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Summary of the Impacts of Urbanization on Selected Maine Streams Detected by the Maine DEP

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Summary of the Impacts of Urbanization on Selected Maine Streams Detected by the Maine DEP



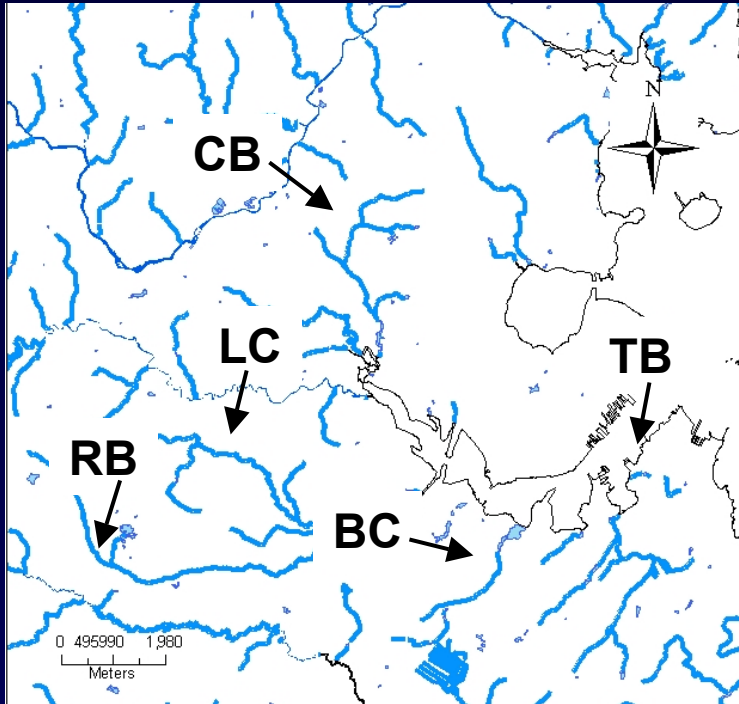
Jeff Varricchione, Maine Department of Environmental Protection
Susanne Meidel, Partnership for Environmental Technology Education

Presentation Objectives

- Present data collected from 2 reference and 8 study streams in Maine
 - biological data
 - physical and chemical data
 - hydrological and habitat data
- Summarize findings
- Where we go from here

Map of Study Streams

Portland Area Streams



Portland: Capisic Brook 2 km

South Portland: Long Creek

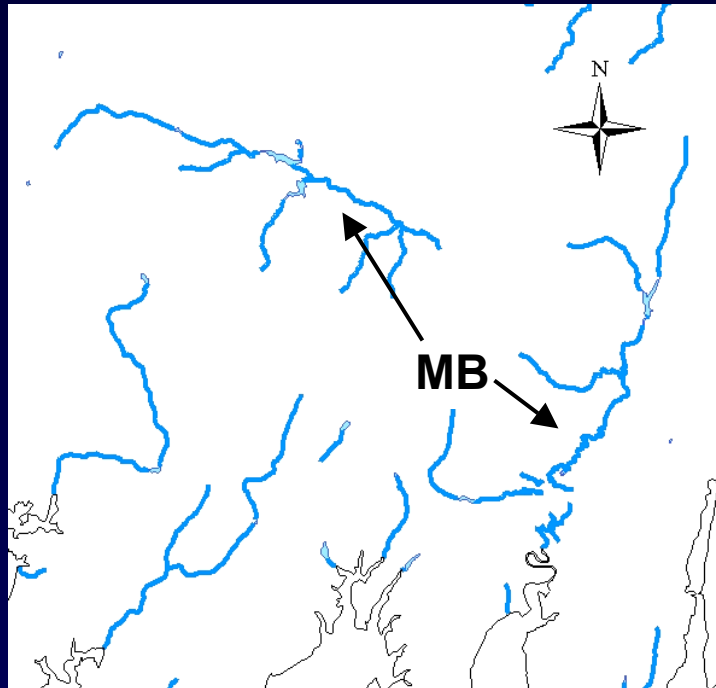
Trout Brook Barberry Creek

Scarborough: Red Brook



Map of Study Streams

Brunswick Stream



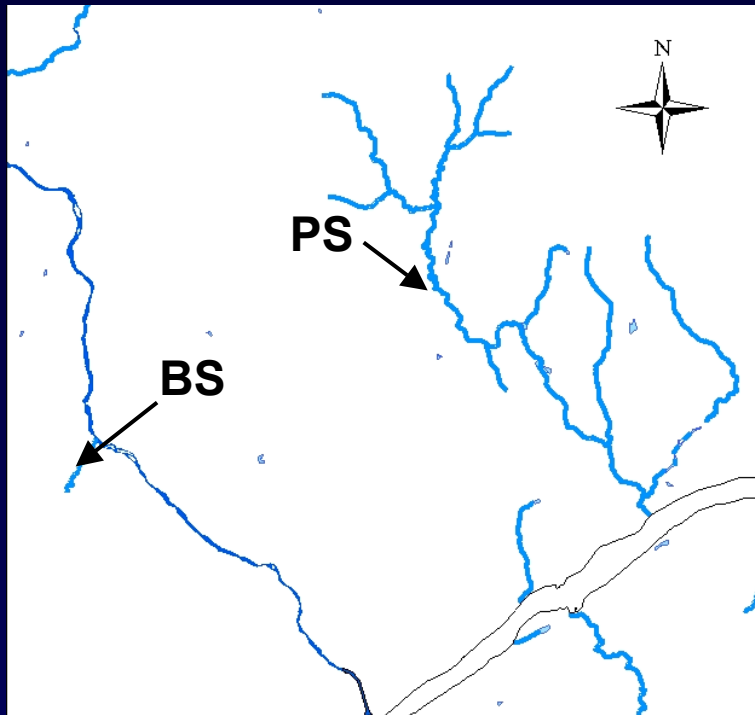
Mare Brook

2 km



Map of Study Streams

Bangor Streams



Birch Stream

2 km

Penjajawoc Stream



Reference Sites

Red Brook,
Scarborough



May 1999

Capisic Brook,
Portland



Upstream, July 2003

Urban Sites

Long Creek,
South Portland



North Branch
June 1999



Mainstem
Dec. 2000



South Branch
June 1999

Urban Sites

Capisic Brook,
Portland



Downstream
September 2003

Barberry Creek,
South Portland



August 2003

Urban Sites

Trout Brook, South Portland



Upstream
September 2003



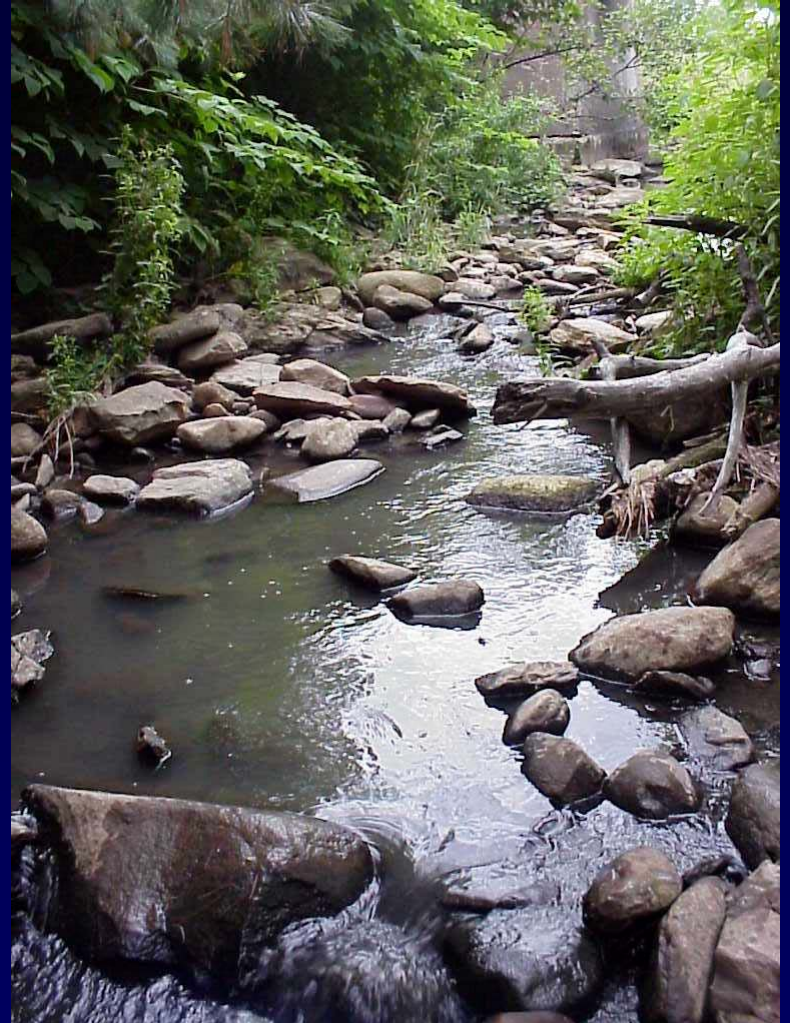
Downstream
June 2003

Urban Sites

Birch Stream, Bangor



Upstream
Summer 1999



Downstream, July 2003

Urban Sites

Penjajawoc Stream, Bangor



July 2003

Maine's Water Classification Program

- Defines water quality classifications for fresh surface waters, as well as estuarine and marine waters.
- River and stream water classes:
 - AA, A, B, and C
- State legislature has assigned classes to every stream and river in the state.

Water Classification Criteria

Narrative Criteria

Numeric Criteria

Aquatic Life (Biological)

Habitat

Dissolved Oxygen

Bacteria (*E. coli*)

Class AA

as naturally occurs

free flowing
and natural

as naturally
occurs

as naturally
occurs

Class A

as naturally occurs

natural

7mg/L; or
75% sat.

as naturally
occurs

Class B

support all aquatic species
indigenous to the receiving
water; no detrimental changes
to the resident biological
community

unimpaired

7 mg/L; or
75% sat.

