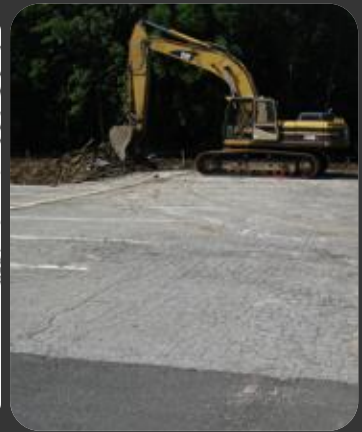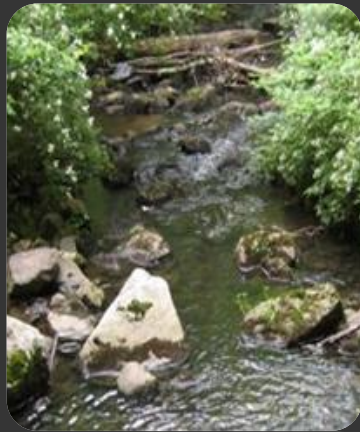# Responding to the First Impervious Cover-Based TMDL:

## Lessons from the Field



Anne Kitchell
Horsley Witten Group
NEIWPCC
May 17-19, 2010

# The Eagleville Brook Story

- Birth of the IC-TMDL

- The lucky watershed

- Can it be done?

- Implications for others

# Birth of the IC-TMDL

**T**otal

**M**aximum

**D**aily

**L**oad

- 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

## Connecticut Probable Sources of Impairments
## for Threatened and Impaired Rivers and Streams
## Reporting Year 2006

Description of this table

| Probable Source | Probable Source Group | Miles Threatened or Impaired |
|---|---|---|
| Source Unknown | Unknown | 393 |
| Unspecified Urban Stormwater | Urban-Related Runoff/Stormwater | 214 |
| Municipal Point Source Discharges | Municipal Dishcarges/Sewage | 132 |
| Sources Outside State Juristiction Or Borders | Other | 107 |
| Industrial Point Source Discharge | Industrial | 105 |
| Combined Sewer Overflows | Municipal Dishcarges/Sewage | 80 |
| Landfills | Land Application/Waste Sites/Tanks | 49 |
| Contaminated Sediments | Legacy/Historical Pollutants | 49 |
| Sanitary Sewer Overflows (Collection System Failures) | Municipal Dishcarges/Sewage | 47 |
| Impacts From Hydrostructure Flow Regulation/Modification | Hydromodification | 42 |
| Upstream Impoundments (E.G., Pl-566 Nrcs Structures) | Hydromodification | 41 |
| Channelization | Hydromodification | 39 |
| Site Clearance (Land Development Or Redevelopment) | Construction | 38 |
| Baseflow Depletion From Groundwater Withdrawals | Hydromodification | 32 |
| Agriculture | Agriculture | 29 |
| Above Ground Storage Tank Leaks (Tank Farms) | Spills/Dumping | 25 |
| Flow Alterations From Water Diversions | Hydromodification | 24 |
| Golf Courses | Recreation And Tourism (Non-Boating) | 22 |
| Dredge Mining | Resource Extraction | 16 |
| Loss Of Riparian Habitat | Habitat Alterations (Not Directly Related To Hydromodification) | 15 |
| Animal Feeding Operations (Nps) | Agriculture | 13 |
| Livestock (Grazing Or Feeding Operations) | Agriculture | 10 |
| Waterfowl | Natural/Wildlife | 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

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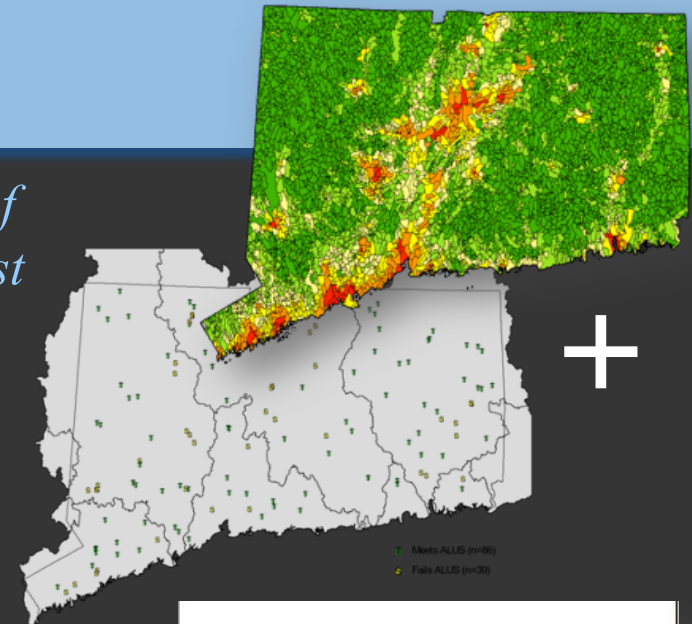
A Total Maximum Daily Load Analysis
for
Eagleville Brook, Mansfield, CT

