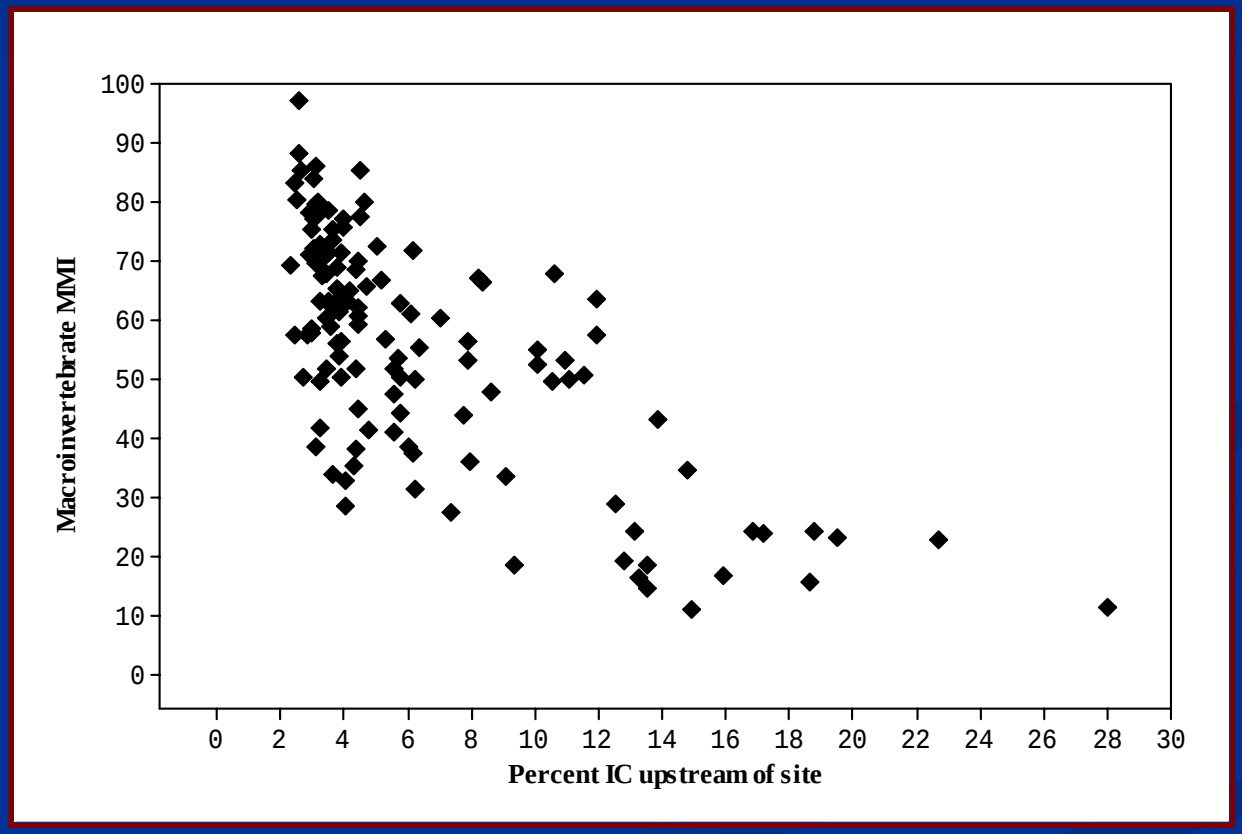
Connecticut's Methodology For Impervious Cover TMDLs



