The Jordan Cove LID Subdivision

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CT Nonpoint Education for Municipal Officials (NEMO)

Making an Impact with Low Impact Development:
Helping Rhode Island communities use the lessons learned from existing projects
Narragansett, RI
April 24, 2007
Jordan Cove Urban Watershed Project

10-year project to investigate:
- Impacts of Residential Construction
- Efficiency of a Group of Selected BMPs
- Effectiveness of a Management Program on a Community Basis
Cooperators

- UConn Depts of Natural Resources Management and Engineering (Jack Clausen), and Plant Science (John Alexopoulos, Karl Guillard)
- NEMO - Chet Arnold
- U. S. E P A - Mel Cote
- Connecticut Department of Environmental Protection - Stan Zaremba, Paul Stacey, Eric Thomas
- Town of Waterford, CT - Tom Wagner, Maureen Fitzgerald
- AQUA Solutions - Bruce Morton
- John Lombardi
Project Goals:

- Flow – peak & volume = pre-development
- Sediment – TSS loading = pre-development
- Nutrients – reduce N export by 65%
  - reduce P export by 85%
- Implement BMPs on 100% of lots
- Bacteria – reduce export by 85%
Study Design

Paired Watershed

Control  Treatment  Control  Treatment

Calibration Period  Treatment Period
Phases

- I. Calibration
- II. Construction
- III. Post-construction
Education Program

- Soil tests
- Property owners association
- 1 on 1 discussions
- Demonstrations - fertilizer application
Control Watershed

Outlet
Treatment Watersheds
### Characteristics of study watersheds

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>LID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed area (ha)</td>
<td>2.0</td>
<td>1.7</td>
</tr>
<tr>
<td>No. of lots</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Average lot size (ha)</td>
<td>0.15</td>
<td>0.10</td>
</tr>
<tr>
<td>% Total Impervious</td>
<td>32</td>
<td>22</td>
</tr>
</tbody>
</table>
Traditional Watershed Construction Period

Removal of Vegetation

Grading
Traditional Watershed Construction Activities

Impervious surface
Stormwater system
Compaction

Stockpiles
Traditional subdivision
LID Watershed
Construction Period

No phased grading
BMP Watershed Construction Period

Basement Excavations & Earthen Berm
LID Subdivision

- Bioretention cul-de-sac
- Grassed swales
- Open space and low-mow area
- Rain gardens
- Cluster layout with shared driveways
- Pervious roadway
Bioretention cul-de-sac
Pervious road and grassed swales
Rain gardens
Driveways
RESULTS
Construction - concentrations

- TSS: 1575
- NO3-N: 150
- NH3-N: 414
- TKN: 256
- TP: 3870
- Cu: 188
- Pb: 267
- Zn
- BOD
September 2, 2003 - \( P = 12.7 \text{ mm} \)

- **Discharge (m\(^3\)/s/ha)**
  - Control
  - Traditional
  - BMP

- **Precipitation (mm)**
  - BMP Q(m\(^3\)/s/ha)
  - TRAD Q(m\(^3\)/s/ha)
  - CONT Q(m\(^3\)/s/ha)

- **Lag time (min)**
  - Control
  - Traditional
  - BMP

- **Time**
  - 8:00 to 10:00
Lag Times

- Centroid lag-to-peak
- Centroid lag
- Lag-to-peak
- Peak lag-to-peak

Time (min)

- BMP
- Traditional
- Control
Runoff depth

Yearly runoff depth (cm) vs. Total impervious area (%)

- Traditional
- LID

R² = 0.02
R² = 0.96

Legend:
- ▲ Traditional
- • LID
- — LID
- - Traditional
Traditional Watershed (construction)

Road & topography increased Q

Erosion controls worked
Traditional Watershed (post-construction)

Flow & export remain high
LID watershed: (construction)

Harder to control
Sediment

Lower flow
Compaction
LID Watershed (post-construction)

Q not different from pre-development

TP export higher, but still much less than traditional
As impervious area increased,
  - The traditional subdivision showed logarithmic increases in runoff and pollutant export
  - The LID subdivision showed no change in runoff volume or pollutant export
Take home message:

☐ LID works!
Recommendations

- **Planning**
  - Cluster design
  - LID model ordinance
  - Disconnect stormwater

- **Construction**
  - Avoid compaction
  - Undisturbed soils
  - On-site supervision
  - Earthen berm
  - Grassed swales
  - Soil testing
Recommendations

- **Post-Construction**
  - Education methods
  - Bioretention maintenance
  - Paver maintenance
  - Turf dam
  - Fire hydrant
  - Seed mix

- **Monitoring**
  - Control
  - Forested control
  - Sampling methods
  - Electric power
Winter performance...
Jen Gilbert
Mike Dietz
Erik Bedan
Rob Phillips
John Engdahl
Mark Hood
Mary Hull
Funded in part by the CT DEP through a US EPA nonpoint source grant under § 319 Clean Water Act
QUESTIONS??
But isn’t it expensive?

- When used throughout a subdivision, LID techniques can actually save developers money!

- A recent study in RI found:
  - Higher property values for conservation design
  - Subdivisions with conservation design are cheaper to build per lot
  - Homes in conservation subdivisions sell more quickly

## A Comparison of Two Different Land Plans for Gap Creek Community, Sherwood, Arkansas

<table>
<thead>
<tr>
<th></th>
<th>Conventional Plan</th>
<th>Revised Green Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lot Yield</strong></td>
<td>358</td>
<td>375</td>
</tr>
<tr>
<td><strong>Linear Feet - Street</strong></td>
<td>21,770</td>
<td>21,125</td>
</tr>
<tr>
<td><strong>Linear Feet - Collector Street</strong></td>
<td>7,360</td>
<td>0</td>
</tr>
<tr>
<td><strong>Linear Feet - Drainage Pipe</strong></td>
<td>10,098</td>
<td>6,733</td>
</tr>
<tr>
<td><strong>Drainage Sections (Inlets, Boxes, Headwalls)</strong></td>
<td>103</td>
<td>79</td>
</tr>
<tr>
<td><strong>Estimated Total Cost</strong></td>
<td>$4.6 million</td>
<td>$3.9 million</td>
</tr>
</tbody>
</table>

NAHB Research Center website, accessed 2006
### ACTUAL RESULTS FROM PHASE ONE

<table>
<thead>
<tr>
<th>Total Site (engineer’s estimate)</th>
<th>Conventional Plan</th>
<th>Revised Green Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot Yield</td>
<td>63</td>
<td>72</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1,028,544</td>
<td>828,523</td>
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<tr>
<td>Cost Per Lot</td>
<td>$16,326</td>
<td>$11,507</td>
</tr>
</tbody>
</table>

### BENEFITS FROM LOW-IMPACT DEVELOPMENT

<table>
<thead>
<tr>
<th>General Benefit</th>
<th>Specific Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Lot Yield</td>
<td>17 additional lots</td>
</tr>
<tr>
<td>Higher Lot Value</td>
<td>$3,000 more per lot than competition</td>
</tr>
<tr>
<td>Lower Cost per Lot</td>
<td>$4,800 less per lot</td>
</tr>
<tr>
<td>Enhanced Marketability</td>
<td>80% of lots sold in the first year</td>
</tr>
<tr>
<td>Added Amenities</td>
<td>23.5 acres of green space/parks</td>
</tr>
<tr>
<td>Recognition</td>
<td>National, state, and professional group recognition</td>
</tr>
<tr>
<td>TOTAL ECONOMIC BENEFIT</td>
<td>More than $2.2 million in savings</td>
</tr>
</tbody>
</table>