Final- February 8, 2007

This document has been established pursuant to the requirements of Section 303(d) of the Federal Clean Water Act
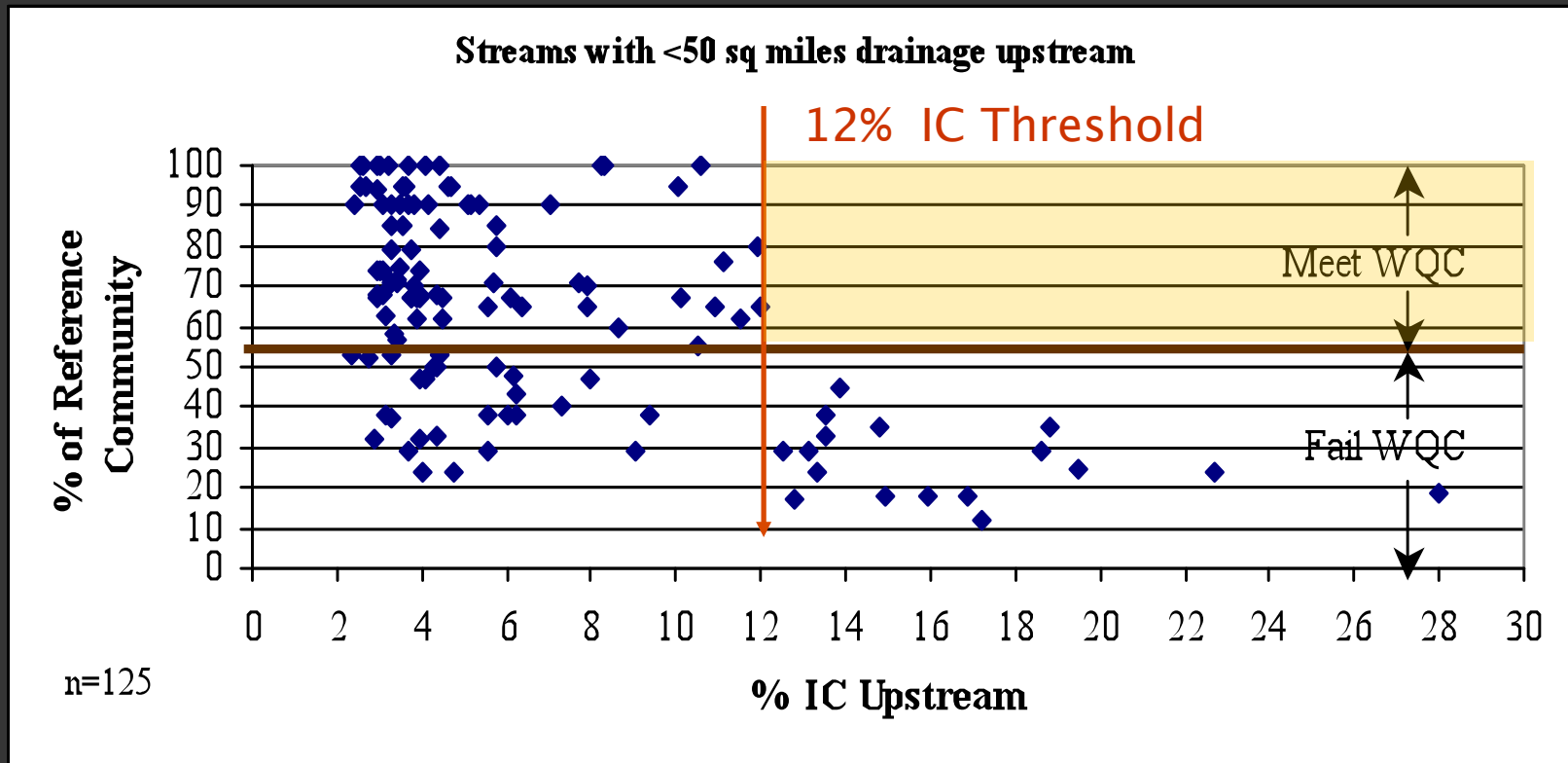
Amey Marrello          Date
Deputy Commissioner