Chris Bellucci
Connecticut Department of Environmental Protection

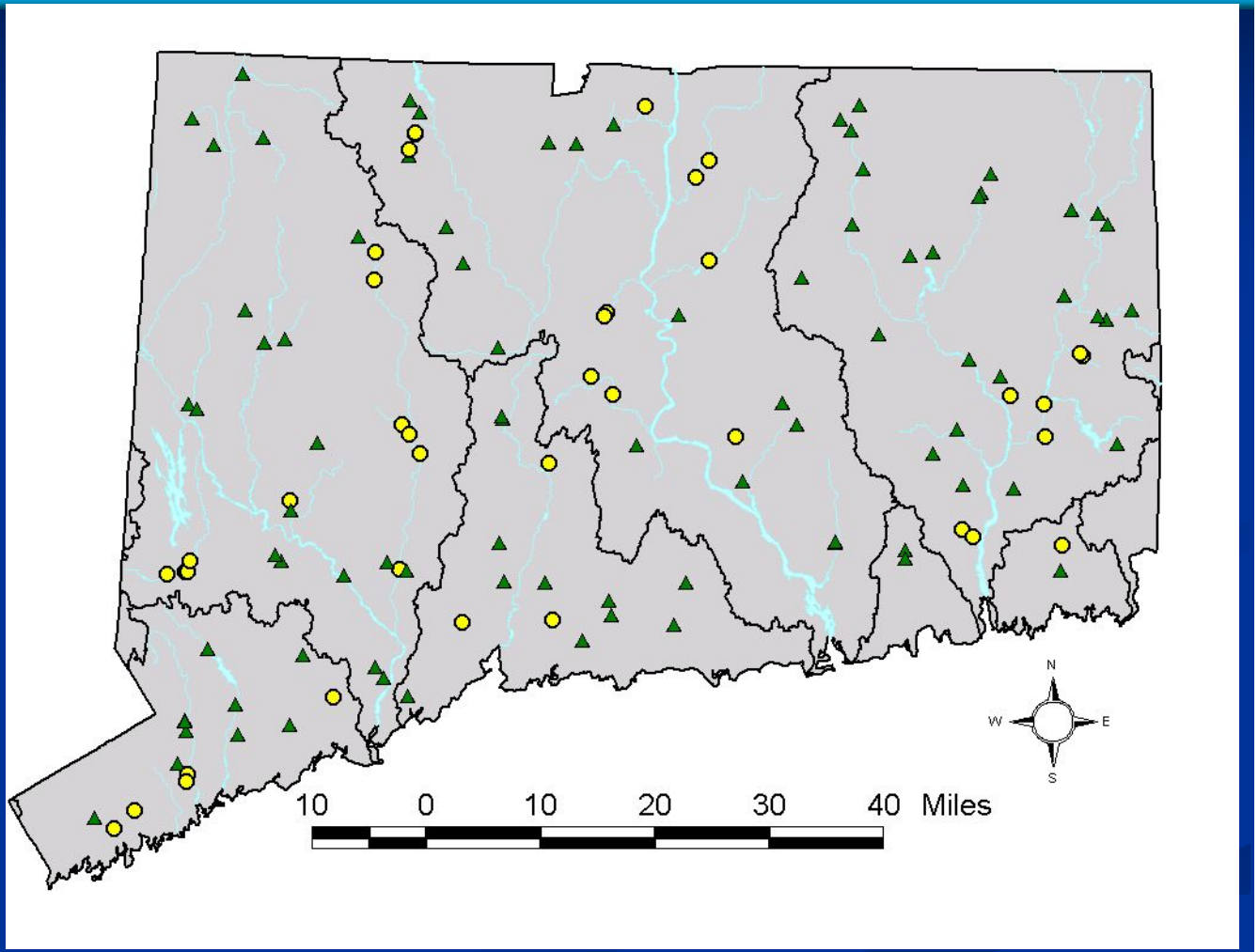
TMDL Challenge

- Need to Develop TMDLs for Multiple Stressor Syndrome caused by stormwater runoff that impairs aquatic life
- Traditional stormwater models are data intensive and site specific
- 105 Stream Segments Impaired for Aquatic Life with high percentage in Urbanized areas

General Impervious Cover Model

Connecticut Macroinvertebrate Data

- < 50 square miles drainage
- No Sewage Treatment Plants
- No streams with portion of watershed in another state
- Consistent level of sampling effort



