Making urban landscapes work for local waterbodies and wildlife

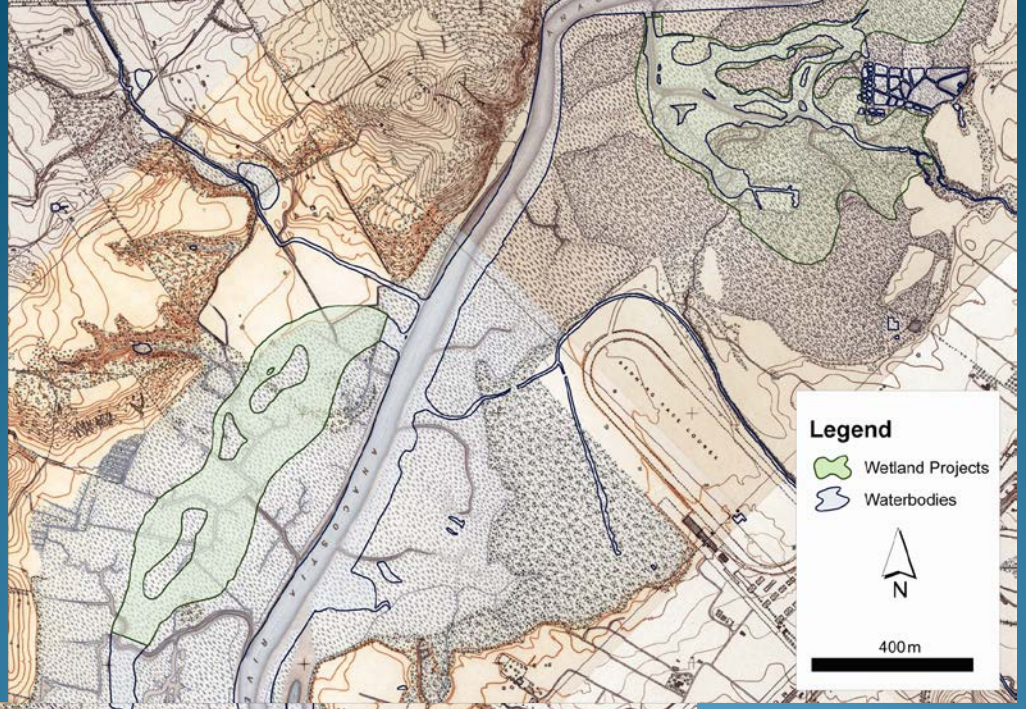
Peter Hill
District Department of the Environment
Watershed Protection Division
Planning and Restoration Branch

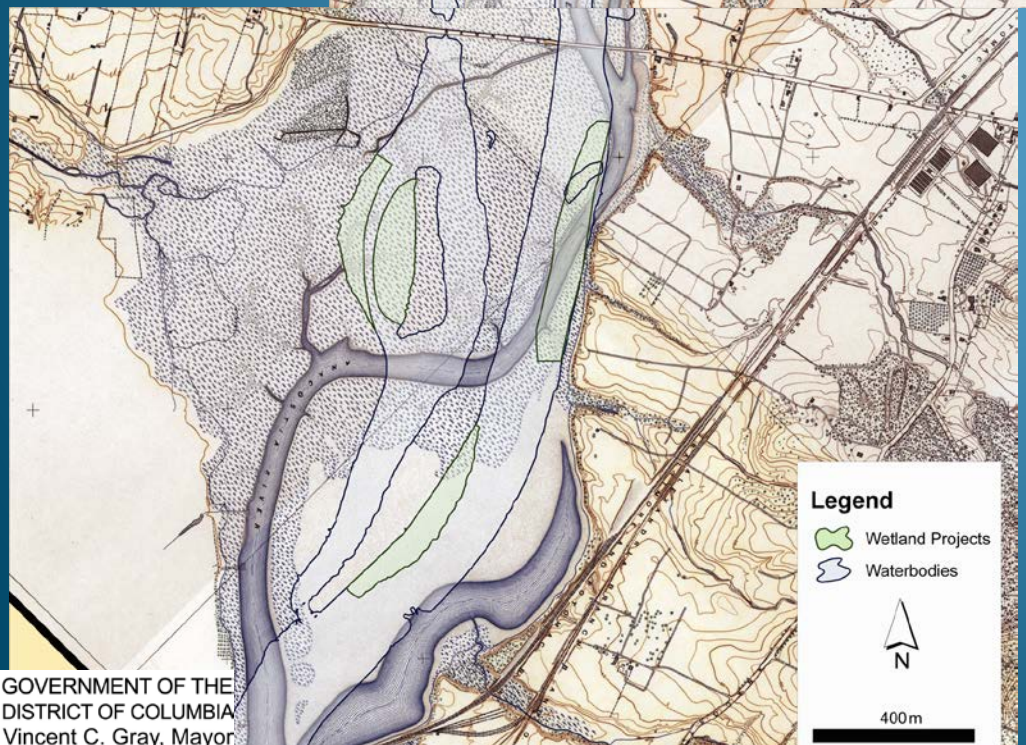
Overview

- Current urban challenges and framework for evaluation of our effort
- Role of people in urban efforts
- DDOE's RiverSmart Homes program
- DDOE's stream restoration projects
- Ideas for expanded evaluation framework

Urban streams = massively altered hydrology with major impacts for restoration potential

- What are our goals?
  - For resource, human behavior?
- What can be accomplished? What is success?
- What is the timeframe – within 5 years or 30 yr horizon?
- What are the costs?
- What are other benefits or services beside water quality?





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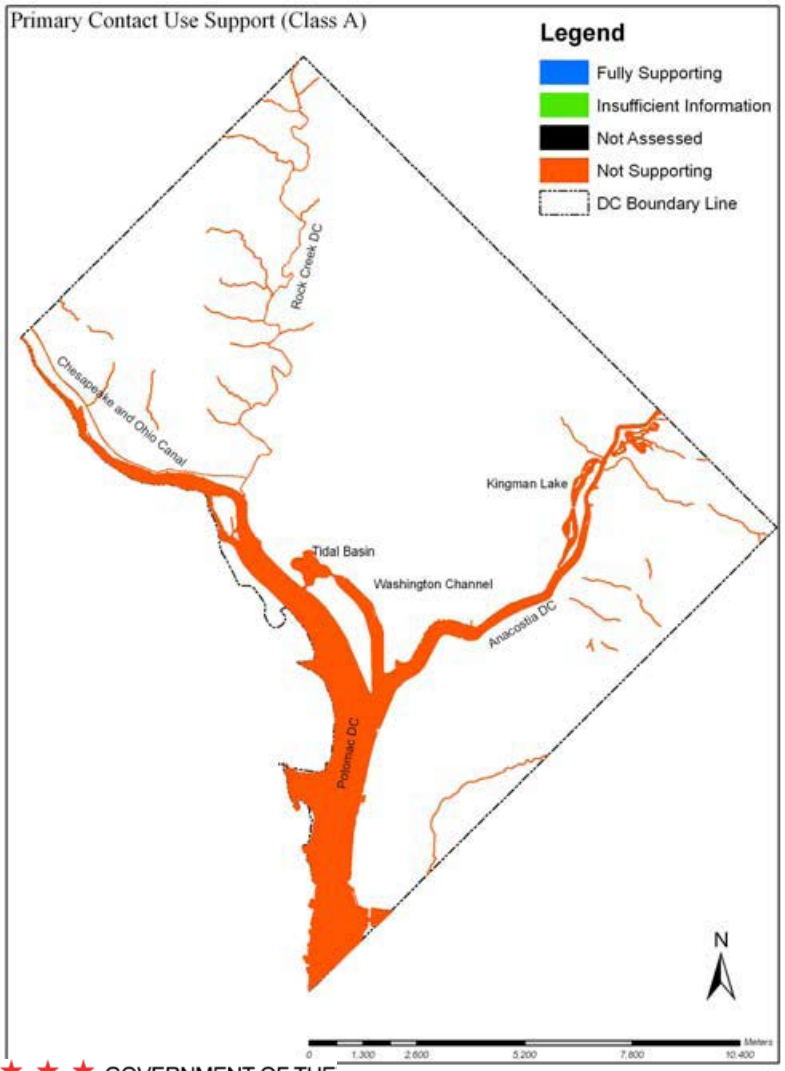
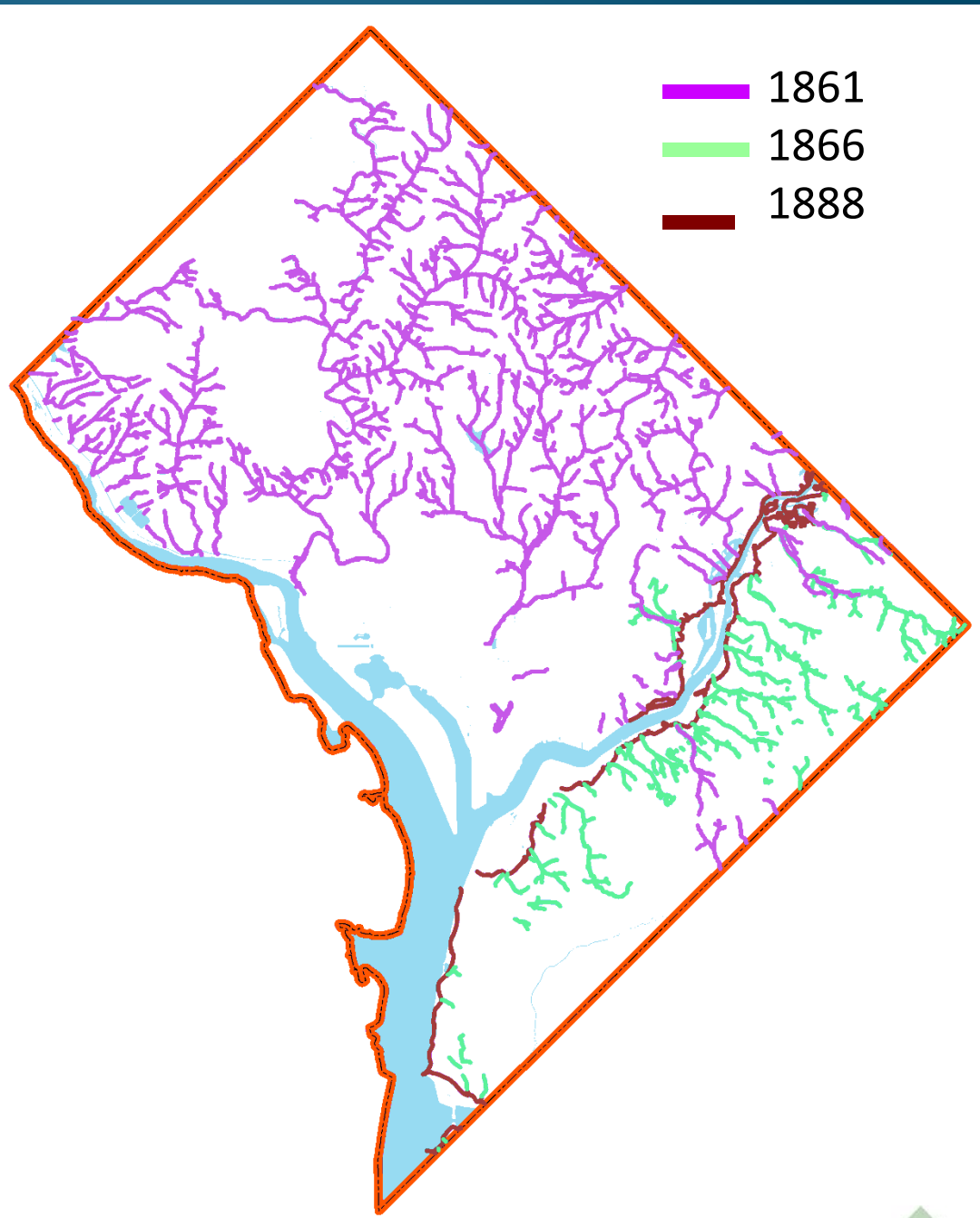
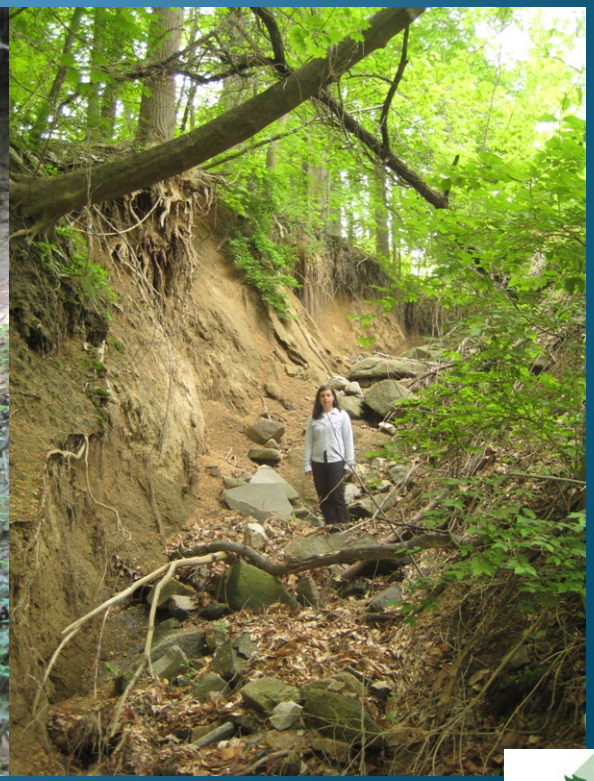