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

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

Gina McCarthy, Commissioner

# Linking the Bugs to IC



Streams with <50 sq miles drainage upstream

12% IC Threshold

Meet WQC

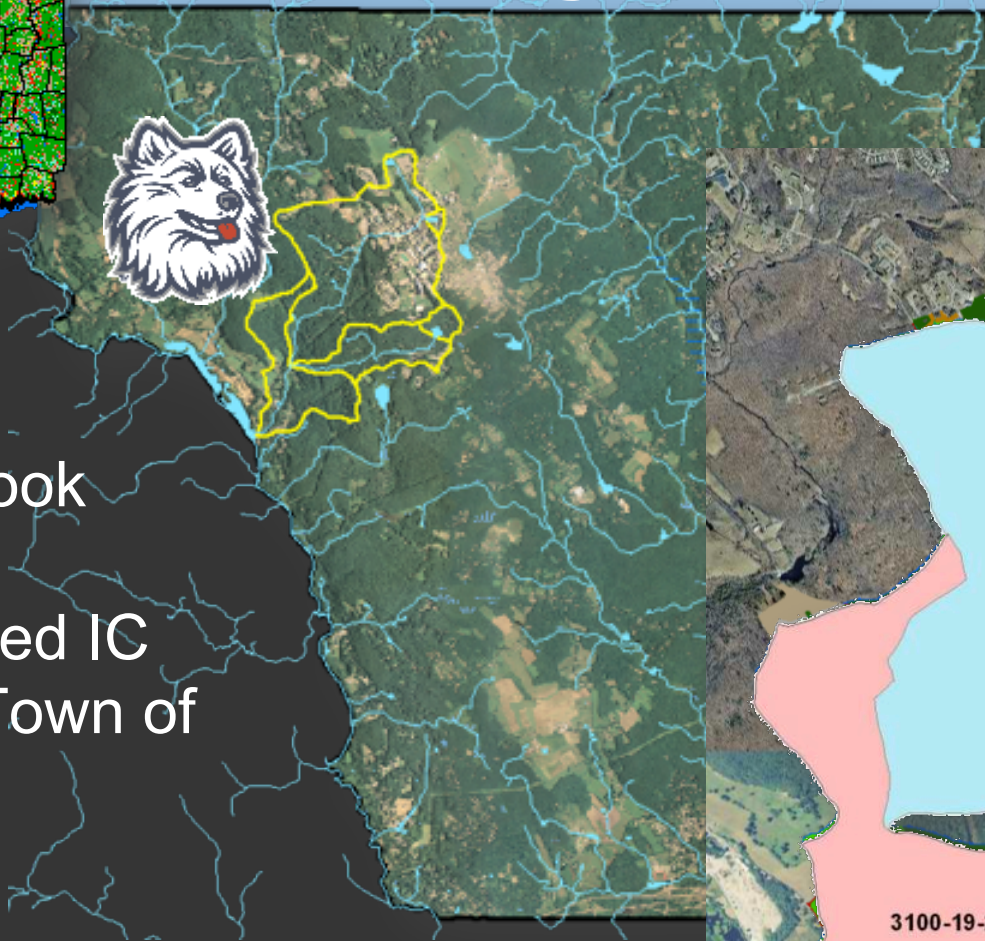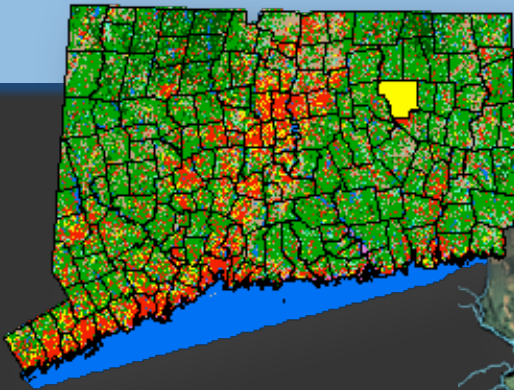Fail WQC

% of Reference Community

% IC Upstream

n=125

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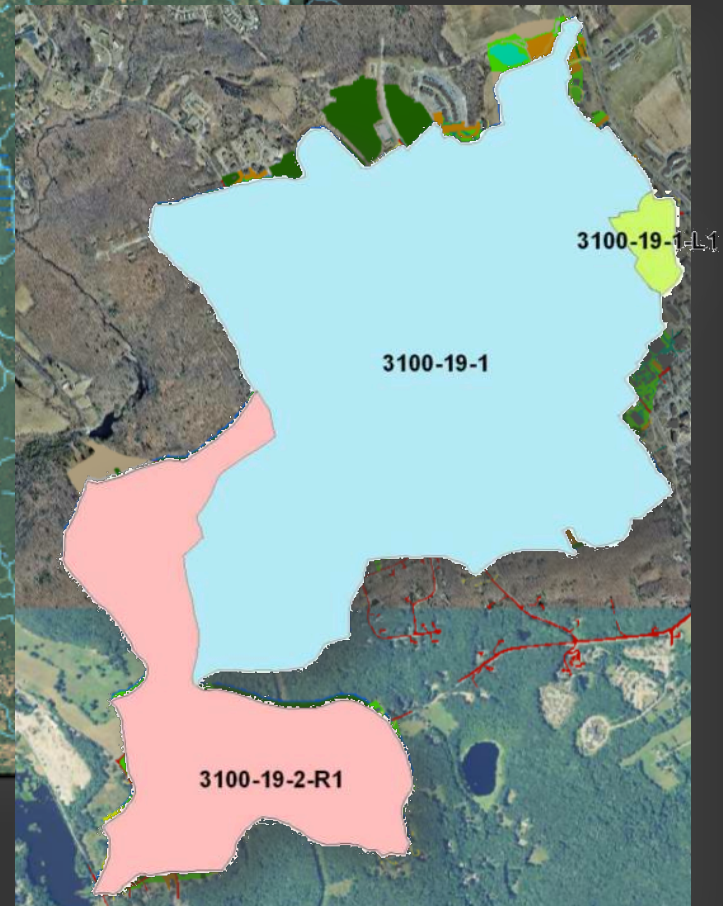
Bellucci, CTDEP

# The Lucky Watershed

- Eagleville Brook
- 2.4 sq miles
- 18% watershed IC
- UConn and Town of Manchester
- No MS4s
- 3 "basins"

3100-19-1-L1

3100-19-1

3100-19-2-R1

# *Why Focus on Eagleville Brook?*

- Listed on *CT 2002 Impaired Waters List*

- Does not meet aquatic life use goals – Cause Unknown

- In-stream biology severely impacted

- Visible impacts from sedimentation and altered flow

# *Eagleville Brook IC-TMDL*

| Waterbody Name and Segment ID | Map ID | Waterbody Segment Description | Percent Impervious Cover | | | | TMDL Implementation Objective |
|---|---|---|---|---|---|---|---|
| | | | TMDL Target | WLA and LA | MOS | Current Condition | |
| Eagleville Brook_01 CT 3100-19_01 | 1 | From the mouth at Eagleville Pond upstream to confluence with Kings Brook, Mansfield. | 12 % | 11% | 1% | 5 % | Anti-degradation |
| Eagleville Brook_02 CT 3100-19_02 (Map ID 2) | 2 | From confluence with Kings Brook to headwaters near UCONN campus. | 12 % | 11% | 1% | 14 % | 21 % Reduction in % IC accomplished by improved stormwater management |
| Eagleville Brook_02 CT 3100-19_02 (Map ID 3) | 3 | Unnamed Pond on UCONN Campus (contained within CT 3100-19_02) | 12 % | 11% | 1% | 27% | 59 % Reduction in % IC accomplished by improved stormwater management |

