Addressing an Impervious Cover TMDL Through the Use of LID



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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

Total

Maximum

Daily

Load

- 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

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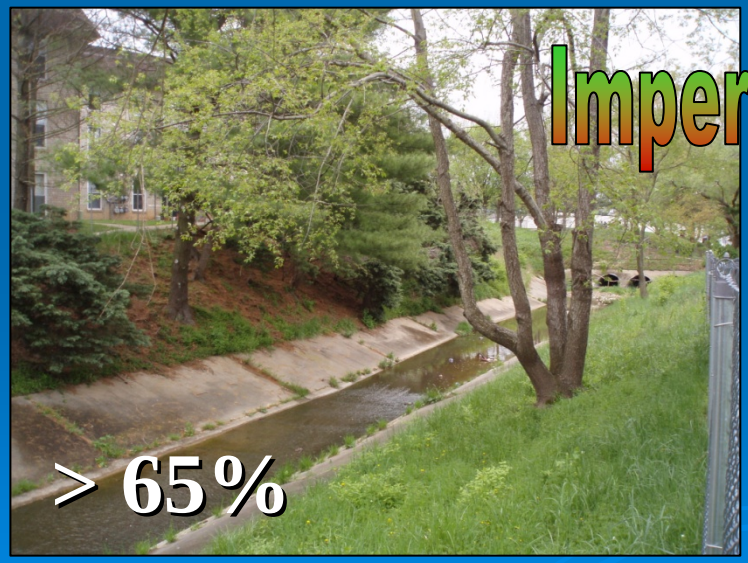
Connecticut Probable Sources of Impairments for Threatened and Impaired Rivers and Streams Reporting Year 2008

Description of this table

Probable Source	Probable Source Group	Miles Threatened or Impaired
Source Unknown	Unknown	766.0
Unspecified Urban Stormwater	Urban-Related Runoff/Stormwater	222.2
Municipal Point Source Discharges	Municipal Dishcarges/Sewage	130.5
Sources Outside State Jurisdiction Or Borders	Other	106.6
Industrial Point Source Discharge	Industrial	105.3
Combined Sewer Overflows	Municipal Dishcarges/Sewage	78.6
Illicit Connections/Hook-Ups To Storm Sewers	Municipal Dishcarges/Sewage	52.0
Landfills	Land Application/Waste Sites/Tanks	49.5
Contaminated Sediments	Legacy/Historical Pollutants	48.8
Sanitary Sewer Overflows (Collection System Failures)	Municipal Dishcarges/Sewage	46.5
Agriculture	Agriculture	43.1
Impacts From Hydrostructure Flow Regulation/Modification	Hydromodification	42.4
Upstream Impoundments (E.G., Pl-566 Nrcs Structures)	Hydromodification	41.1
Channelization	Hydromodification	39.4
Site Clearance (Land Development Or Redevelopment)	Construction	37.9
Baseflow Depletion From Groundwater Withdrawals	Hydromodification	32.3
Above Ground Storage Tank Leaks (Tank Farms)	Spills/Dumping	25.5
Flow Alterations From Water Diversions	Hydromodification	23.7
Golf Courses	Recreation And Tourism (Non-Boating)	22.2
Dredge Mining	Resource Extraction	15.7
Loss Of Riparian Habitat	Habitat Alterations (Not Directly Related To Hydromodification)	15.2
Animal Feeding Operations (Nps)	Agriculture	11.9

- 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



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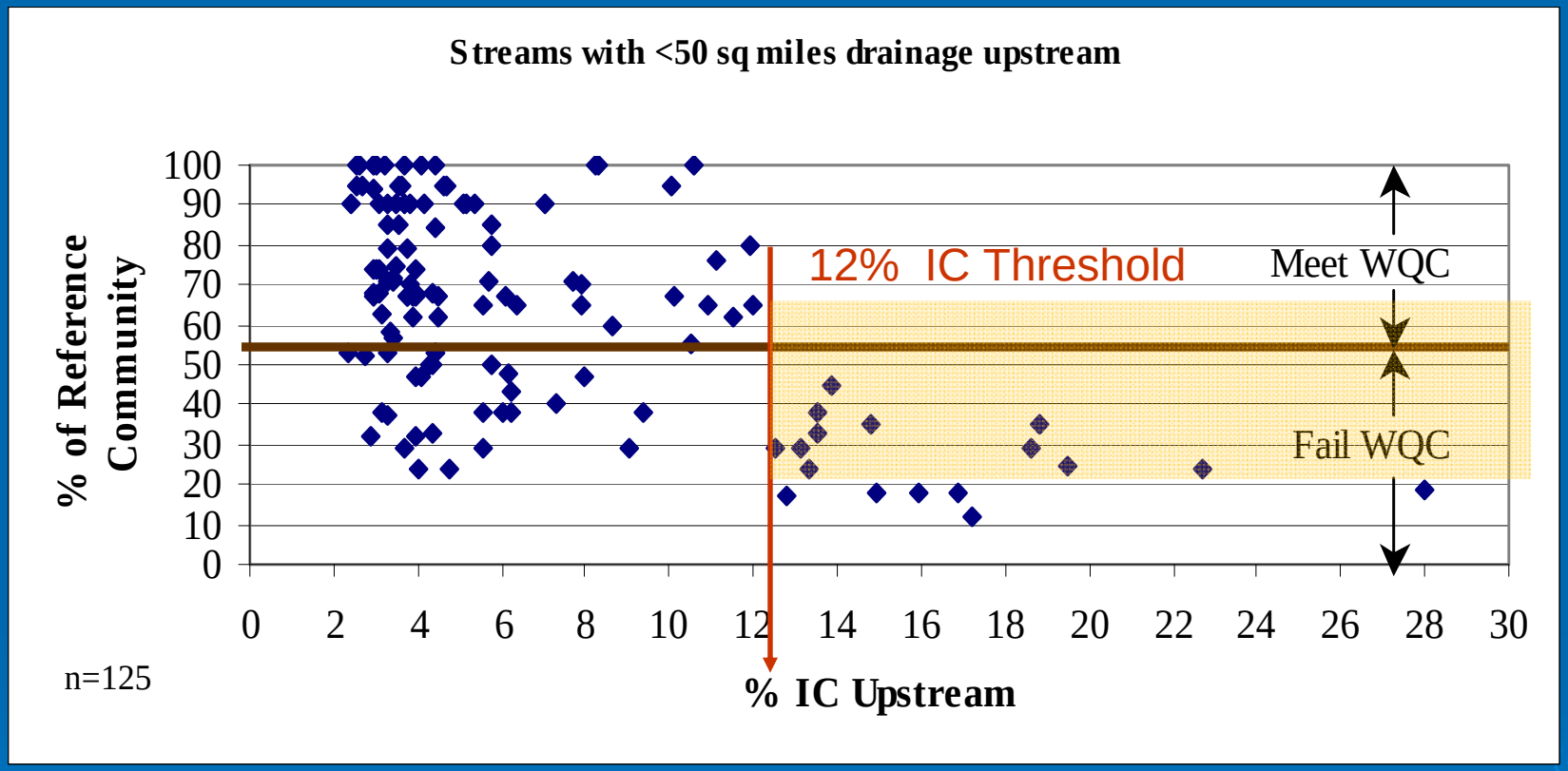
Linking the Bugs to IC…