Primary Contact Use Support (Class A)
Legend
Fully Supporting
Insufficient Information
Not Assessed
Not Supporting
DC Boundary Line
Rock Creek DC
Chesapeake and Ohio Canal
Kingman Lake
Tidal Basin
Washington Channel
Anacostia DC
Potomac DC
N
0
1,300
2,600
5,200
7,800
10,400
Meters


1861
1866
1888



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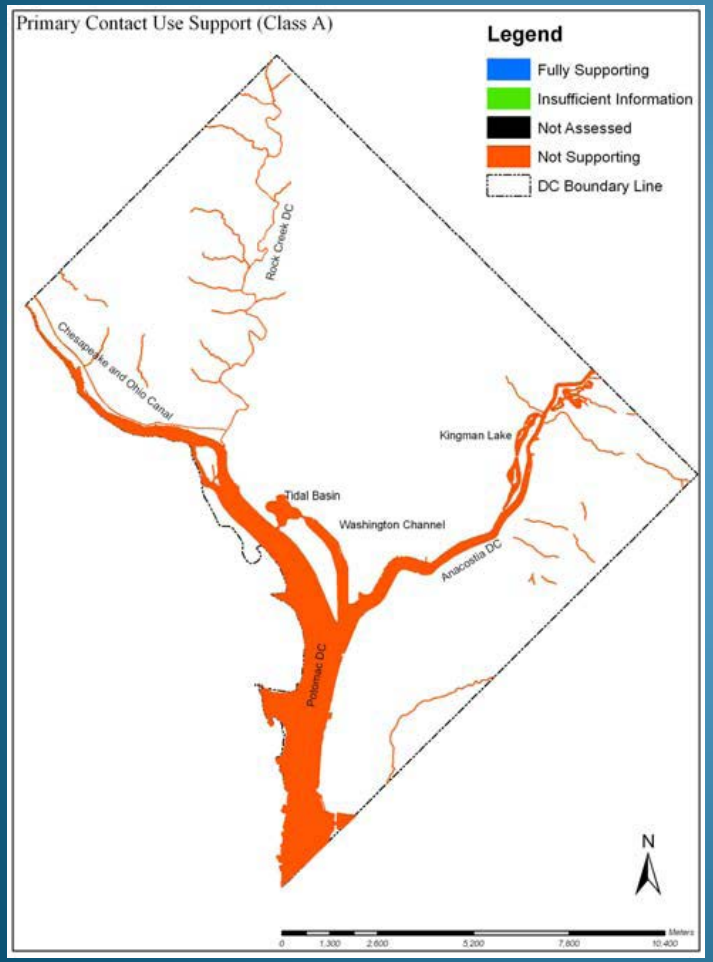
Loss of ecological function of typical urban stream

- Loss of floodplain leads to
  - lower nutrient uptake and processing
  - lower sediment storage (flushes through)

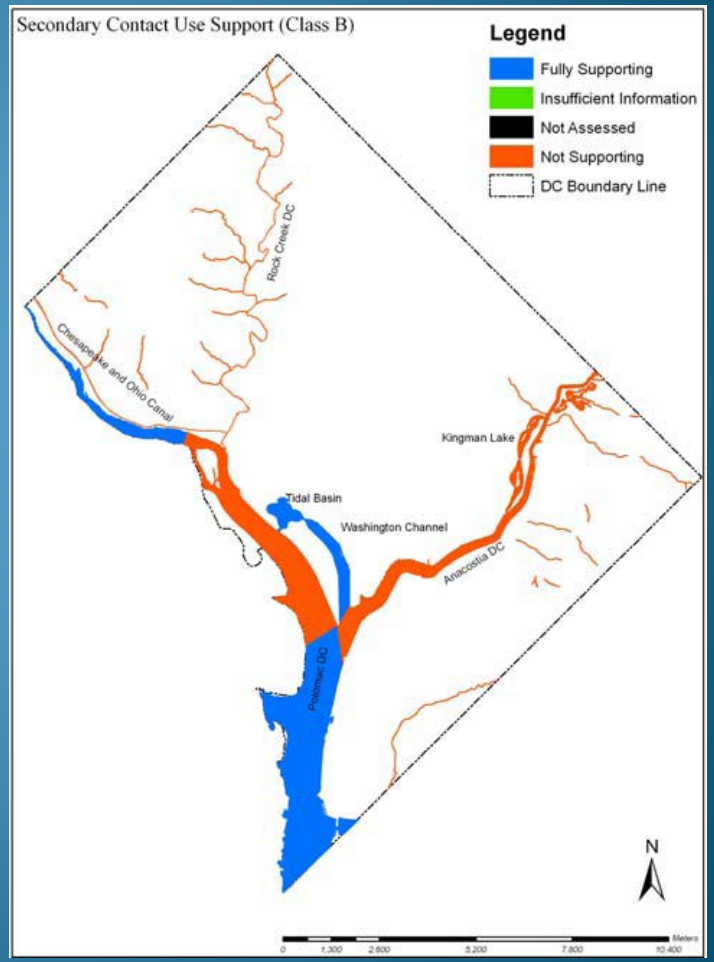
- Incised channel leads to
  - lowered groundwater levels and impacts to forest health
  - in most cases an incised channel that does not adjust and reform a new floodplain
  - for most headwater streams, generally very few pools or water sources – poor for habitat

303d Water quality impairments in DC

- Where to start?
- What results are meaningful to residents and the natural resources?



Waters that support swimming (primary contact)



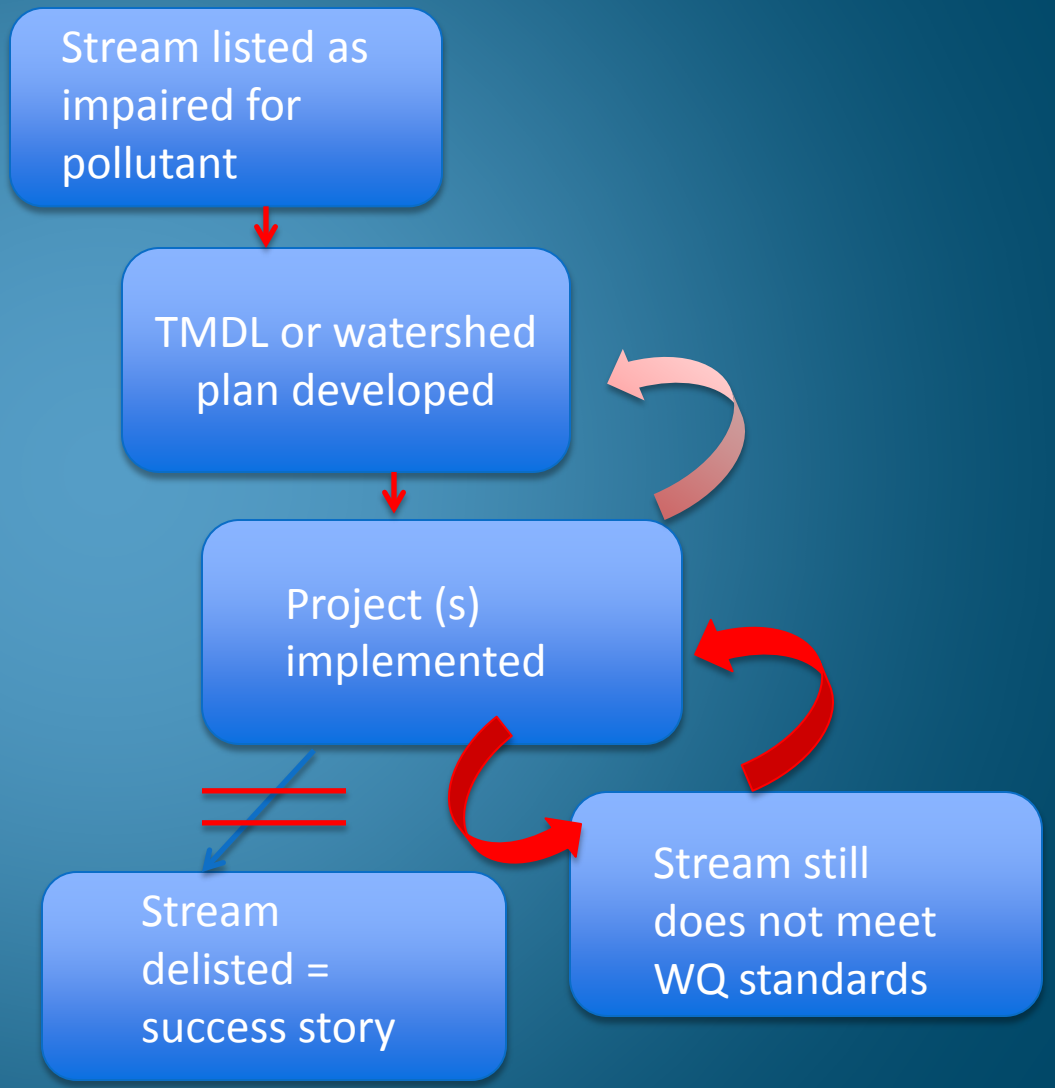
Waters that support boating (secondary contact)

	TN reduction (lbs/yr)	TP reduction (lb/yr)	TSS reduction (lb/yr) **2.55lb/lf**	%age of ***TSS TMDL*** goal	TSS reduction **3.58lb/lf ***	%age of **TSS TMDL ***
Stream restoration (20K ln ft)	**400**	**70**	**51,000**	**32.86%**	**71,600**	**46.13%**
Reductions from comprehensive school retrofits (listed in WIP)	**73.5**	**11.68**	**5,328**	**3.43%**		
Reductions realized from additional SW retrofits in (roadways, parking lots listed in WIP)	**134.4**	**18.64**	**10,063**	**6.48%**		
Reductions realized from tree planting	**134.1**	**21.8**	**5,532.1**	**3.56%**		
Reductions realized from RS Homes **(75 RB, 50 RG, 75 ST, 10 PP, 50 BS)**	**21.3**	**3.0**	**850.1**	**0.55%**		
Total reductions from all programs/practices	**763.3**	**111.4**	**72,773 lbs/yr** **(36.39 Tons/yr)**	**46.88%**		**60.15 %**
Reduction needed to meet TMDL	**No TMDL**	**No TMDL**	**155,200 lbs/yr** **77.6 Tons/yr** **(61.2 SR + 16.4 SW)**	**100%**		
Shortfall to meeting TMDL			**82,427lbs/yr** **(41.21 Tons/yr)**	**53.12%**		**39.85 %**

How to evaluate results? Water quality lens

Funding states that only WQ Improvements are successes

- Partnership with UMD, Biohabitats, and DDOE will answer
  - Removal rates of all MS4 priority pollutants
  - Change in groundwater levels
  - Change in discharge pre/post stream restoration project



Conventional wisdom about urban systems:

- Humpty Dumpty is broken
- Expensive to restore
- Underlying physical factors so altered

that restoration to appropriate reference state is not realistic

- implicit assumption that humans are the problem ***(In most cases we are)***

What if?

- Being free from pristine reference points would allow for greater ecological function?
- If restoring urban areas catalyzed human support and changed behaviors on numerous fronts (ie. Trash, C footprint, social ties) ?

Urban ecosystems and human interaction

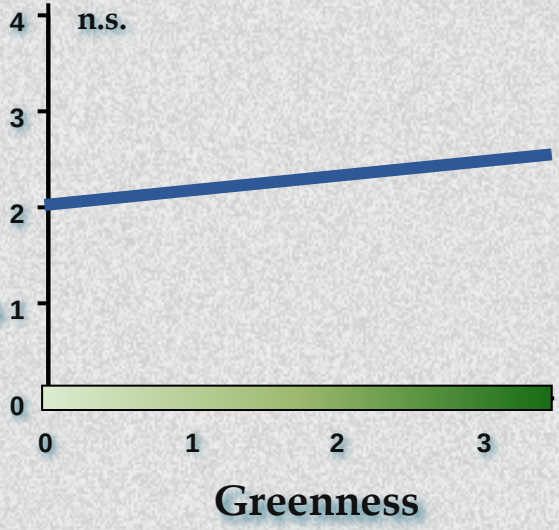
- not only have humans defined the boundary conditions, but they continue to define the inputs thru
  - Negative: littering, excess fertilizer, altered drainage
  - Positive: political support, rainwater harvesting, cleanups, native landscape
  - Pollution prevention activities could have unintended benefits
  - Predicting outcomes is nearly impossible and thus impossible to really know the restoration potential of an urban system

Behavior change

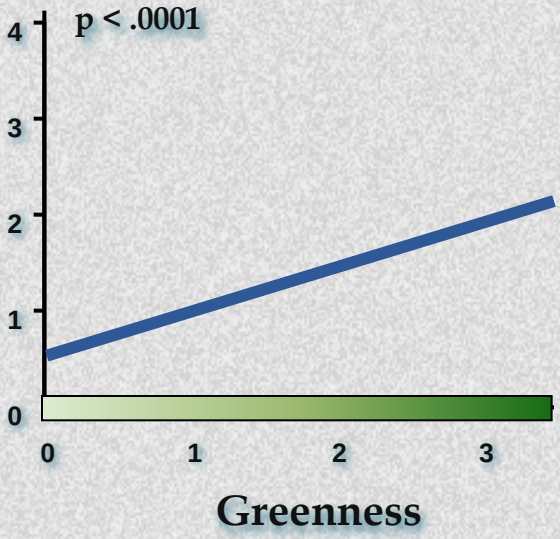
William Sullivan of Univ. of Illinois at Urbana-Champagne


