Addressing an Impervious Cover TMDL Through the Use of LID

Lori Lilly
Center for Watershed Protection
StormCon
August 4, 2010
Project Partners

- UConn CLEAR/NEMO
- Center for Watershed Protection
- Horsley & Witten Group
- UConn Architectural & Engineering Services
- UConn Office of Environmental Policy
- Town of Mansfield
- CTDEP
- EPA CWA Section 319 Nonpoint Source Program
• The maximum amount of a pollutant a waterbody can receive without adverse impact to designated uses

• Under section 303(d) of the Federal Clean Water Act (CWA), states are required to develop TMDLs for impaired waters

• The end result is a Water Quality Management Plan with quantitative pollutant load reduction targets

• Generally expressed as pollutant concentration targets, % reductions in pollutant levels, or mass load reductions
CTDEP developed a method to address impairments caused by storm water runoff using impervious cover.

Eagleville Brook was the first location to get an impervious cover TMDL.
Impervious Cover

< 5%

8-10%

~20%

> 65%

30%
Streams with <50 sq miles drainage upstream

% of Reference Community compares 7 metrics- Taxa Richness, Modified HBI, Scraper/Filterer, EPT/Chironomidae, % Dominant Taxa, EPT Index, Community Loss

(Bellucci, CTDEP)
Why Impervious Cover?

DEP Stressor ID Study identified a complex array of pollutants generated from storm water runoff as most probable cause of impairment.

- Simplifies complex impacts but based on good science
- Good correlation between IC and stream health
- IC data available statewide
- Measurable and generated by local land use
- We can do something about better land use decisions and stormwater

February, 2007
The IC-TMDL Location

- Eagleville Brook
- 2.4 sq miles
- 18% watershed IC
- UConn and Town of Mansfield
- No MS4s
Goal *Is Not* to reduce the % IC in the watershed per se, but to reduce the *impact* of IC through *stormwater management* to levels equivalent to < 11% IC.
Project Goals

1. Reduce IC where practical (i.e., remove or replace with pervious surfaces)
2. Disconnect IC from surface waterbody (e.g., disconnect roofs)
3. Minimize additional disturbance to natural areas
4. Retrofit with distributed BMPs to reduce runoff volumes & improve water quality
5. Increase tree canopy cover and restore permeability of open areas
Project Approach

1. Mapping Analysis
   - Actual IC acres vs TMDL estimates

2. On-the-Ground Reality Check
   - Revised drainage boundaries
   - Connected vs disconnected IC
   - Retrofit potential

3. Bean Counting
   - Do IC reductions = improved biota?
   - Ultimately, success will be measured by assessing aquatic life directly - Interim measurements – IC reduction, flow
Mapping Analysis

- Original IC estimates based on 2002 state data and land use coefficients
- Revised IC based on GIS measurements 2008 aerials

<table>
<thead>
<tr>
<th>BASIN NUMBER</th>
<th>IC Acres</th>
<th>TMDL</th>
<th>Direct measure GIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3100-19-1 (Upper)</td>
<td>126</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td>3100-19-1-L1 (Swan Lake)</td>
<td>3.6</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>3100-19-2-R1 (Lower)</td>
<td>15.6</td>
<td>14.9</td>
<td></td>
</tr>
</tbody>
</table>
On-the-Ground Reality Check

- Revisions to drainage boundaries changes TMDL DA and IC assumptions
- Swan Lake may not be in watershed

<table>
<thead>
<tr>
<th>BASIN NUMBER</th>
<th>DA Acres</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>TMDL</td>
</tr>
<tr>
<td>3100-19-1 (Upper)</td>
<td>900</td>
</tr>
<tr>
<td>3100-19-1-L1 (Swan Lake)</td>
<td>13</td>
</tr>
<tr>
<td>3100-19-2-R1 (Lower)</td>
<td>312</td>
</tr>
</tbody>
</table>
On-the-Ground Reality Check

- What counts as “disconnected” IC?
  - Drains to pervious area
  - Managed by existing BMP
- **51 IC acres** already disconnected in “upper” subbasin
What is “effective” pervious cover?

Existing stormwater wetland draining Hilltop residential complex
### Existing Conditions

<table>
<thead>
<tr>
<th></th>
<th>TMDL Estimated</th>
<th>GIS Measured</th>
<th>Field Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed DA (acres)</td>
<td>1225</td>
<td>1225</td>
<td>1199&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Watershed IC (acres)</td>
<td>145&lt;sup&gt;a&lt;/sup&gt;</td>
<td>216&lt;sup&gt;b&lt;/sup&gt;</td>
<td>165&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>% Watershed IC</td>
<td>12%</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>11% IC TMDL target (acres)</td>
<td>135</td>
<td>135</td>
<td>132</td>
</tr>
<tr>
<td>Remaining IC to manage (acres)</td>
<td>10</td>
<td>81</td>
<td>33</td>
</tr>
</tbody>
</table>