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

(Bellucci, CTDEP)

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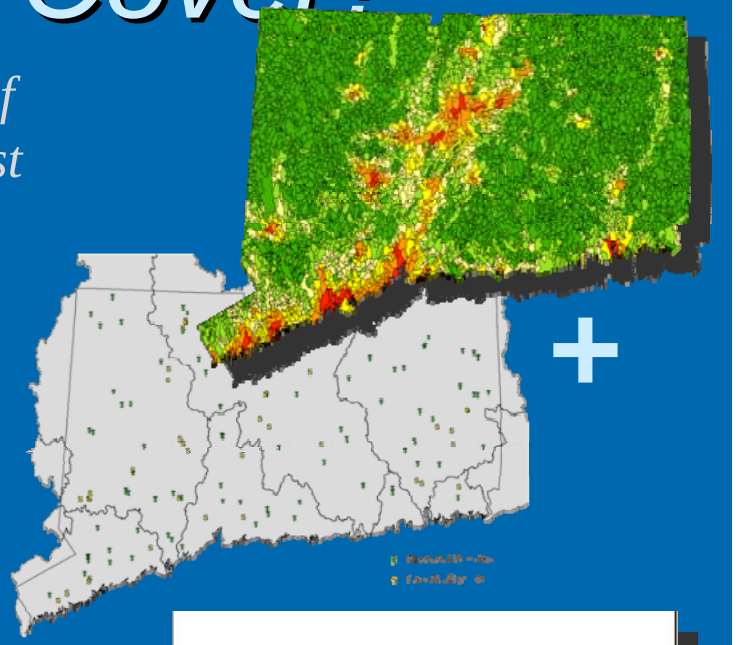
CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION

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



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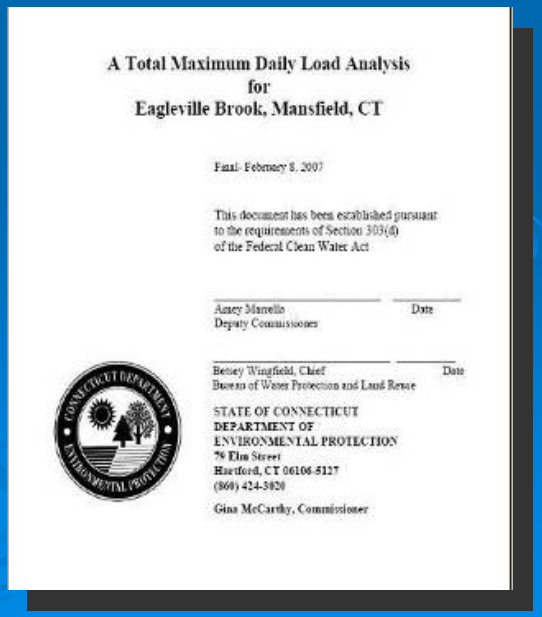

A Total Maximum Daily Load Analysis
for
Eagleville Brook, Mansfield, CT

Final- February 8, 2007

This document has been established pursuant to the requirements of Section 303(d) of the Federal Clean Water Act