FedEx

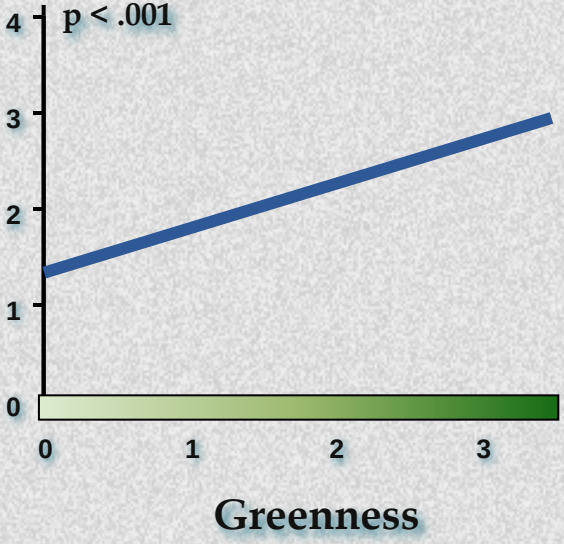
General Social Ties



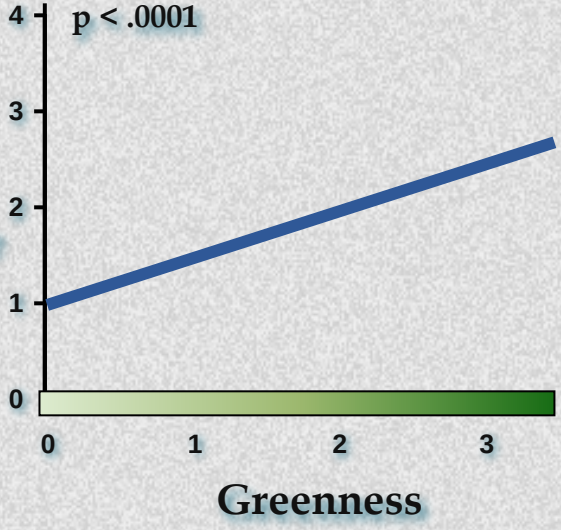
Socializing at Taylor



Nearby Neighbors

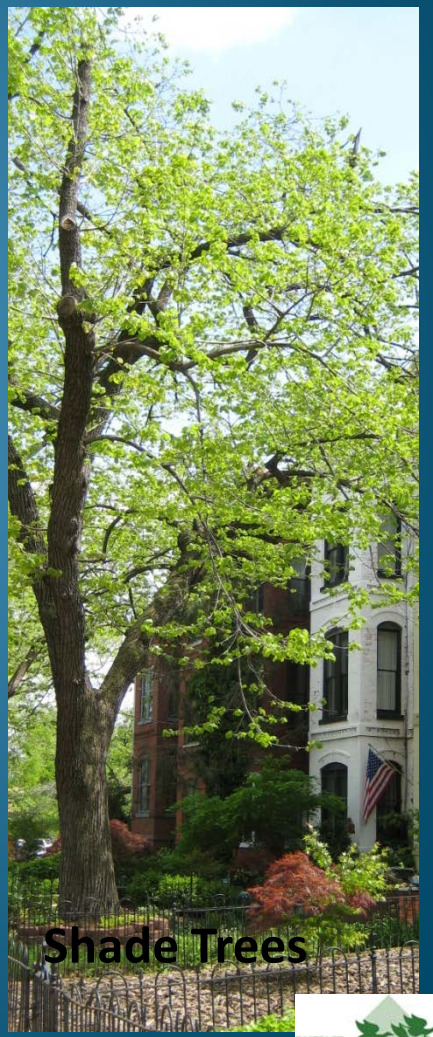


Local Sense of Comm.



Goals of *RiverSmart Homes*:

- Reduce quantity and improve quality of stormwater runoff
- Recharge groundwater
- Habitat diversity
- Promote water conservation
- Promote watershed stewardship



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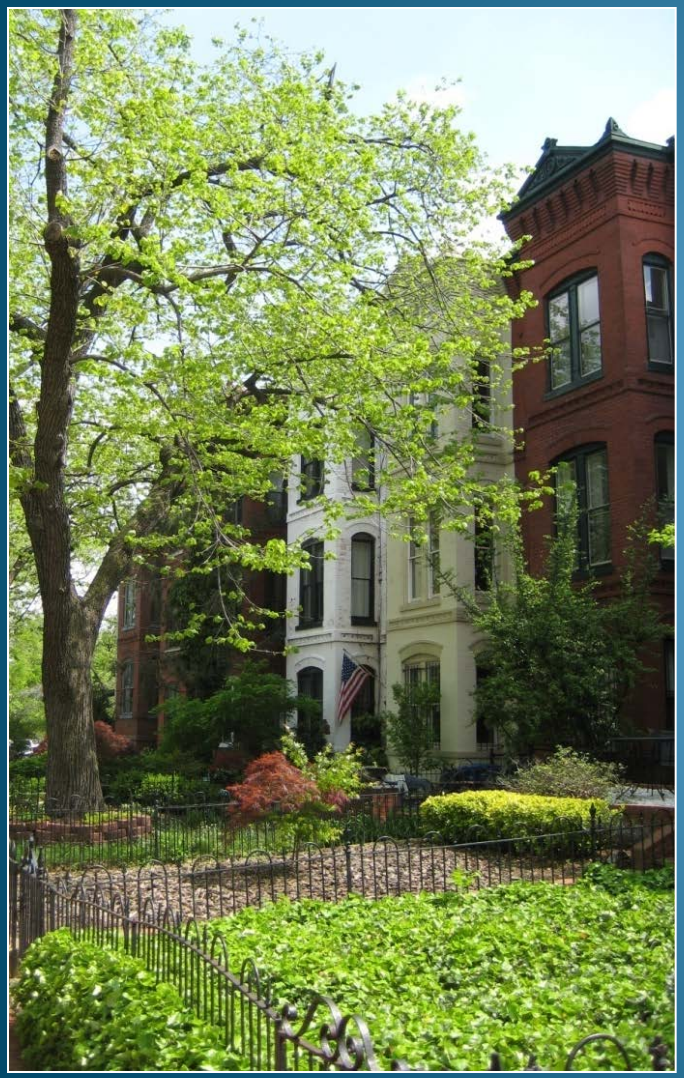
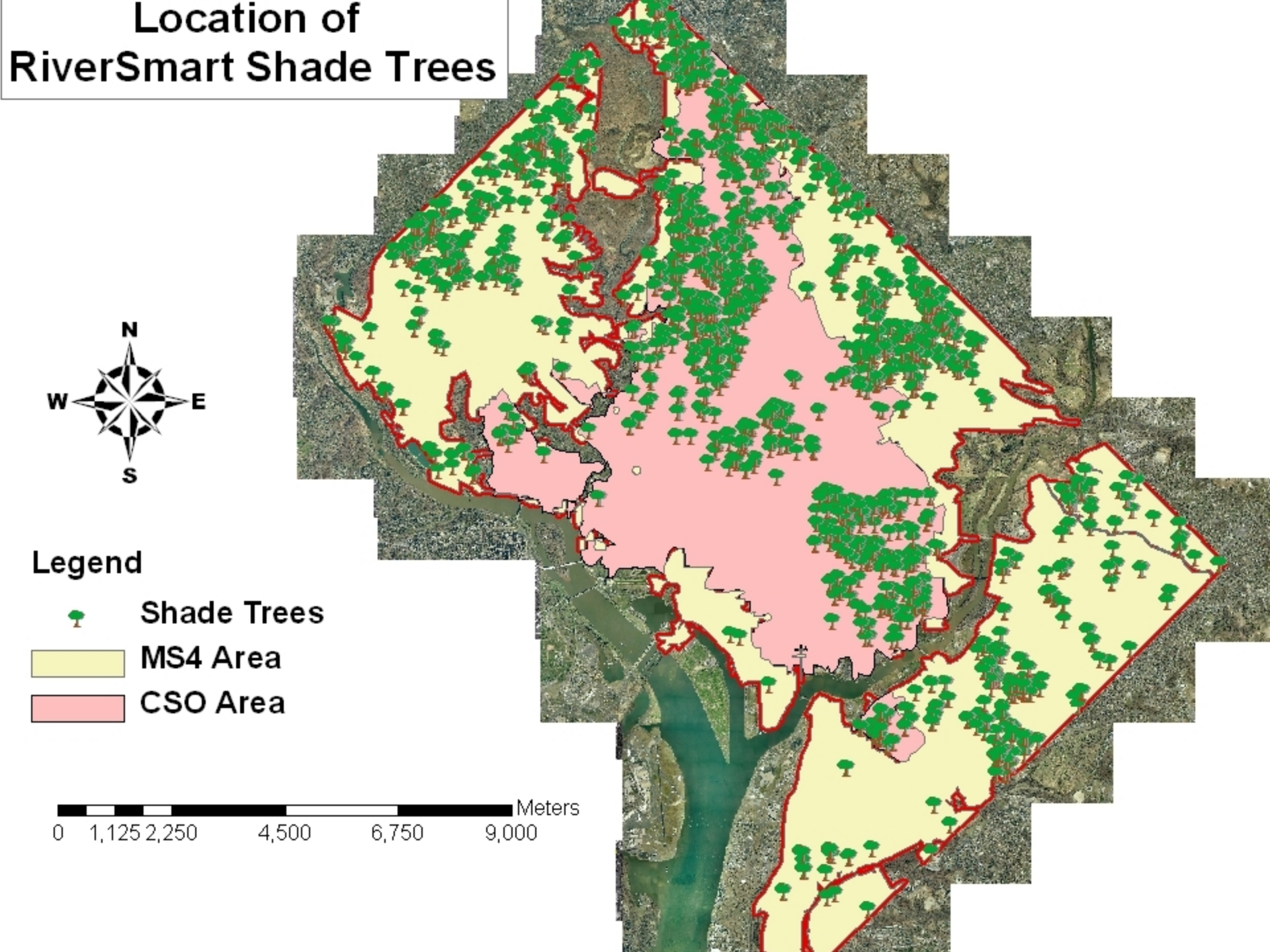
Why Focus on Private Property?

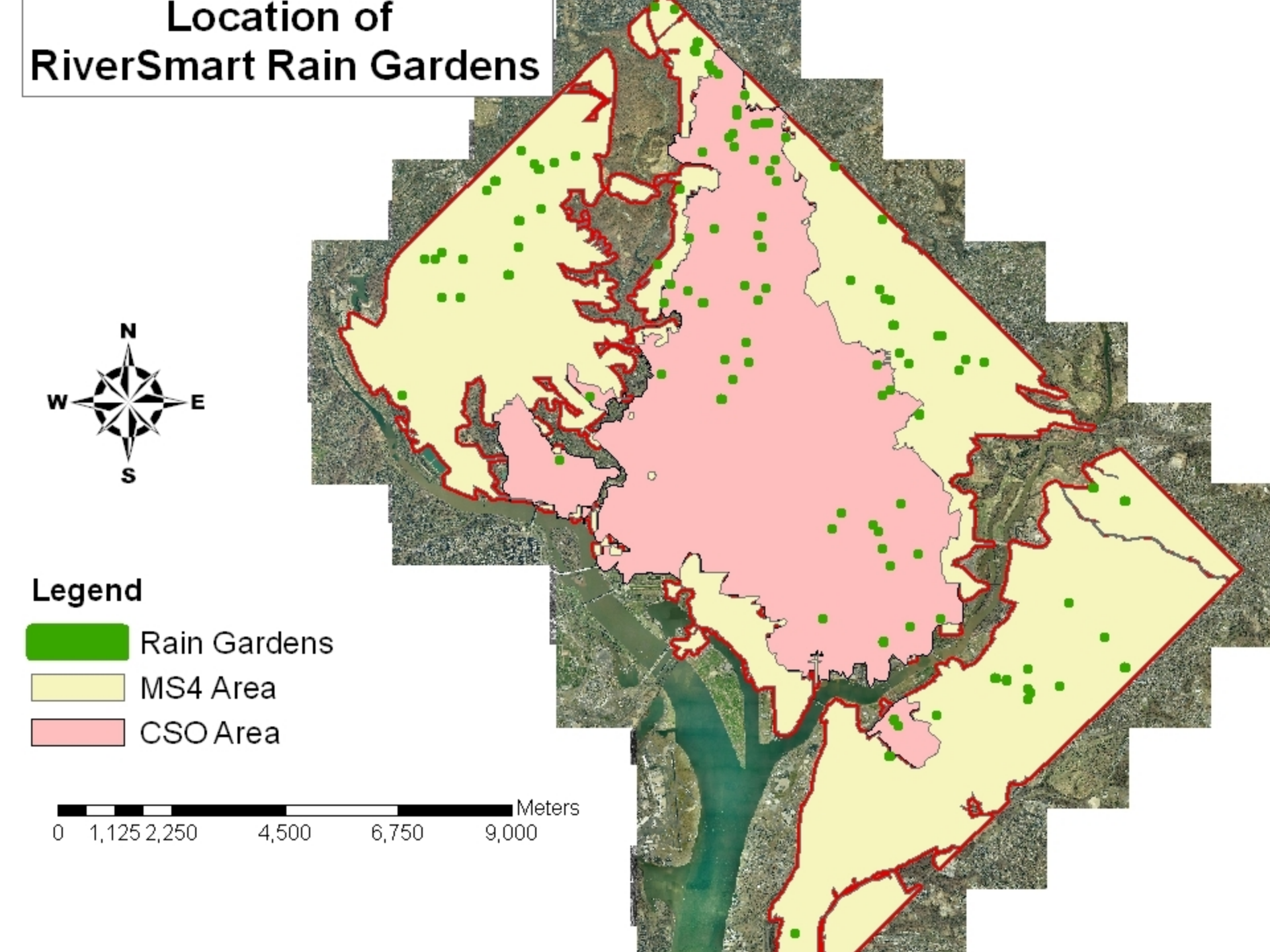


- Federal lands – where most space is available but they are not often a willing partner
- Residential development makes up greatest land use in the District (27%)
- 17% of land area is single family homes
- Area the slowest for redevelopment & least likely to require stormwater retrofits