### Immediate Catchment of 3100-19-1

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</tr>
</thead>
<tbody>
<tr>
<td>3100-19-1 DA (acres)</td>
<td>900</td>
<td>900</td>
<td>876&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>3100-19-1 IC (acres)</td>
<td>126&lt;sup&gt;a&lt;/sup&gt;</td>
<td>194&lt;sup&gt;b&lt;/sup&gt;</td>
<td>143&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>% IC</td>
<td>14%</td>
<td>22%</td>
<td>16%</td>
</tr>
<tr>
<td>11% IC TMDL target (acres)</td>
<td>99</td>
<td>99</td>
<td>96</td>
</tr>
<tr>
<td>Remaining IC to manage (acres)</td>
<td>27</td>
<td>95</td>
<td>47</td>
</tr>
</tbody>
</table>

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<sup>a</sup> IC estimated using land use coefficients and 2002 ISAT data

<sup>b</sup> IC measured from GIS mapping of 2008 high resolution imagery

<sup>c</sup> Field assessment revealed areas that did not drain to Eagleville Brook

<sup>d</sup> Field assessment identified 51 acres of watershed IC was already disconnected and should not be considered “effective.”
On-the-Ground Reality Check

- **50** sites visited
- **110** individual retrofits identified
- **127 IC acres** potentially managed
- Met with UConn planners, researchers, facility managers
- Link with Master Plans and Landscaping
- Rank “top 10” projects
- 25% design concepts to manage **32 IC acres**
Retrofits Types

- Bioretention
- Swales
- Tree planters/filters
- Gravel-based wetland
- Sand filter
- Green roofs
- Cisterns
- Pervious pavement
- Soil Amendments
IC-TMDL Strategies

Large surface parking lots

Redesign large surface parking lots to make use of bioretention
IC-TMDL Strategies

*Large surface parking lots*
Reduce impervious cover when repaving large surface parking lots.
IC-TMDL Strategies

Center campus / academic core

Concentrate on roof runoff using green roofs, cisterns, and rooftop leader disconnects to rain gardens.
IC-TMDL Strategies

*Center campus / academic core*

Increase tree cover in collaboration with UConn Master Landscape Plan

Trees can be major stormwater control devices!

From draft Landscape Master Plan
IC-TMDL Strategies

*Roads*

Combine aesthetics, stormwater management & safety with traffic calming & vegetated strips

[Diagram of roads with various elements labeled]
Ranking Factors: TOP 10

- Amount of IC removed/disconnected
- Integration with other campus planning/improvements
- Use of different LID practices
- Distribution across campus (location and use, e.g., academic buildings, dorms, parking lots)
- Feasibility (timeline & cost)
- WQ benefits beyond just reduction of volume
Bean Counting

1. Volume Reduction
   - Stream volume monitoring at downstream weir
   - Runoff reduction estimates as retrofits occur
   - Possible runoff red. modeling by UConn Engineering Dept.

2. Impervious Cover Mitigation
   - IC removed (pervious lots)
   - IC disconnected (bioretention)
   - % credits depending on practice?

3. Beyond Volume & Cover
   - Water quality projects (gravel wetland, pollution prevention)
   - Rehabilitate & plant trees
   - Rehabilitate soils
   - Restore stream buffers

4. Back to the Bottom-Line Bugs
Table 2. Project Benefits Summary

<table>
<thead>
<tr>
<th></th>
<th>Impervious Cover Drainage Area Treated (acres)</th>
<th>Watershed Treated (%)</th>
<th>TP Removed (lb/yr)</th>
<th>TN Removed (lb/yr)</th>
<th>TSS Removed (lb/yr)</th>
<th>Runoff Reduction (cf)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Priority Projects</td>
<td>31.88</td>
<td>2.6</td>
<td>33</td>
<td>207</td>
<td>6,433</td>
<td>18,881</td>
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<tr>
<td>All Projects</td>
<td>127.19</td>
<td>22</td>
<td>72</td>
<td>517</td>
<td>14890</td>
<td>55,167</td>
</tr>
</tbody>
</table>

*The runoff reduction represents the reduction in runoff for a 1” storm event

Does not yet account for all projects in action
<table>
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<tr>
<th>Eagleville Brook Watershed</th>
<th>Existing Conditions*</th>
<th>Future IC with Retrofit Implementation</th>
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<th>Eagleville Brook Watershed Upper “Basin” 3100-19-1</th>
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* Using field adjusted watershed DA and IC values
** Projects manage a total of 32 acres IC (subtract from 143 acres)
*** Projects manage a total of 127 acres IC (subtract from 143 acres).
Assumes B7g option 1; Discounts C15 (already completed) and double treatment by A2.
Implications for Others?

- Setting IC targets
  - Others in Region 1 (ME, CT…)
  - Swift Creek, NC has a 9% IC Target
  - What are protocols for establishing existing and “effective” IC?
- What if not enough on-the-ground opportunities?
  - Lack of publicly-owned properties
  - No single large land owner like UConn
- Elevates LID as a preferred approach to stormwater management in impaired (and non-impaired) waters
Questions ???

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http://clear.uconn.edu/eagleville/Eagleville_TMDL