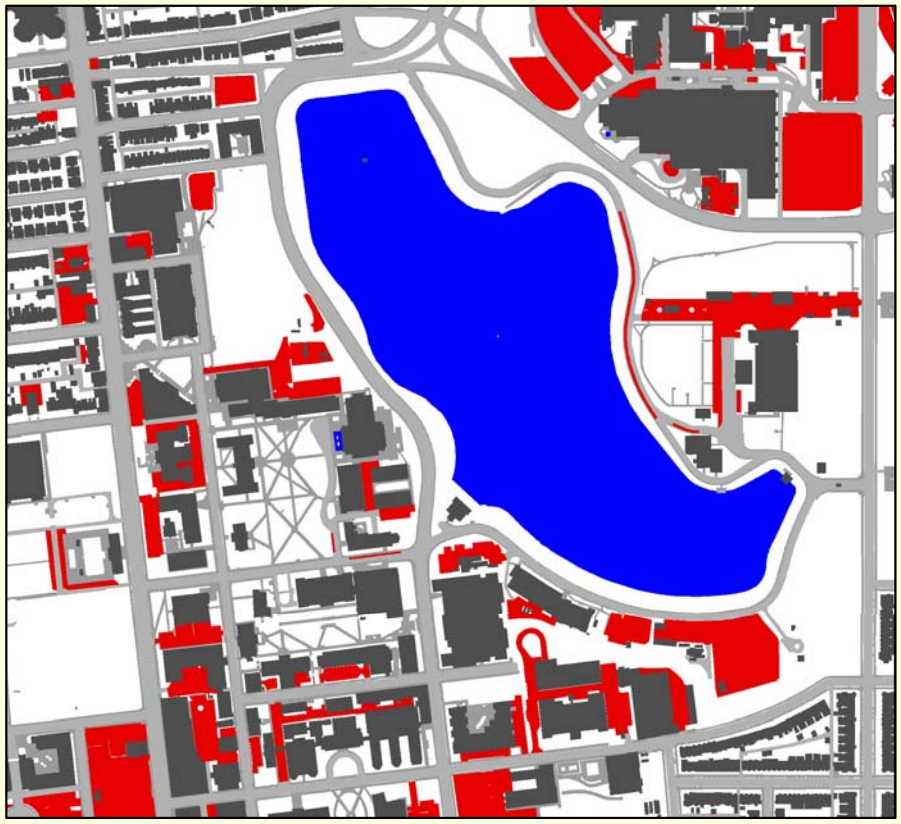
UTC - DC Data

Roads, Sidewalks,
Parking Lots, Buildings



Street Trees

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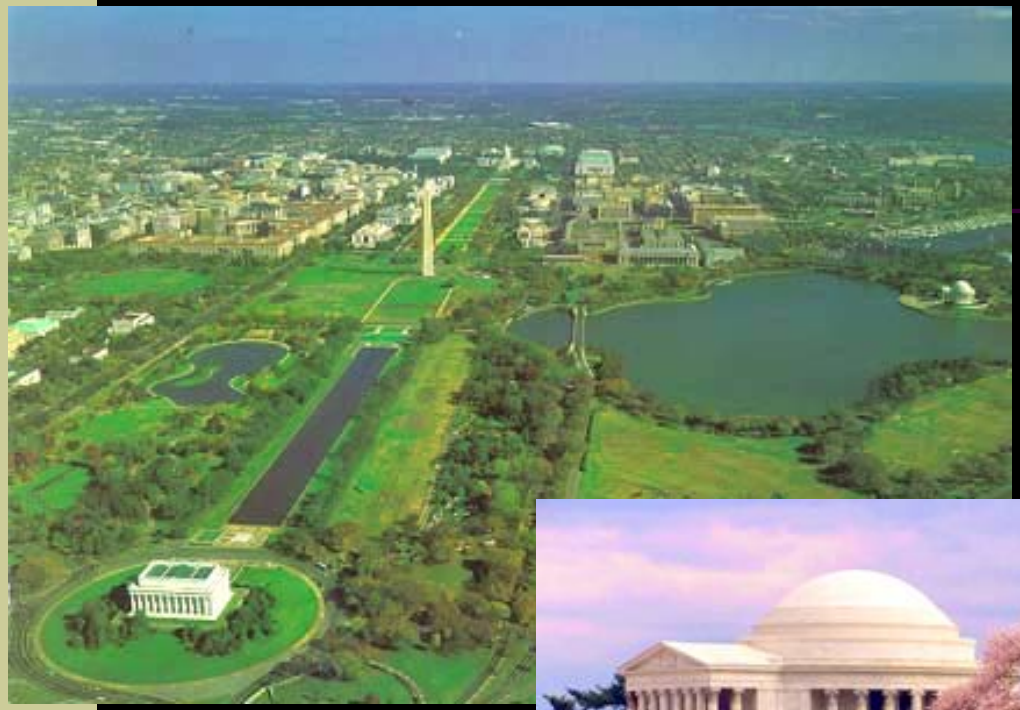
UTC Applied to Stormwater:
Green Build-out Model




WARNING
COMBINED SEWER OVERFLOW
DISCHARGE POINT
POLLUTION MAY OCCUR
DURING RAINFALL
CSO OUTFALL NO. 007
PERMIT NO. DC 0021199
TO REPORT PROBLEMS CALL
DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
TELEPHONE NO. (202) 612-3400

Water Quality Issues in DC

- Potomac River, Anacostia River, and Rock Creek are listed as impaired
- Combined Sewer Overflows
- MS4 Permits
- TMDLs
- Limited solutions in urban areas