427/100
ml (instan-
taneous)

Class C

maintain the structure and
function of the resident
biological community

habitat for fish
and other
aquatic life

5 mg/L; or
60% sat.

949/100
ml (instan-
taneous)

BioME Model

- BioME is a statistical model that uses biological data to predict the likelihood of a sample attaining classes **A**, **B**, **C**, or **NA**.
- BioME was developed and calibrated using:
 - 25 biological variables
 - 373 samples representing a range of conditions
 - 15+ years of data.
- For more information, see MDEP Biomonitoring website:
www.state.me.us/dep/blwq/docmonitoring/biomonitoring/index.htm

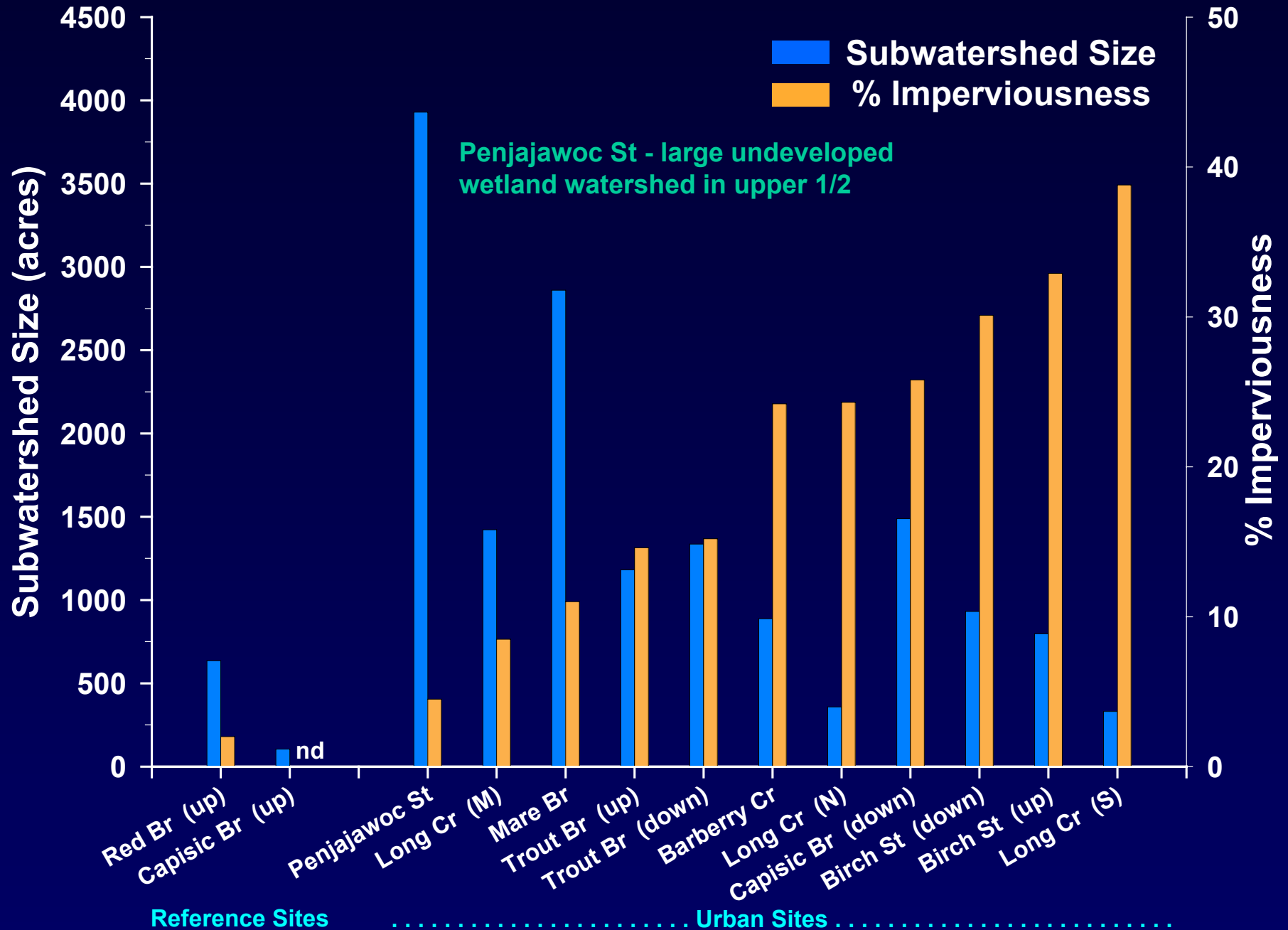
Comparison of Assigned Class versus Statistical Model Class

Reference Sites	<u>Assigned Class</u>	<u>Statistical Model Class</u>
Red Brook	C	A
Capisic Brook up	C	A, C

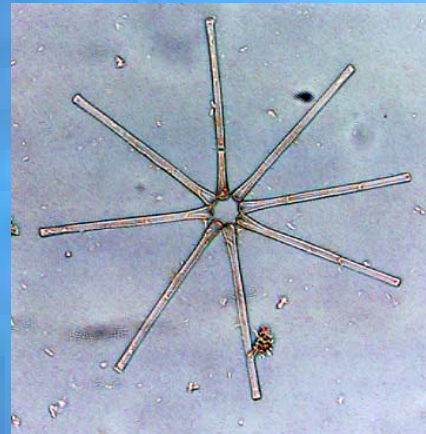
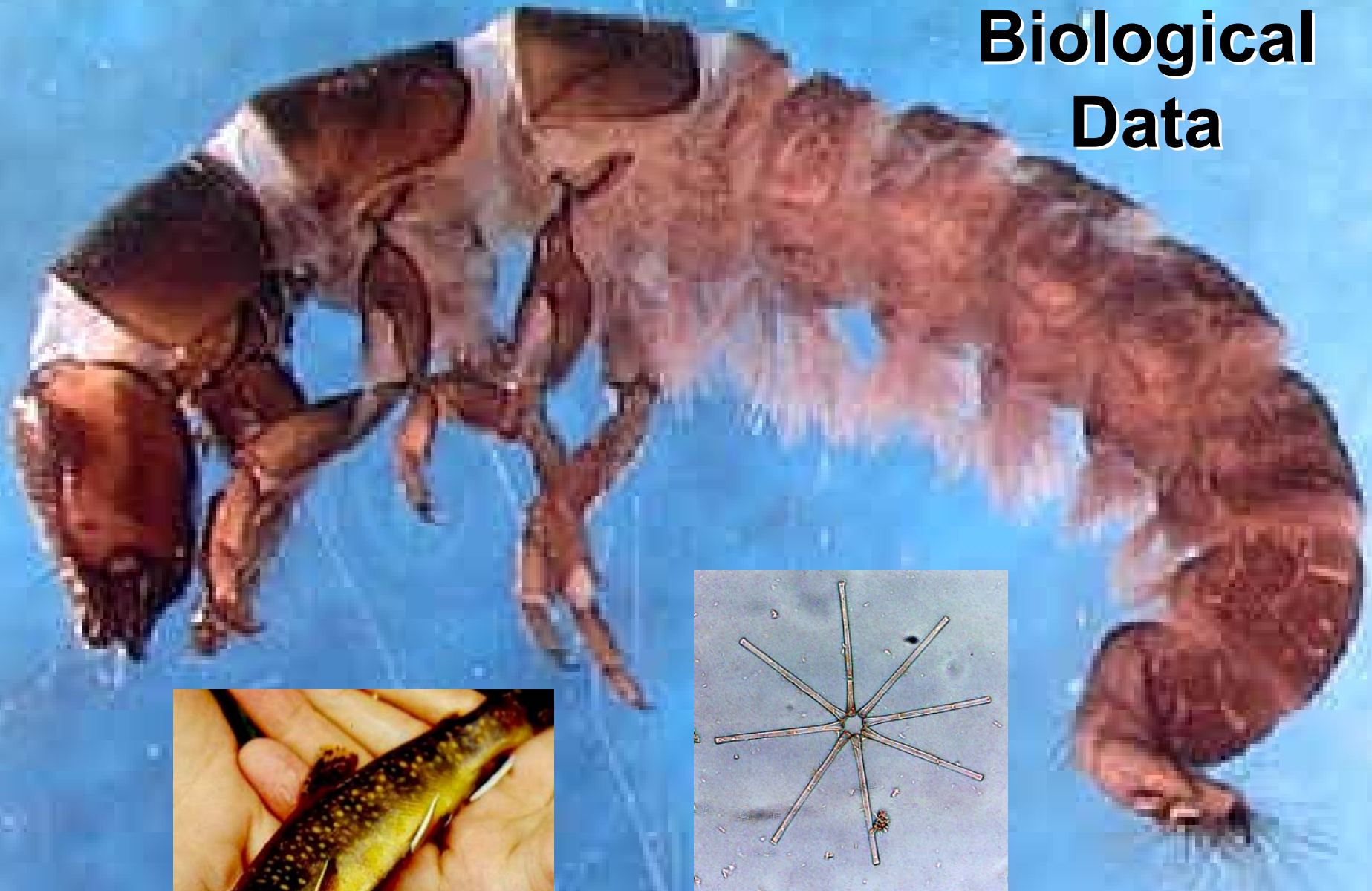
Urban Sites

Long Creek	northern	C	NA
	mainstem	C	C
	southern	C	C
Capisic Brook	down	C	NA, NA
Trout Brook	up	C	NA, B, NA
	down	C	nd
Barberry Creek		C	NA
Birch Stream	down	B	NA, NA, C (NA)
	up	B	NA
Mare Brook		B	NA, NA
Penjawoc Stream		B	NA, NA, NA