3100-19-1-L1
3100-19-1
3100-19-2-R1

## *Eagleville Brook IC-TMDL*

- TMDL Target is 12% IC; where

**11% IC = WLA + LA**
**1% = Margin Of Safety**
**12%**

- Expressed as % reduction in IC per subbasin

- IC used as surrogate for "complex array of pollutants transported by stormwater runoff"

- Success measured by assessing aquatic life, but interim progress may be measured by reducing the impacts of IC

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.

# *Implementation Strategies*
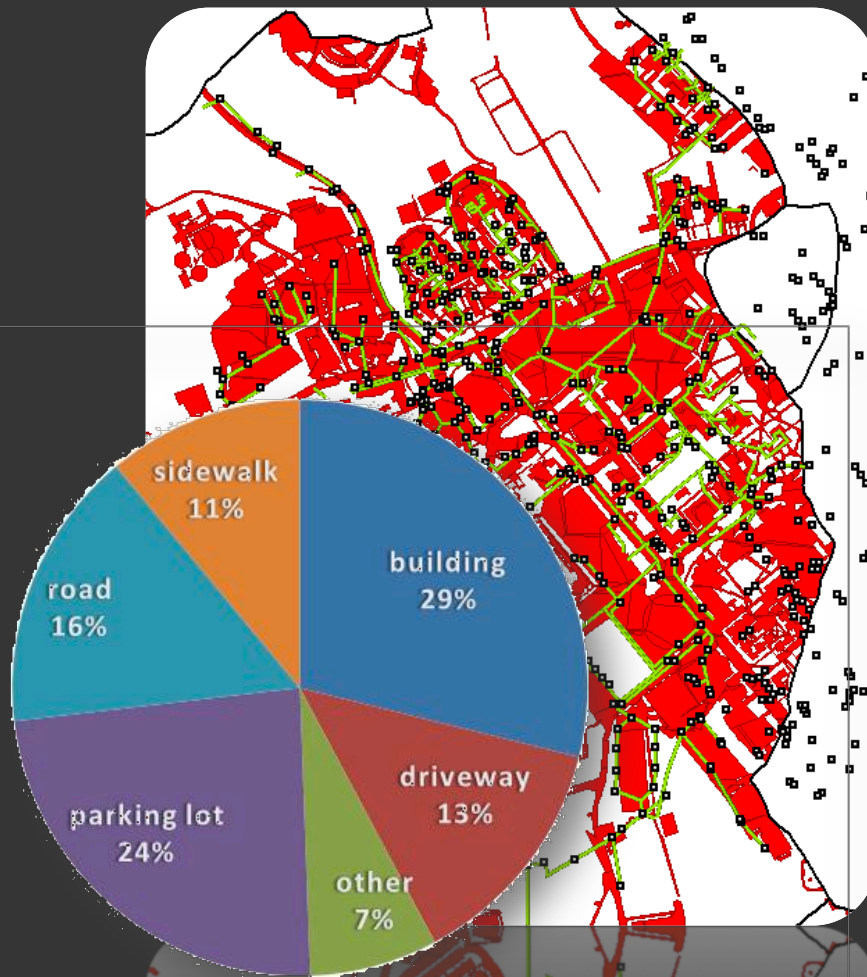


1. Reduce IC where practical (i.e., remove or replace with pervious surfaces)

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

# Can it be done???

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?

## *Mapping Analysis*

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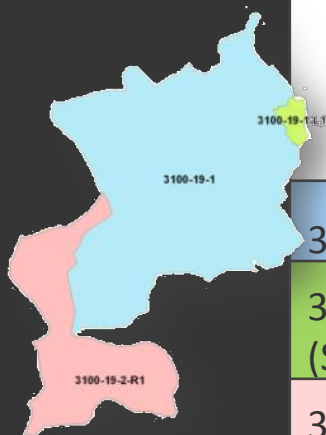- Revised IC based on GIS measurements 2008 aerials
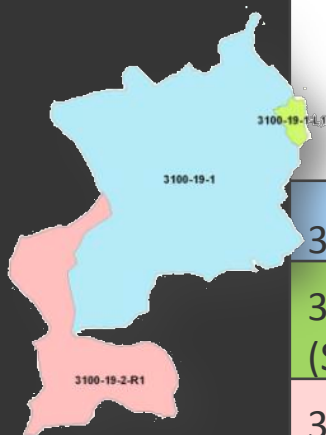


| BASIN NUMBER | IC Acres | |
|---|---|---|
| | TMDL | Direct measure GIS |
| 3100-19-1 (Upper) | 126 | 194 |
| 3100-19-1-L1 (Swan Lake) | 3.6 | 6.4 |
| 3100-19-2-R1 (Lower) | 15.6 | 14.9 |