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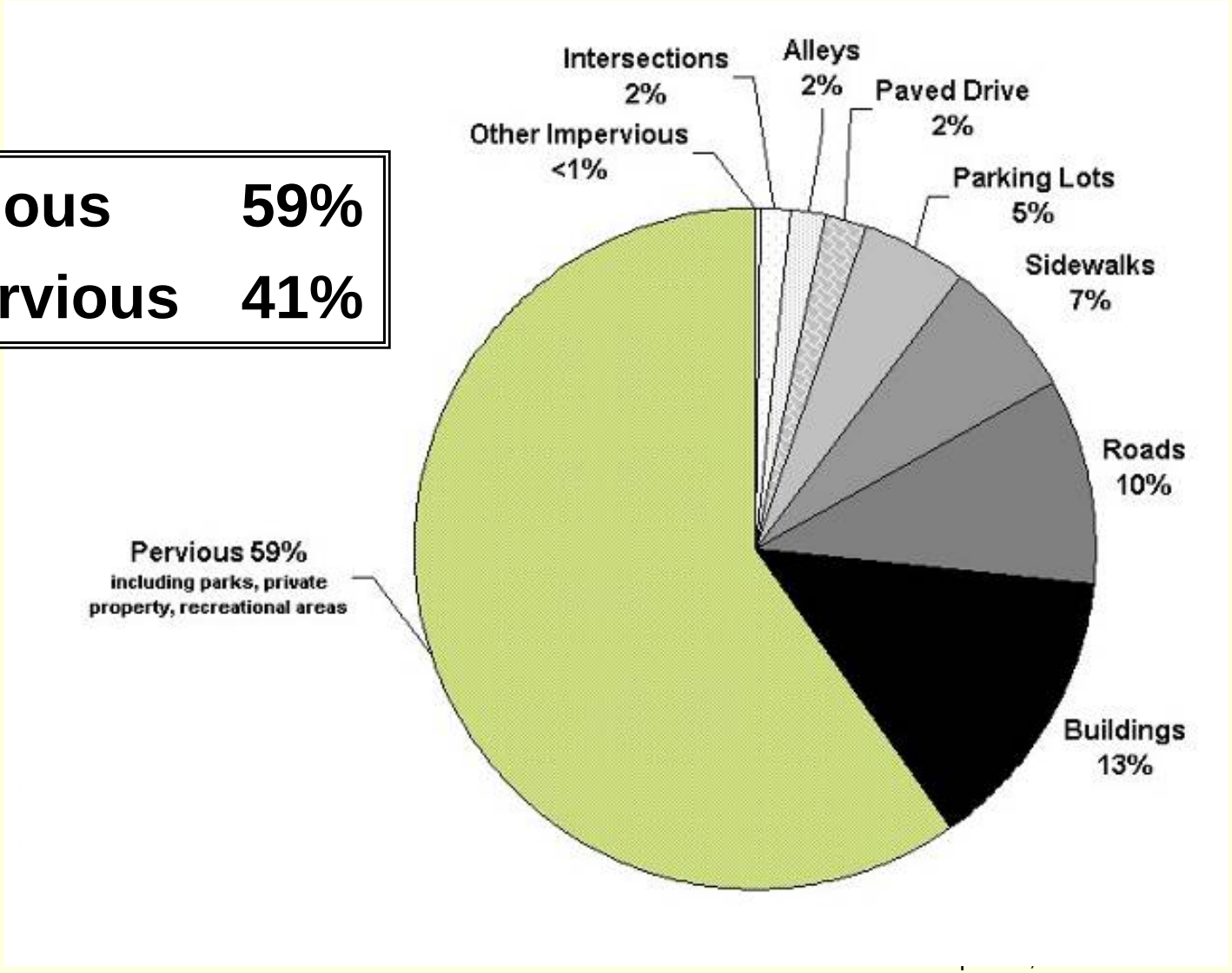
DC Land Cover

Total Pervious	**59%**
Total Impervious	**41%**



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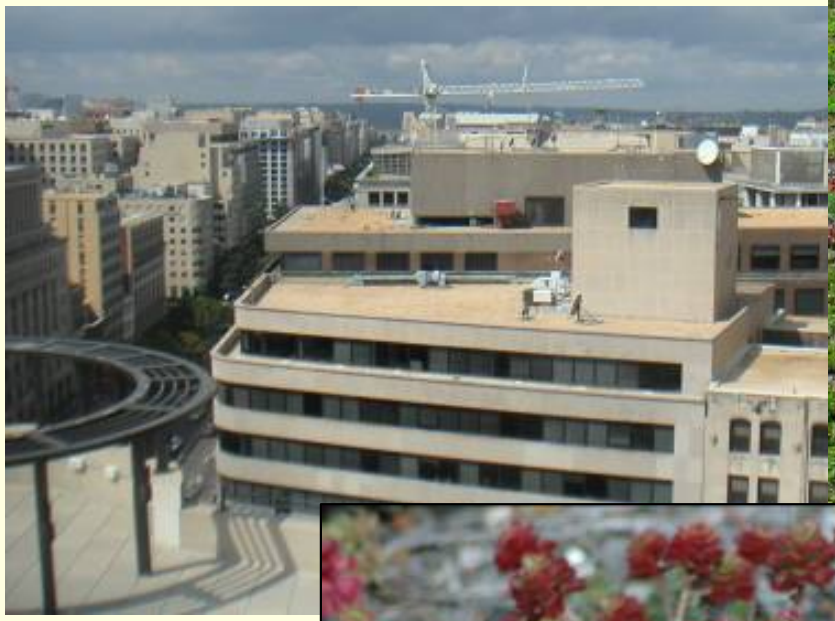
Green Roofs



