

National Biological Assessment
and Criteria Workshop

Advancing State and Tribal Programs



Coeur d'Alene, Idaho
31 March – 4 April, 2003

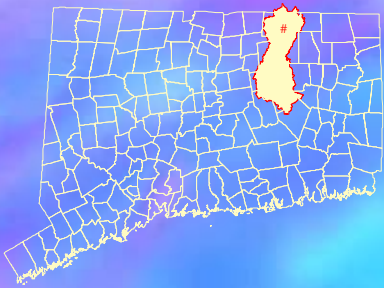
SI 101

Environmental Protection Without Conclusive Causal Analysis

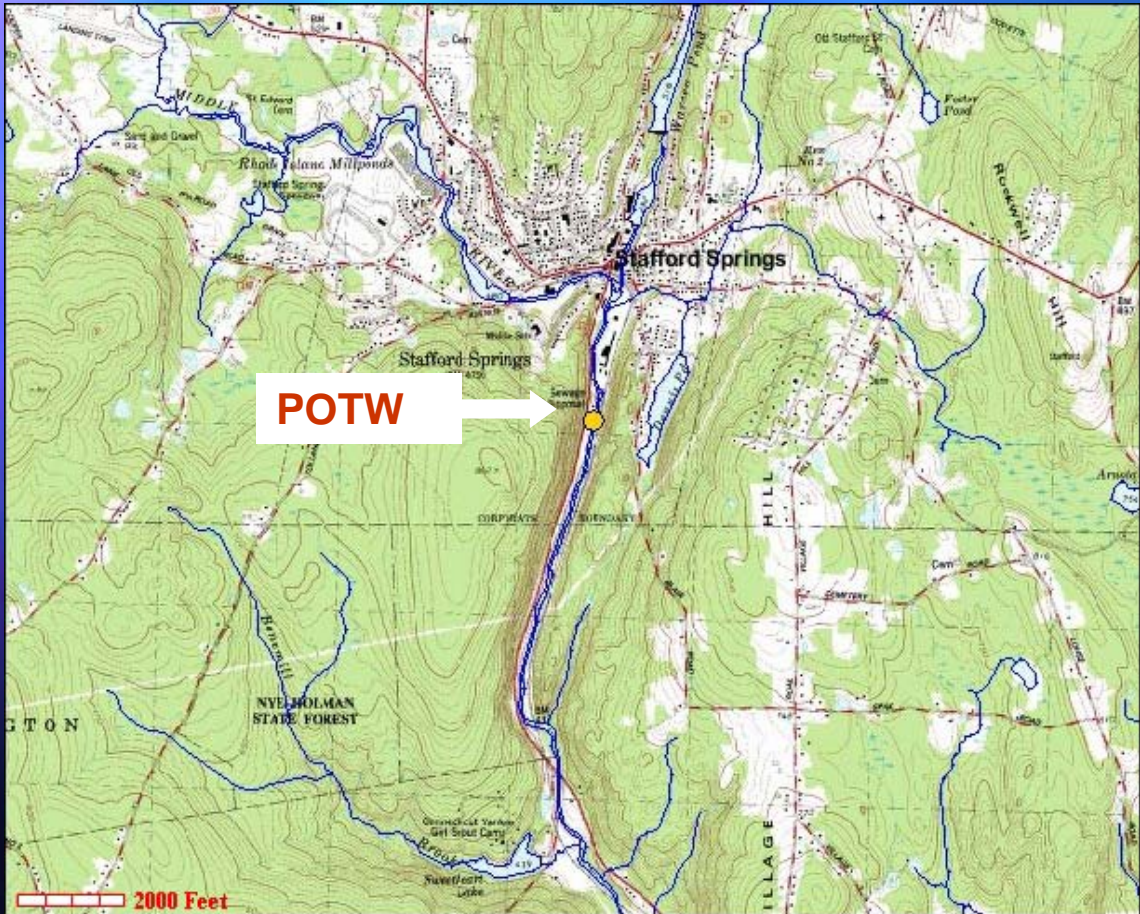
Presented by
Chris Bellucci,
Connecticut Dept of Environmental Protection

TMDLs and SI

- Often times the data used to “list” a waterbody are insufficient for TMDL development.
- CT 2002 Impaired Waters List has 87 waterbody segments for ALUS where cause is unknown
- SI can be one of the tools to help solve the complex nature of aquatic life impairments