# *On-the-Ground Reality Check*

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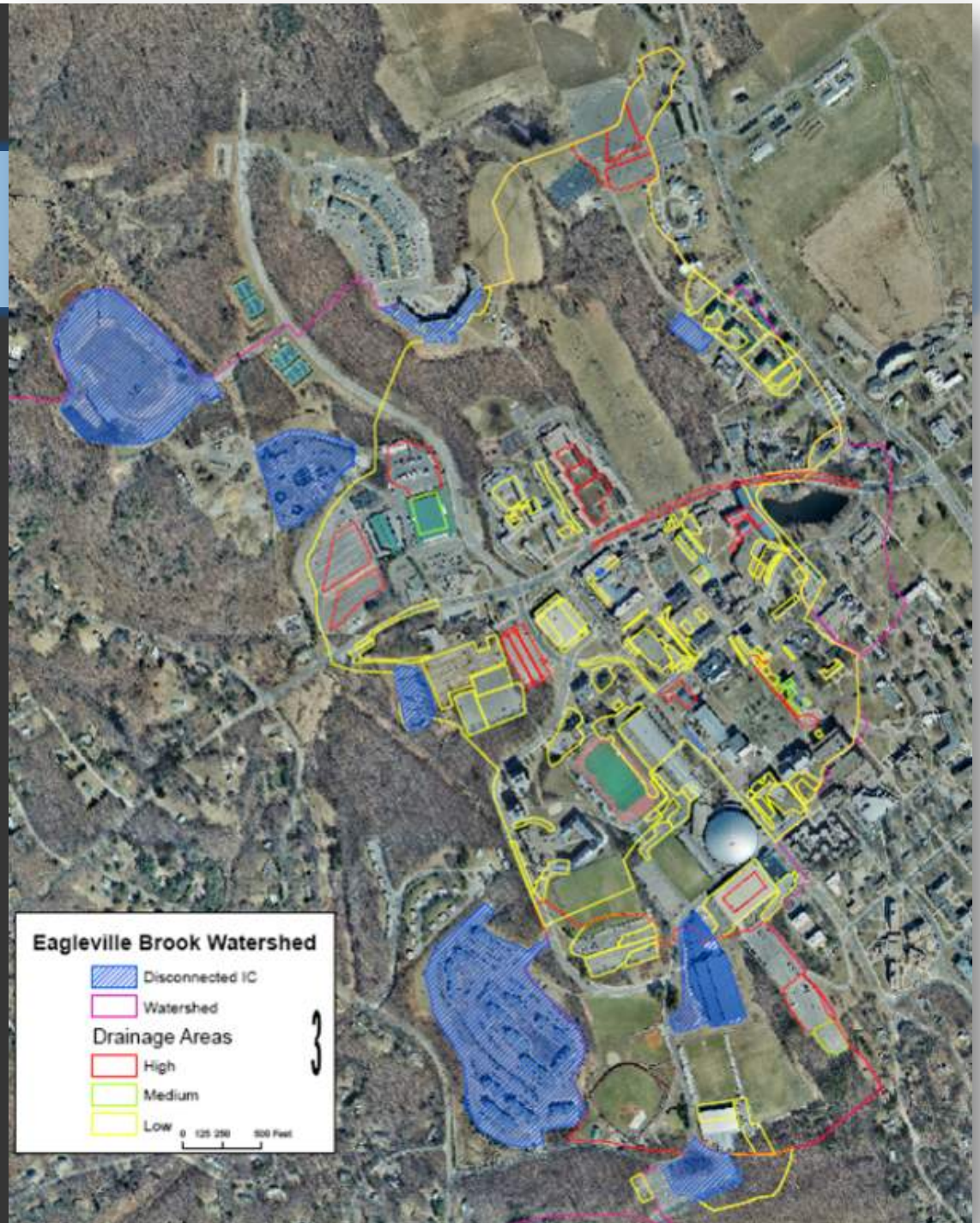
- Swan Lake may not be in watershed