N = 125 : Green = Meet WQC, Yellow = Fails WQC

Impervious Cover Data Using ISAT

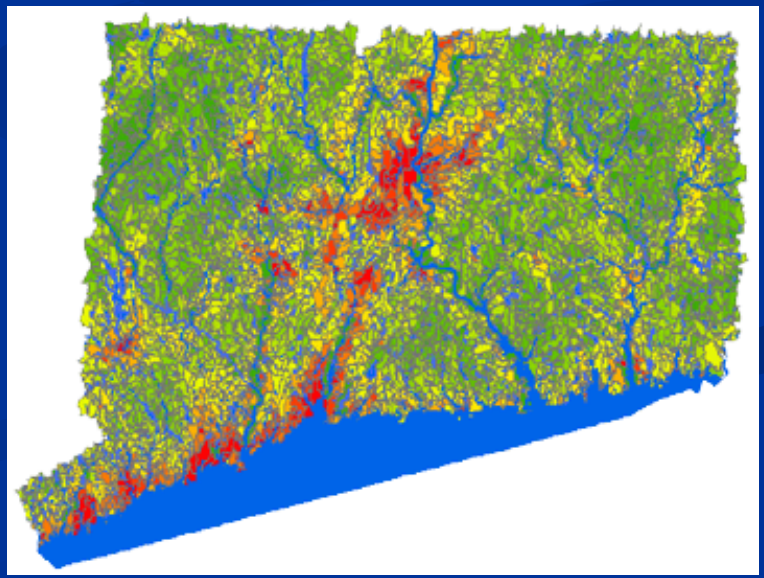
CT Land Cover

ISAT Info

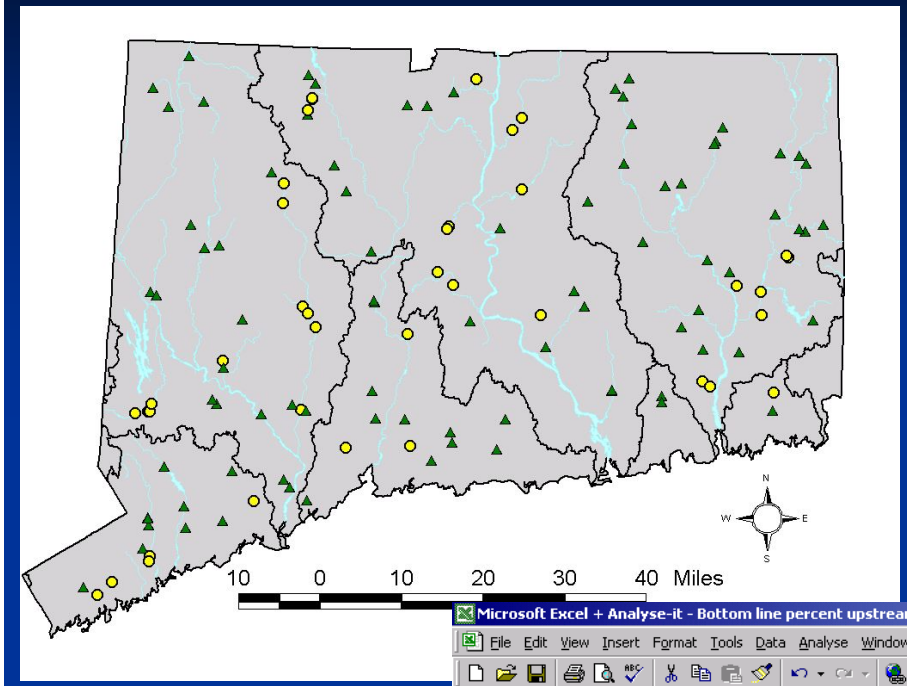
http://www.csc.noaa.gov/crs/cwq/isat.html

Impervious Surface Analysis Tool

	Low	Medium	High
Developed	22.67	26.07	42.26
Turf and grass	8.58	12.09	12.87
Other grasses and agriculture	2.97	6.25	11.56
Deciduous forest	1.37	2.91	5.08
Coniferous forest	1.00	3.17	14.98
Water	0.46	0.77	4.25
Non-forested wetland	0.48	2.29	5.98
Forested wetland	0.46	1.03	1.20
Tidal wetland	3.11	1.63	1.02
Barren	8.18	12.29	19.92
Utility right of way	1.20	0.80	5.52



Linking the Bug Data with Impervious Cover Data



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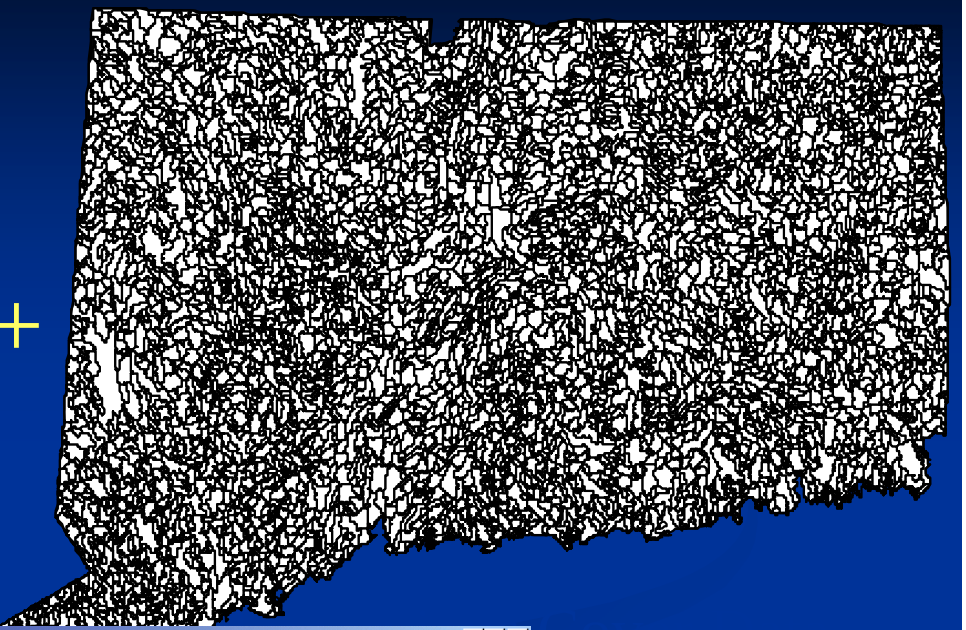