Amey Marrello
Deputy Commissioner — Date

Betsey Wingfield, Chief
Bureau of Water Protection and Land Reuse — Date

STATE OF CONNECTICUT
DEPARTMENT OF
ENVIRONMENTAL PROTECTION
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3020

Gina McCarthy, Commissioner

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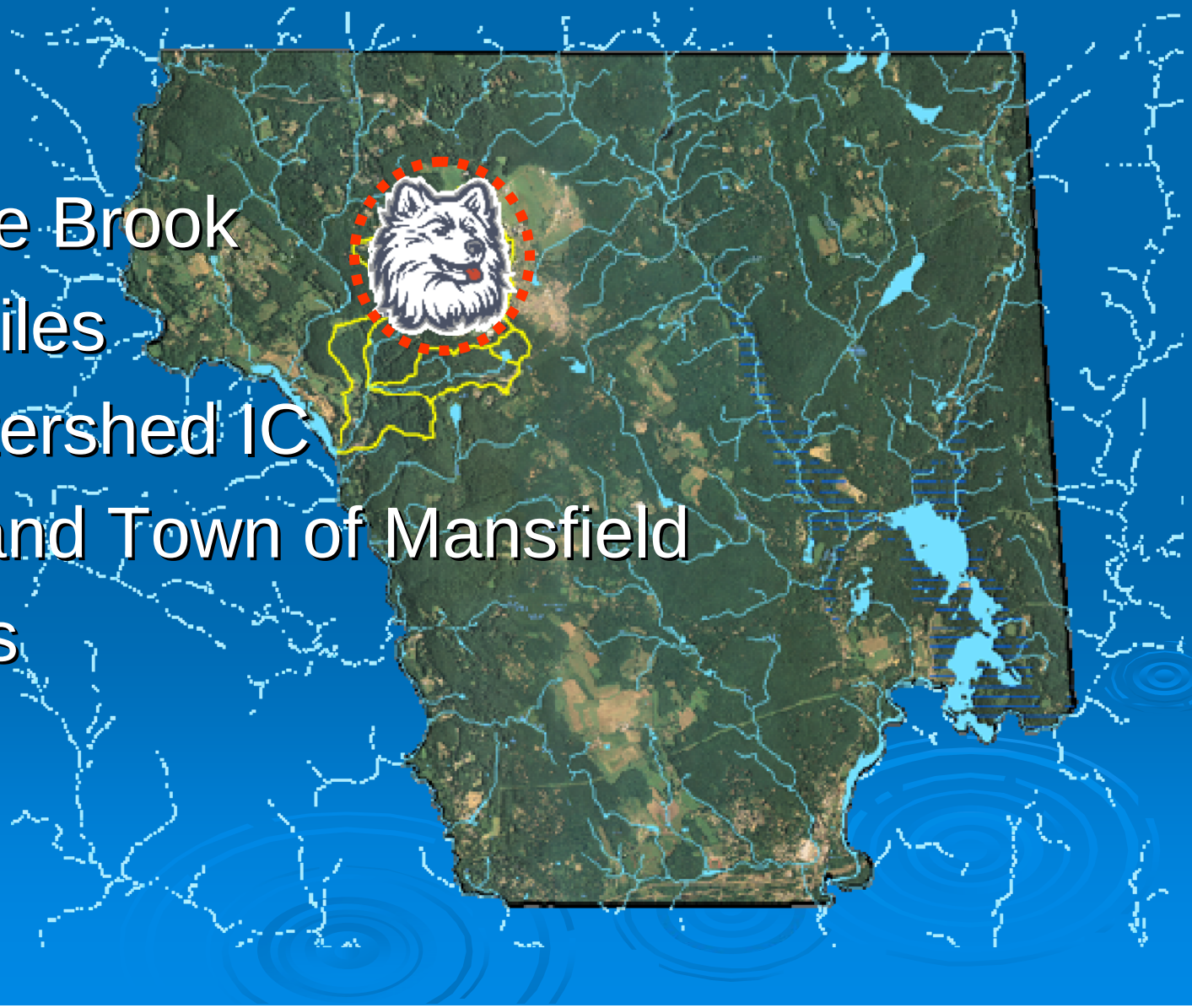
February, 2007

The IC-TMDL Location



- Eagleville Brook
- 2.4 sq miles
- 18% watershed IC
- UConn and Town of Mansfield
- No MS4s