Location of RiverSmart Shade Trees



Location of RiverSmart Rain Gardens



RiverSmart Rainbarrels Installed

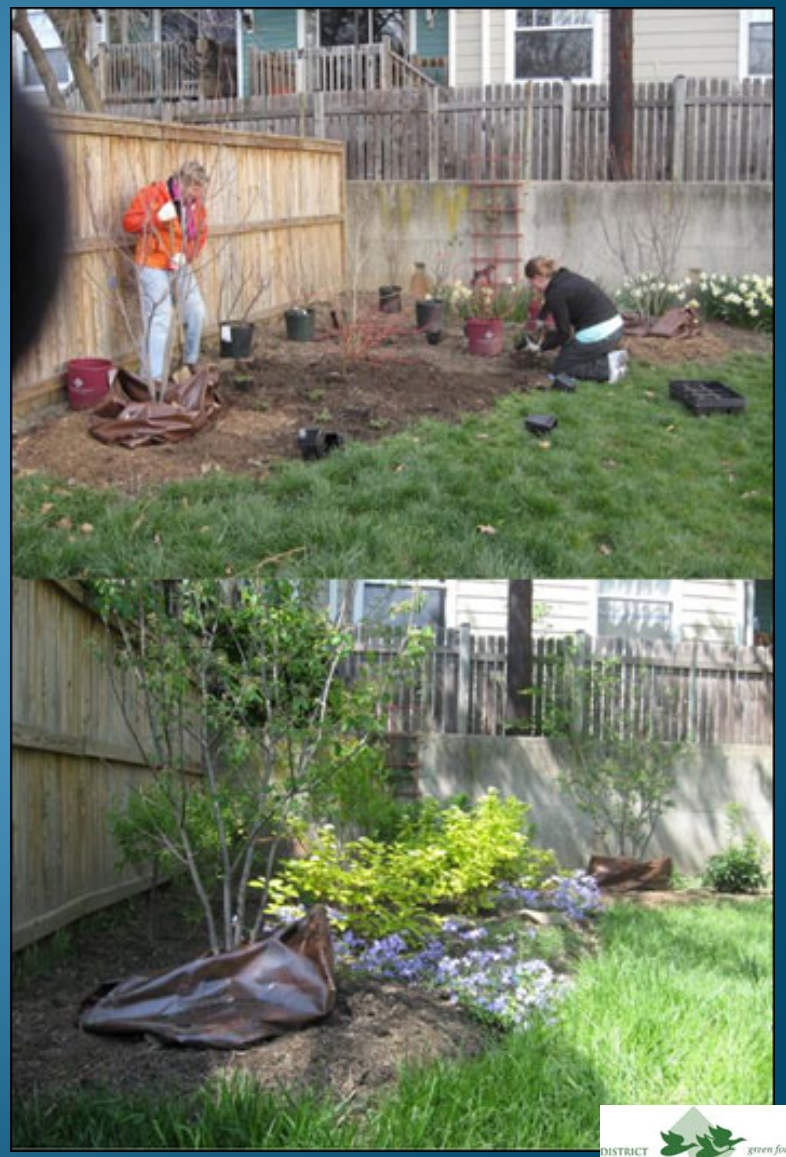
Legend

- RiverSmart Rainbarrels
- MS4 area
- CSO area

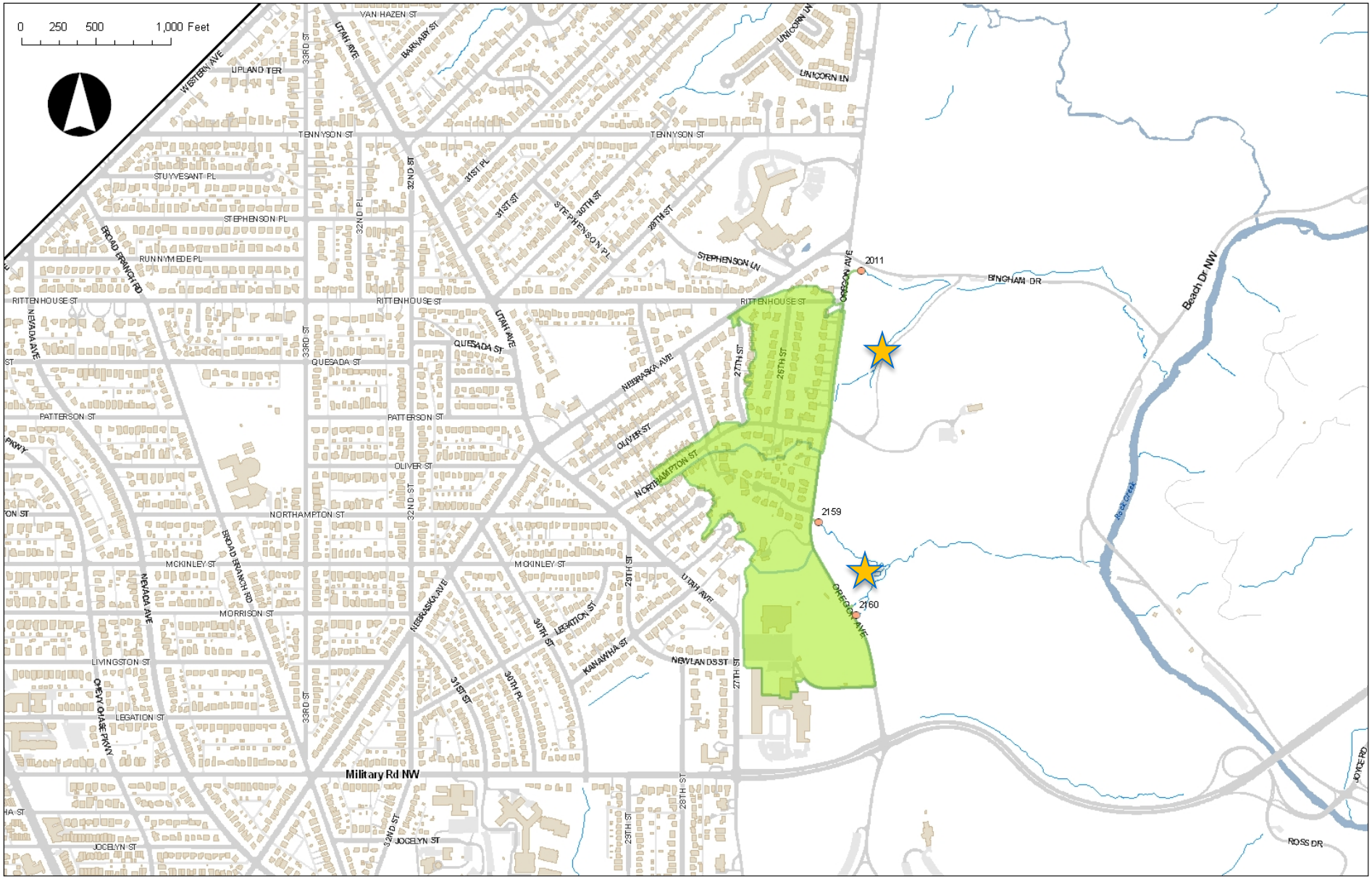
0 850 1,700 3,400 5,100 6,800
Meters

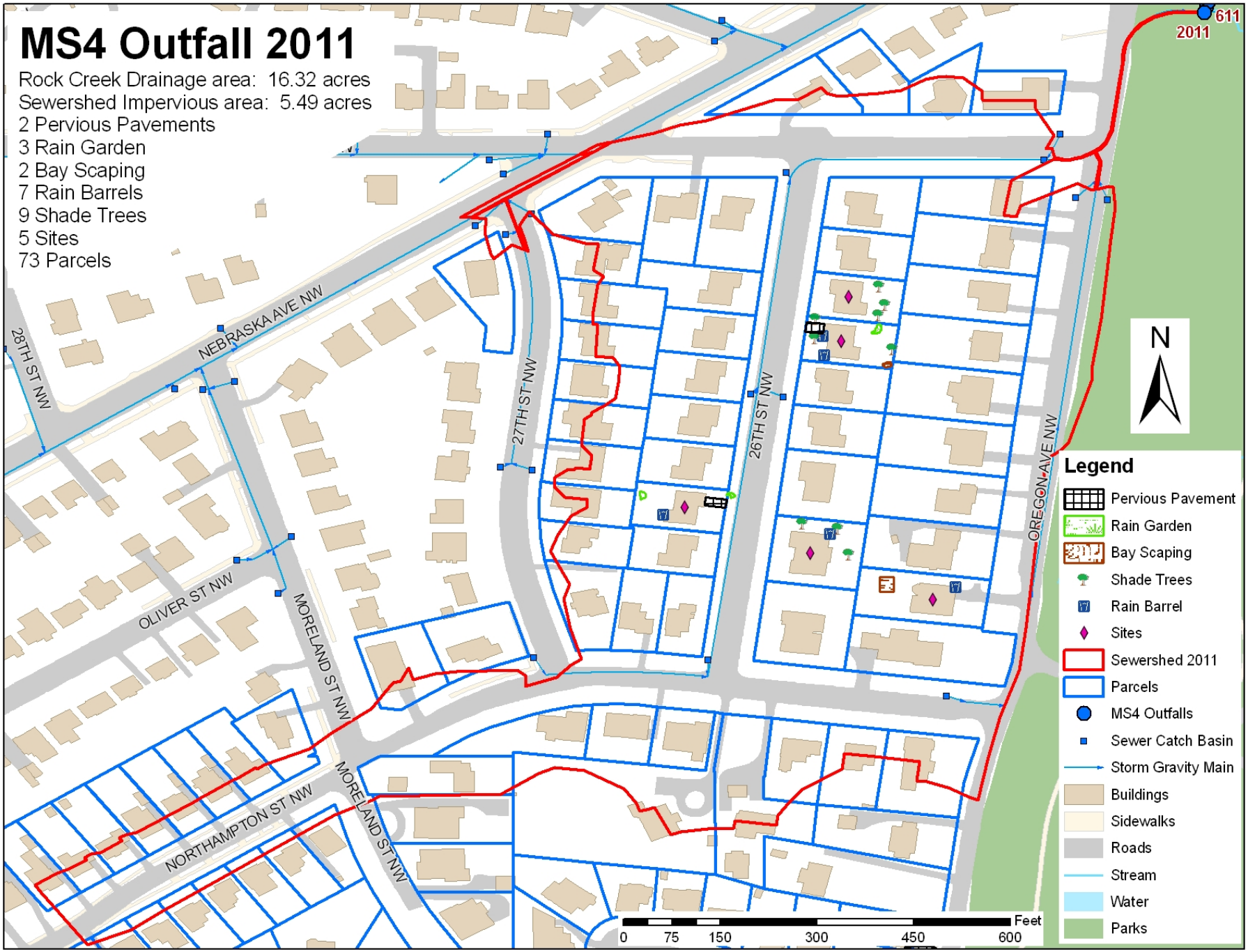
A Snapshot of Today

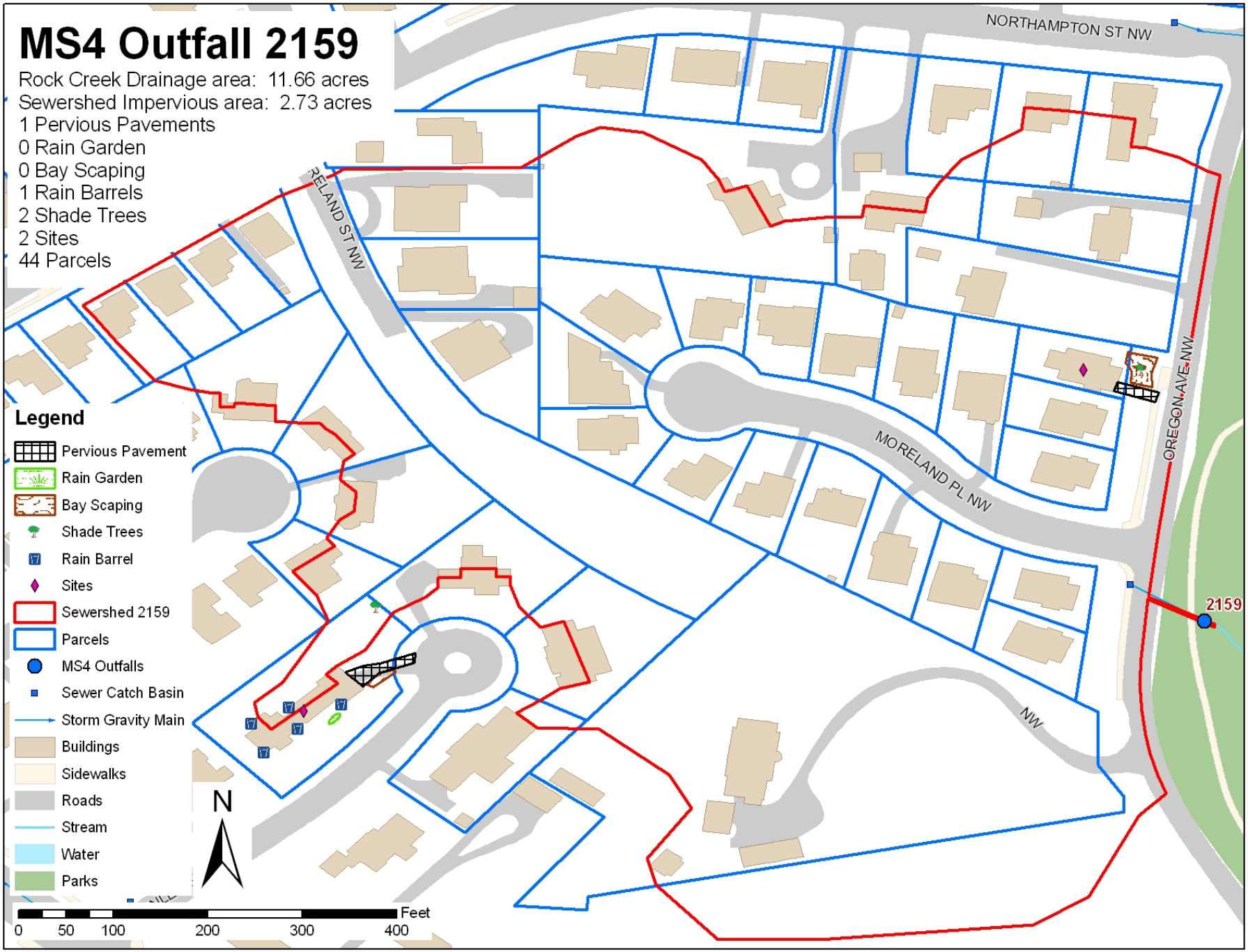
- **City-wide Installations:**
  - 3,370 audits completed
  - 2,100 rain barrels installed
  - 1,300 trees planted
  - 327 rain gardens installed
  - 441 BayScapes installed
  - 57 impervious surfaces removed



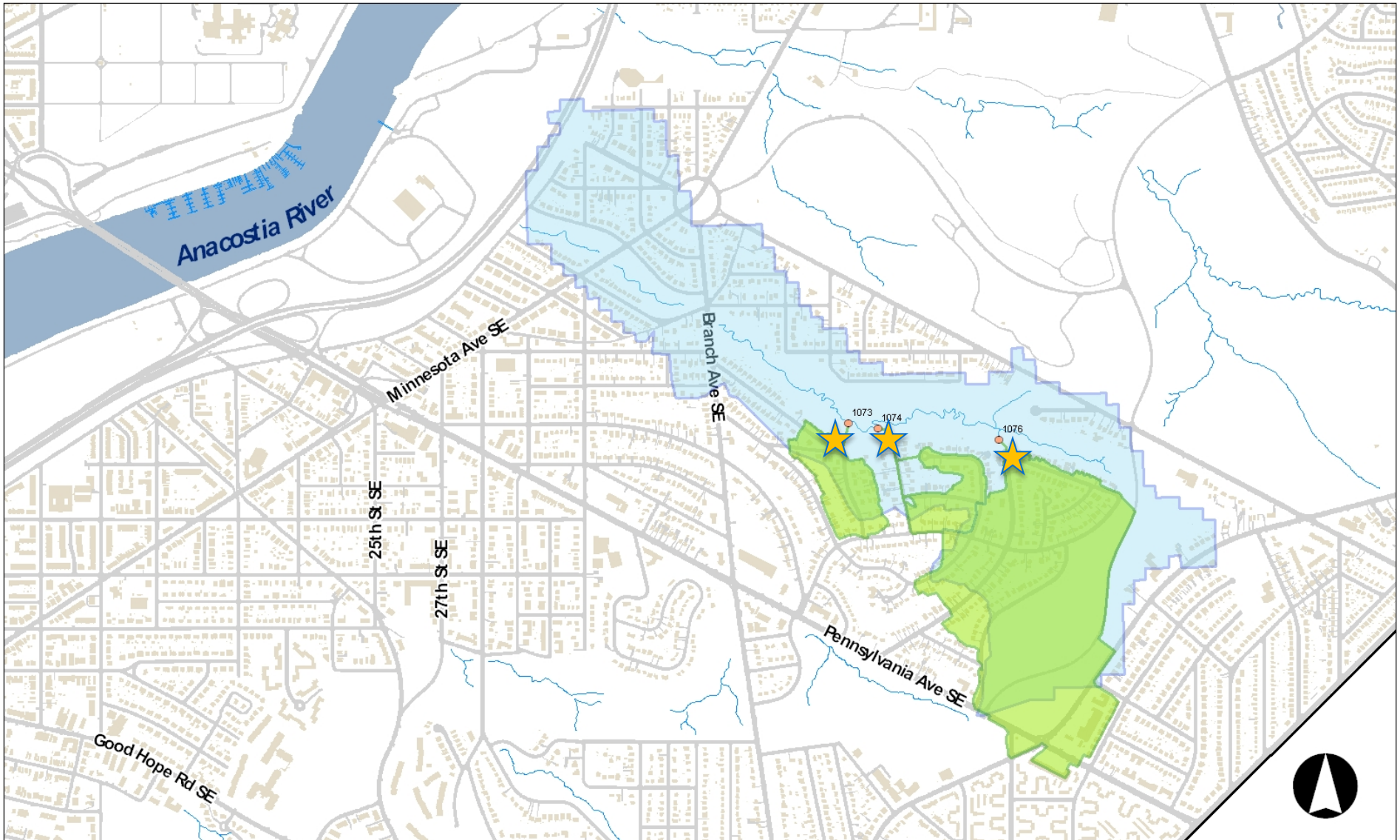