Willimantic River Study Area

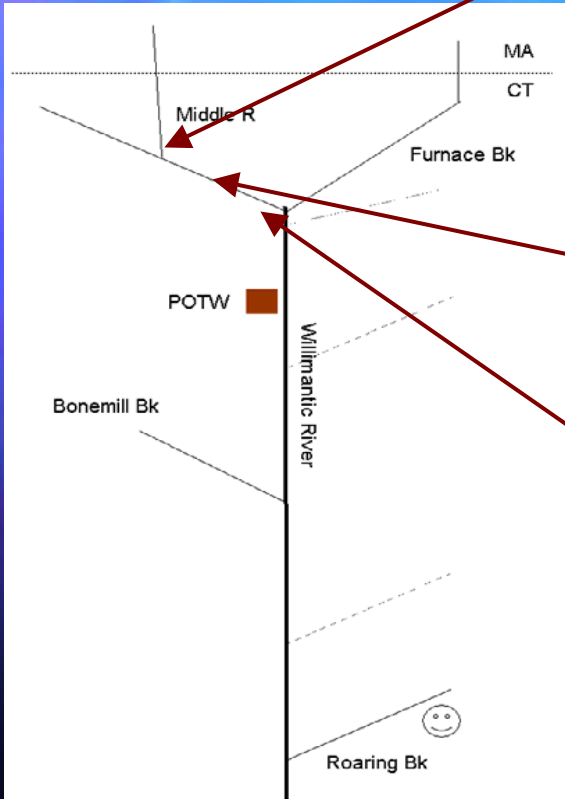
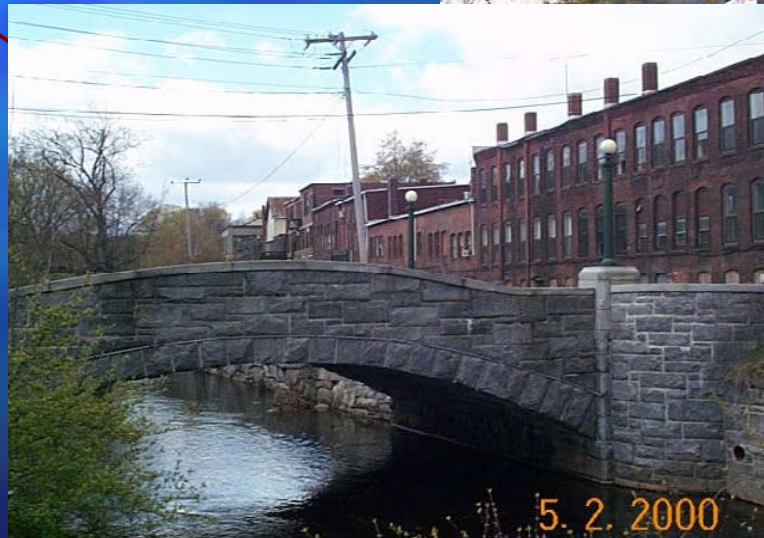
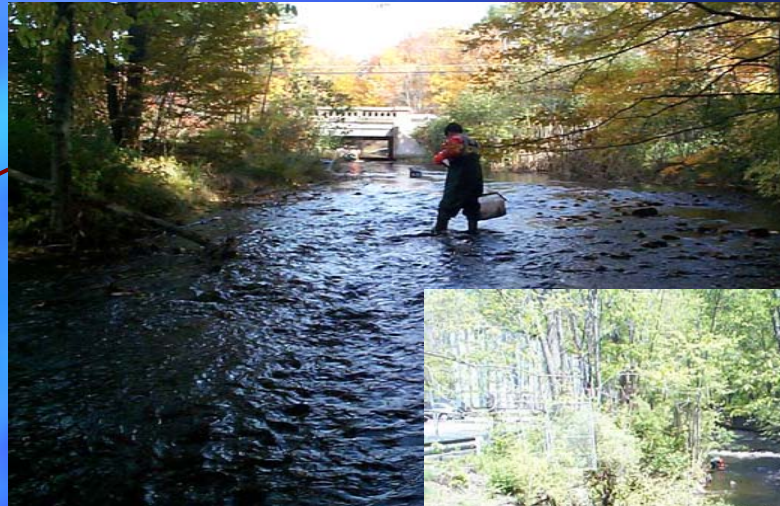


1:39409
Dec 17, 2002

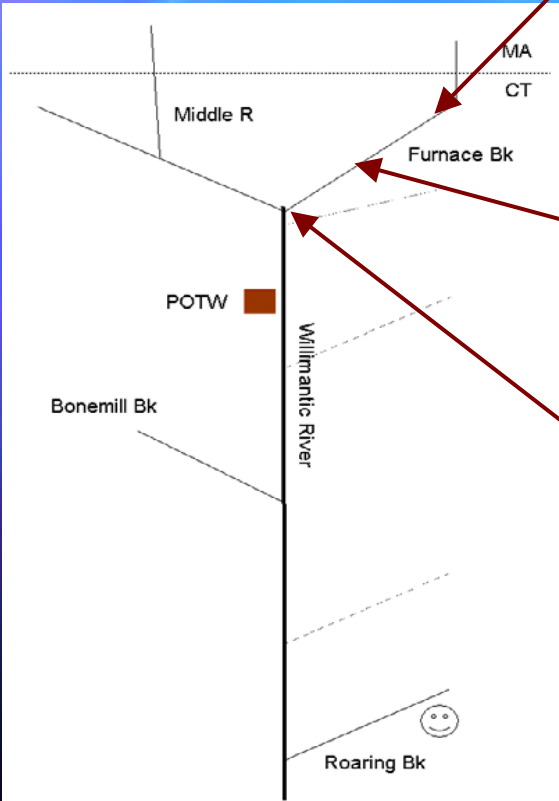


- '98 303(d) List based on desktop dilution calculations
- TMDLs target Cu, Pb, Zn
- POTW main focus 2 MGD Design Q IWC ~ 25%

Middle River



Furnace Brook

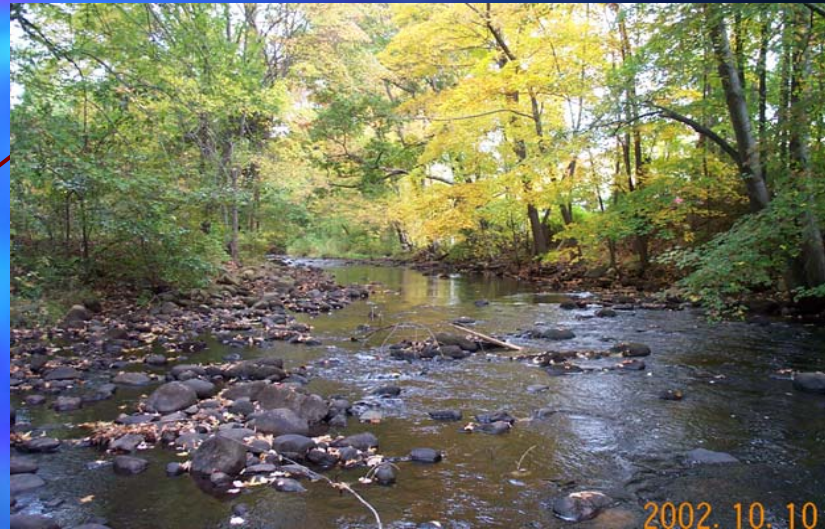
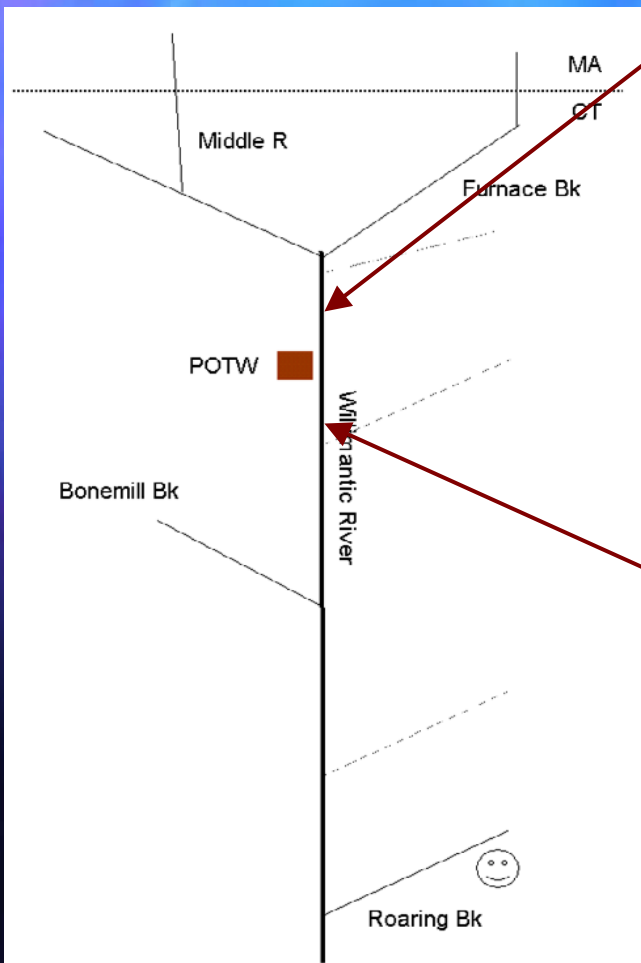