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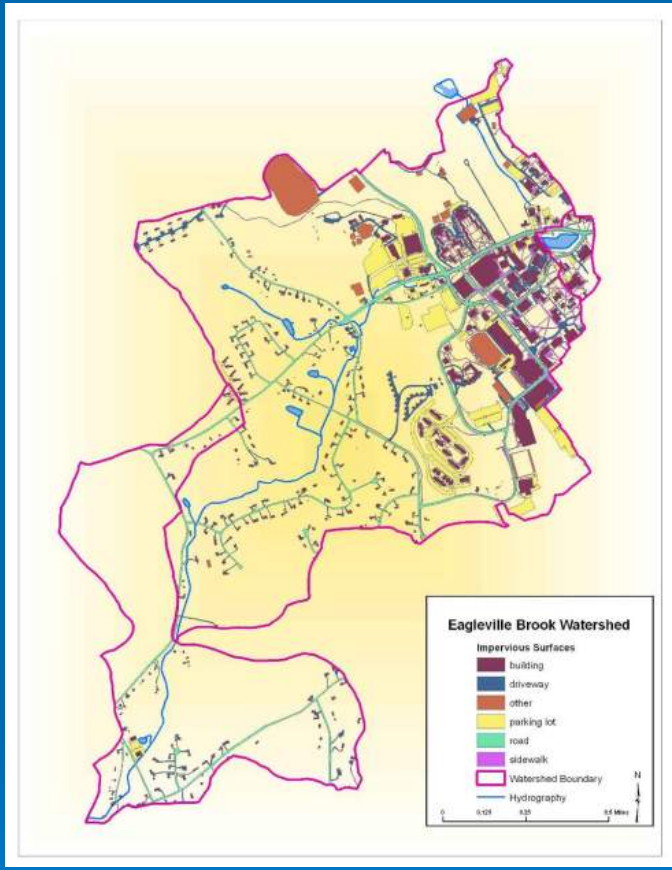
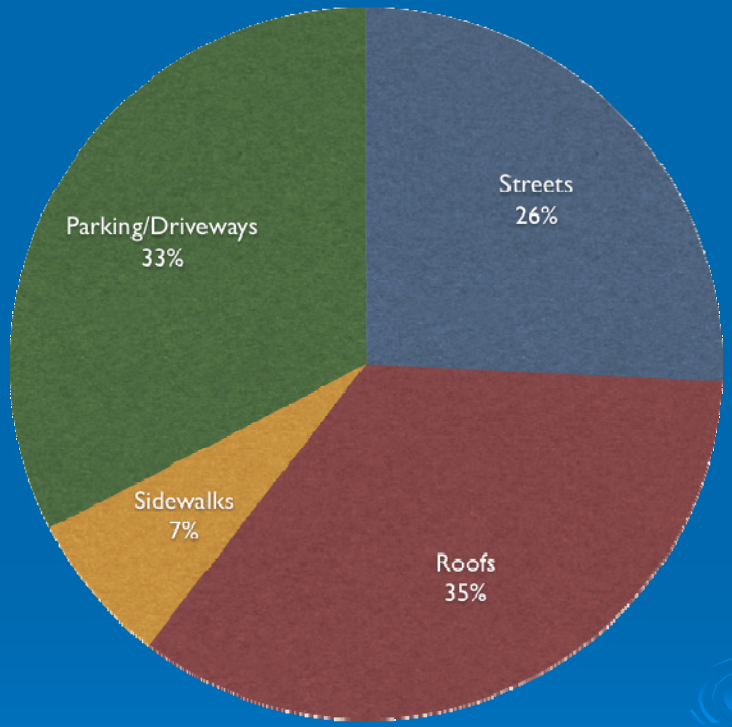
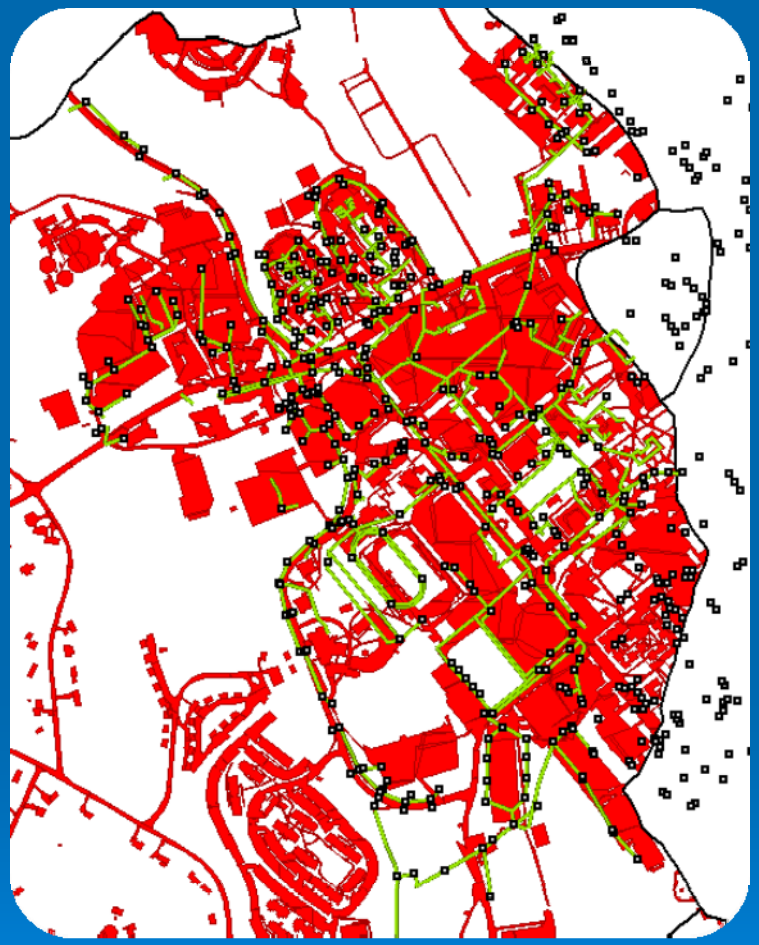
Eagleville Brook Watershed





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

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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

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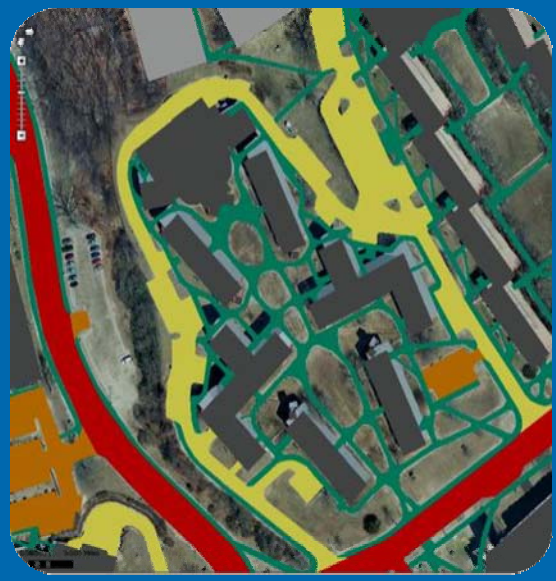
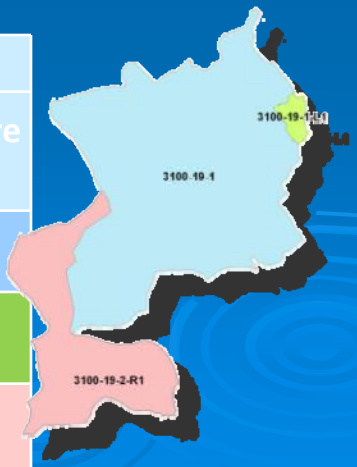
Mapping Analysis

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



BASIN NUMBER	IC Acres	
	TMDL	Direct measure GIS
3100-19-1 (Upper)	126	194
3100-19-1-L1 (Swan Lake)	3.6	6.4
3100-19-2-R1 (Lower)	15.6	14.9