Subwatershed Size and % Imperviousness



Biological Data



Sensitive and Intermediate Species

Dragonflies and Damselflies



Mayflies



Stoneflies

Plecoptera



Caddisflies



Tolerant Species

Scuds



Snails



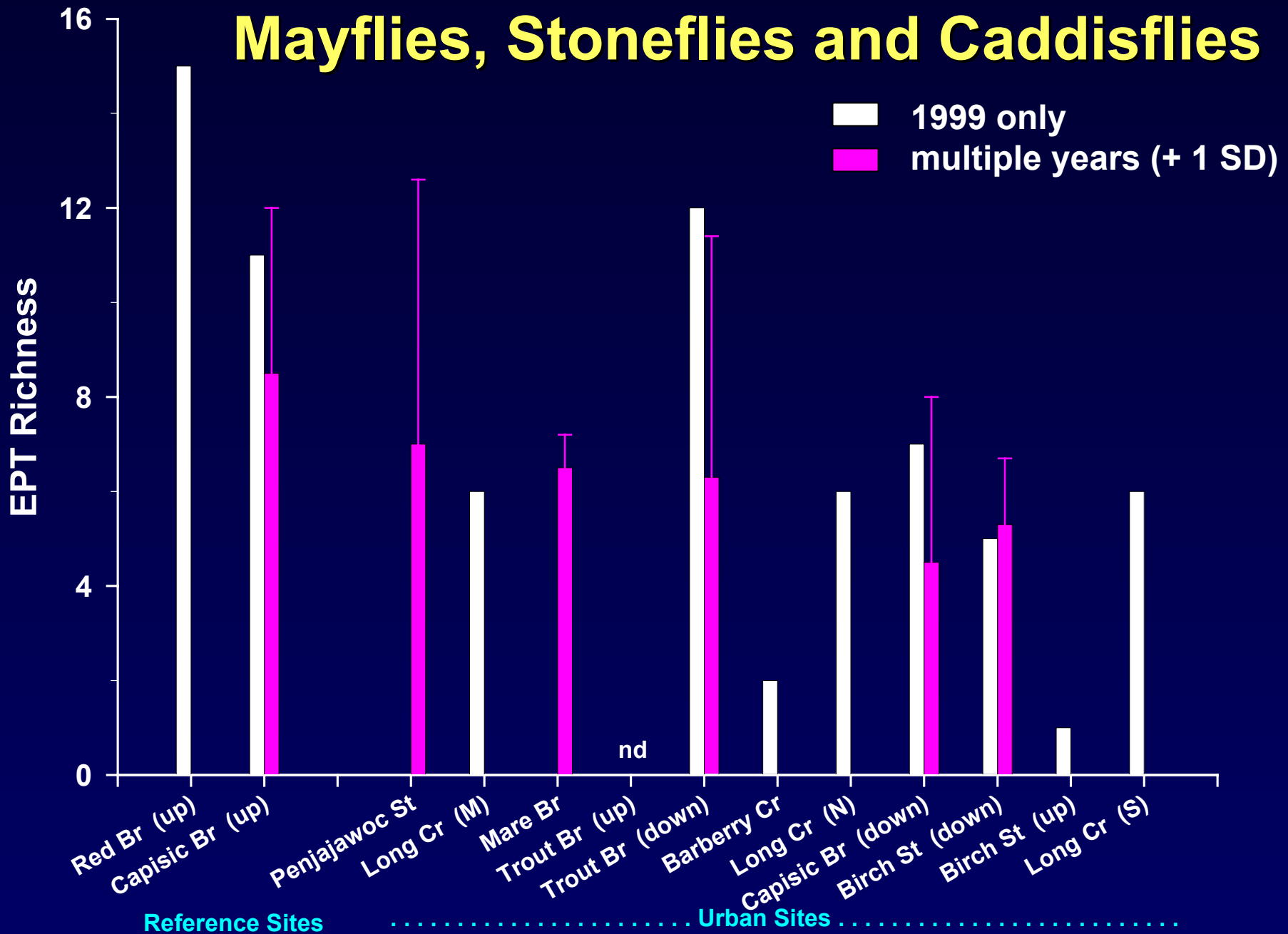
Leeches



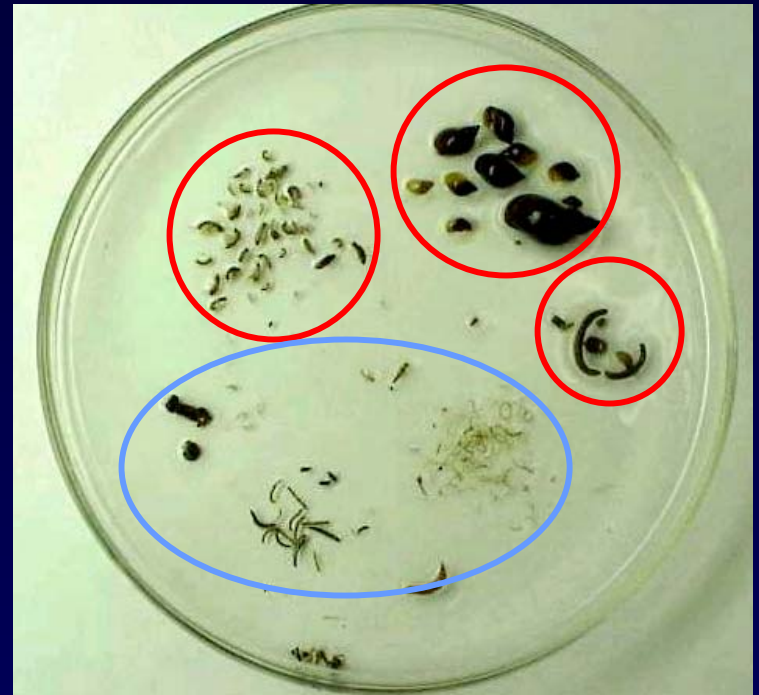
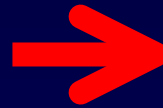
Midges