Stafford Springs

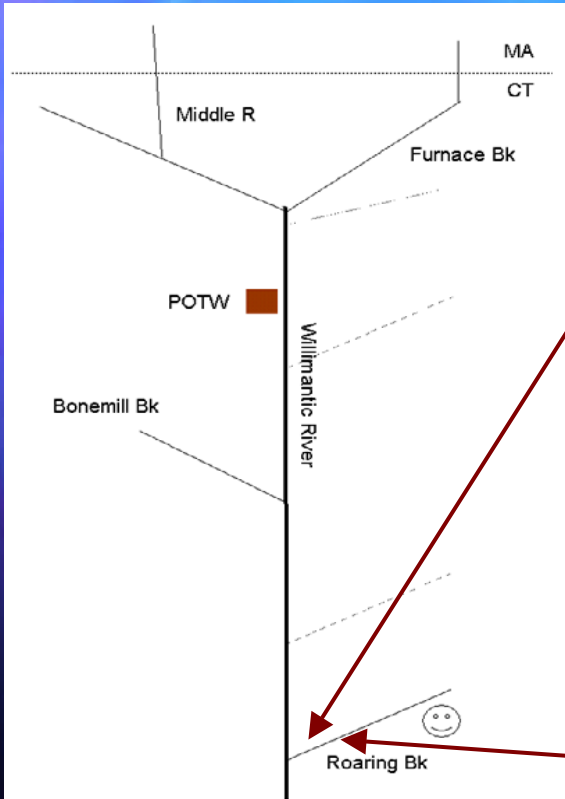
- Incorporated as a town in 1719
- Business Center
- Historic Mill Town (Textile)
- Industry in watershed include Woolen Mills, Manufacturing of Printed Circuit board and Filters