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Tree Canopy and Stormwater

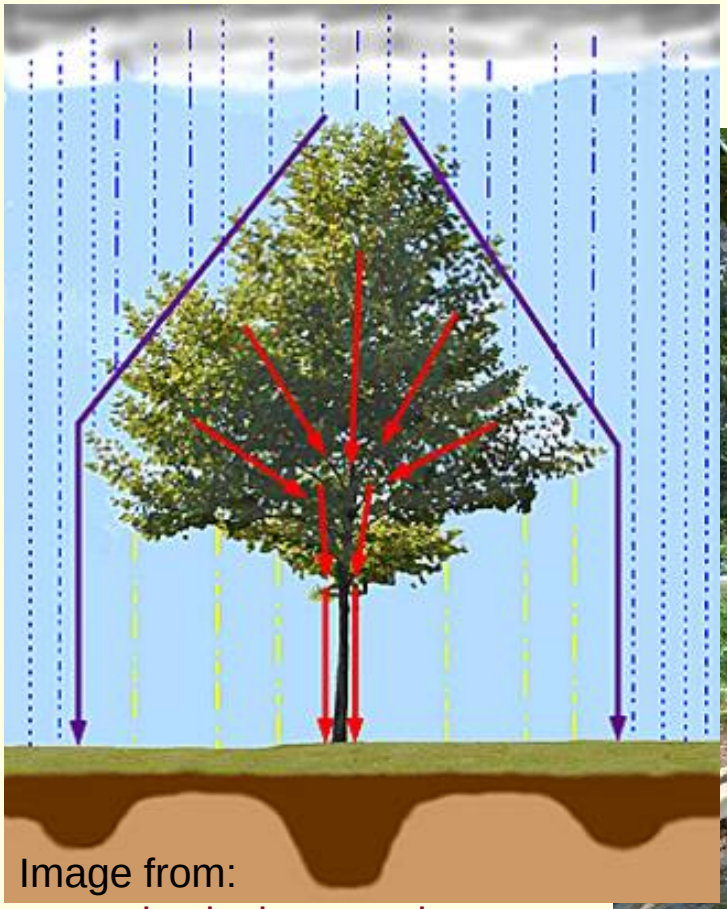
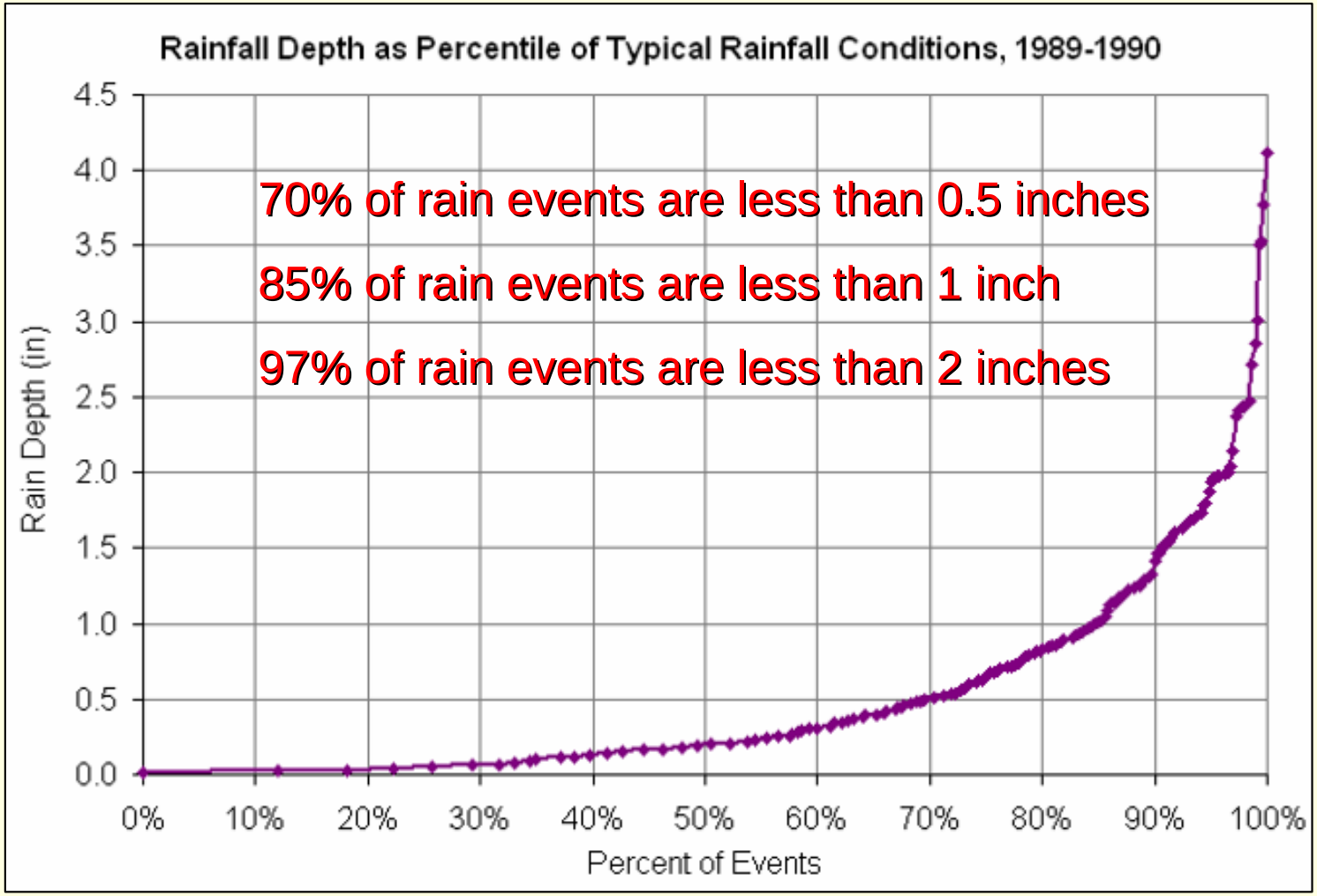


Image from:
www.physicalgeography.net

DC Precipitation



Graph courtesy of LimnoTech

Green Build-Out Model

- Casey Trees / LimnoTech study
- Funded by EPA Office of Water and Office of Wastewater Management
- Stormwater benefits of trees and green roofs
- Tree and green roof coverage scenarios
- DC agency support
- Grant completion: April 14, 2007

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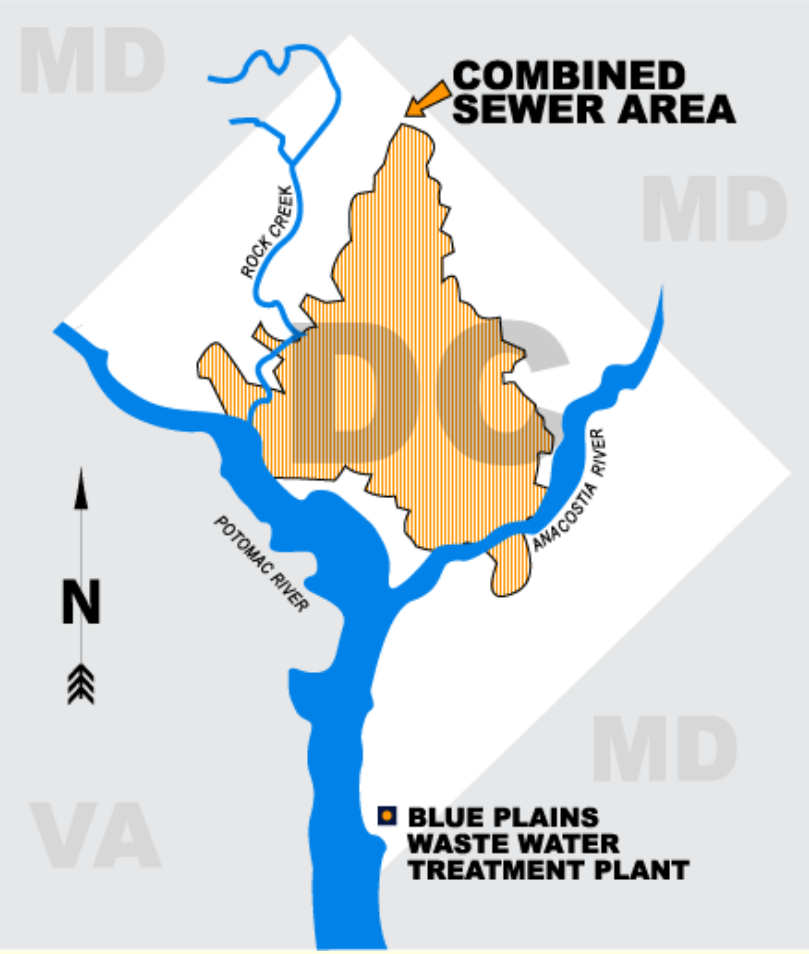
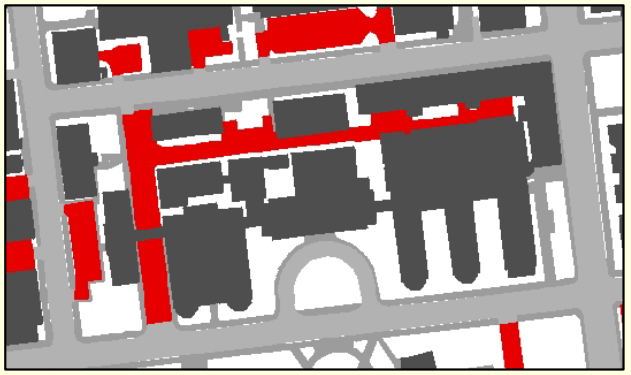
Grant Methodology