Number of Different Kinds of Mayflies, Stoneflies and Caddisflies



Reference versus Urban Streams

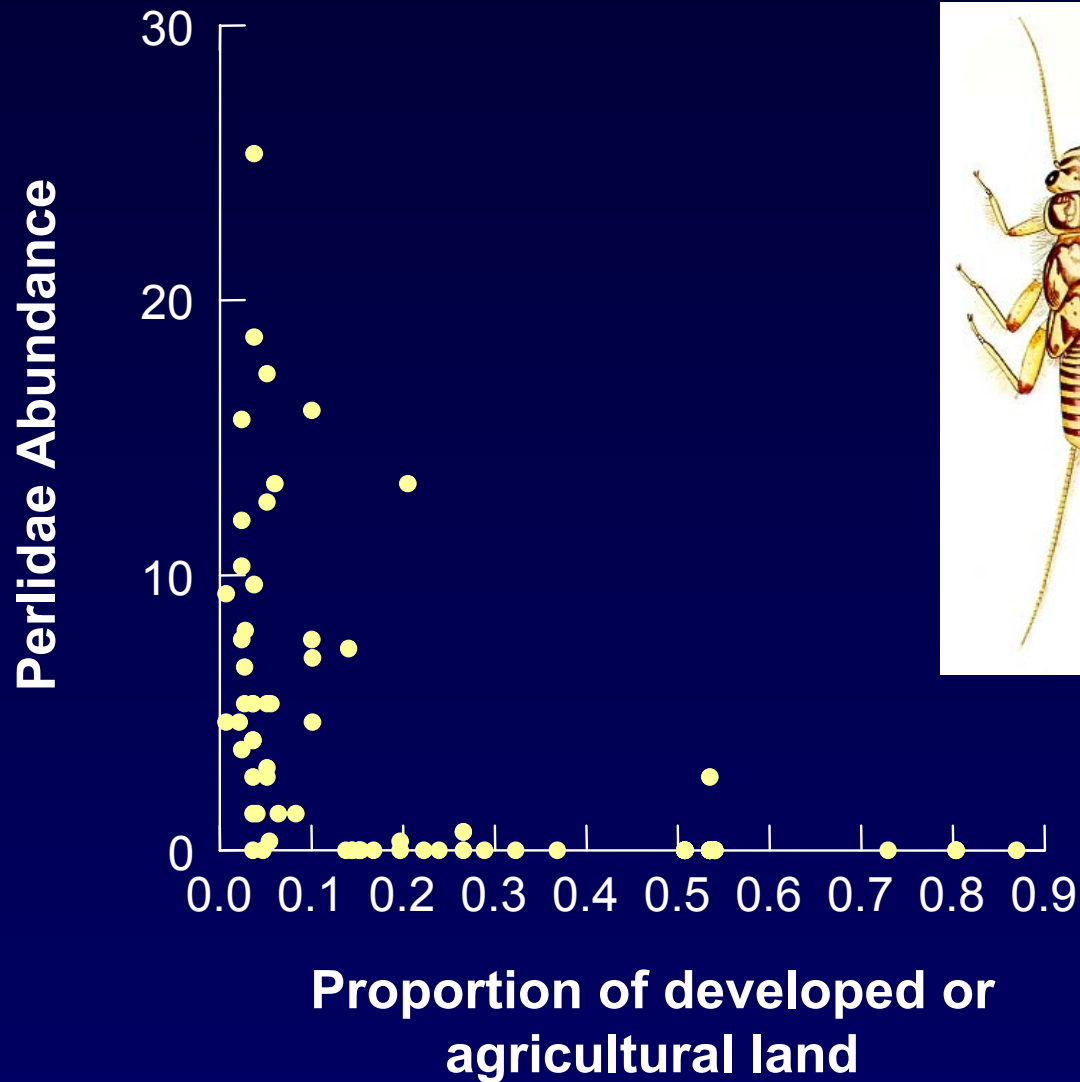


Shift from **insect** to **non-insect** taxa

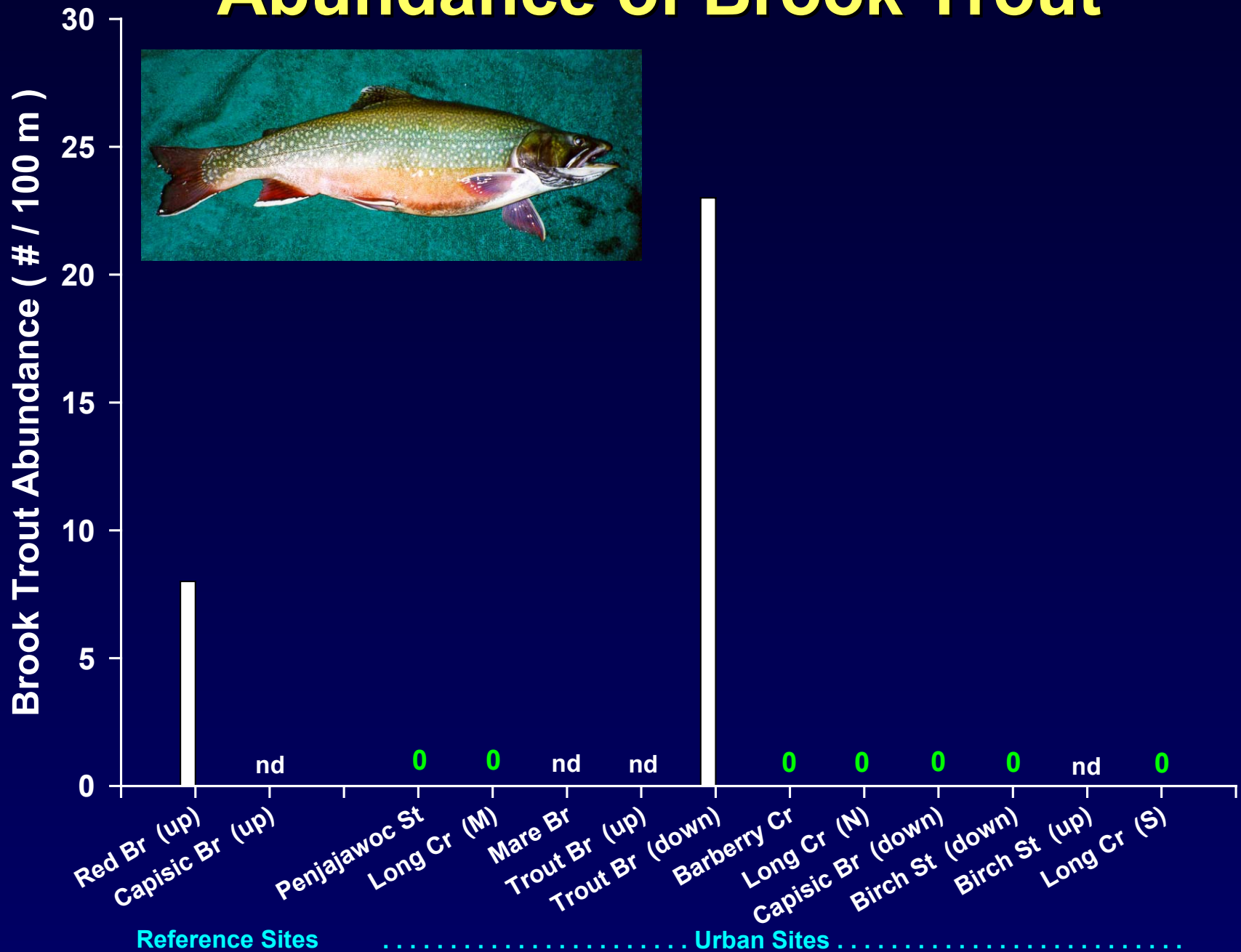
Percentage of Organisms That Are Not Insects