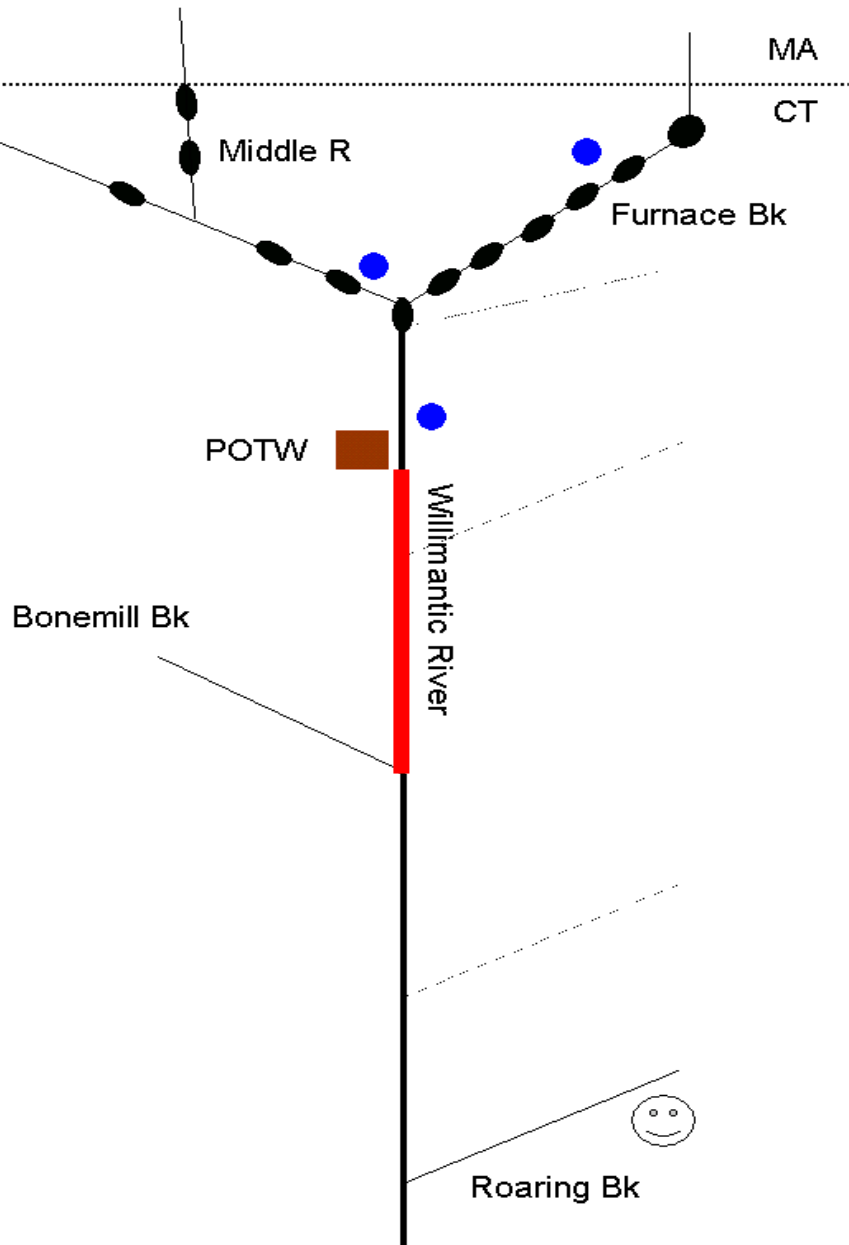
Willimantic River



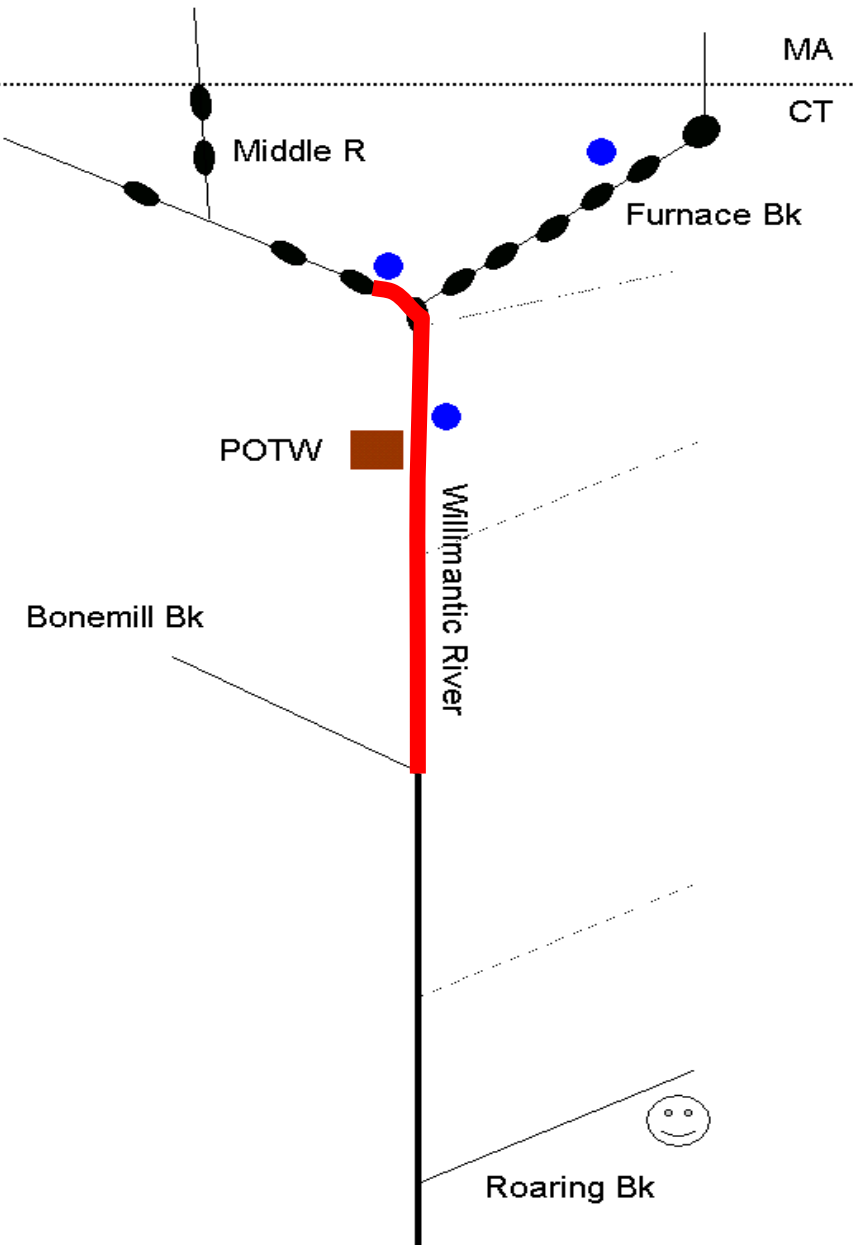
Reference Site



Preliminary Thoughts



After 1 Year Additional Data



Where Do We Go From Here ?

- List potential causes
- Develop conceptual model
- Collect additional data
- Validate ideas in model with data



Potential Causes of Impairment

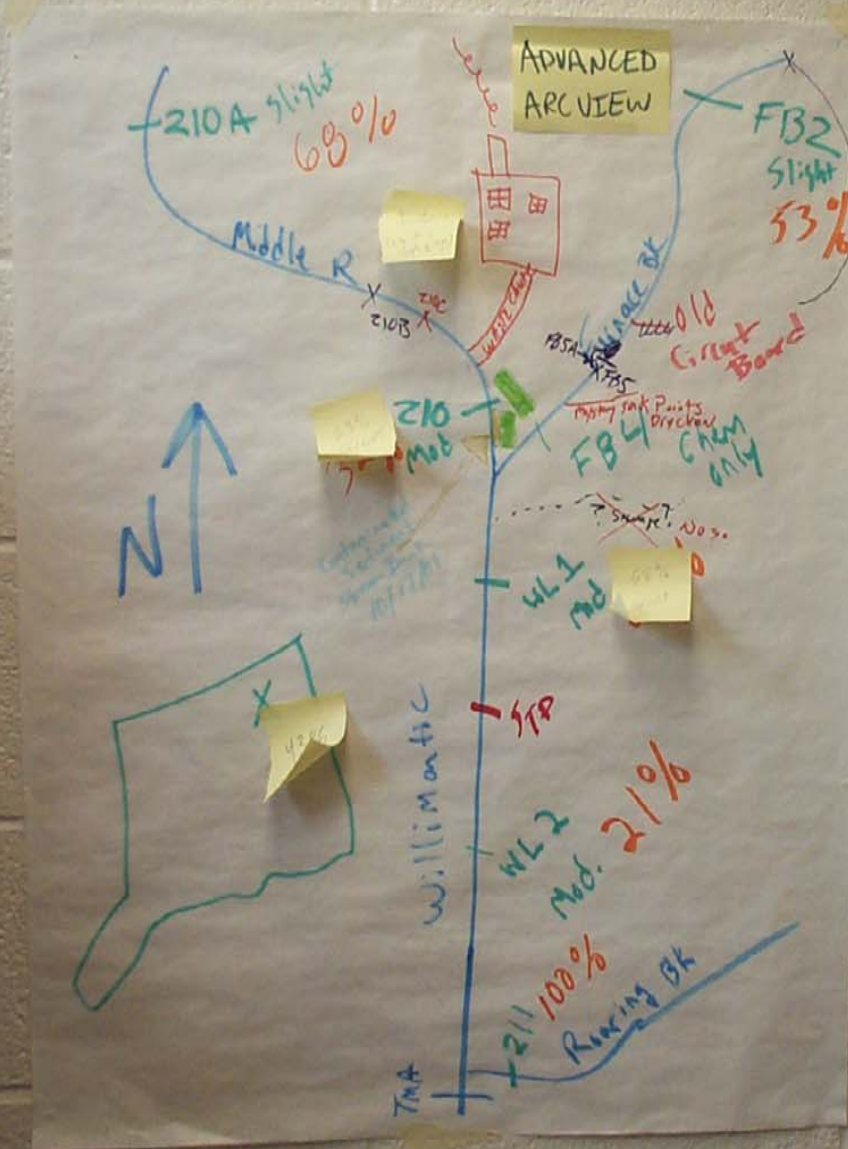
CTDEP

Metals
Impoundments?
Lack of flow during dry
periods?
Urban Runoff?
Sedimentation?
Unknown Toxicity (water
column and sediment)?
Habitat?