Microsoft Excel + Analyse-it - Bottom line percent upstream and assessment_no Potws

File Edit View Insert Format Tools Data Analyse Window Help

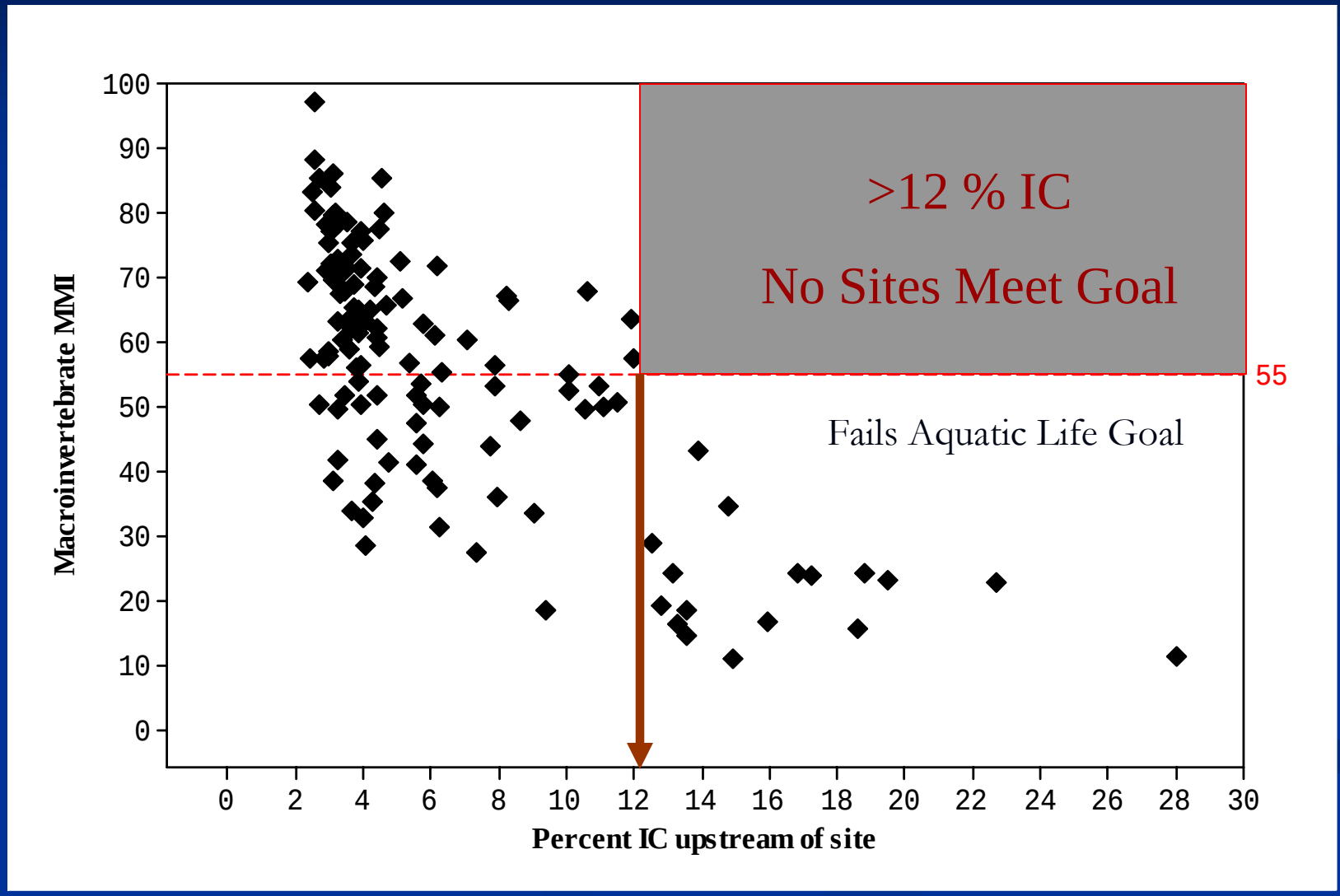
MS Sans Serif 10 100%

G1 = 'StreamName/FacilityName

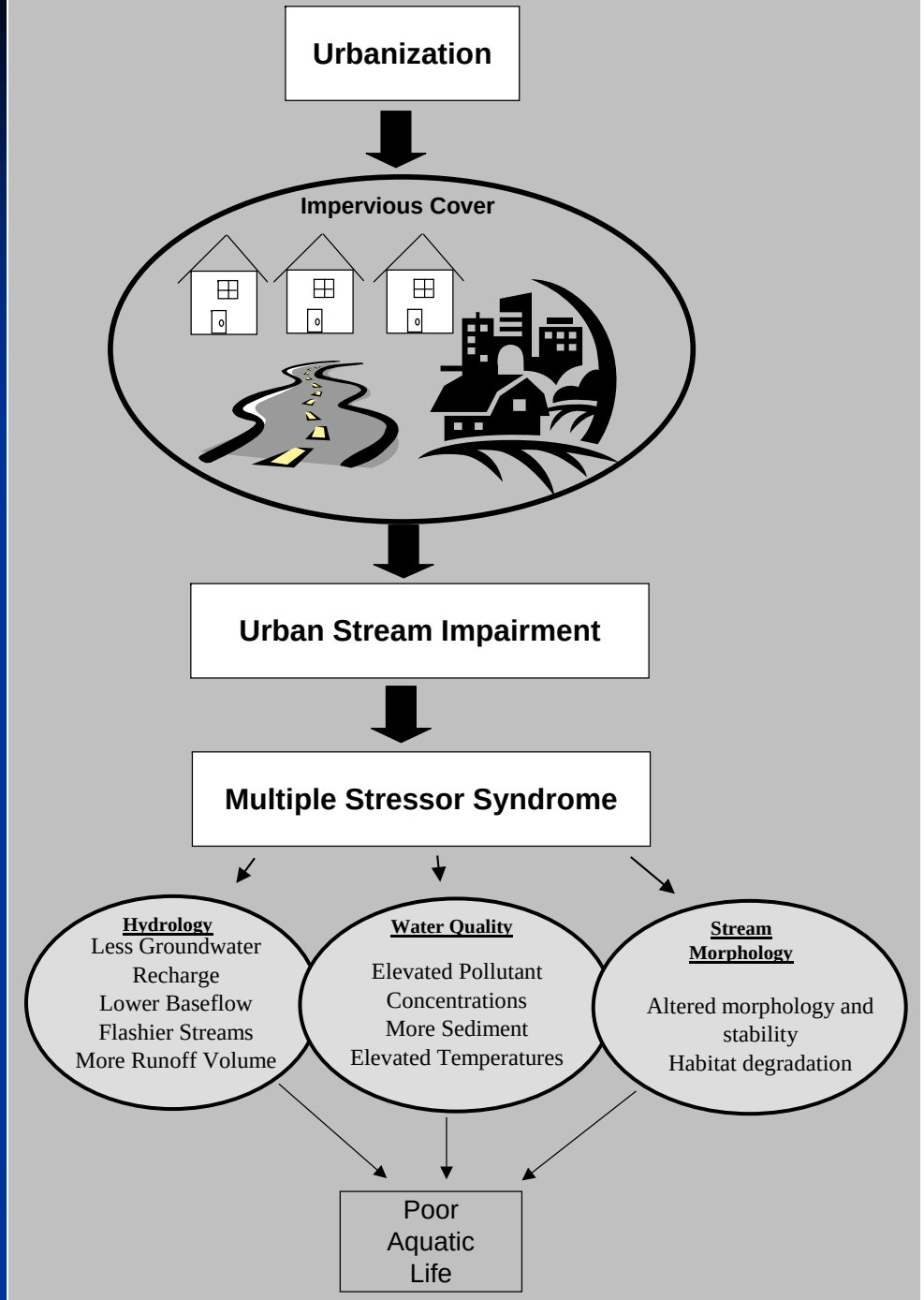
	G	H	I	J	K
1	StreamName/FacilityName	Acres Of IC Upstream	SumOf total acres	Percent IC upstream of sit	percent of reference
2	Myron Kinney Brook	90.7136	3893.3376	2.33	53
3	Shepaug River	184.2992	7554.59004	2.44	90
4	Hollenbeck River	278.1107	11235.58464	2.48	105
5	Bigelow Brook	409.6167	16117.63716	2.54	95
6	Sandy Brook	441.7072	17171.54712	2.57	100
7	Sandy Brook	399.208	15479.68992	2.58	100
8	Eightmile River	417.835	15630.7404	2.67	95
9	Stony Brook	99.4679	3659.87508	2.72	52
10	Broad Brook	277.4453	9729.44148	2.85	32
11	Bungee Brook	264.6705	9083.00052	2.91	74
12	Ekonk Brook	100.4138	3410.80248	2.94	67
13	West River	136.5084	4626.32268	2.95	94
14	West River	136.5084	4626.32268	2.95	100
15	Quanduck Brook	244.2564	8238.9084	2.96	68
16	Roaring Brook	428.3141	14087.86764	3.04	100
17	Still River	310.9829	10217.48604	3.04	74
18	Merrick Brook	253.3281	8309.15376	3.05	74
19	Mount Hope River	553.9483	17969.26812	3.08	68
20	West Branch Salmon Brook	524.7803	17016.82368	3.08	90
21	Little River	734.6365	23478.249	3.13	63
22	Little River	840.3848	26793.78408	3.14	38