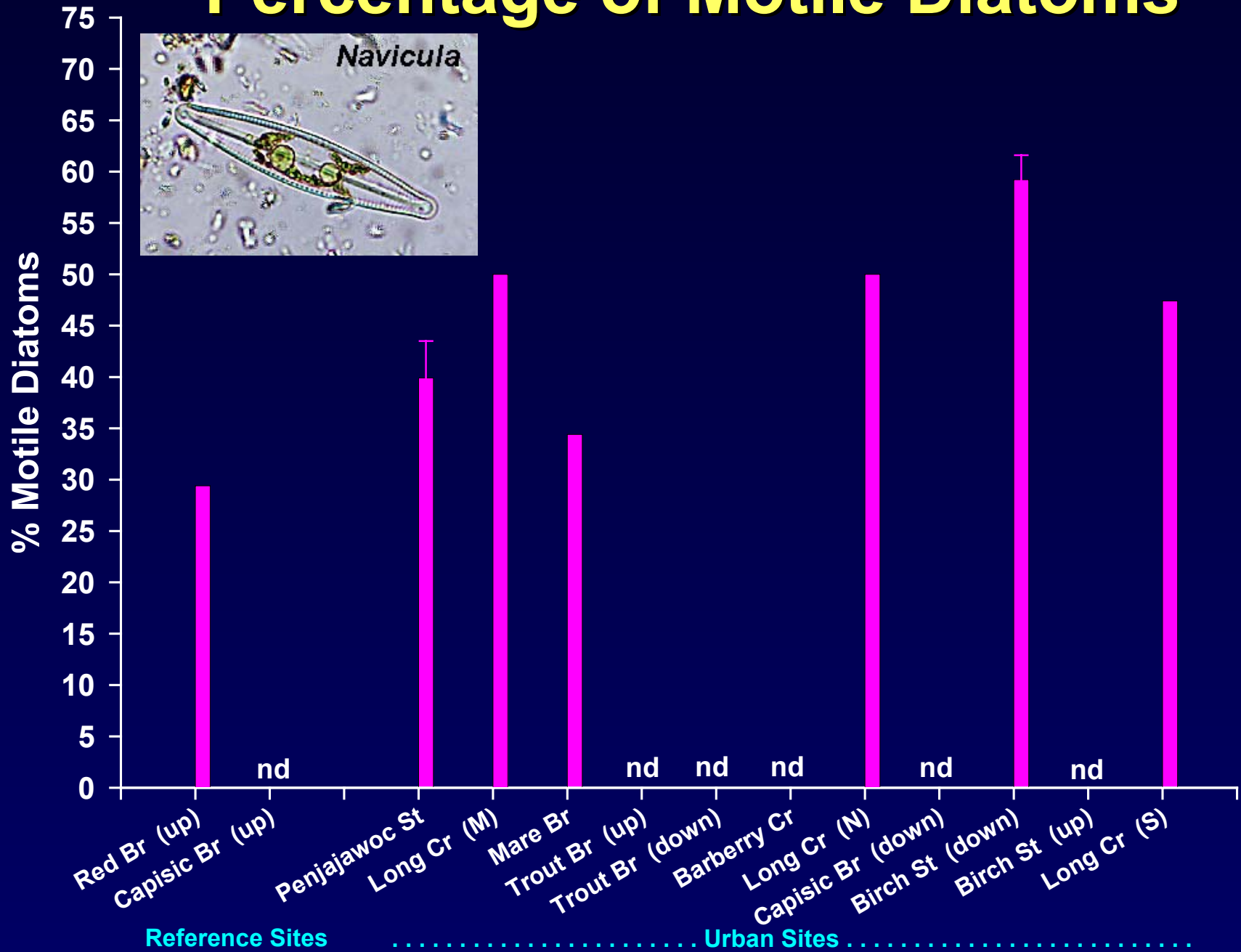
Stonefly Abundance and Land Use



Abundance of Brook Trout



Percentage of Motile Diatoms



Temperature

Oxygen

TSS

Chloride

Physical and Chemical Data

Zinc

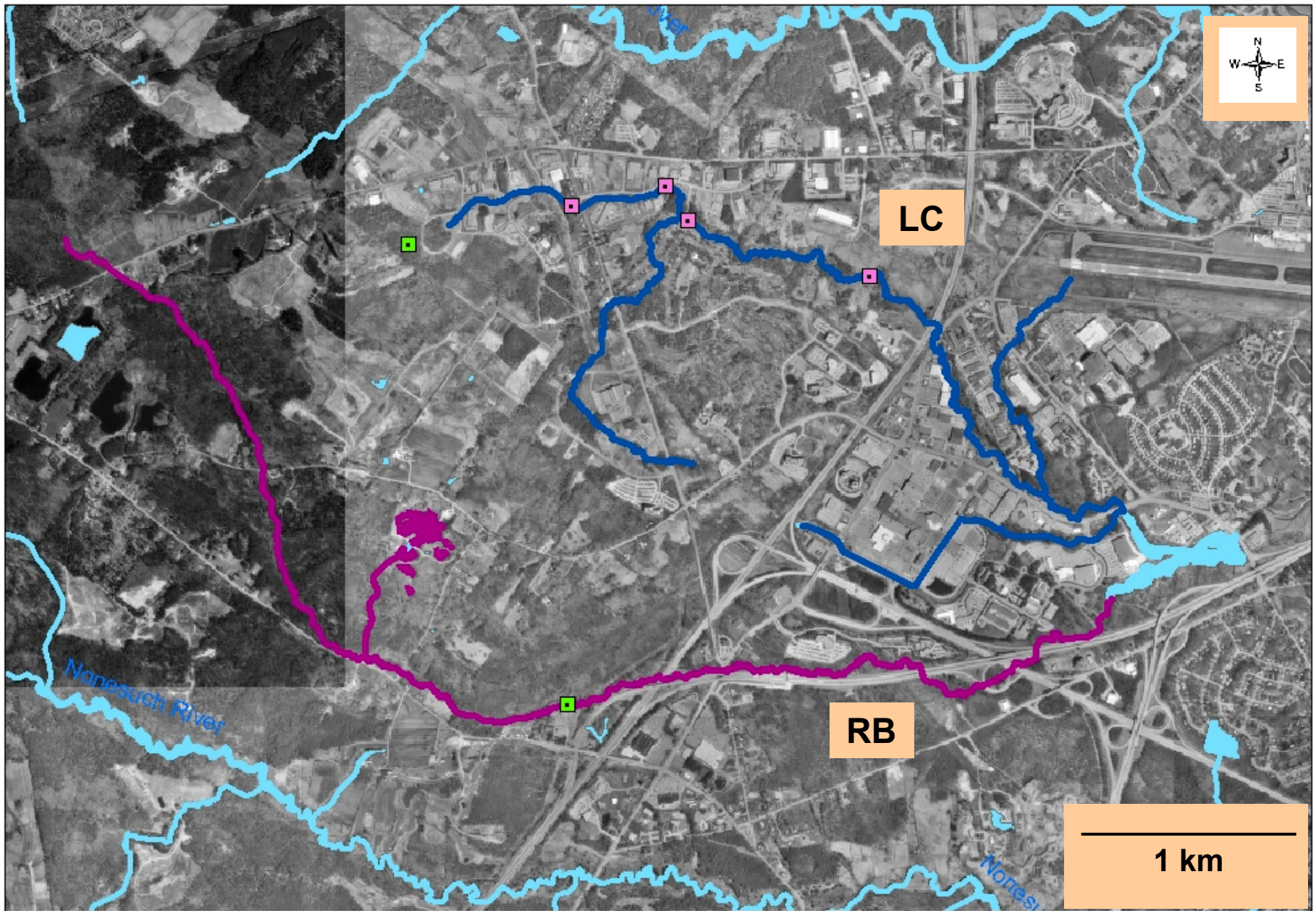
Lead

Conductivity

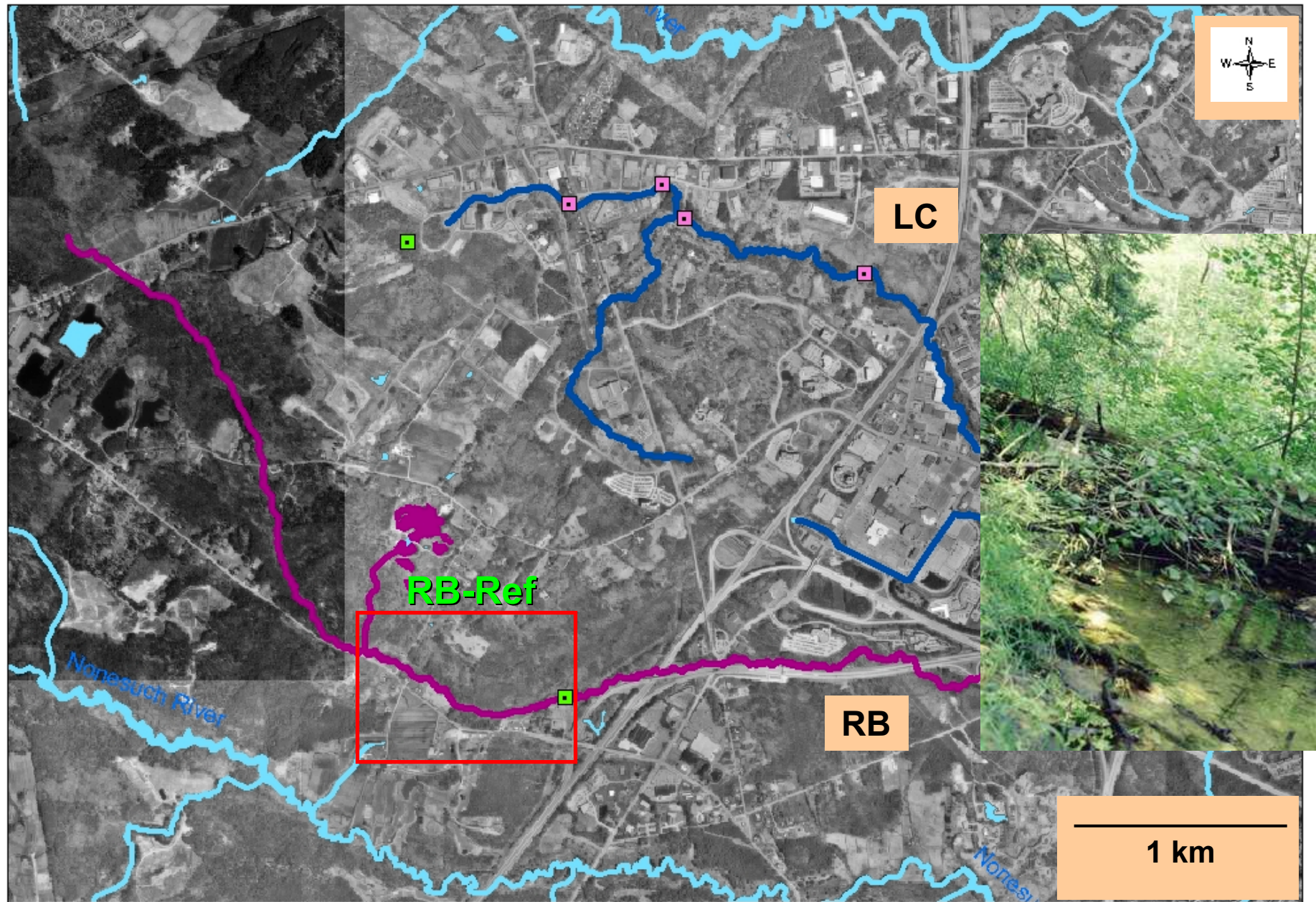
Temperature Study in Long Creek and Red Brook