Cincy SI Workshop

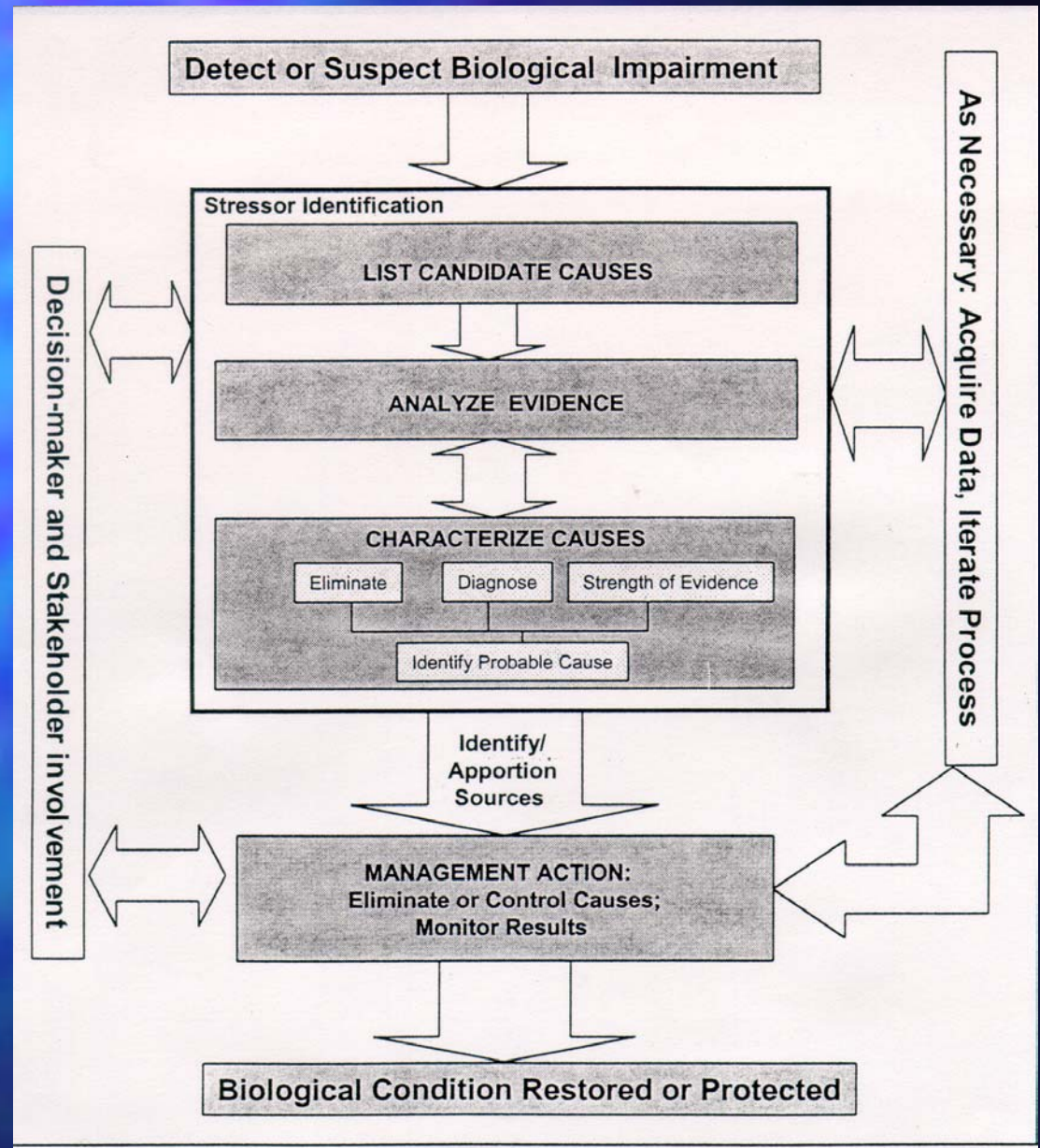
Metals Toxicity?
Nutrients?
High Flows?
Habitat Loss?
Low DO?
High Temps?
PAH in sediments