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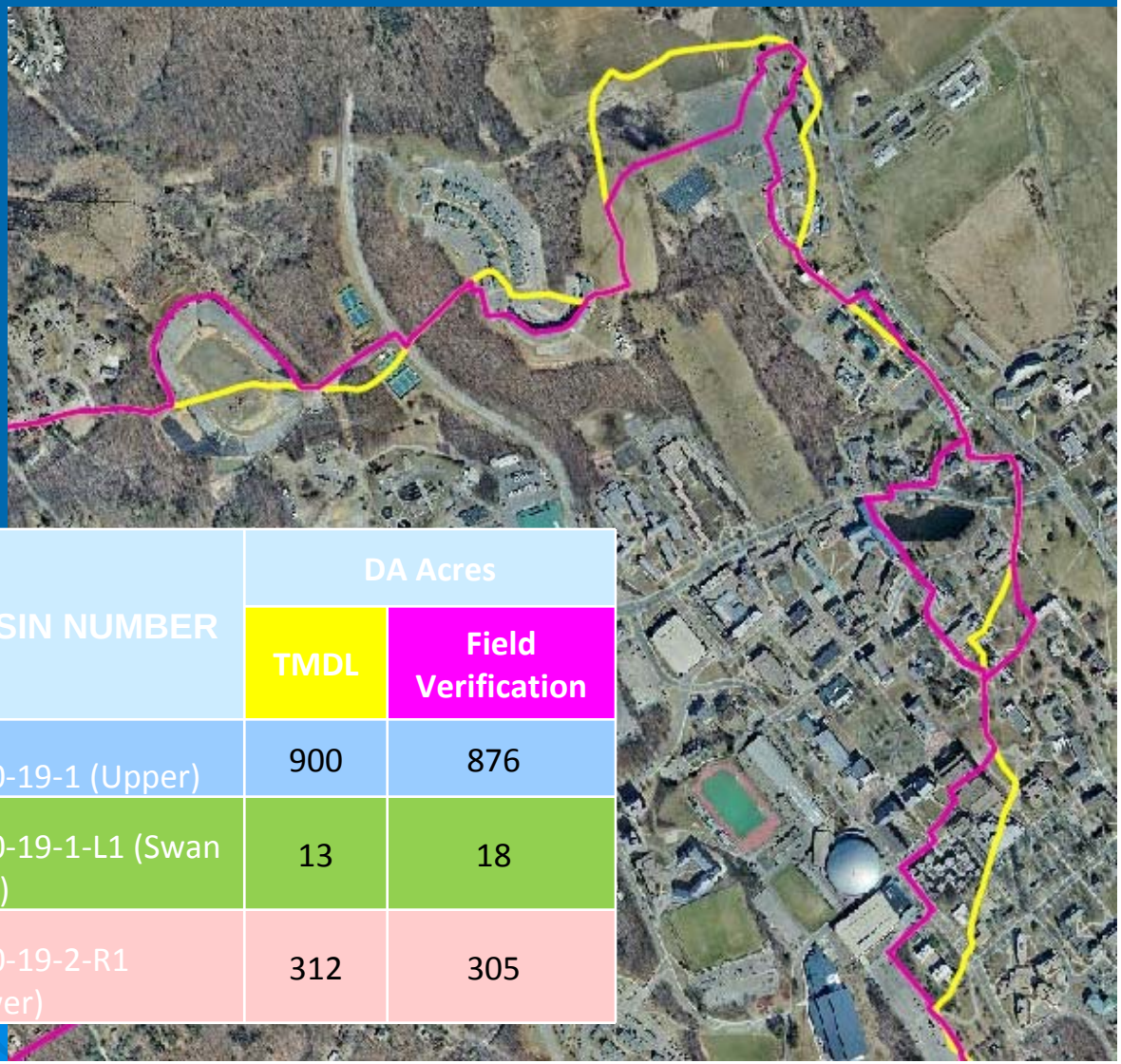
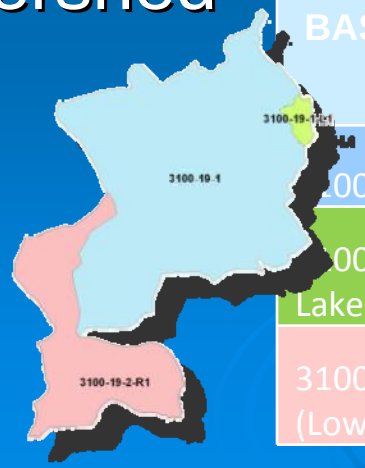
On-the-Ground Reality Check

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



BASIN NUMBER	DA Acres	
	TMDL	Field Verification
3100-19-1 (Upper)	900	876
3100-19-1-L1 (Swan Lake)	13	18
3100-19-2-R1 (Lower)	312	305