Table 2 / file descriptor / Bottom_line_percent_upstream_an / barchart / pivot / Sheet1 / meet vs dont n

CT Impervious Cover Model



Stormwater Runoff and Impervious Cover



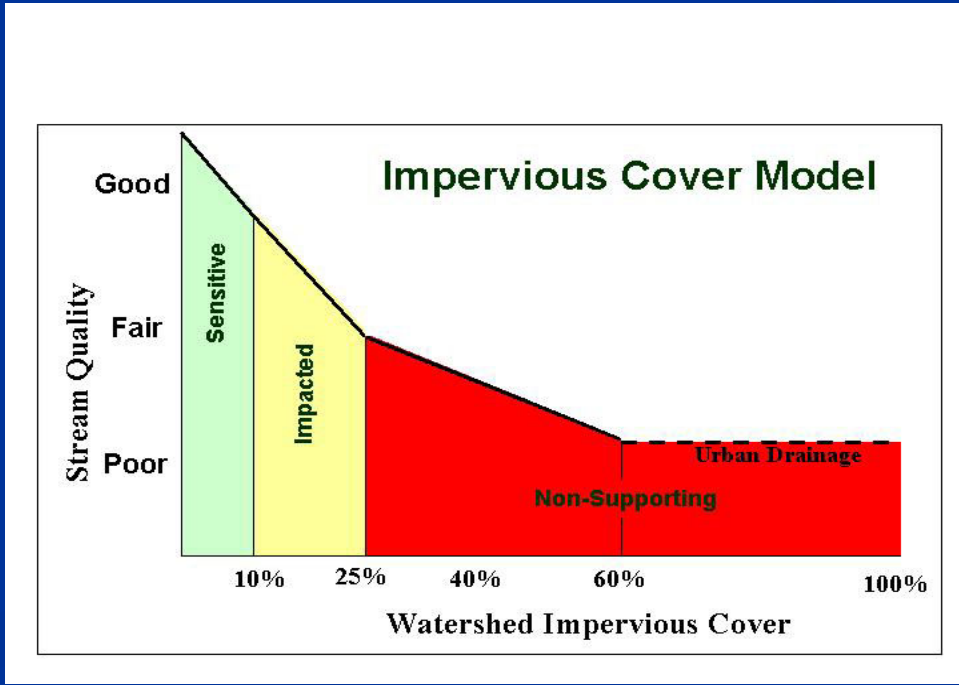
IC as the Answer to TMDL Challenge

- Relationship between IC and Macroinvertebrates
- Relationship between IC and Stormwater
- Therefore IC Provides a Good Link Between Stormwater and Macroinvertebrates
- Since Stormwater is difficult to measure and has mixture of many potential pollutants that together impact aquatic life (multiple stressor syndrome), *develop Stormwater TMDLs based on the amount of IC in the watershed using GIS*

IC Disclaimer

"Impervious Cover Model predictions are general, and may not fully apply to every stream. Factors such as stream gradient, stream order, stream type, age of subwatershed development, prior land use, past management practices can and will make some streams depart from these predictions"

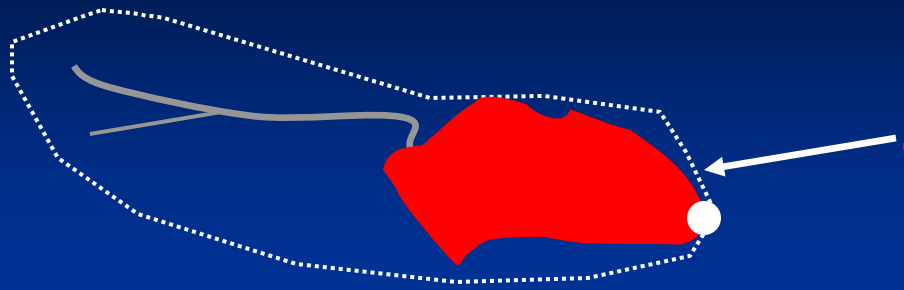
Must be 18 or older to enter. Not valid in TX, UT and Pluto. APR of 6.15%. Not everyone qualifies for special financing. Offer may be restricted due to Acts of God. You can never win. I'm not liable for any damages, I don't have any $ even if I was.