Model Development Using Advanced Arcview

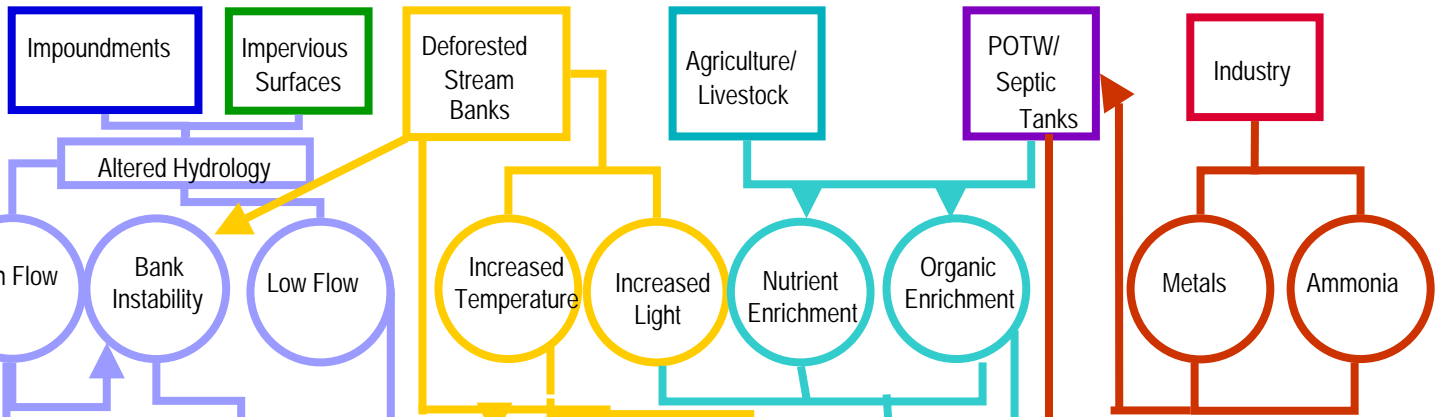


1999. 5. 31

SI Procedure

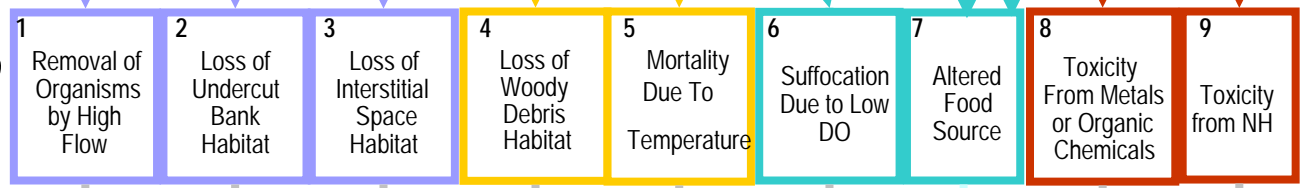


Sources



Conceptual Model-Willimantic

Candidate Causes



Effects



List Candidate Causes

1. Removal of organisms by high flow
2. Loss of habitat associated with undercut banks
3. Loss of habitat associated with interstitial space
4. Loss of habitat associated with woody debris
5. Mortality due to elevated temperature
6. Suffocation due to low DO
7. Competitive exclusion due to altered food source
8. Acute or chronic toxicity from metals or organic chemicals
9. Toxicity from ammonia (NH_3)

Analyze Evidence and Eliminate

1. Removal of organisms by high flow
2. Loss of habitat associated with undercut banks
- 3. Loss of habitat associated with interstitial space**
4. Loss of habitat associated with woody debris
- 5. Mortality due to elevated temperature**
- 6. Suffocation due to low DO**
- 7. Competitive exclusion due to altered food source**
- 8. Acute or chronic toxicity from metals or organic chemicals**
9. Toxicity from ammonia (NH₃)

Eliminate Improbable Causes

5. Mortality due to elevated temperature:

Unlikely due to shade and similar temperatures throughout watershed

6. Suffocation due to low dissolved oxygen (DO) :

Unlikely due to many riffles, DO levels were at or near saturation

Probable Causes Remaining

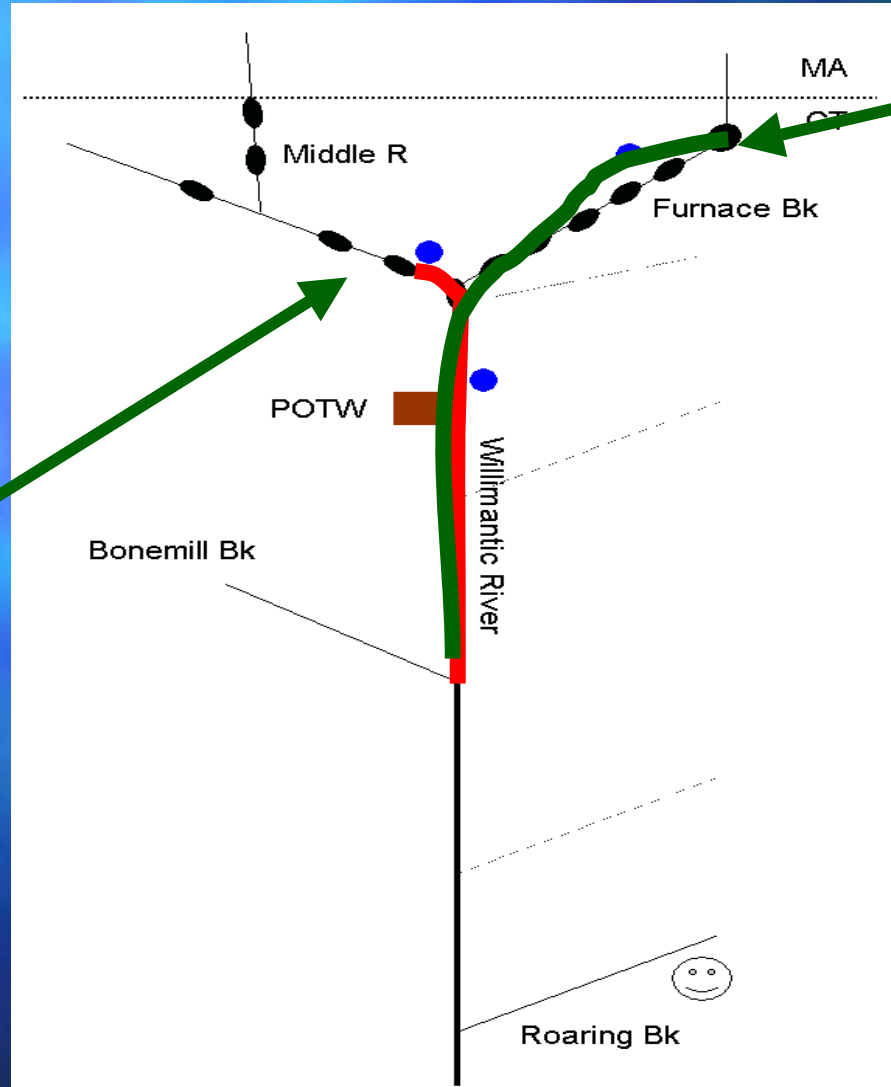
- 3. Loss of habitat associated with interstitial space**
- 7. Competitive exclusion due to altered food source**
- 8. Acute or chronic toxicity from metals or organic chemicals**

Strength of Evidence

Candidate cause	Consistency of evidence	Coherence of evidence
Toxicity	Multiple inconsistencies	Might be episodic
Loss of habitat	Consistent, but decrease not sufficient	
Competitive exclusion	Consistent, but data not sufficient	