- Add to trees and green roofs to existing model (Mike Urban)
- Quantify interception storage at different coverage scenarios
  - Intensive greening or "Green Build-out" *(Physically possible)*
  - Moderate greening *(Practical and reasonable)*

Coverage Scenarios

- **Green Roofs**
  - Use building footprint layer
  - Determine a percent cover
- **Trees**
  - For roads, sidewalks and alleys
    - Use street tree dataset
    - “Grow out” street trees
  - For other land covers
    - Determine percent cover
- **Tree Boxes**
  - Use street tree dataset
  - Determine larger average size



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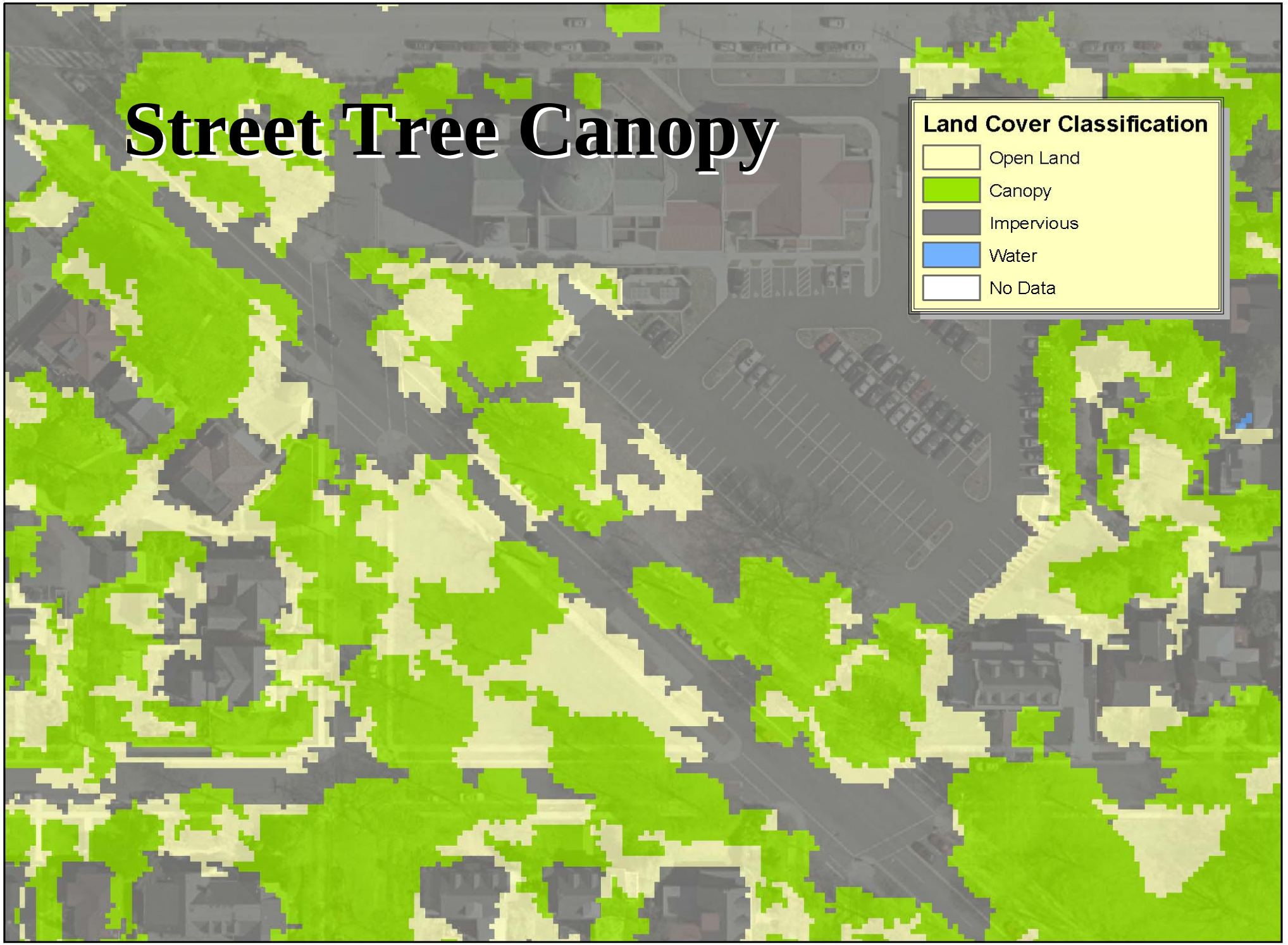
Street Tree Canopy




Existing Street Tree Canopy
Over pervious
Over road
Over intersection
Over sidewalk


Street Tree Points
Street Trees with 20ft Buffer


Tree canopy over 'pervious'
Tree canopy over road
Tree canopy over intersection
Tree canopy over sidewalk

Tree Cover Assumptions

Land Cover Type	Existing Tree Cover	Moderate Greening	Intensive Greening
Impervious			
Roads, sidewalks, intersections	22%	25%	35%
Parking lots	7%	30%	50%
Paved drives	23%	50%	80%
Alleys	26%	35%	50%
Median islands, other	23%	30%	40%
Pervious			
Includes parks, playing fields, cemeteries, yards, etc	53%	57%	80%
TOTAL Tree Cover	**35%**	**40%**	**57%**

Model Results

Moderate Greening Scenario

- Prevented over 310 million gallons of stormwater from entering the sewer system
- Resulting in a reduction of
  - 2.6% or 282 million gallons in discharge volumes to DC's rivers
  - 1.5% in cumulative CSO frequency (16 events)

Intensive Greening Scenario

- Prevented over 1.2 billion gallons of stormwater from entering the sewer system
- Resulting in a reduction of
  - 10% or >1 billion gallons in discharge volumes to DC's rivers
  - 6.7% in cumulative CSO frequency (74 events)