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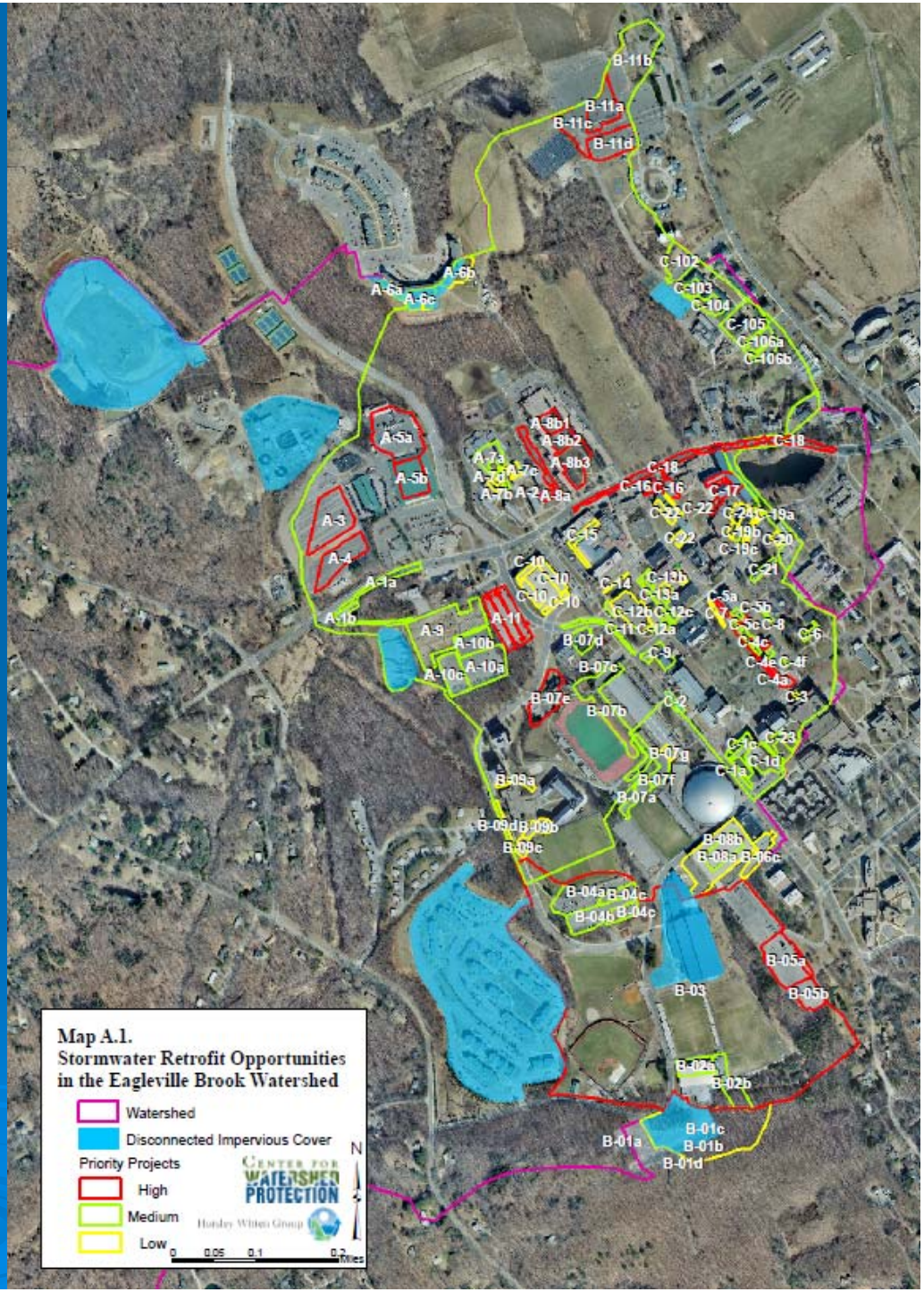
On-the-Ground Reality Check

- What counts as "disconnected" IC?
  - Drains to pervious area
  - Managed by existing BMP
- **51 IC acres** already disconnected in "upper" subbasin



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What is "effective" pervious cover?

Existing stormwater wetland draining Hilltop residential complex

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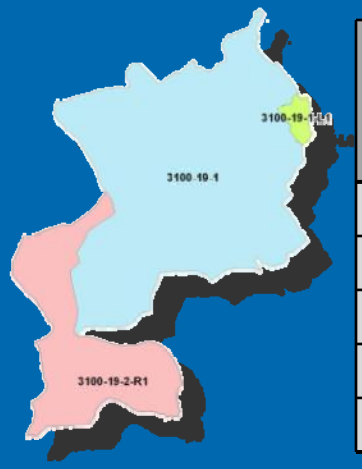

Eagleville Brook Watershed	Existing Conditions		
	TMDL Estimated	GIS Measured	Field Adjusted
Watershed DA (acres)	1225	1225	1199[c]
Watershed IC (acres)	145[a]	216[b]	165[d]
% Watershed IC	12%	18%	14%
11% IC TMDL target (acres)	135	135	132
Remaining IC to manage (acres)	10	81	33

Eagleville Brook Watershed Upper "Basin" 3100-19-1	Existing Conditions		
	TMDL Estimated	GIS Measured	Field Adjusted
3100-19-1 DA (acres)	900	900	876[c]
3100-19-1 IC (acres)	126[a]	194[b]	143[d]
% IC	14%	22%	16%
11% IC TMDL target (acres)	99	99	96
Remaining IC to manage (acres)	27	95	47

[a] IC estimated using land use coefficients and 2002 ISAT data
[b] IC measured from GIS mapping of 2008 high resolution imagery
[c] Field assessment revealed areas that did not drain to Eagleville Brook
[d] 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**

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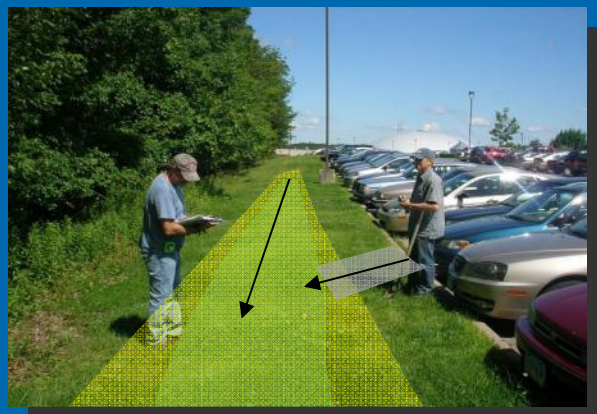
Retrofits Types