Zooming into greater focus: Rock Creek Park

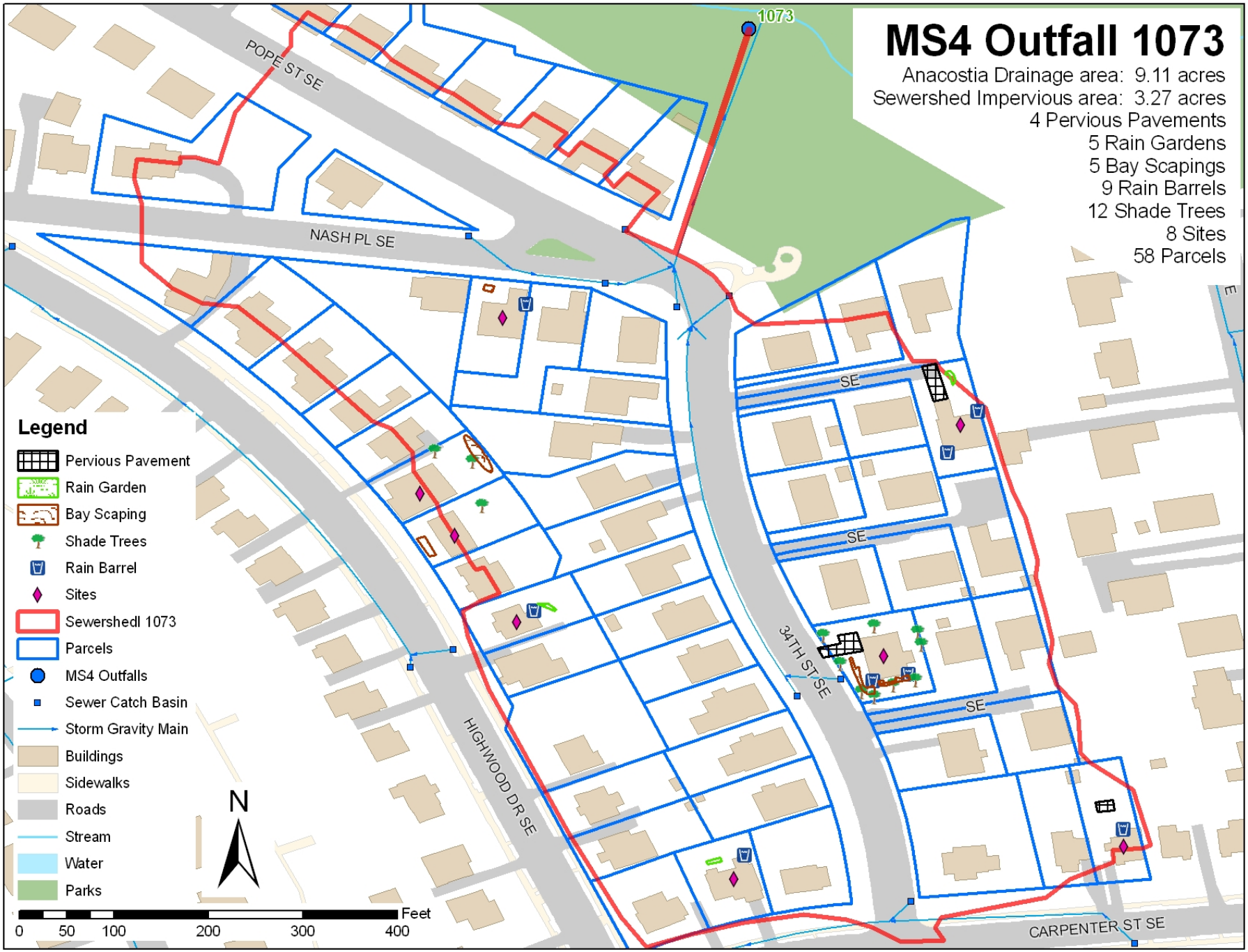


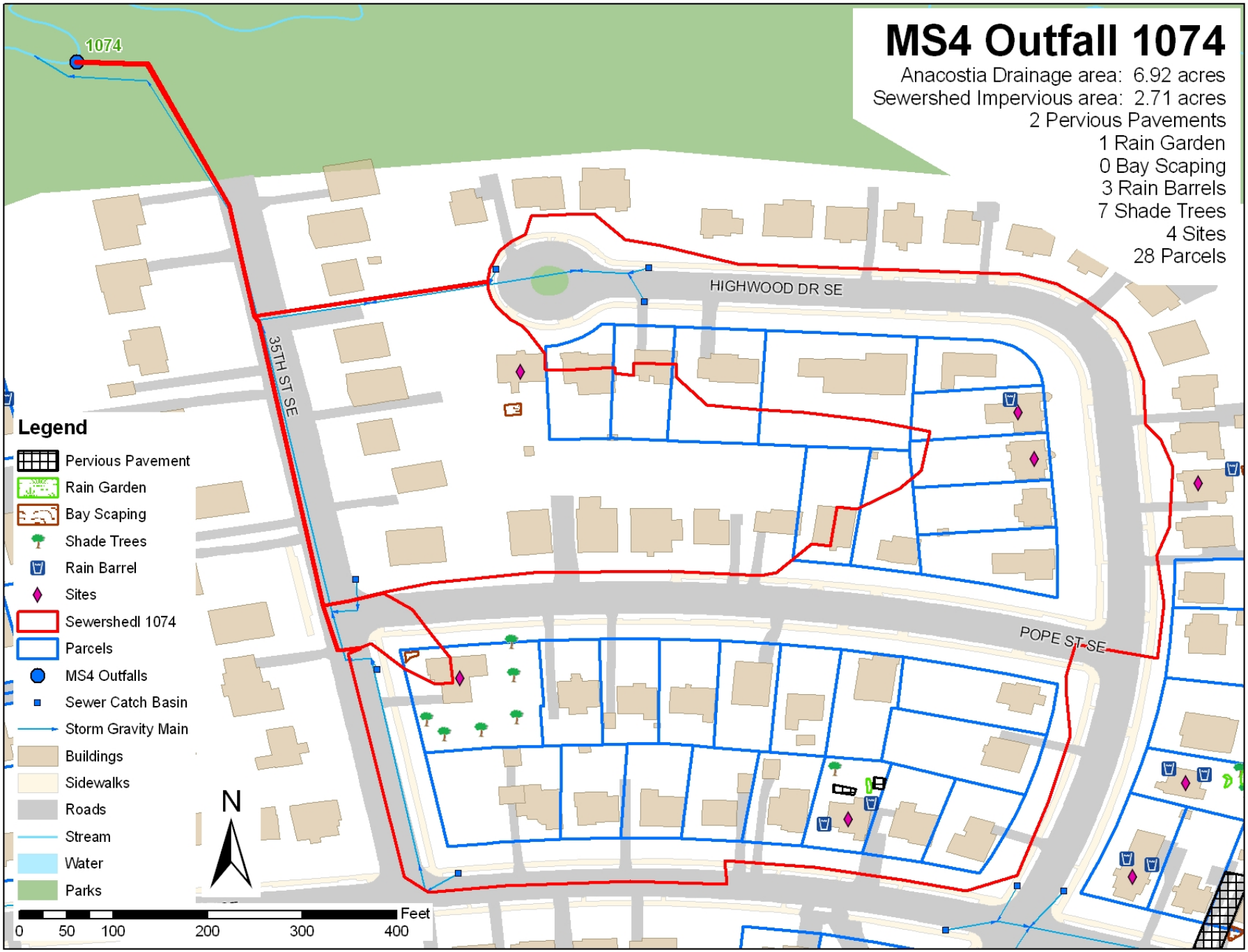

MS4 Outfall 2011
Rock Creek Drainage area: 16.32 acres
Sewershed Impervious area: 5.49 acres
2 Pervious Pavements
3 Rain Garden
2 Bay Scaping
7 Rain Barrels
9 Shade Trees
5 Sites
73 Parcels
611
2011
NEBRASKA AVE NW
28TH ST NW
27TH ST NW
26TH ST NW
OREGON AVE NW
OLIVER ST NW
MORELAND ST NW
NORTHAMPTON ST NW
N
Legend
Pervious Pavement
Rain Garden
Bay Scaping
Shade Trees
Rain Barrel
Sites
Sewershed 2011
Parcels
MS4 Outfalls
Sewer Catch Basin
Storm Gravity Main
Buildings
Sidewalks
Roads
Stream
Water
Parks
Feet
0 75 150 300 450 600