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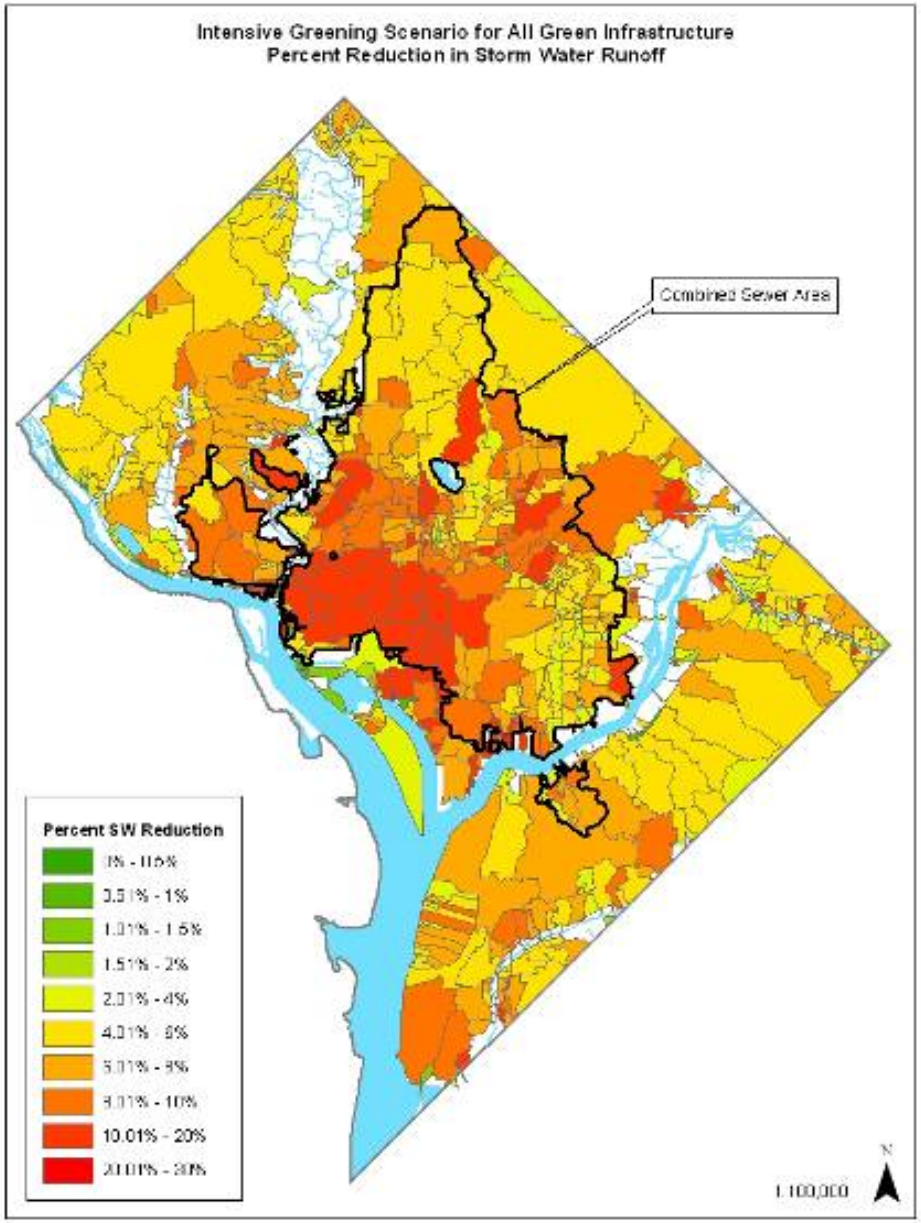
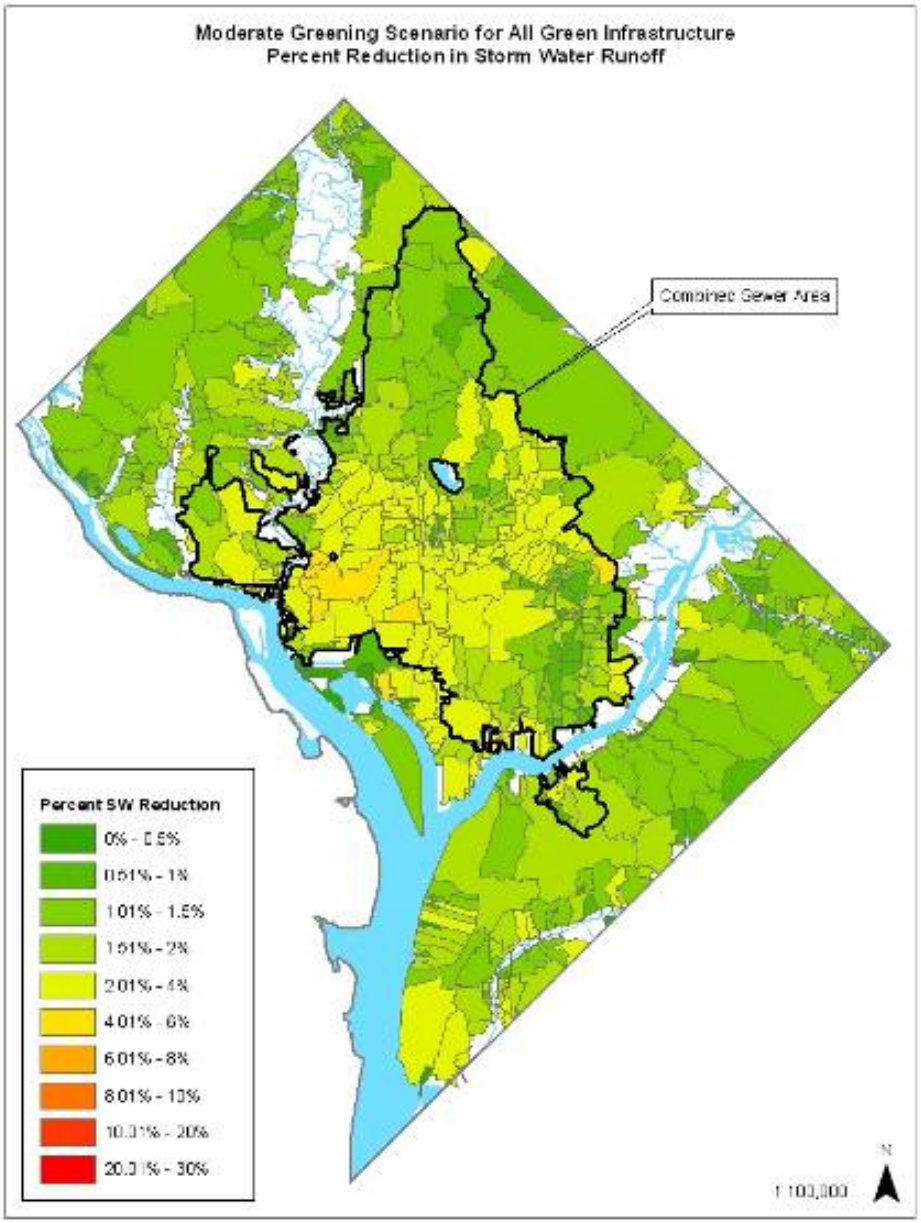
Findings – Discharge Volumes