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



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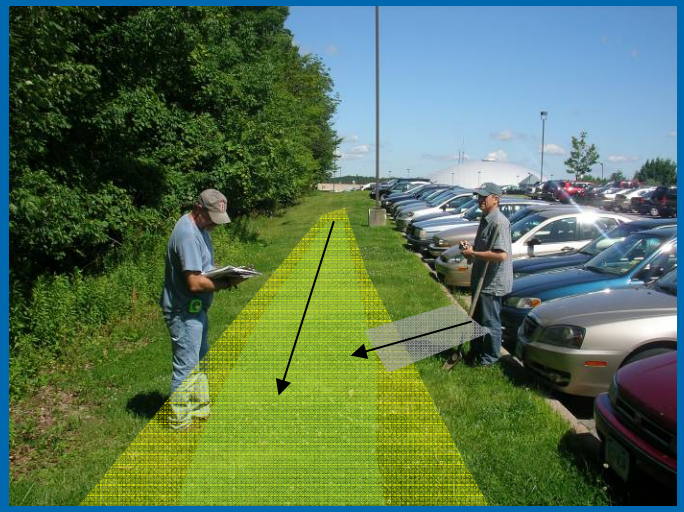
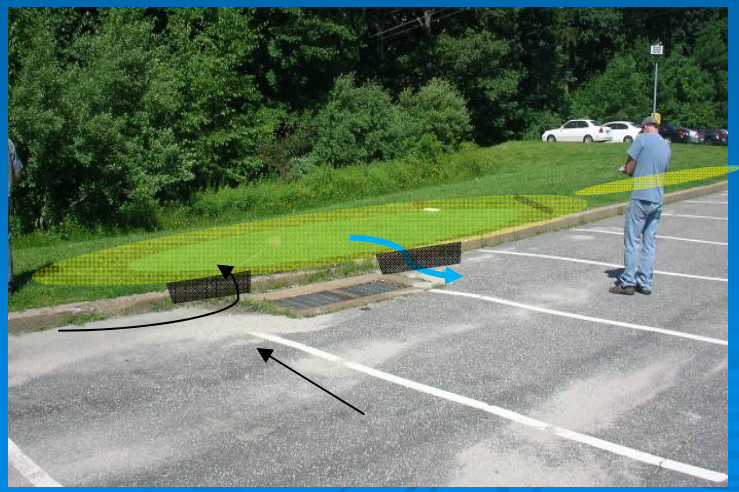
IC-TMDL Strategies

Large surface parking lots

Redesign large surface parking lots to make use of bioretention





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IC-TMDL Strategies

Large surface parking lots

Reduce impervious cover when repaving large surface parking lots.

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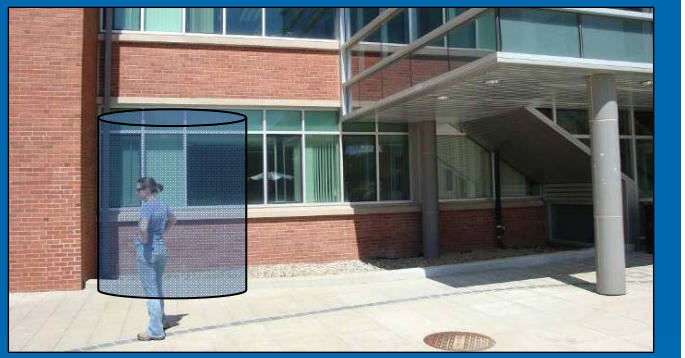
IC-TMDL Strategies

Center campus / academic core

Concentrate on roof runoff using green roofs, cisterns, and rooftop leader disconnects to rain gardens



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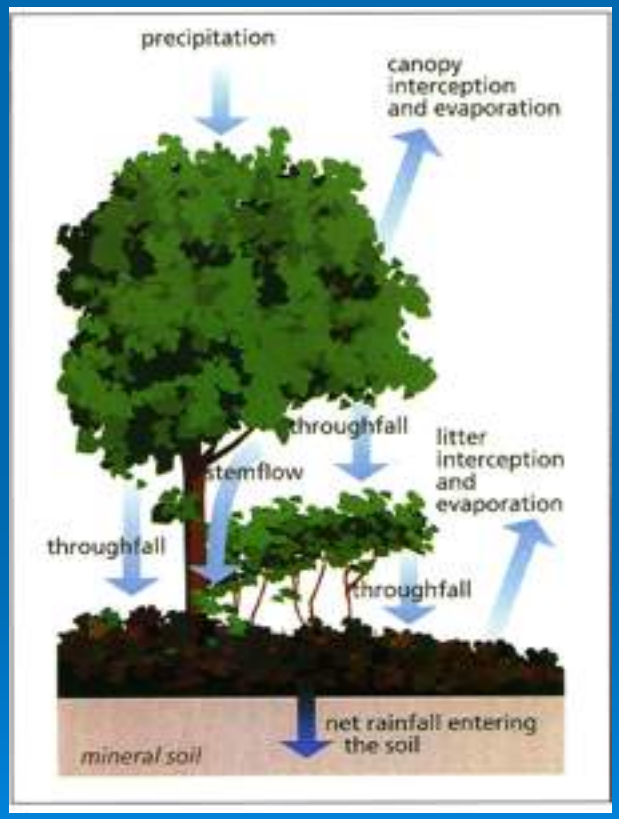
IC-TMDL Strategies

Center campus / academic core

Increase tree cover in collaboration with UConn Master Landscape Plan



From draft Landscape Master Plan

Trees can be major stormwater control devices!

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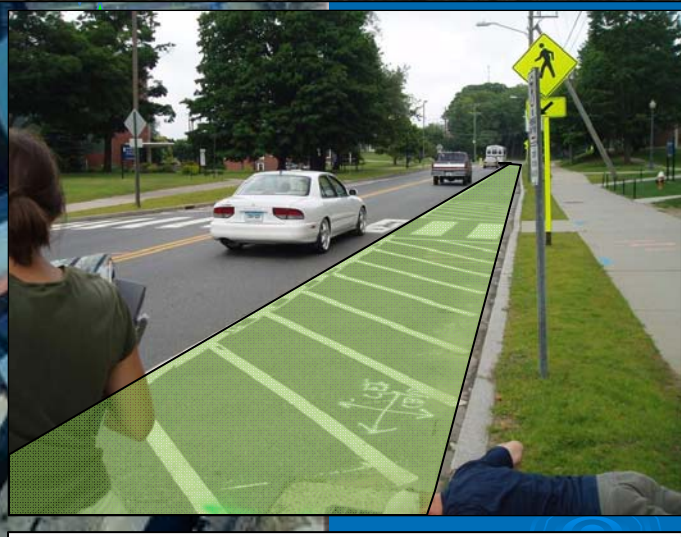
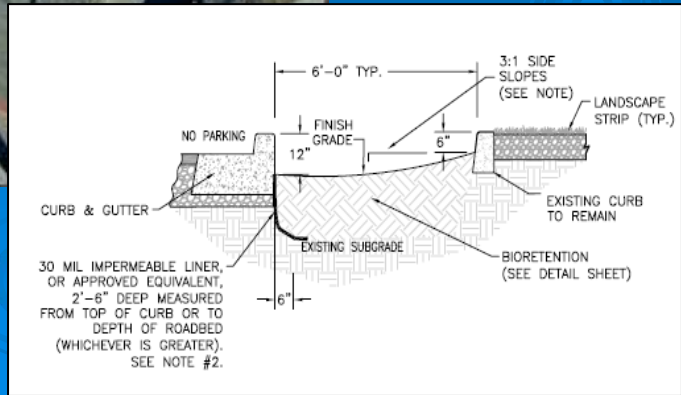
IC-TMDL Strategies