MS4 Outfall 2159
Rock Creek Drainage area: 11.66 acres
Sewershed Impervious area: 2.73 acres
1 Pervious Pavements
0 Rain Garden
0 Bay Scaping
1 Rain Barrels
2 Shade Trees
2 Sites
44 Parcels
NORTHAMPTON ST NW
RELAND ST NW
MORELAND PL NW
OREGON AVE NW
NW
2159
Legend
Pervious Pavement
Rain Garden
Bay Scaping
Shade Trees
Rain Barrel
Sites
Sewershed 2159
Parcels
MS4 Outfalls
Sewer Catch Basin
Storm Gravity Main
Buildings
Sidewalks
Roads
Stream
Water
Parks
N
0 50 100 200 300 400
Feet

Zooming into greater focus: Pope Branch watershed




1073
MS4 Outfall 1073
Anacostia Drainage area: 9.11 acres
Sewershed Impervious area: 3.27 acres
4 Pervious Pavements
5 Rain Gardens
5 Bay Scapings
9 Rain Barrels
12 Shade Trees
8 Sites
58 Parcels
POPE ST SE
NASH PL SE
SE
SE
SE
34TH ST SE
HIGHWOOD DR SE
CARPENTER ST SE
Legend
Pervious Pavement
Rain Garden
Bay Scaping
Shade Trees
Rain Barrel
Sites
Sewershedl 1073
Parcels
MS4 Outfalls
Sewer Catch Basin
Storm Gravity Main
Buildings
Sidewalks
Roads
Stream
Water
Parks
N
Feet
0
50
100
200
300
400


MS4 Outfall 1074
Anacostia Drainage area: 6.92 acres
Sewershed Impervious area: 2.71 acres
2 Pervious Pavements
1 Rain Garden
0 Bay Scaping
3 Rain Barrels
7 Shade Trees
4 Sites
28 Parcels
1074
HIGHWOOD DR SE
35TH ST SE
POPE ST SE
Legend
Pervious Pavement
Rain Garden
Bay Scaping
Shade Trees
Rain Barrel
Sites
Sewershedl 1074
Parcels
MS4 Outfalls
Sewer Catch Basin
Storm Gravity Main
Buildings
Sidewalks
Roads
Stream
Water
Parks
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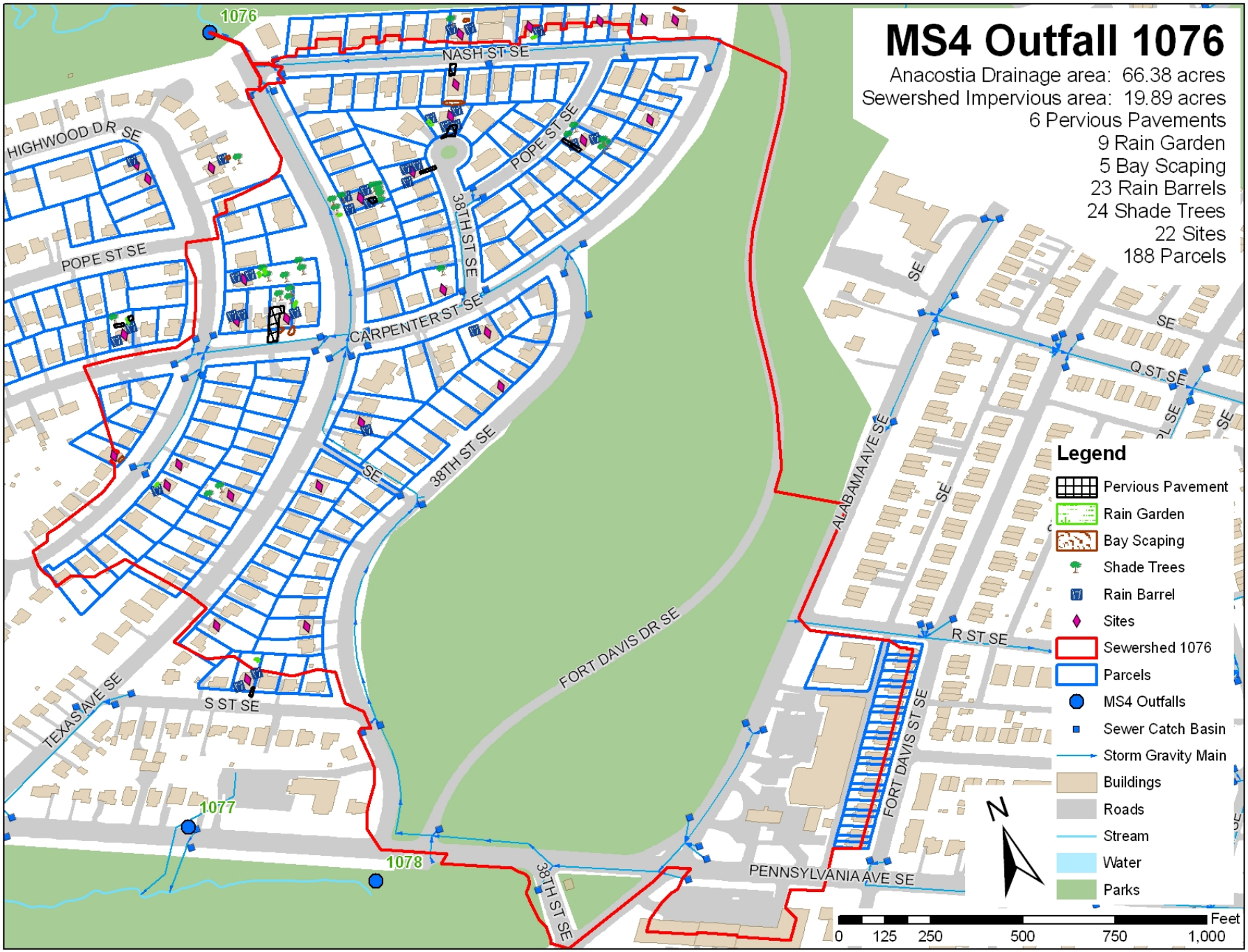
0 50 100 200 300 400
Feet


MS4 Outfall 1076
Anacostia Drainage area: 66.38 acres
Sewershed Impervious area: 19.89 acres
6 Pervious Pavements
9 Rain Garden
5 Bay Scaping
23 Rain Barrels
24 Shade Trees
22 Sites
188 Parcels
1076
1077
1078
NASH ST SE
HIGHWOOD D R SE
POPE ST SE
38TH ST SE
CARPENTER ST SE
S ST SE
TEXAS AVE SE
FORT DAVIS DR SE
ALABAMA AVE SE
R ST SE
Q ST SE
FORT DAVIS ST SE
PENNSYLVANIA AVE SE
Legend
Pervious Pavement
Rain Garden
Bay Scaping
Shade Trees
Rain Barrel
Sites
Sewershed 1076
Parcels
MS4 Outfalls
Sewer Catch Basin
Storm Gravity Main
Buildings
Roads
Stream
Water
Parks
N
0 125 250 500 750 1,000
Feet

Passive vs. targeted approach

Sewershed	Watershed	Participation (# of house participating /total houses)	Partic. Percent	# practices	Practices/ home
2011	Milkhouse/ Bingham	5/73	7%	23	.31/home
2159	Milkhouse/ Bingham	2/44	4.5%	4	.09/home
1073	Pope	8/67	12%	35	.52/home
1074	Pope	4/28	14%	13	.46/home
1076	Pope	22/88	25%	67	.76/home

Stormwater Retrofits: How to evaluate choices?

- What can be accomplished:
  - private property (homes, condos, businesses, etc.)
  - public property (roadways, sidewalks, etc…

→ Some examples but not fully known – saturation rate TBD

- What should it cost? (limited resources)

→ Some examples but field is evolving…costs in urban areas can vary greatly

- What were the results from similar efforts?

→ some related efforts but frequently each project is unique

- What were the benefits to the local waterbodies/wildlife

→ Generally not enough time/$ to understand this

Springhouse Run Rest. & BMP installation

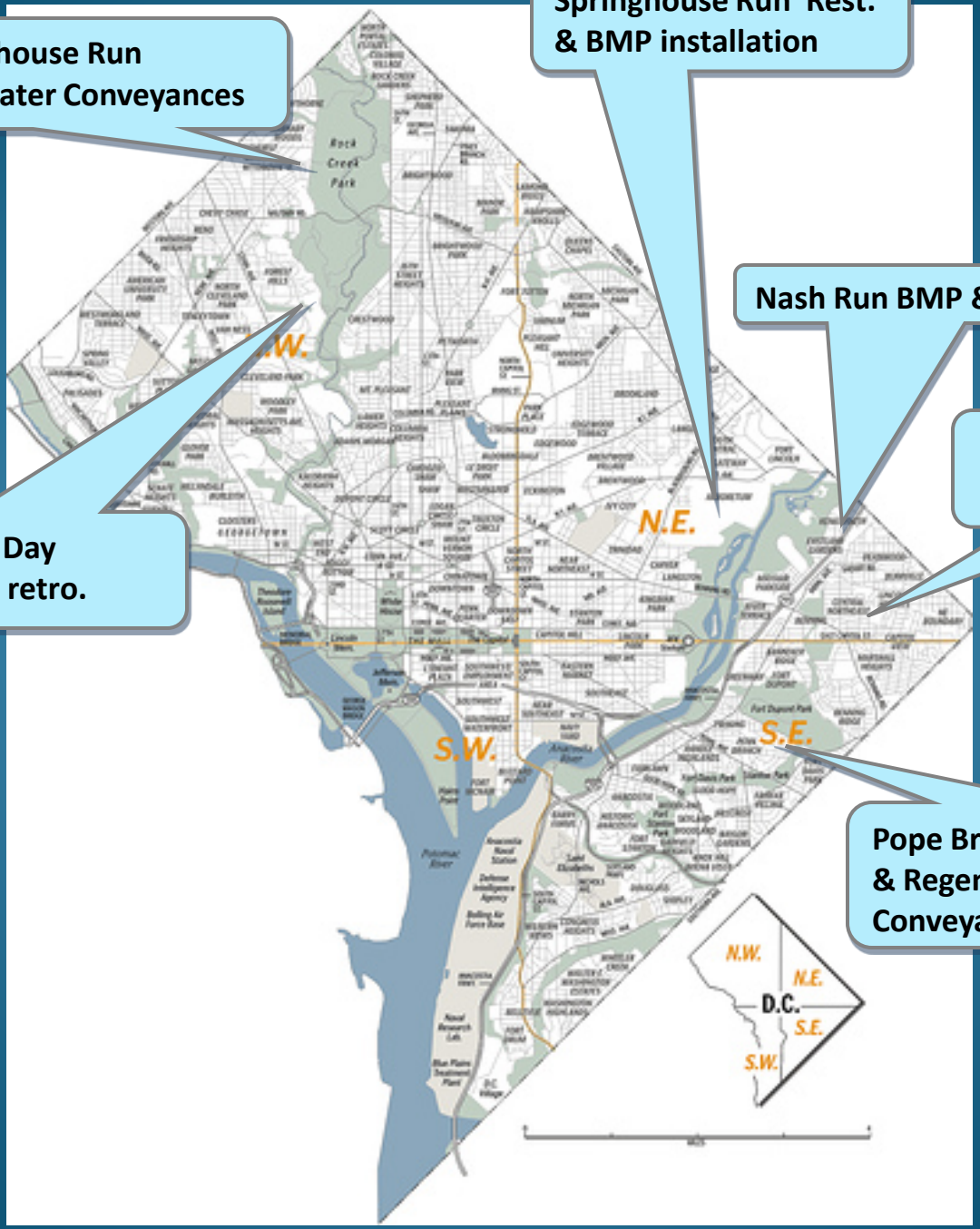
Bingham Ford & Milkhouse Run Regenerative Stormwater Conveyances