Iteration- Revisit Candidate Causes

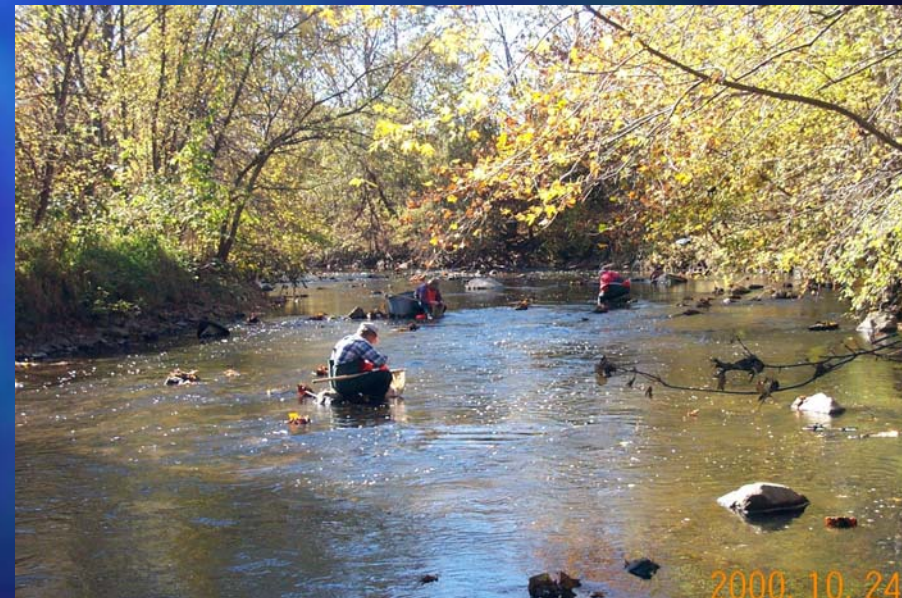
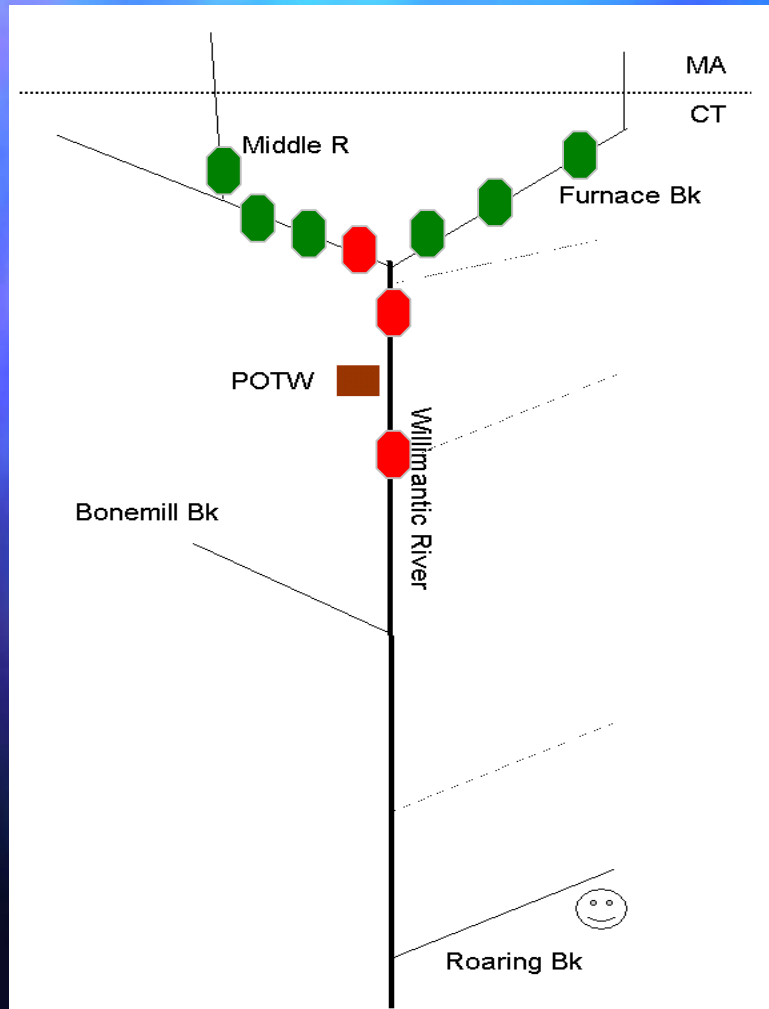
Unknown
toxicity?



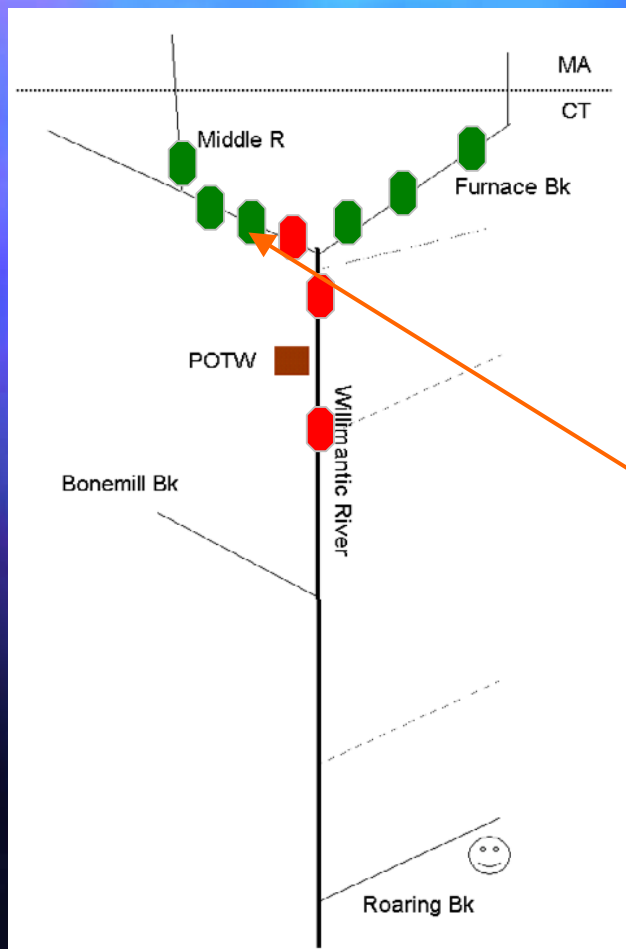
Sediment
load?

Increase
FPOM?