Average Year Point Discharge Volume (1990)

	Baseline	Intensive Greening	Moderate Greening
MS4 Area	8,755	8,174 MG (6.6% reduction)	8,614 MG (1.6% reduction)
CSS Area	2,291	1,777 MG (22.4% reduction)	2,150 MG (6.1% reduction)
Total	11,046	9,951 MG (10.0% reduction)	10,764 MG (2.6% reduction)

Runoff Reductions By Sewershed





Data Display Tool

Green Build-Out Model Results Display Tool

Quantifying Stormwater Benefits of Trees and Green Roofs in the District of Columbia

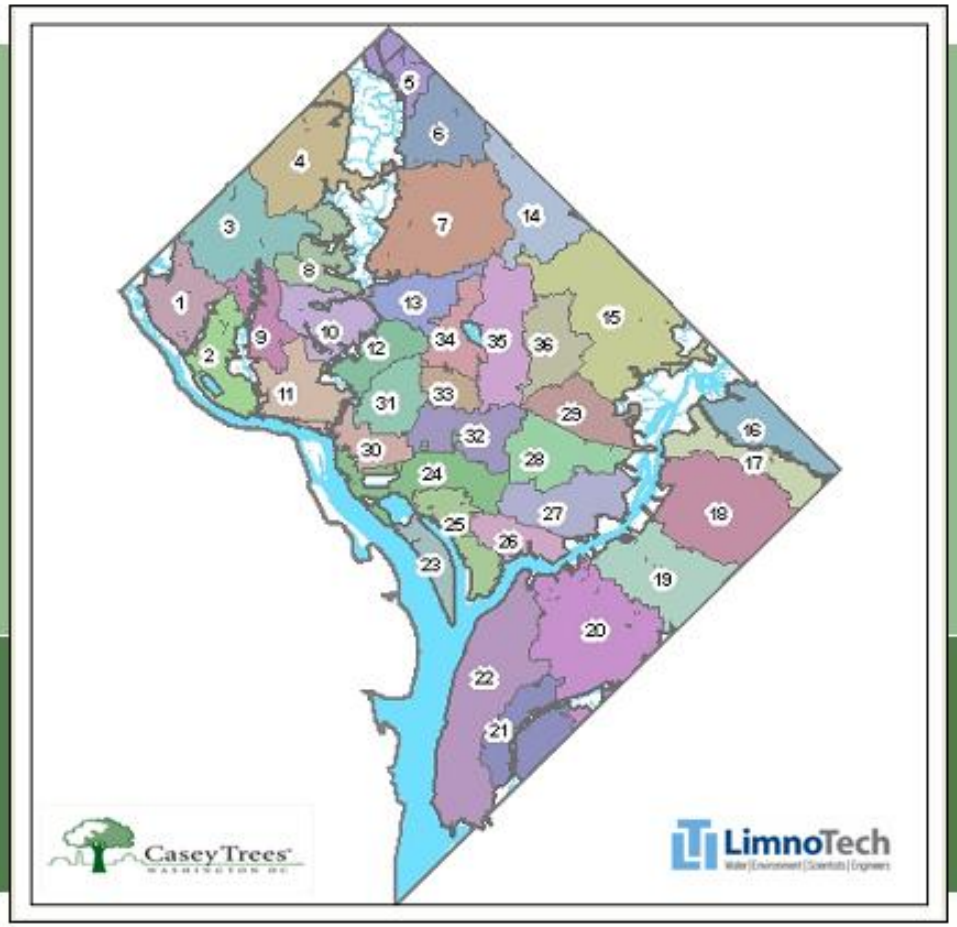
This display tool presents the model results for the Moderate and Intensive Greening scenarios for green roofs and trees. Results are presented as reductions in stormwater flow and can be viewed on a city-wide, neighborhood, or sewershed scale.

To begin, choose an area that you are interested in from the list below.

Choose area from map to view model results:

Friendship Heights

16 Watts Branch North - Deanwood
17 Watts Branch South - Benning
18 Fort Dupont Park
19 Penn Branch - Randle Highlands
20 Buena Vista - Douglas
21 Oxon Run - Congress Heights
22 Bolling AFB
23 Hains Point



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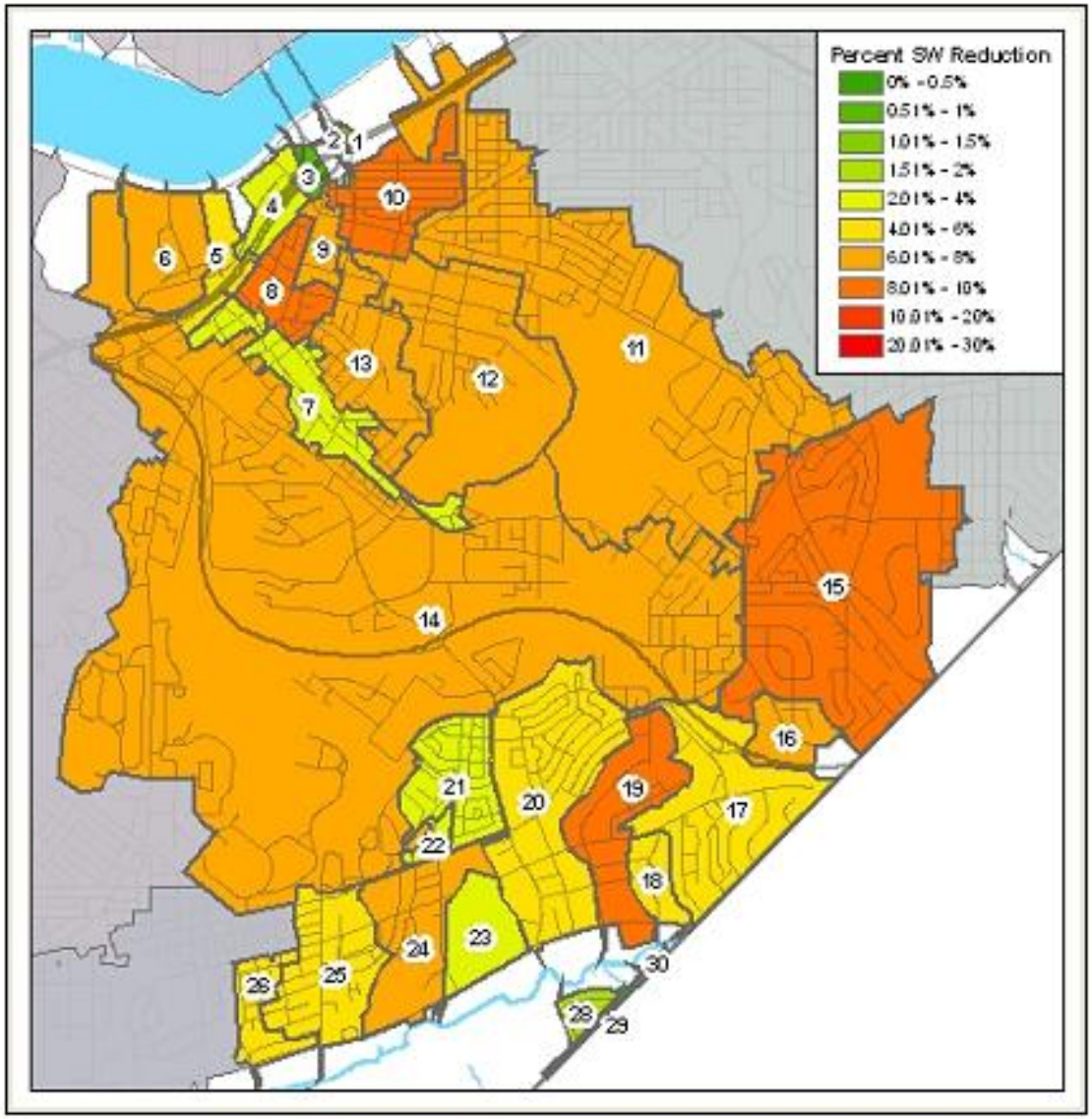
Buena Vista - Douglas