| 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 |
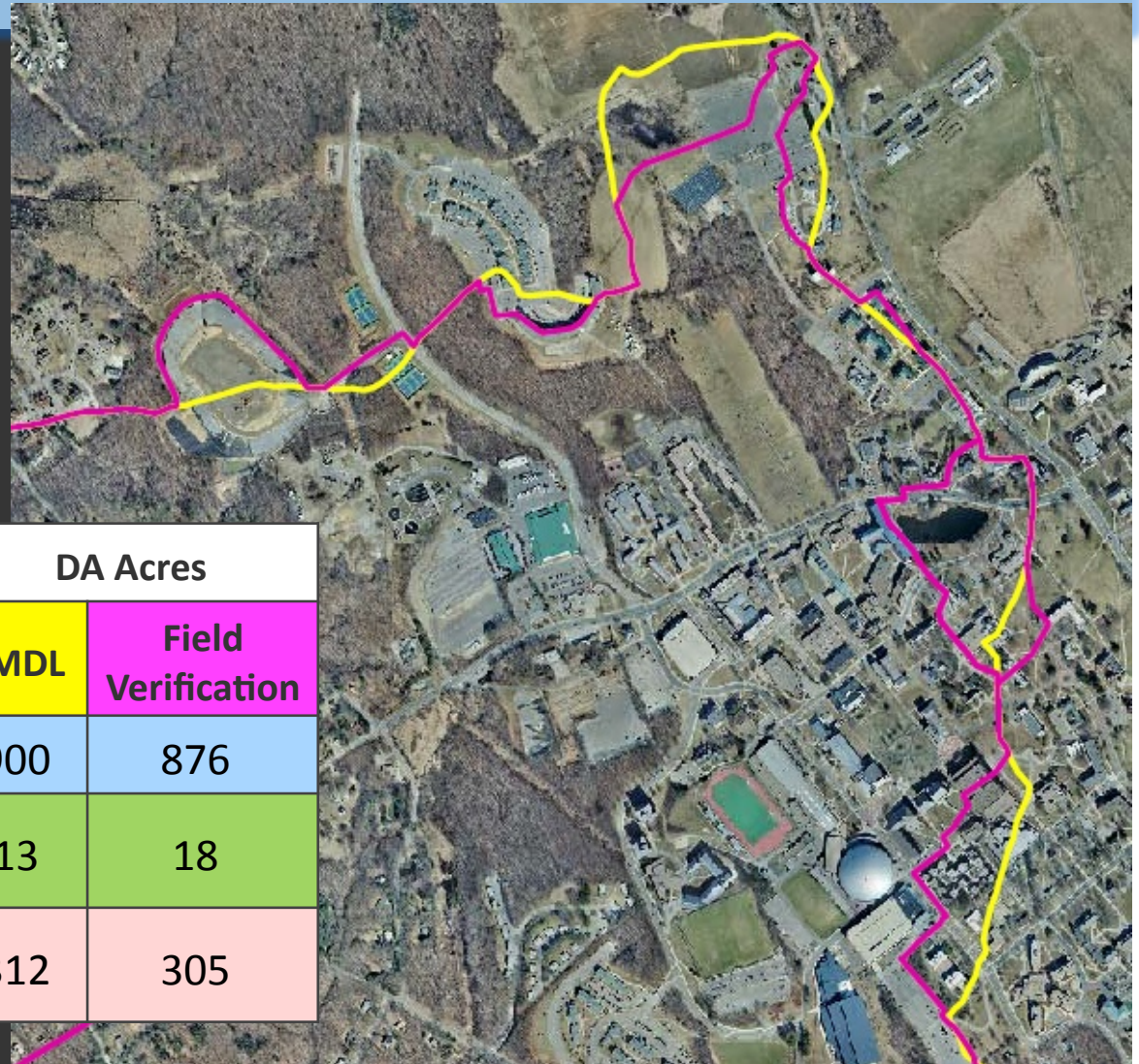
## *On-the-Ground Reality Check*

- What counts as "disconnected" IC?
  - Drains to pervious area
  - Managed by existing BMP
  - WQ vs runoff reduction

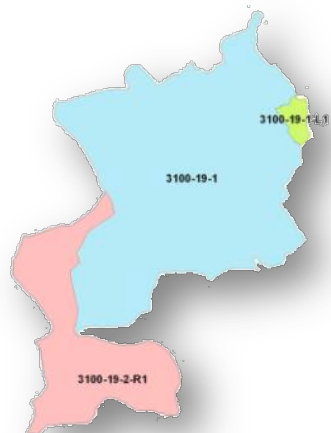- **51 IC acres** already disconnected in "upper" subbasin



Eagleville Brook Watershed
- Disconnected IC
- Watershed
Drainage Areas
- High
- Medium
- Low

0  125 250      500 Feet

# What is "effective" pervious cover?



Existing stormwater wetland draining Hilltop residential complex
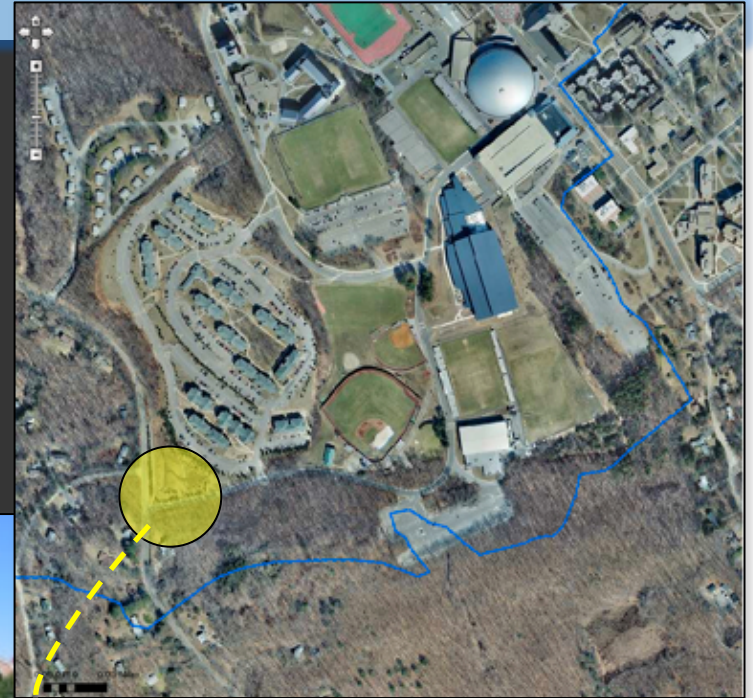
16