Summer 2000

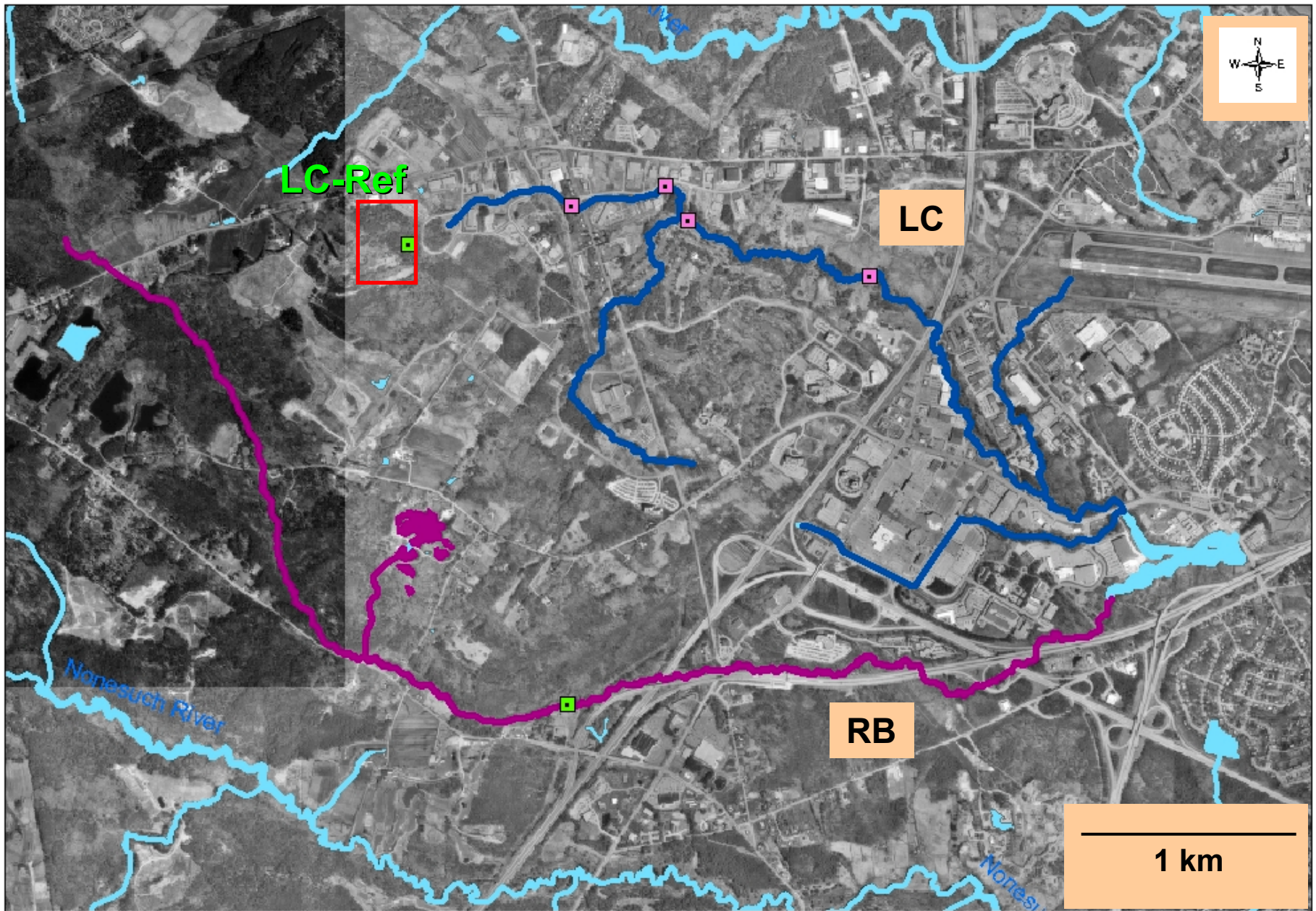
Aerial Photo of Study Streams and Sites



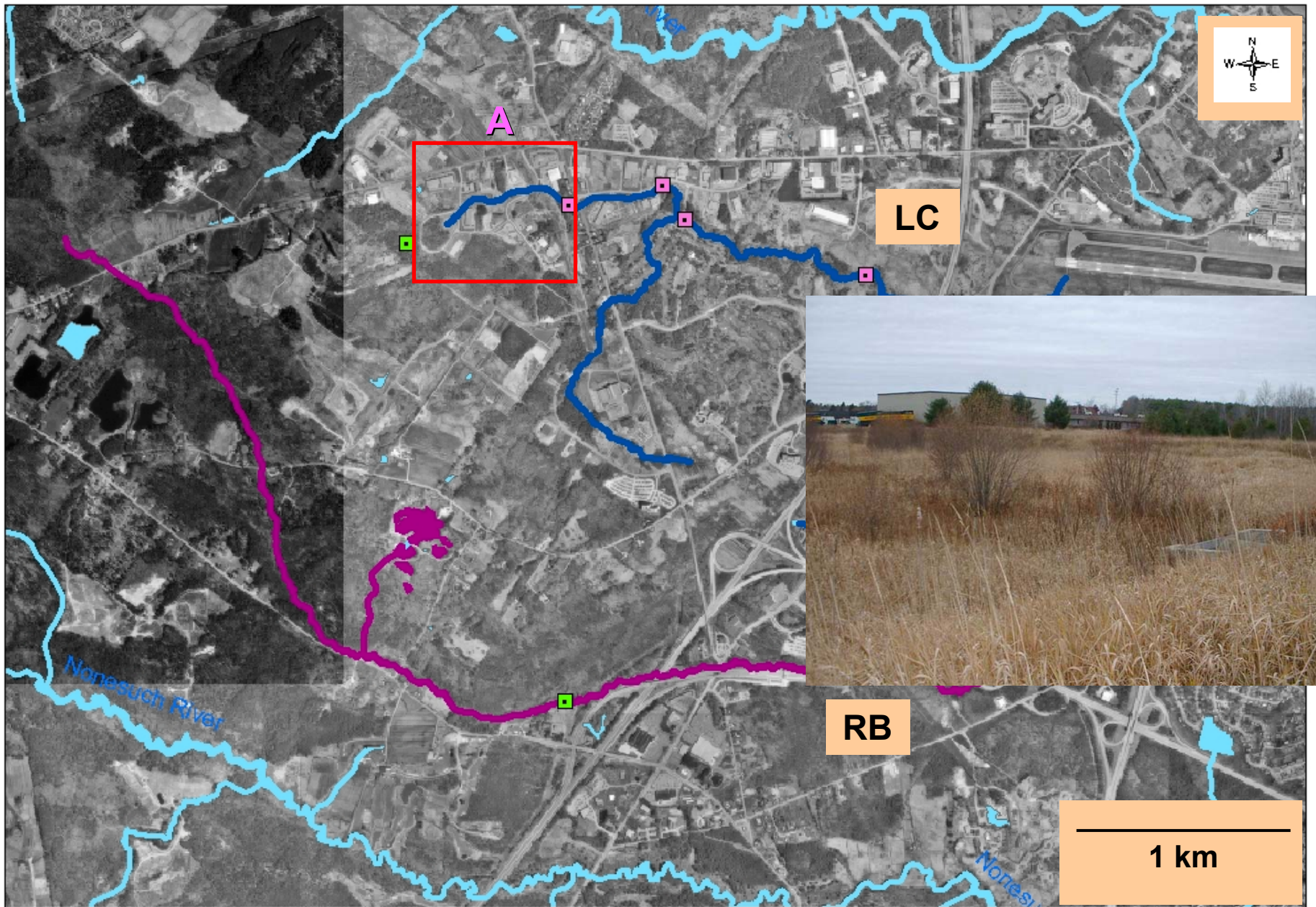
Aerial Photo of Study Streams and Sites



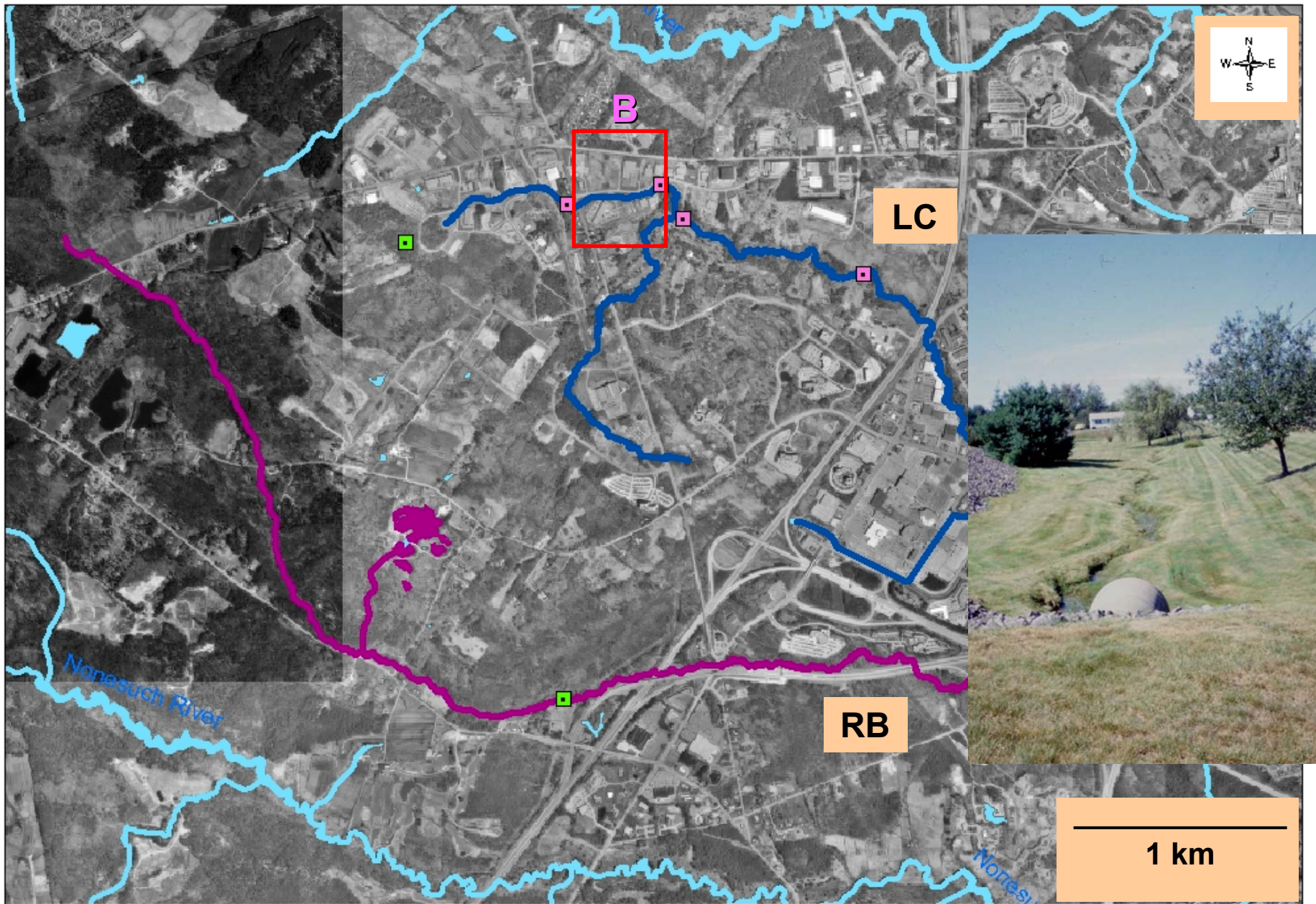
Aerial Photo of Study Streams and Sites



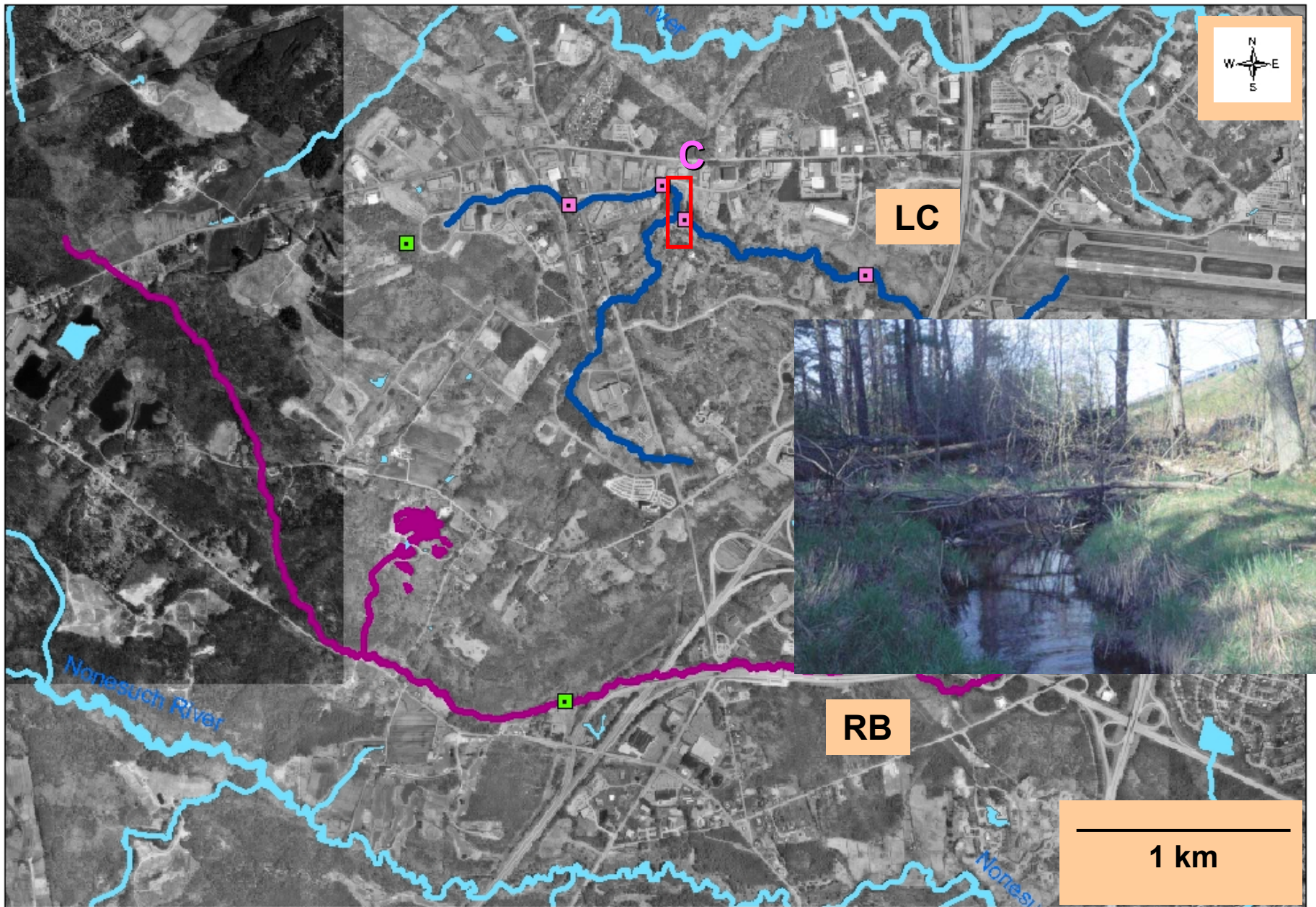