Nash Run BMP &Stream Restoration

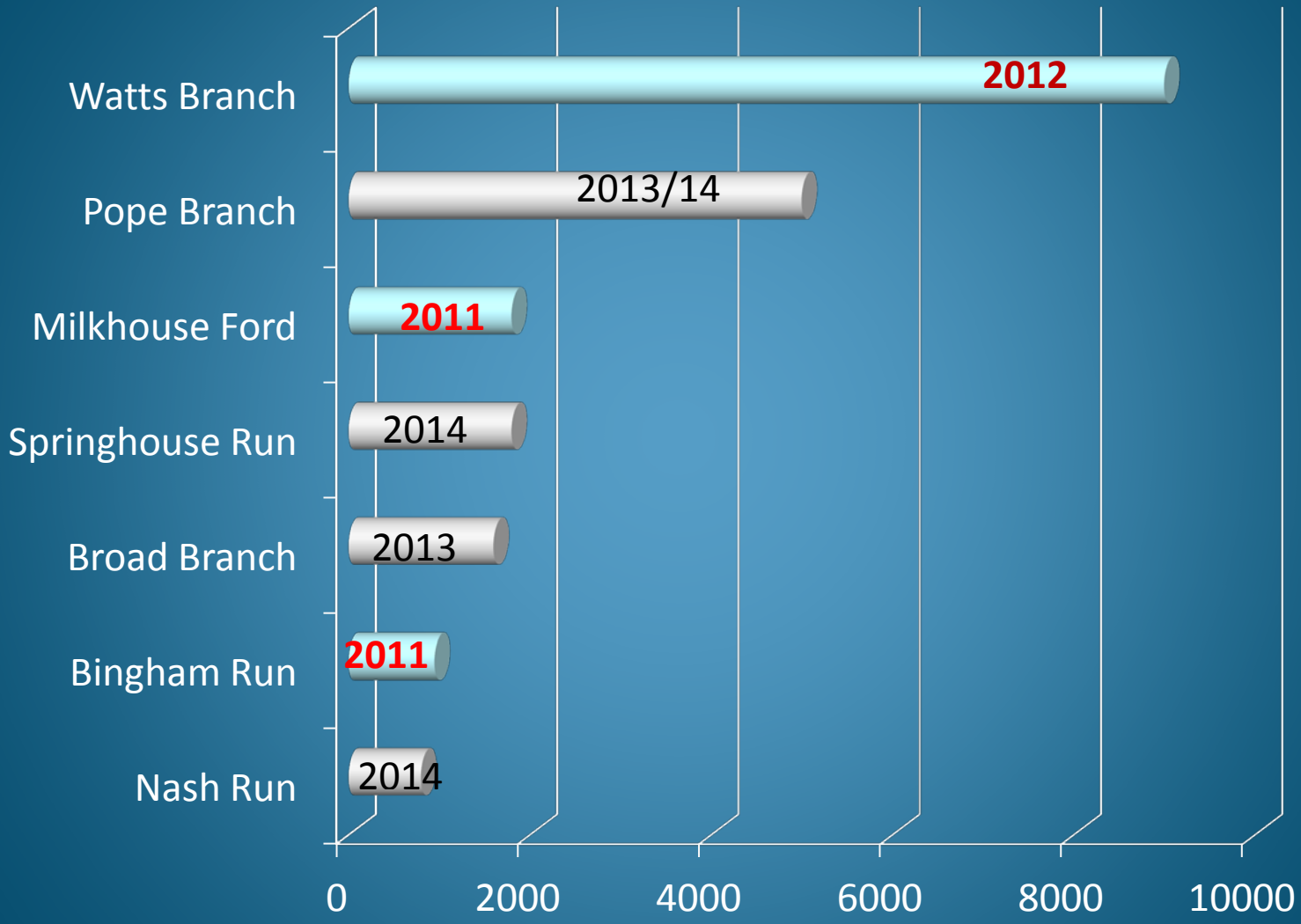
Watts Branch Stream Restoration

Broad Branch Stream Day Lighting Project & LID retro.

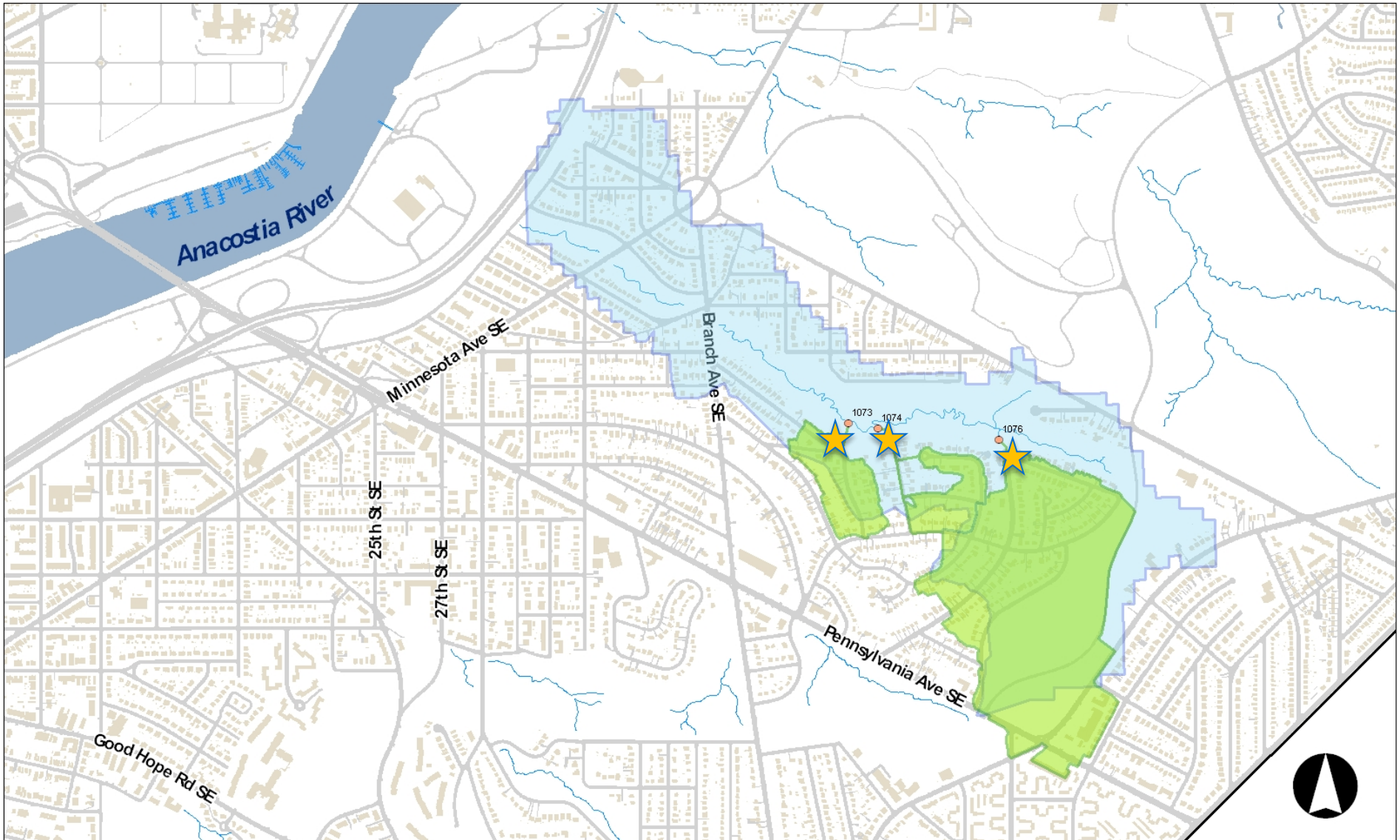
Pope Branch Stream Restoration & Regenerative Stormwater Conveyances



Streams & Total Length (ft.)