Roads

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





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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

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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**

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Table 2. Project Benefits Summary						
	Impervious Cover Drainage Area Treated (acres)	**Watershed Treated** (%)	**TP Removed** (lb/yr)	**TN Removed** (lb/yr)	**TSS Removed** (lb/yr)	**Runoff Reduction** (cf)*
High Priority Projects	**31.88**	**2.6**	**33**	**207**	**6,433**	**18,881**
All Projects	**127.19**	**22**	**72**	**517**	**14890**	**55,167**

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

Does not yet account for all projects in action

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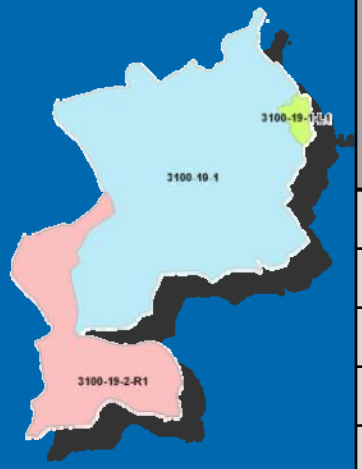

Eagleville Brook Watershed	Existing Conditions*	Future IC with Retrofit Implementation	
		"Top 10" Projects	All Projects
Watershed DA (acres)	1199	1199	1199
Watershed IC (acres)	165	133**	38***
% Watershed IC		11%	3.2%
11% IC TMDL target (acres)		**Target met**	**Target exceeded**
Remaining IC to manage (acres)			

Eagleville Brook Watershed Upper "Basin" 3100-19-1	Existing Conditions*	Future IC with Retrofit Implementation	
		"Top 10" Projects	All Projects
3100-19-1 DA (acres)	876	876	876
3100-19-1 IC (acres)	143	111**	16***
% IC	16%	13%	2%
11% IC TMDL target (acres)	96	**Target not met**	**Target exceeded**
Remaining IC to manage (acres)	47		

* 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.

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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

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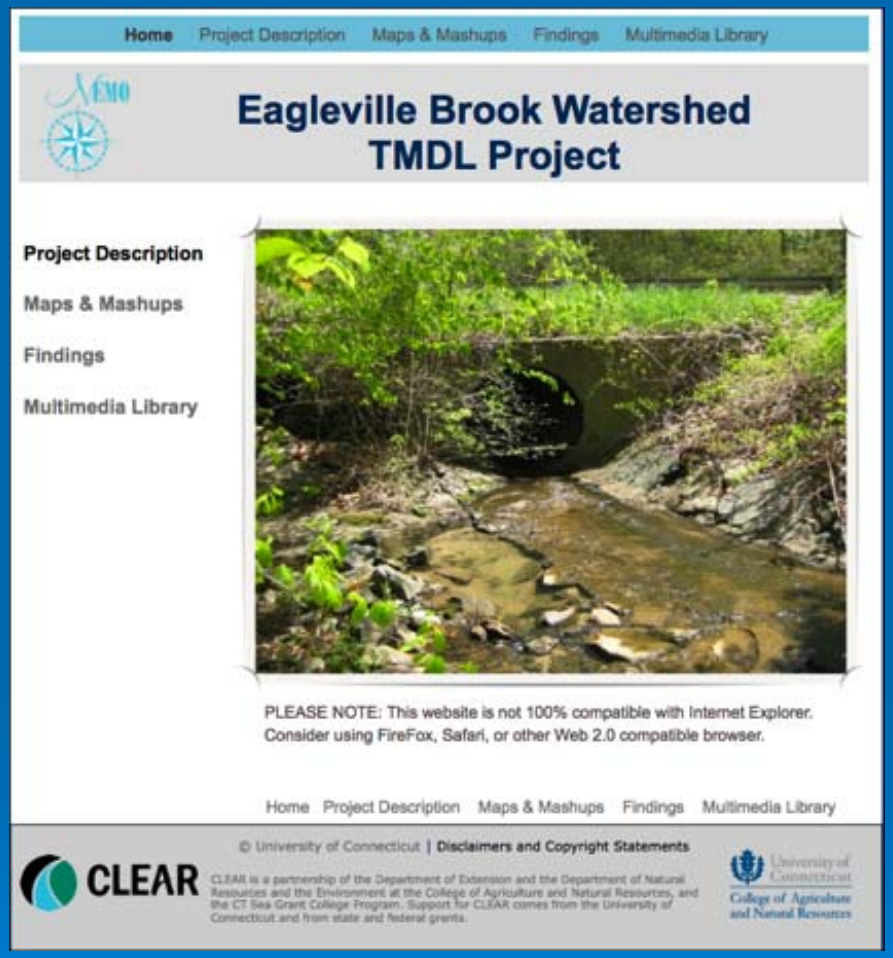
Questions ???



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Department of Extension
Center for Land Use Education and Research
University of Connecticut

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