But……..

- CT data show that once we reach ~ 12% IC upstream, there is very little chance of meeting aquatic life goals
- Many other studies show similar patterns for macroinvertebrates and fish (Maine, Pennsylvania, Maryland, Georgia, Minnesota, Wisconsin, Washington, Alaska, Canada, and many more……)
- Streams that don't conform to the pattern in CT have logical explanations (e.g. diversions, farms)

How the TMDL Works



- Percent Reduction in IC Using 12% IC Target
- Reserve 1% for MOS →→ 12% - 1% = 11% WLA and LA
- e.g. (27% - 11% / 27%) x 100 = 59 % Reduction in %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 < 12% IC

Eagleville Brook TMDL

Table 4. Summary of TMDL analysis for Eagleville Brook.

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

ANOTHER COMPETING STORMWATER MODEL

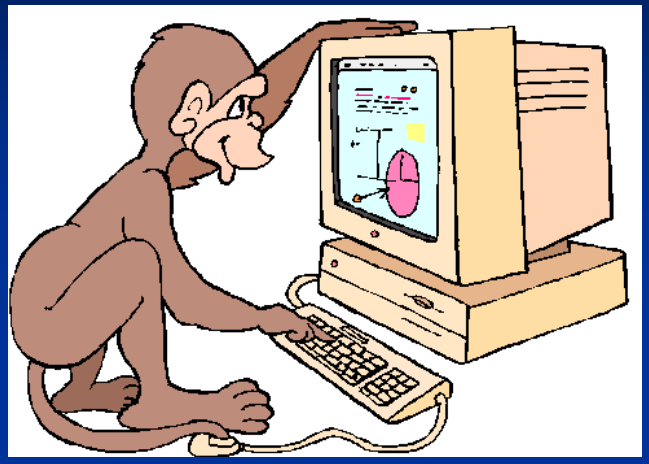
[7.44] $$iL = \left(fL + \frac{Q}{B} \right) + L\frac{\Delta y}{\Delta t}$$

[7.45] $$Q = B\frac{C_M}{n} S^{1/2} \left(y - y_d \right)^{5/3}$$

The Storm Water Management Model is a comprehensive computer model for analysis of quantity and quality problems associated with urban runoff. Both single-event and continuous simulation can be performed on catchments having storm sewers, or combined sewers and natural drainage, for prediction of flows, stages and pollutant concentrations. Extran Block solves complete dynamic flow routing equations (St.Venant equations) for accurate simulation of backwater, looped connections, surcharging, and pressure flow.

Recommendation - Stormwater Management

Connecticut Impervious Cover Model



When it rains, stormwater runoff carries pollutants to streams, alters natural streamflow, and causes negative impacts to fish and bugs that live in the stream. The greater the impervious cover, the greater the chance of killing or reducing numbers of sensitive fish and bugs.

Recommendation - Stormwater Management

Eagleville TMDL Implementation

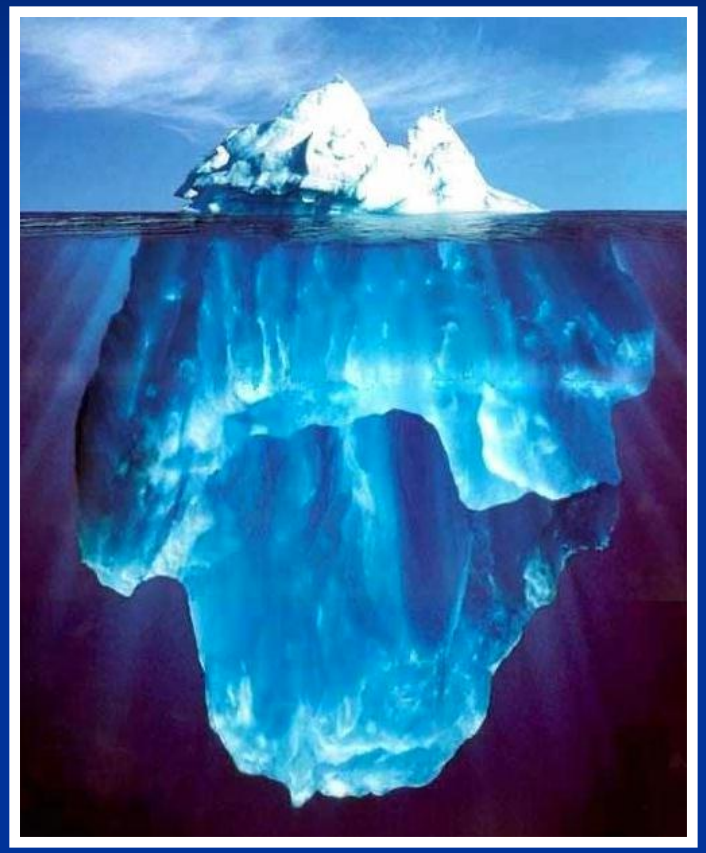
"We get it, now what do you want us to do??"