| 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**
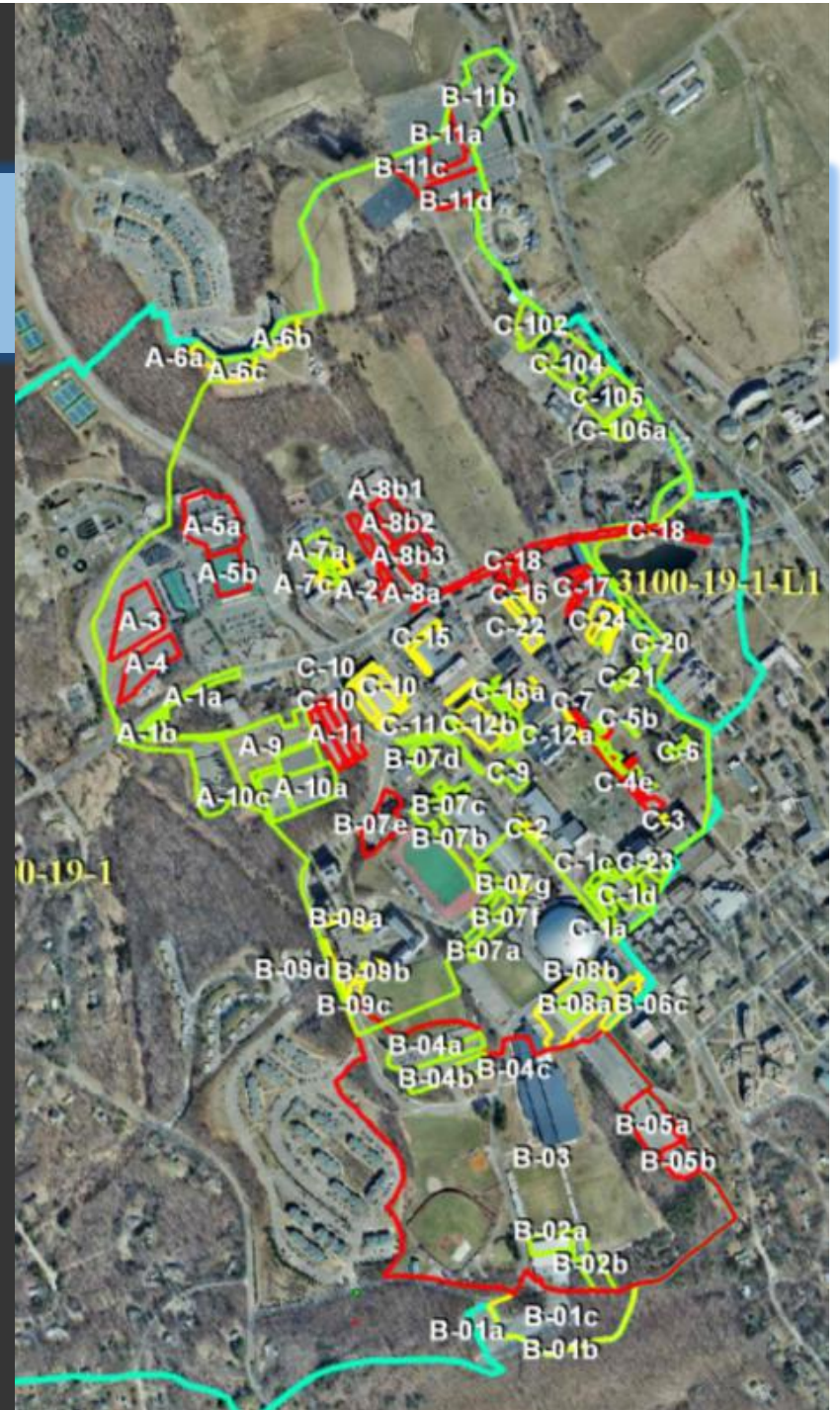
## *Retrofits Types*

