Making urban landscapes work for local waterbodies and wildlife

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

Stream listed as impaired for pollutant

TMDL or watershed plan developed

Project(s) implemented

Stream delisted = success story

Stream still does not meet WQ standards
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 \((\text{In most cases we are})\)

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-Champaign
Nearby Neighbors

Local Sense of Comm.

Socializing at Taylor

General Social Ties

p < .001

n.s.

p < .0001

p < .001

p < .0001
Goals of RiverSmart Homes:

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

Images:
- BayScaping
- Rain Barrels
- Permeable Pavement
- Shade Trees
- Rain Gardens
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
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
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
Zooming into greater focus: Pope Branch watershed

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

• What will it cost? (limited resources)

• What were the results from similar efforts?

• What were the benefits to the local waterbodies/wildlife
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

Legend
- Pervious Pavement
- Rain Garden
- Bay Scaping
- Shade Trees
- Rain Barrel
- Sites
- Sewershed 1074
- Parcels
- MS4 Outfalls
- Sewer Catch Basin
- Storm Gravity Main
- Buildings
- Sidewalks
- Roads
- Stream
- Water
- Parks
## Passive vs. targeted approach

<table>
<thead>
<tr>
<th>Sewershed</th>
<th>Watershed</th>
<th>Participation (# of house participating /total houses)</th>
<th>Partic. Percent</th>
<th># practices</th>
<th>Practices/home</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Milkhouse/ Bingham</td>
<td>5/73</td>
<td>7%</td>
<td>23</td>
<td>.31/home</td>
</tr>
<tr>
<td>2159</td>
<td>Milkhouse/ Bingham</td>
<td>2/44</td>
<td>4.5%</td>
<td>4</td>
<td>.09/home</td>
</tr>
<tr>
<td>1073</td>
<td>Pope</td>
<td>8/67</td>
<td>12%</td>
<td>35</td>
<td>.52/home</td>
</tr>
<tr>
<td>1074</td>
<td>Pope</td>
<td>4/28</td>
<td>14%</td>
<td>13</td>
<td>.46/home</td>
</tr>
<tr>
<td>1076</td>
<td>Pope</td>
<td>22/88</td>
<td>25%</td>
<td>67</td>
<td>.76/home</td>
</tr>
</tbody>
</table>
Stormwater Retrofits: How to evaluate choices?

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

• What should it cost? (limited resources)

• What were the results from similar efforts?

• What were the benefits to the local waterbodies/wildlife

• Some examples but not fully known – saturation rate TBD

• Some examples but field is evolving...costs in urban areas can vary greatly

• some related efforts but frequently each project is unique
• Generally not enough time/$ to understand this
Bingham Ford & Milkhouse Run Regenerative Stormwater Conveyances

Springhouse Run Rest. & BMP installation

Nash Run BMP & Stream Restoration

Watts Branch Stream Restoration

Broad Branch Stream Day Lighting Project & LID retro.

Pope Branch Stream Restoration & Regenerative Stormwater Conveyances
Zooming into greater focus: Pope Branch watershed

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

- What will it cost? (limited resources)

- What were the results from similar efforts?

- What were the benefits to the local waterbodies/wildlife
Before and after of 34th St. outfall
Zooming into greater focus: Rock Creek Park
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

Stream listed as impaired for pollutant

TMDL or watershed plan developed

Project (s) implemented

Stream delisted = success story

WQ in stream does not meet WQ standards
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
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
<table>
<thead>
<tr>
<th>Watershed restoration initiative</th>
<th>2 year prior actions</th>
<th>1 year before actions</th>
<th>1 year after actions</th>
<th>2 years after actions</th>
<th>3 years after actions</th>
<th>4 years after actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality change in most relevant pollutant</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
<tr>
<td>spp. Richness of bird populations</td>
<td>+/-</td>
<td>+/-</td>
<td>+/-</td>
<td>+/-</td>
<td>+/-</td>
<td>+/-</td>
</tr>
<tr>
<td>% of macro-invertebrates that are pollution intollerant</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
<tr>
<td># of homeowners participating in voluntary stormwater control</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
<tr>
<td># of social behavior changing in positive env. direction</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
<tr>
<td>Trash found in stream</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
<tr>
<td># of backyard habitat projects</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
<td>+/- %</td>
</tr>
</tbody>
</table>
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


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