Print Results | Return to Main Map

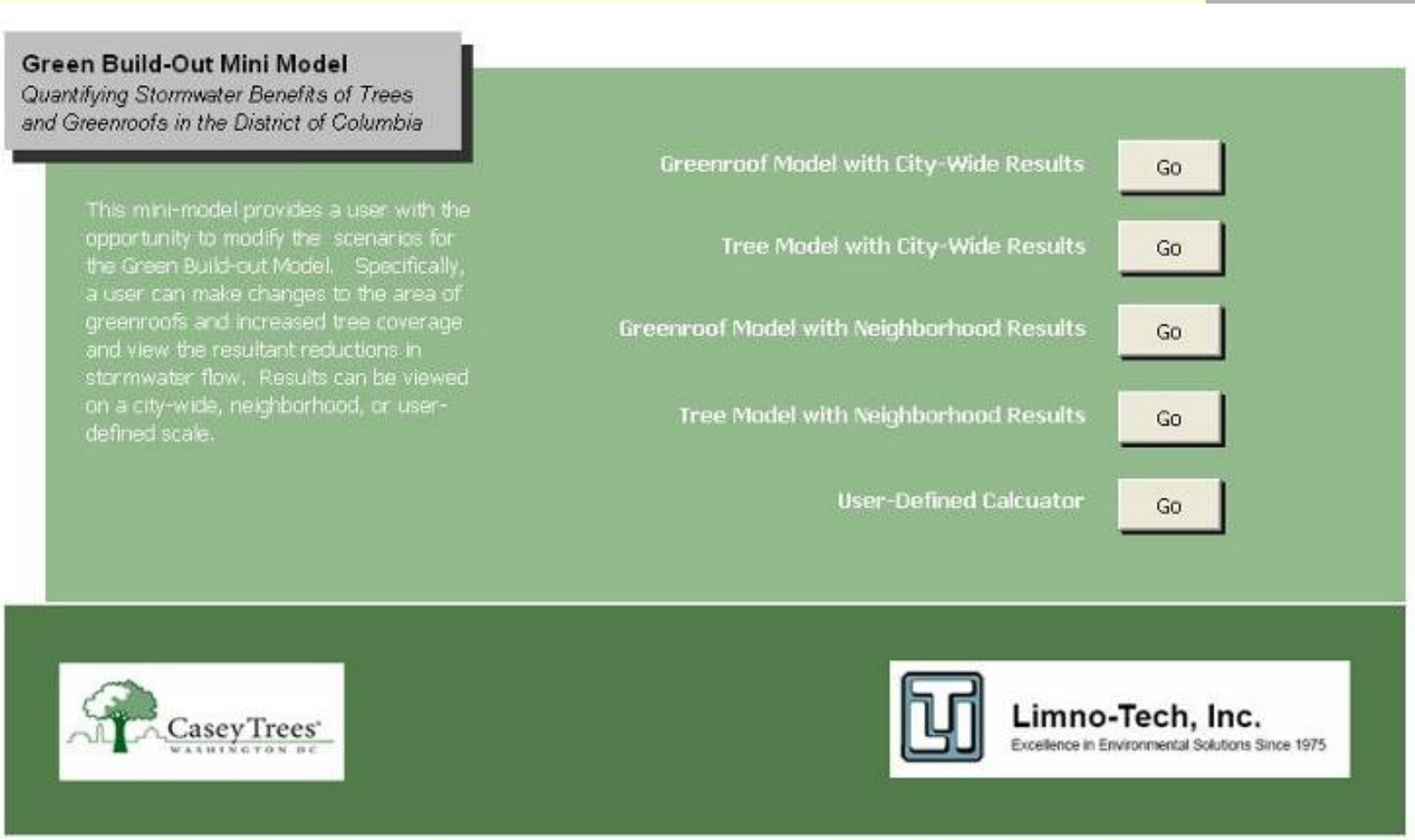
Choose a green infrastructure type to view associated data:* ○ Green Roofs ○ Trees ◉ Total



*Map depicts percent flow reduction associated with Intensive Greening scenario and all green infrastructure types.