- Create a Road Map for Implementation
- What Can We Do Where and for How Much?
- Quick fixes for projects that can be inexpensively implemented
- Implementation Plan for Eagleville Brook IC TMDL will serve as template to implement other IC TMDLs
- Monitor Biology in the Brook to Measure Success of Implementation

Benefits of IC TMDL

- Gets to the Root Cause of the problem
- Easily Understood By Public
- IC Data Available for State
- Provides a Streamlined Template for Future Stormwater TMDLs
- Meets State's Obligations under Federal CWA
- Applies on "any given day"
- Provides a Framework for Education and Future Research

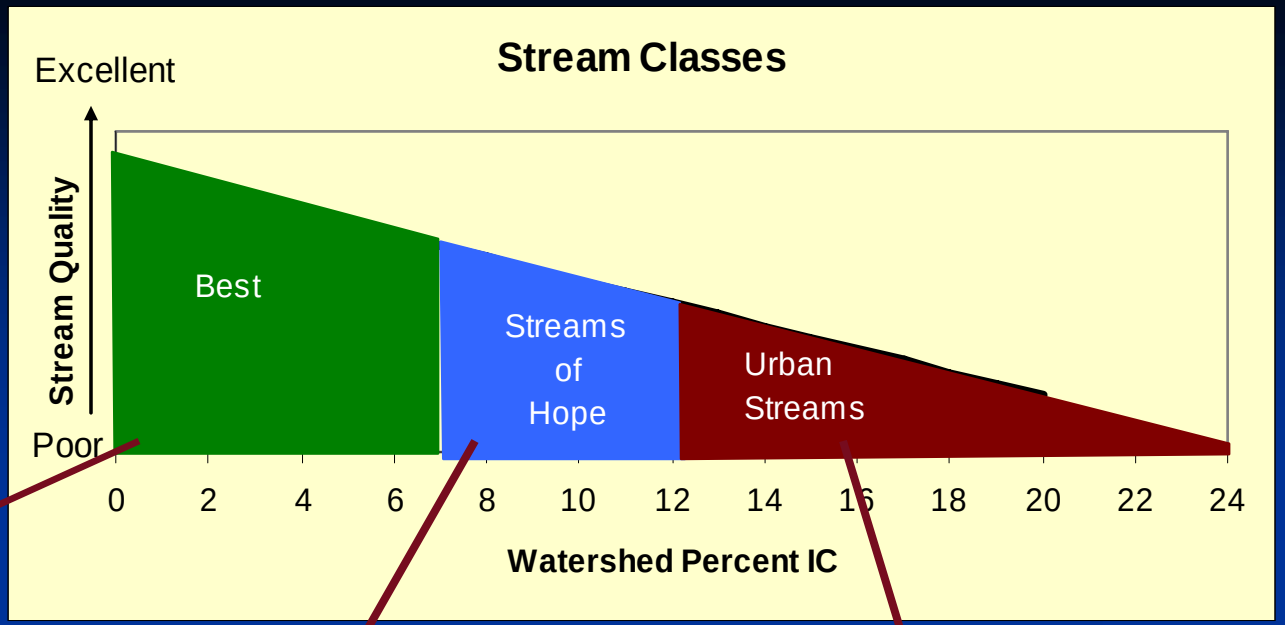
Challenges



"Thus, the challenge for stream ecologists in furthering our understanding of streams in urban areas is to not only better understand interactions between catchments and stream processes, but to integrate this work with social, economic, and political drivers of the urban environment."

Walsh et al. 2005. JNABS.

Challenges



How Do We Get People To Care About the Fish and Bugs ?

Identify Mechanisms of Degradation

Can We Reverse the Degradation ?

What Are Attainable Goals ?

Questions/Comments

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Eagleville Brook Impervious Cover TMDL
http://www.ct.gov/dep/tmdl