Green Infrastructure as a Climate Adaptation Measure

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Newmarket, NH April 2007
The New Orleans Hurricane Protection System: What Went Wrong and Why—10 Lessons Learned from Katrina by the ASCE Hurricane Katrina External Review Panel and the USACE Interagency Performance Evaluation Task Force

1. Failure to think globally and act locally—We must account for climate change
2. Failure to absorb new knowledge
3. Failure to understand, manage, and communicate risk—Need to take rigorous risk-based approach,
4. Failure to build quality in
5. Failure to build in resilience
6. Failure to provide redundancy
7. Failure to see that the sum of many parts does not equal a system
8. The buck couldn’t find a place to stop—Poor organization, lack of accountability
9. Beware of interfaces: materials and jurisdiction
10. Follow the money—People responsible for design and construction had no control of the monies.
<table>
<thead>
<tr>
<th>County</th>
<th>Historic 100-Yr</th>
<th>NRCC 100-Yr</th>
<th>% Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockingham</td>
<td>6.4</td>
<td>8.8</td>
<td>27%</td>
</tr>
<tr>
<td>Strafford</td>
<td>6.3</td>
<td>8.2</td>
<td>23%</td>
</tr>
</tbody>
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http://precip.eas.cornell.edu/
Changing Trends

Increasing Impervious Surfaces


- Population: 8.2%
- Land Conversion: 25%
- Impervious Surfaces: 41%

(Source, USGS, Reston, VA, 2007)
Hydrology Overview

- Conventional
- Low Impact Development
- Manufactured Treatment Devices
Low Impact Development
Low Impact Development as a Climate Adaptation Tool and Community Resiliency

Mill Pond Rd after dam failure at Nottingham Lake, 4/18/2007
Boulder Hills, Pelham, NH

LID Design

Conventional Site Design
Comparison of Runoff and Recharge Depths for Pre-Development, Post-Development, and LID Conditions

Runoff and Recharge Depth (Inches)

- Pre-Development
- Conventional
- LID

Design Storm Scenarios:
- Water Quality Event
- 2-YR
- 25-YR
- 100-YR

Recharge depth
Runoff depth
Infiltration
Runoff

Boulder Hills, Pelham, NH
Newmarket, NH Moonlight Brook

LID zoning achieved a 53% reduction of build-out impacts from current zoning.
Does Impervious Cover Reduction Really Work?

Urban Watershed Renewal in Berry Brook

Robert Roseen, Viktor Hlas, Tom Schueler, Tom Ballestero, Mark Voorhees, Melinda Bubier, Joel Ballestero, James Houle, Dean Peschel, Bill Boulanger, David Burdick, Lorie Chase, Ann Scholz, Sally Soule, John Magee, Ben Nugent, Matt Carpenter, University of New Hampshire Stormwater Center, City of Dover, University of New Hampshire, Cocheco River Watershed Coalition, New Hampshire Fish and Game, New Hampshire Department of Environmental Services

Funding Sources: NHDES 319 Watershed Assistance
NHDES Aquatic Resource Mitigation Funds
Stream Restoration Objective
Recreate a stream last seen in the 1800’s

LID Retrofit Objective
Recreate predevelopment hydrology and restore biological integrity
Watershed Urbanization and IC

Source: Impacts of Impervious cover on Aquatic Systems, CWP March 2010.

Source: Effects of Urbanization on Stream Quality at Selected Sites in the Seacoast Region in New Hampshire, 2001-03, USGS 2005
Gravel Wetland
DA = 11.0 ac, Treated IC = 9.55 ac (86.8%)

Stream Restoration
~800 ft, including C, A and Aa - channel

Page Ave
DA = 5.23 ac,
Treated IC = 1.88 ac (36.0%)

Crescent Ave
DA = 2.97 ac
Treated IC = 1.5 ac (28.5%)

Wetland Expansion
~0.6 acres

Glencrest Ave
DA = 6.8ac
Treated IC = 2.3 ac (33%)

Lowell Ave
DA = 2.6 ac
Treated IC =  ac (43%)

Upper Horne Street
DA = 12.2 ac
Treated IC = 3.7 ac (31%)

Roosevelt Ave
Hydrology---Benefits of LID Retrofits

Average Daily Flow per Watershed Area

- Separation of hydrographs for developed and undeveloped watersheds pre-constructions
- Similarity of hydrographs for developed and undeveloped watersheds post-LID installs

Shift towards pre-development hydrology

POST-CONSTRUCTION

LID

CONSTRUCTION

PRE-CONSTRUCTION

Date

Discharge/Area (cfs/ac)

Precip (in)
Average daily area weighted flow duration curves for Berry Brook-Lower Watershed (Station, DA = 184.8 acres) and Isinglass River (DA = 73.6 sq.miles)
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Questions?

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