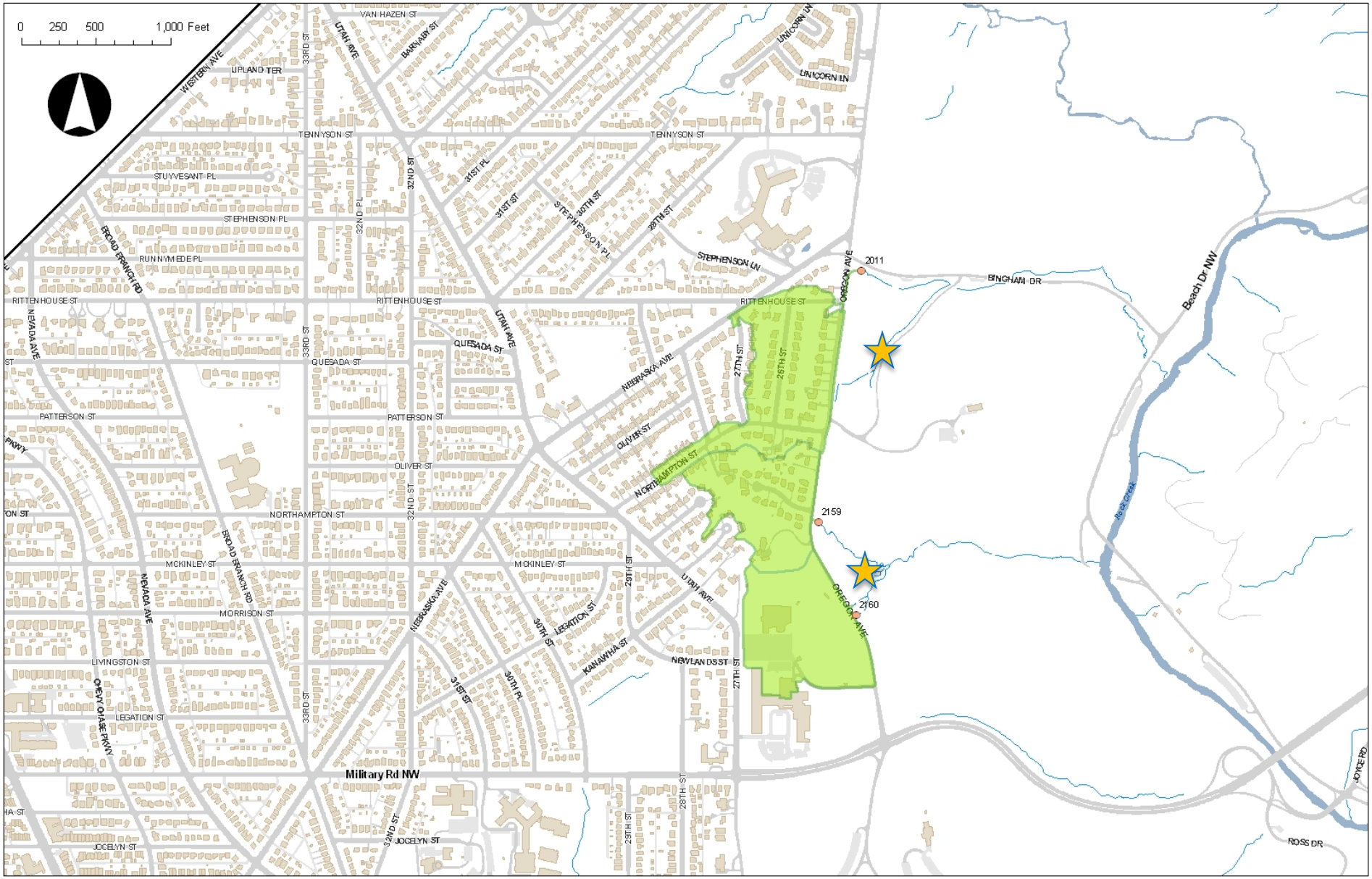


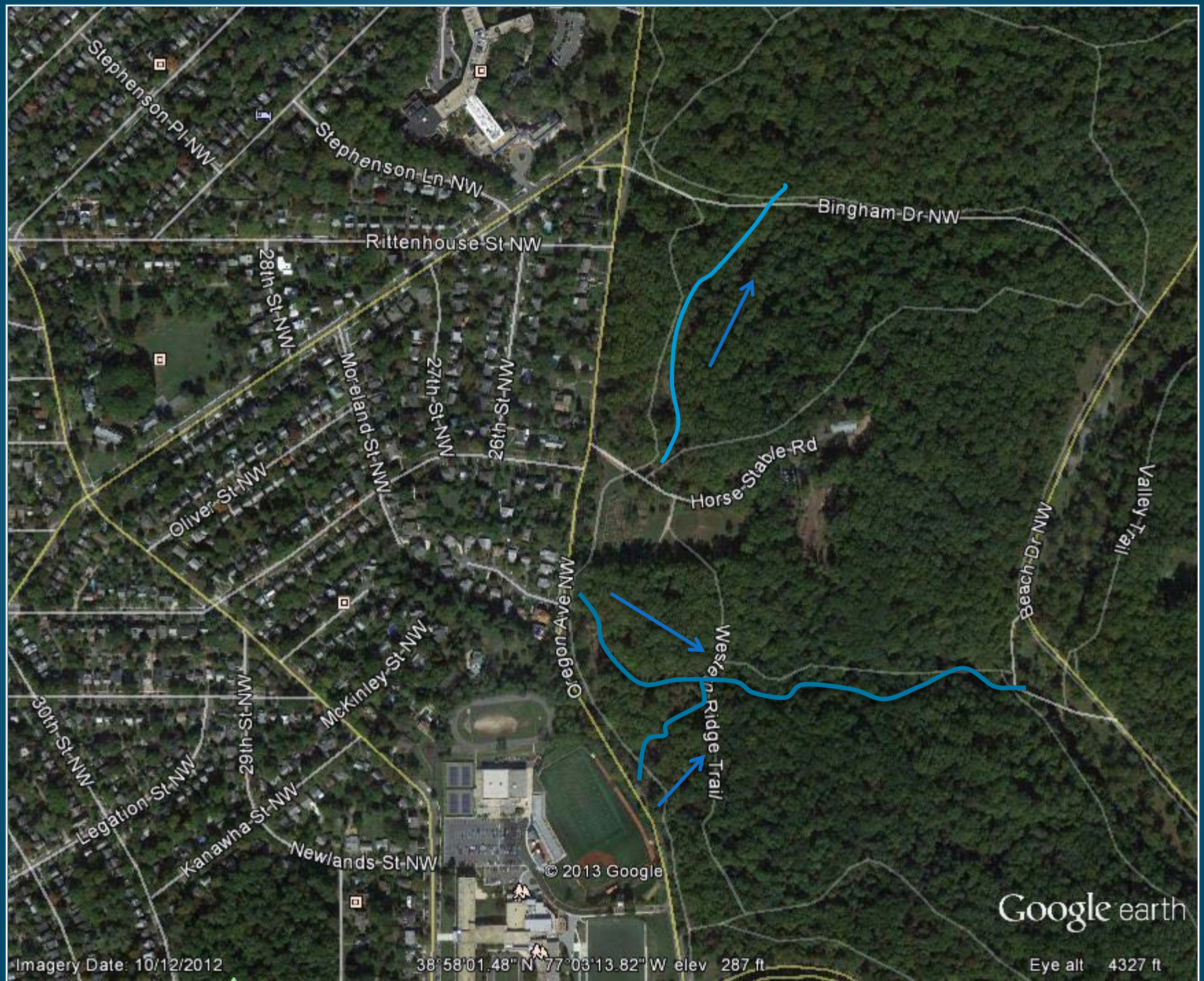
Zooming into greater focus: Pope Branch watershed



Before and after of 34th St. outfall

Zooming into greater focus: Rock Creek Park




Stephenson Pl NW
Stephenson Ln NW
Bingham Dr NW
Rittenhouse St NW
28th St NW
Moreland St NW
27th St NW
26th St NW
Oliver St NW
Horse Stable Rd
Valley Trail
Beach Dr NW
Oregon Ave NW
Western Ridge Trail
McKinley St NW
30th St NW
29th St NW
Legation St NW
Kanawha St NW
Newlands St NW
© 2013 Google
Google earth
Imagery Date: 10/12/2012
38°58'01.48" N 77°03'13.82" W elev 287 ft
Eye alt 4327 ft

Before and after of Milkhouse Run

Permitting challenges

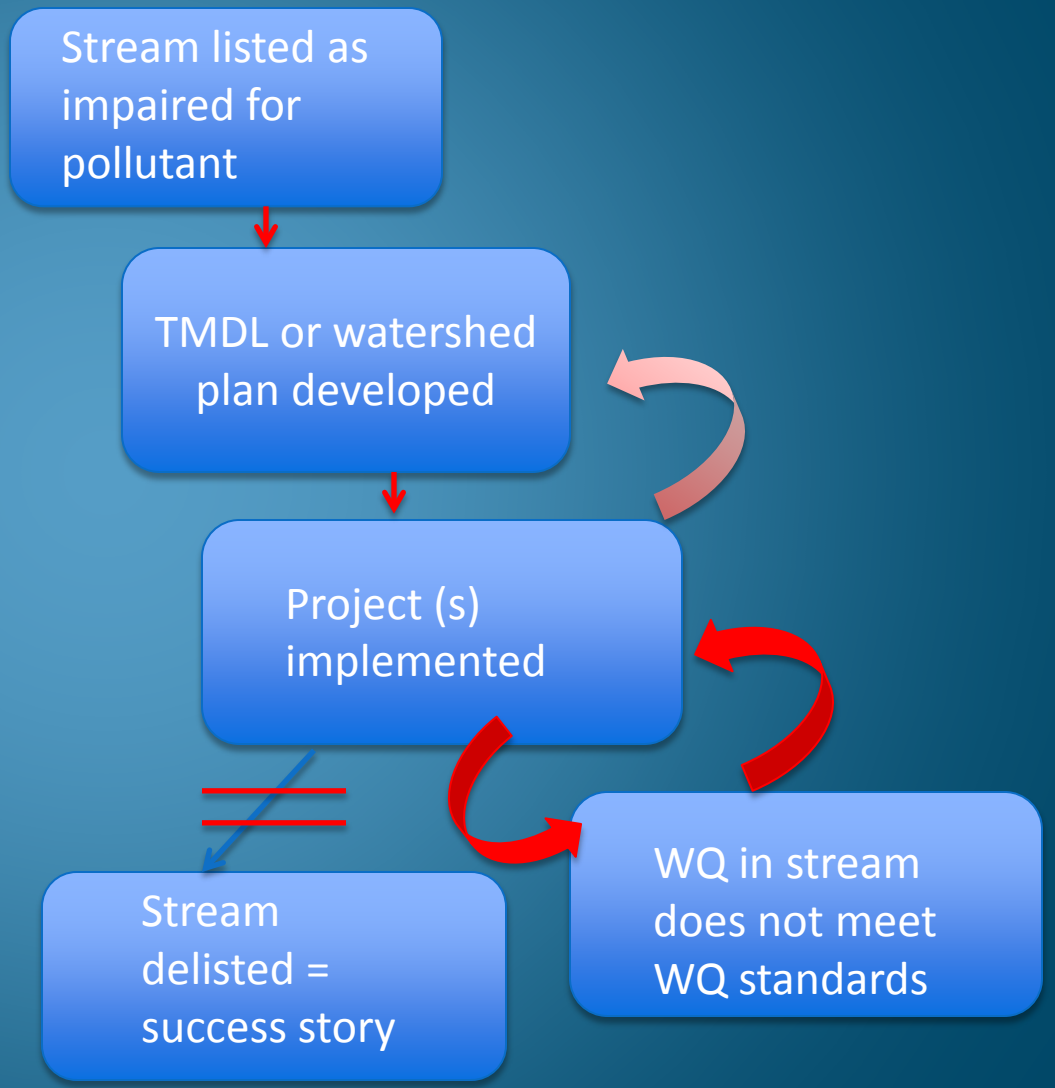
What is stream restoration?
What constitutes upland retrofits?
What is your reference condition – particularly if you've had major downcutting?
Is it okay to change the wetland type if you're improving watershed health?

?

How to evaluate results? SOP

Funding drives us to answer what were the changes in downstream water quality

- Partnership with UMD, Biohabitats, and DDOE will answer
  - Removal rates of all MS4 priority pollutants
  - Change in groundwater levels
  - Change in hydrograph from stream restoration project



The standard playbook for restoring our rivers

- What are our goals?
  - related to specific silo – ie. Water quality improvements – delisting, fish passage – ie. salmon
- What can be accomplished?
  - only modest improvements possible based upon strict criteria
- What is the timeframe – within 5 years or rosy future scenario?
  - need long-term implementation – no short term commitments! (5 yrs past retirement model)
- What are the costs?
  - always high – always need more money
- What are other benefits beside water quality?
  - nod to other benefits but never taken too seriously

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Expansion of playbook for our river restoration work

- What are our goals?
  - Water quality, habitat for multiple species, recreation, community cohesion, other environmentally beneficial behavior
- What can be accomplished?
  - For human actions: Hit 10% adoption and use social diffusion
  - For wildlife and water quality : year over year improvement in usage
- What is the timeframe – within 5 years or rosy future scenario?
  - Have annual or bi-annual targets and evaluate as you progress
- What are the costs?
  - Fit strategy to existing budget rather than always looking for more – look for freebies!
- What are other benefits beside water quality?
  - Look for all possible benefits and try to measure them in some way

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Watershed restoration initiative	2 year prior actions	1 year before actions	1 year after actions	2 years after actions	3 years after actions	4 years after actions
Water quality change in most relevant pollutant			+/- %	+/- %	+/- %	+/- %
spp. Richness of bird populations			+/-	+/-	+/-	+/-
% of macro-invertebrates that are pollution intollerant			+/- %	+/- %	+/- %	+/- %
# of homeowners participating in voluntary stormwater control			+/- %	+/- %	+/- %	+/- %
# of social behavior changing in positive env. direction			+/- %	+/- %	+/- %	+/- %
Trash found in stream			+/- %	+/- %	+/- %	+/- %
# of backyard habitat projects			+/- %	+/- %	+/- %	+/- %

(psst...we don't know...)

Survey: Behavior Change

- Have you completed additional stormwater management projects beyond RiverSmart Homes… **35%**
  - replaced turf with native plantings
  - removed impervious surface
  - planted additional trees
  - additional rain gardens
  - downspout disconnections

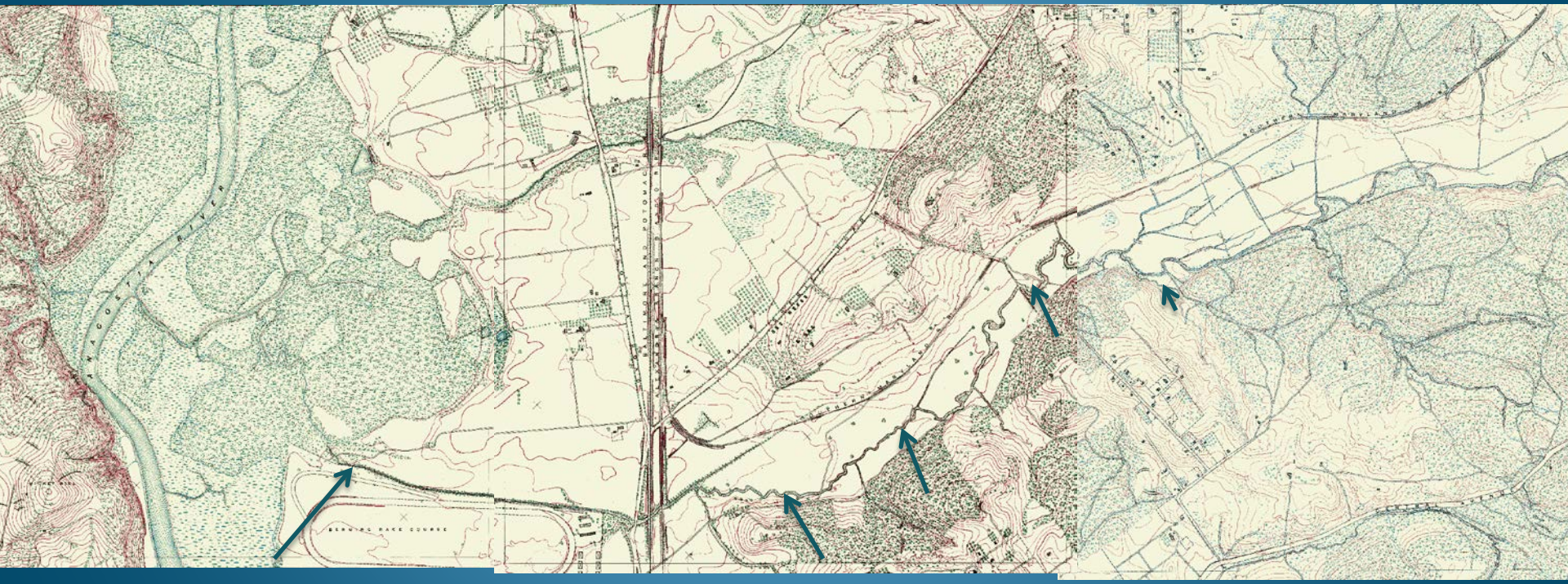
Build it and they will come….

Other benefits: Wildlife Habitat

52 species found in Rock Creek RSCs over 1 year

Mourning dove American robin Northern cardinal Pileated woodpecker Song sparrow Tufted titmouse Red-bellied woodpecker European starling White-breasted nuthatch American goldfinch Eastern phoebe Golden-crowned kinglet Downy woodpecker Barred owl Common grackle Carolina wren House sparrow Mallard Dark-eyed junco Northern flicker Blue-gray gnatcatcher Winter wren Cooper's hawk Blue jay Carolina chickadee Yellow-rumped warbler Wood duck Brown-headed cowbird Eastern towhee Louisiana waterthrush Ruby-crowned kinglet Wild turkey Common yellowthroat Northern mockingbird Broad-winged hawk Baltimore oriole Wood thrush American crow Gray catbird Ovenbird White-throated sparrow Red-tailed hawk American redstart Acadian flycatcher Red-eyed vireo Black-and-white warbler Black-throated blue warbler Veery Northern parula Eastern wood-pewee Scarlet tanager Blackpoll warbler Brown creeper Chestnut-sided warbler Common nighthawk Yellow-bellied flycatcher Tennessee warbler House wren Blackburnian warbler Warbling vireo Ruby-throated hummingbird Osprey Chimney swift Black-throated green warbler Magnolia warbler Canada warbler Great-crested flycatcher Yellow-billed cuckoo Hairy woodpecker Red-shouldered hawk

thanks to ***Dan Rausch*** – Wildlife biologist – DDOE, Fisheries and Wildlife Div.


ANACOSTIA RIVER

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