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

## *Ranking factors: TOP 10*
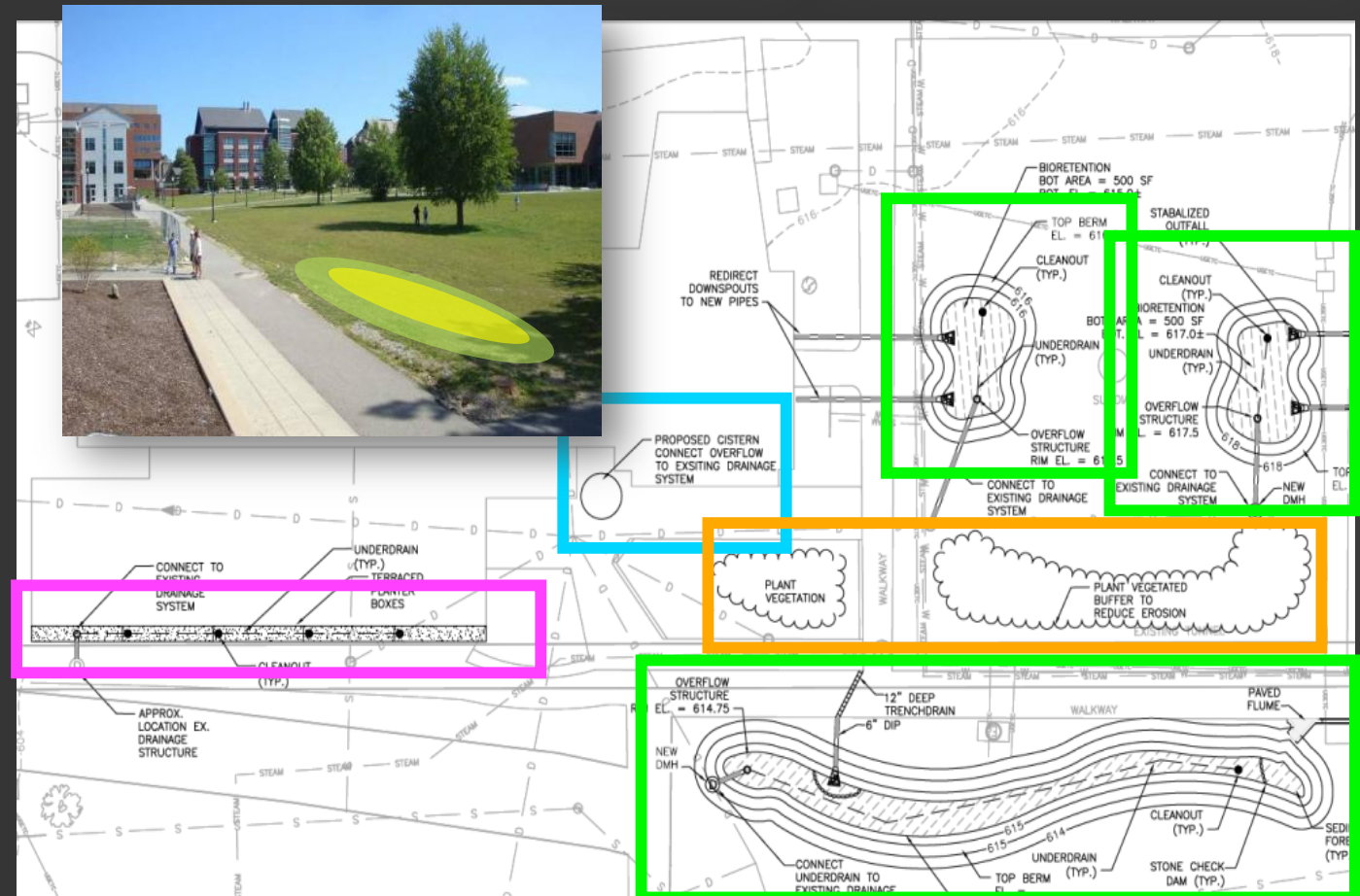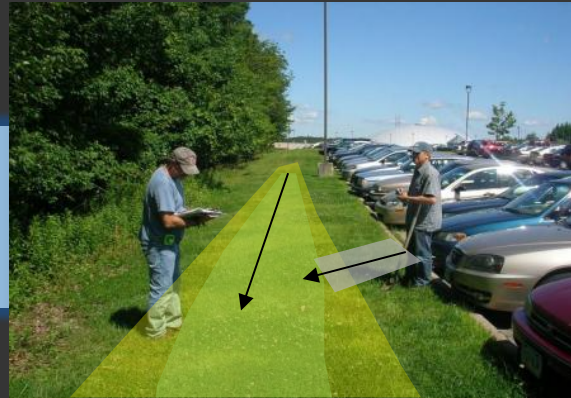
- Amount of IC removed/ disconnected
- Integration with other campus planning/improvements
- Use of different LID practices
- Distribution across campus *(location and use, e.g., academic buildings, dorms, parking lots)*
- Feasibility *(timeline & cost)*
- WQ benefits beyond just reduction of volume
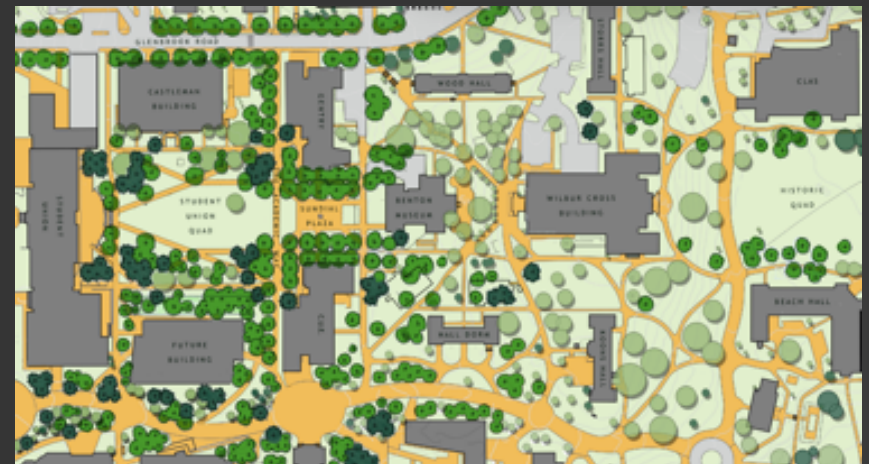
## *Bean Counting*

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**

| | 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 |



Does not yet account for all projects in action
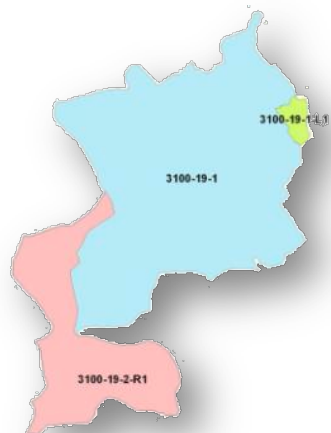
| Eagleville Brook Watershed | Existing Conditions* | Future IC with Retrofit Implementation | |
|---|---|---|---|
| | | "Top 10" Projects | All Projects |
| Watershed DA (acres) | 1199 | 1199 | 1199 |
| Watershed IC (acres) | 165 | 133** | 38*** |
| % Watershed IC | 14% | 11% | 3.2% |
| 11% IC TMDL target (acres) | 132 | **Target met** | **Target exceeded** |
| Remaining IC to manage (acres) | 33 | | |

| 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.

# 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?

- How do new NPDES permit requirements for MA and NH MS4s relate *(e.g., tracking IC and DCIA, retrofit inventories of municipal properties)?*

- 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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Center for Land Use Education and Research
University of Connecticut

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