ID	Subshed	Sewer Area	Baseline Flow (MGY)	Moderate Greening Scenario Flow (MGY)	Moderate Greening Scenario Flow Reduction	Intensive Greening Scenario Flow (MGY)	Intensive Greening Scenario Flow Reduction
1	SW-ANA61	MS4	0.51	0.51	0.04%	0.51	1.12%
2	CSO 007-a	CSS	0.60	0.59	0.25%	0.59	1.07%
3	CSO 006-a	CSS	1.87	1.86	0.30%	1.85	0.94%
4	SW-ANA54	MS4	5.77	5.70	1.24%	5.59	3.20%
5	CSO 005-a	CSS	5.26	5.19	1.34%	5.05	4.02%
6	SW-ANA52	MS4	12.32	12.08	1.95%	11.57	6.16%
7	CSO 005-b	CSS	17.34	17.17	1.00%	16.71	3.63%
8	CSO 005-c	CSS	15.73	15.30	2.72%	14.27	9.27%
9	CSO 006-b	CSS	7.42	7.27	2.10%	6.88	7.26%
10	CSO 007-d	CSS	24.65	24.15	2.07%	22.62	8.26%
11	SW-ANA30	MS4	116.07	114.06	1.73%	107.99	6.96%
12	CSO 007-c	CSS	35.66	35.12	1.53%	33.41	6.33%
13	CSO 007-b	CSS	20.21	19.89	1.59%	18.97	6.15%
14	SW-ANA50	MS4	241.86	237.12	1.96%	224.26	7.28%
15	SW-OXR46	MS4	79.87	78.36	1.89%	73.37	8.14%
16	SW-OXR47	MS4	6.93	6.82	1.66%	6.48	6.49%
17	SW-OXR1	MS4	30.61	30.19	1.36%	28.96	5.38%
18	SW-OXR3	MS4	4.58	4.51	1.57%	4.36	4.86%
19	SW-OXR4	MS4	19.52	19.09	2.18%	17.67	9.46%
20	SW-OXR5	MS4	35.34	34.89	1.26%	33.46	5.31%
21	SW-OXR32	MS4	4.32	4.27	1.11%	4.17	3.55%
22	SW-OXR33	MS4	2.26	2.24	0.92%	2.17	4.00%
23	SW-OXR6	MS4	3.36	3.34	0.56%	3.26	2.88%
24	SW-OXR7	MS4	17.24	16.98	1.51%	16.05	6.87%
25	SW-OXR8	MS4	21.84	21.54	1.39%	20.60	5.70%
26	SW-OXR9	MS4	7.32	7.21	1.48%	6.91	5.66%
27	SW-OXR20	MS4	27.60	27.01	2.13%	25.71	6.83%
28	SW-OXR2	MS4	3.65	3.63	0.44%	3.58	1.80%
29	SW-OXR38	MS4	2.31	2.31	0.13%	2.30	0.28%
30	SW-OXR34	MS4	0.32	0.32	0.00%	0.32	0.00%

Mini-Model


Green Build-Out Mini Model
Quantifying Stormwater Benefits of Trees and Greenroofs in the District of Columbia
This mini-model provides a user with the opportunity to modify the scenarios for the Green Build-out Model. Specifically, a user can make changes to the area of greenroofs and increased tree coverage and view the resultant reductions in stormwater flow. Results can be viewed on a city-wide, neighborhood, or user-defined scale.
Greenroof Model with City-Wide Results
Go
Tree Model with City-Wide Results
Go
Greenroof Model with Neighborhood Results
Go
Tree Model with Neighborhood Results
Go
User-Defined Calcuator
Go
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Limno-Tech, Inc.
Excellence in Environmental Solutions Since 1975

Green Build-Out Mini-Model
Quantifying Stormwater Benefits of Trees and Greenroofs in the District of Columbia

Greenroof Mini-Model Editor

Existing

Roof Type	Available Roof Area (sf)
< 1,000 sf	42,934,330
1,000 - 2,000 sf	46,417,327
5,000 - 2,000 sf	24,765,320
> 5,000 sf	80,738,983
TOTAL	194,855,959

Model Scenario Builder

Choose Greenroof Area for Model Run	Model Greenroof	
	Area (sf)	%
	2,576,060	6%
	10,861,655	23%
	6,191,330	25%
	18,892,922	23%
	38,521,966	20%

Return to Main Menu

Model Results

Sewershed	Runoff Volume Without Green Roofs (MG)	Runoff Volume With Green Roofs (MG)	Reduction In Runoff Volume (MG)	Percent Reduction In Runoff Volume
Anacostia CSS	4,219	4,132	86.68	2.1%
Potomac CSS	1,013	986	27.08	2.7%
Rock Creek CSS	2,437	2,377	59.62	2.4%
Total CSS	**7,668**	**7,495**	**173.38**	**2.3%**
Anacostia MS4	3,719	3,650	68.40	1.8%
Potomac MS4	3,177	3,112	65.11	2.0%
Rock Creek MS4	1,860	1,818	41.54	2.2%
Total MS4	**8,755**	**8,580**	**175.05**	**2.0%**
Anacostia Total	7,938	7,782	155.08	2.0%
Potomac Total	4,189	4,097	92.19	2.2%
Rock Creek Total	4,296	4,195	101.16	2.4%
TOTAL	**16,423**	**16,075**	**348.43**	**2.1%**

Unit Area Reduction Factors

Type of Greening	Annual Stormwater runoff volume reduction per unit area (MG/acre)	Acres required to achieve a one MG reduction in stormwater over an average year (acres/MG)
Green roofs	0.38960	2.5667
Trees over impervious areas	0.11117	8.9952
Trees over pervious areas (NRCS Soil Type D)	0.02210	45.249
Trees over pervious areas (NRCS Soil Type C)	0.00276	362.32
Trees over pervious areas (NRCS Soil Type A & B)	0.00008	12,500

Can be used for quick planning calculations in the Washington, DC area or for other urban areas with similar climate conditions and rainfall distribution patterns

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Findings Summary

- Substantial reduction in runoff & discharge volumes
- Limited reduction in CSO frequencies
- Reduction in stormwater peak flow and velocity
- Operational savings in CSS
  - Less to be pumped and treated
- Trees and green roofs each fill an important niche

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Other Key Messages

- Increasing tree box size both reduces impervious cover and allows trees to grow larger
- Trees provide the most benefit over impervious surfaces
- Stormwater control options in urban areas are limited

Work of
Jim Urban, FASLA

Other Key Messages

Trees and green roofs offer <u>multiple</u> benefits.

- Air quality improvements
- Urban heat island reduction
- Energy savings
- Carbon sequestration
- Urban wildlife habitat
- Aesthetics

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(Some) Policy Recommendations

- Develop green roof cover objectives, strategy, and leadership
- **Develop and adopt Urban Tree Canopy goals and an Urban Forest Management Plan**
- Set vegetated shade requirements (e.g. Parking Lots = 40%)
- Increase tree box sizes

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UTC Goals

Next Steps

- Assess existing canopy with new imagery
- Resolve percent cover with past data
- Work with City leaders to set and adopt a citywide goal
- Set neighborhood goals with community groups, BIDs and university partners

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UTC Goals

Next Steps

- Develop partnerships
  - Goal setting
  - Supporting policies
- Continue grass roots outreach

Casey Trees Mission

To restore, enhance and protect the tree canopy of the Nation's Capital.

Casey Trees
WASHINGTON DC

Heather Whitlow
Director of Planning & Design
Phone: (202) 833-4010 x121
hwhitlow@caseytrees.org

Casey Trees
1425 K St NW, Suite 1050
Washington, DC 20005
www.caseytrees.org