Aerial Photo of Study Streams and Sites



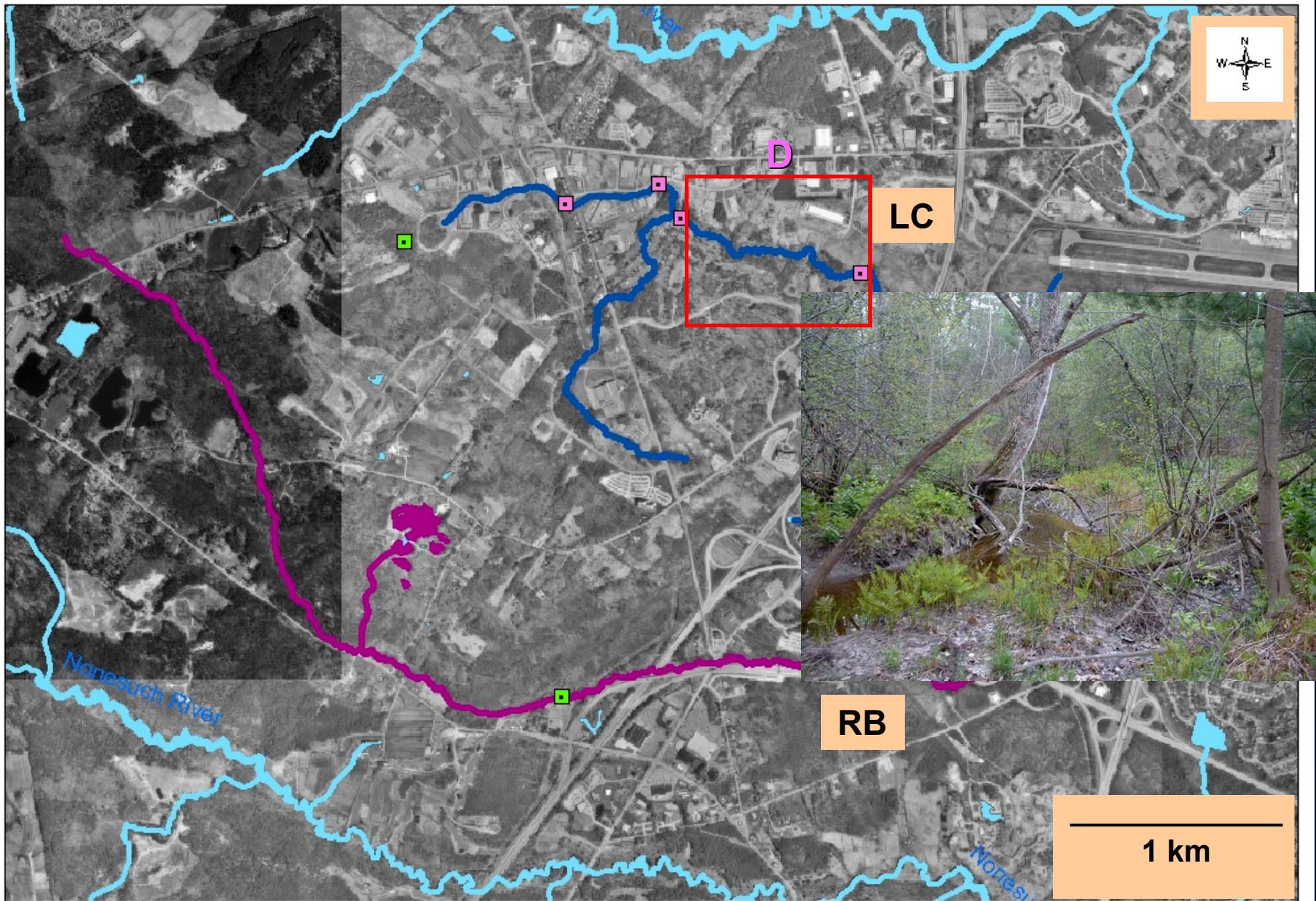
Aerial Photo of Study Streams and Sites



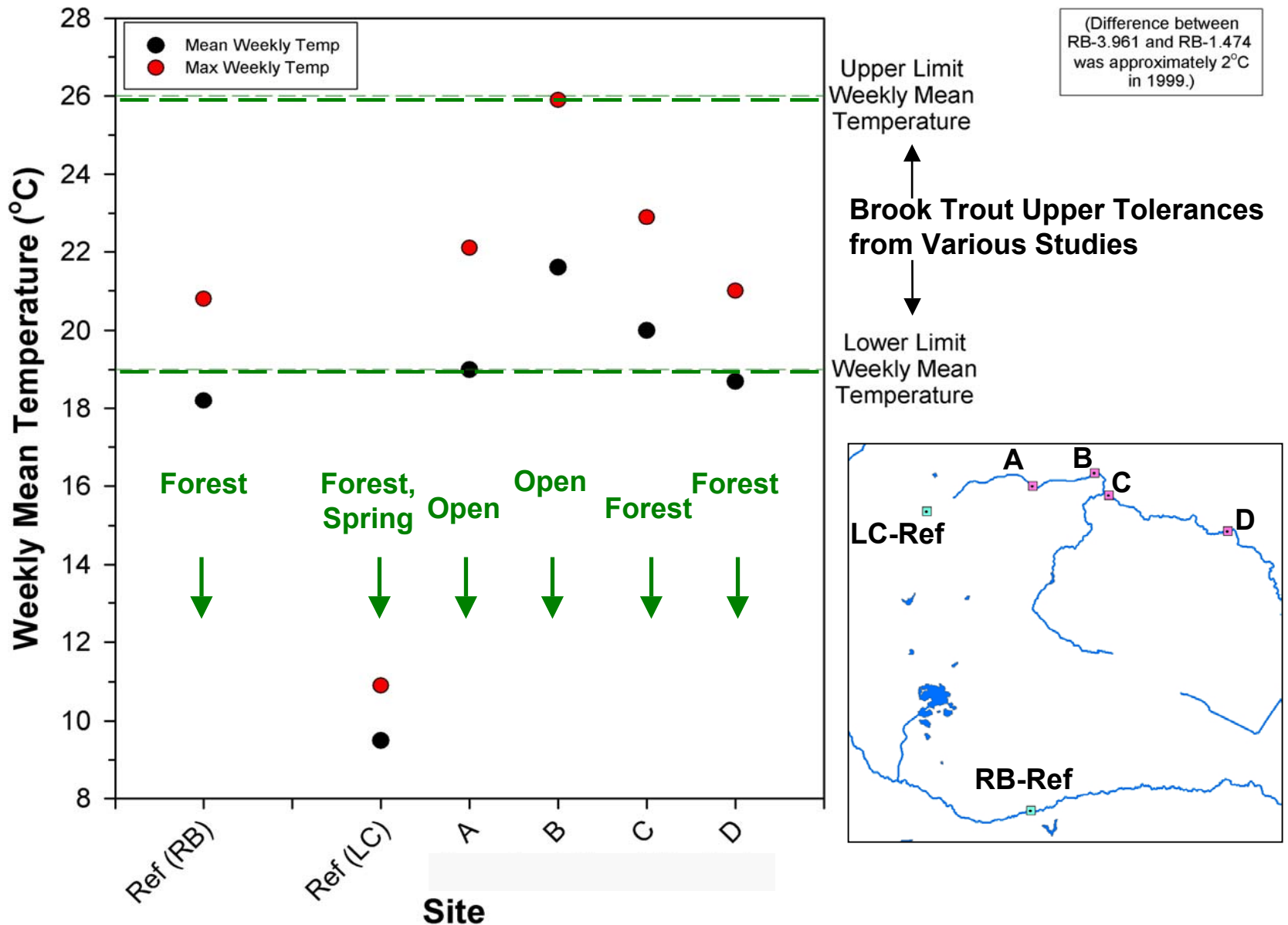
Aerial Photo of Study Streams and Sites



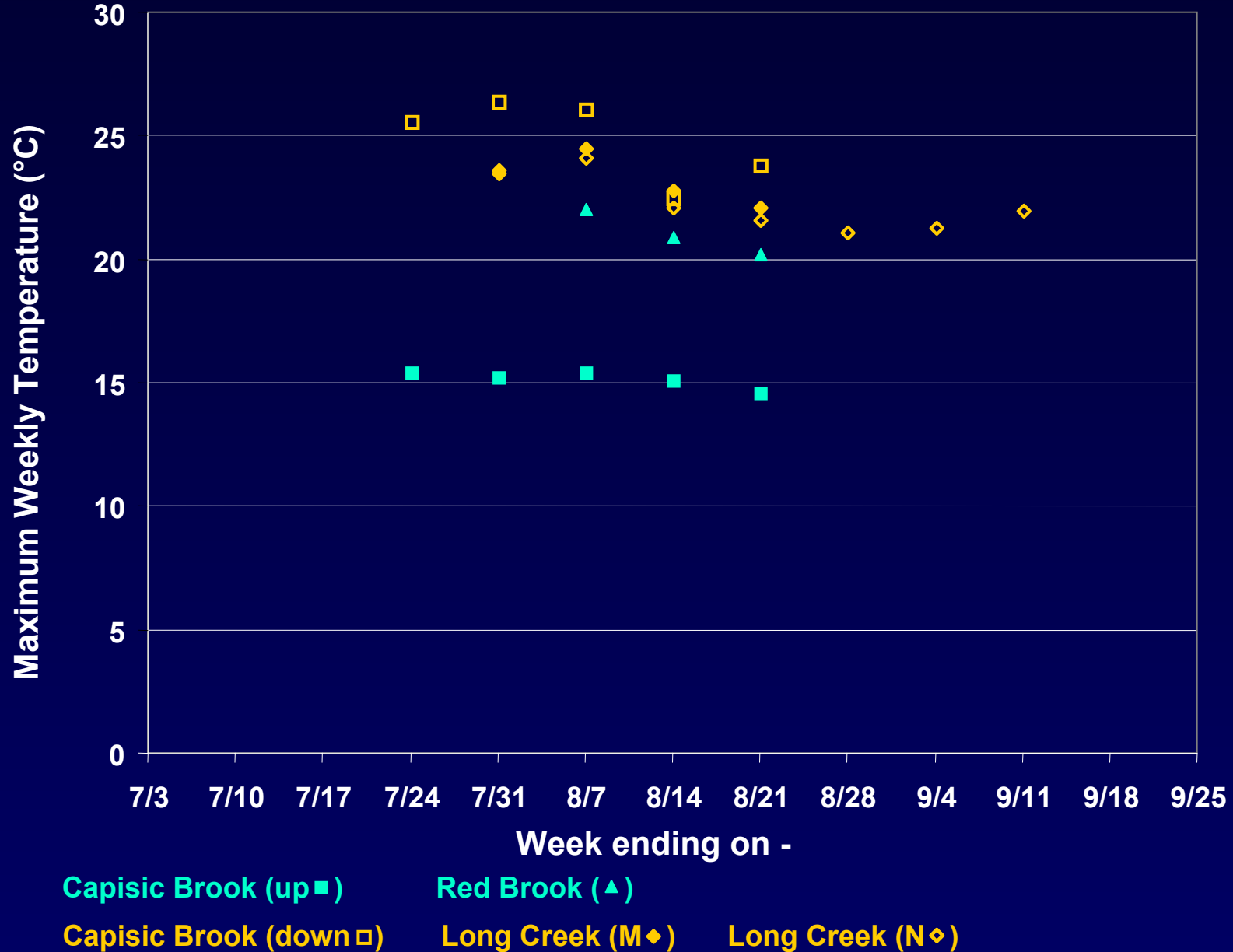
Aerial Photo of Study Streams and Sites