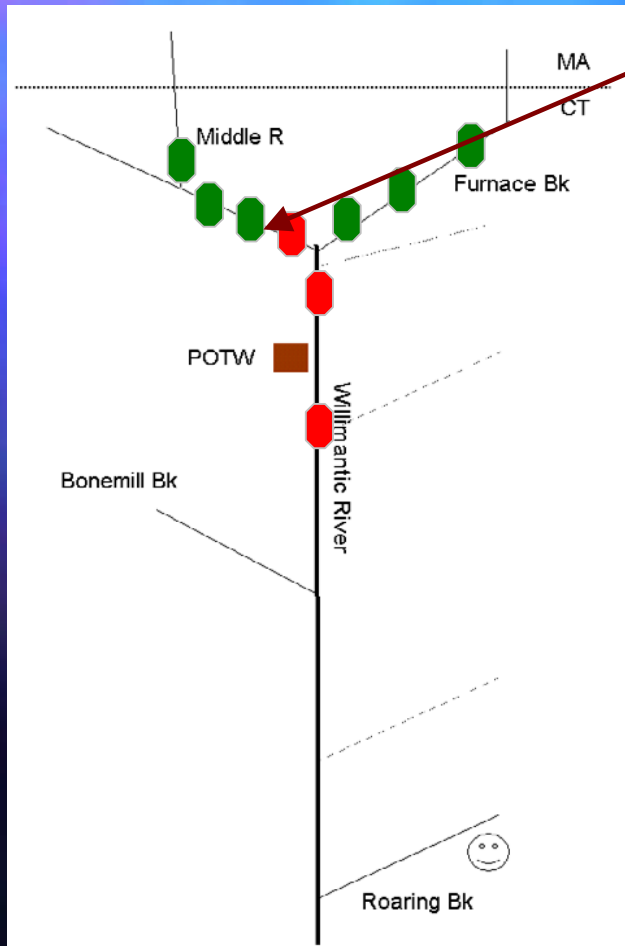
Macroinvertebrate Swat Team



Bugs Tell the Story



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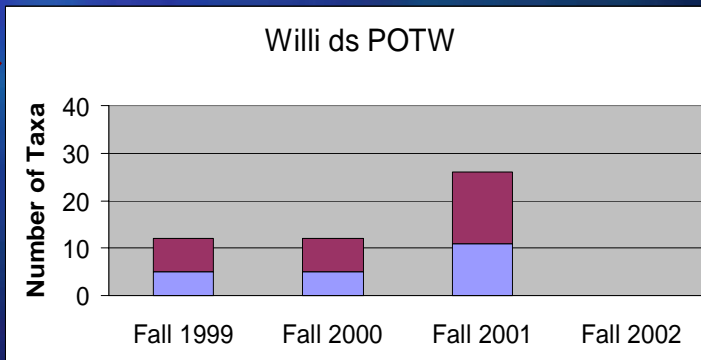
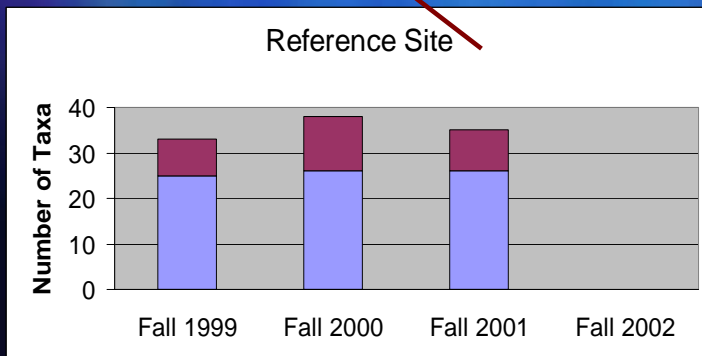
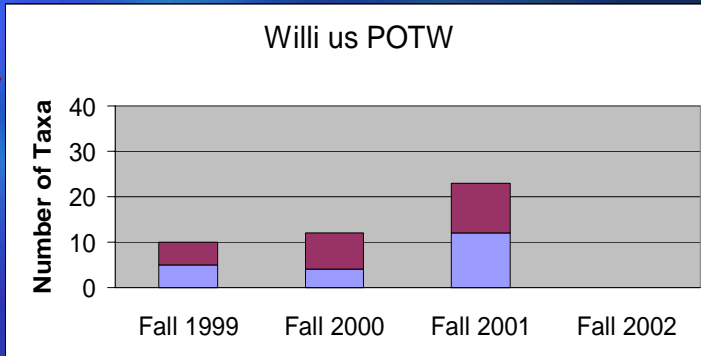
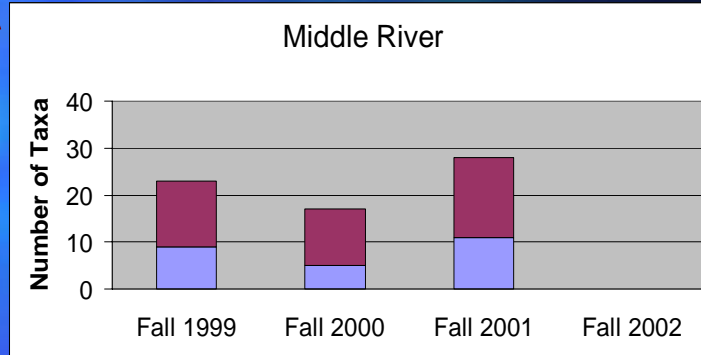
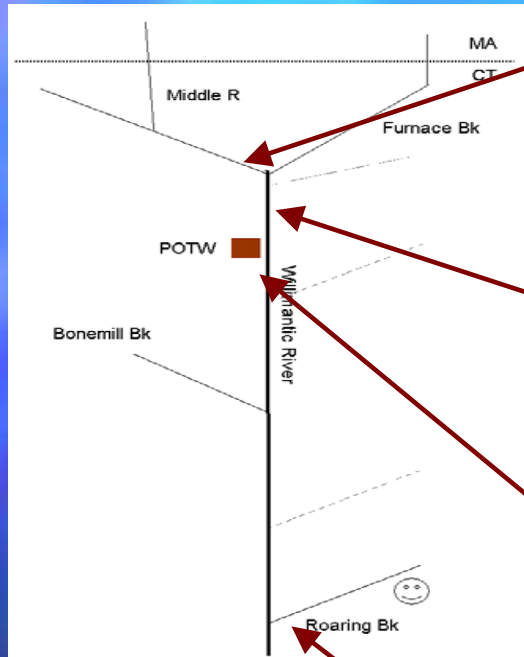
Management Actions



- Reroute illicit discharge to sewer
- Adopt TMDLs for Cu, Pb, Zn w/ revised limits for POTW
- Water Company removes Zn in supply
- POTW begins mass balance study and installs anthracite filters
- Industries issued orders to reduce metals loading to POTW
- Continue biological and chemical monitoring

Taxa Richness and EPT

■ EPT Taxa



Lessons

- Investigative process is what is important
- Listen to the Bugs....
- CTDEP and Cincy SI Group arrived at a similar list of Candidate Causes
- SI neophyte shouldn't be intimidated by the new terminology