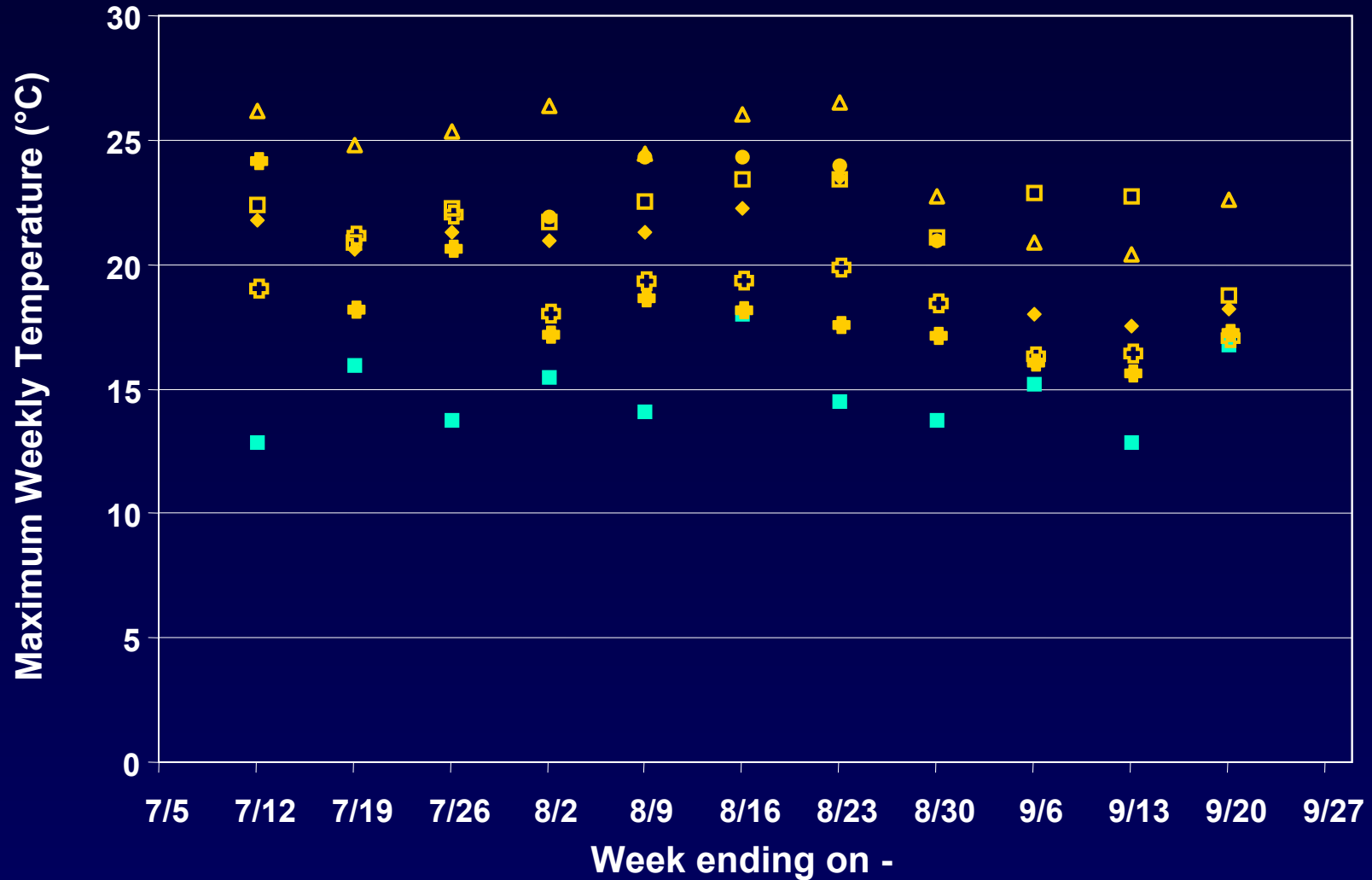
Temperature Data (week ending 7/1/2000)



Maximum Weekly Temperatures, Summer 1999



Maximum Weekly Temperatures, Summer 2003



Capisic Brook (up ■)

Capisic Brook (down □)

Barberry Creek (◆)

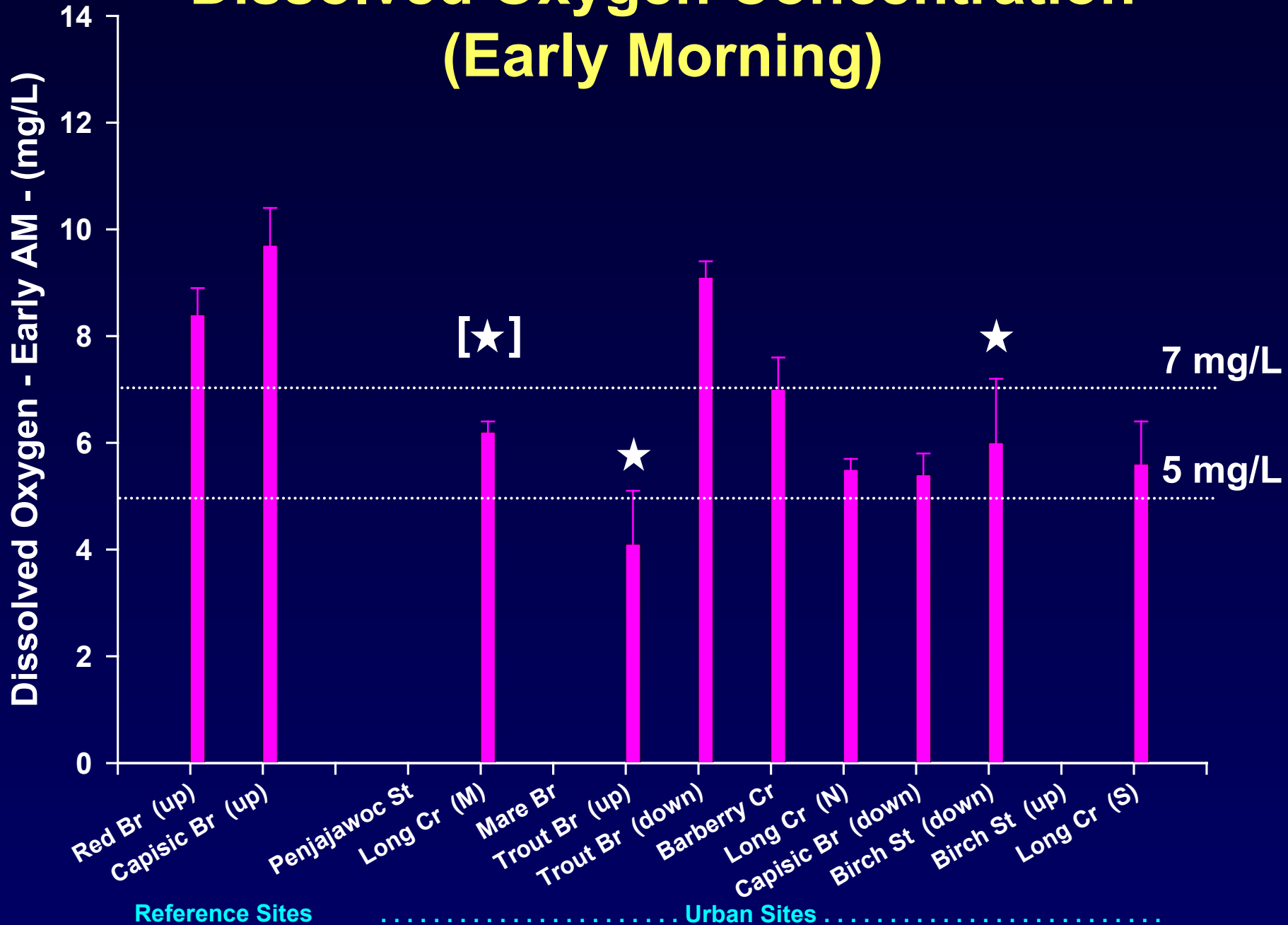
Trout Brook (down ⊕)

Trout Brook (up ⊕)

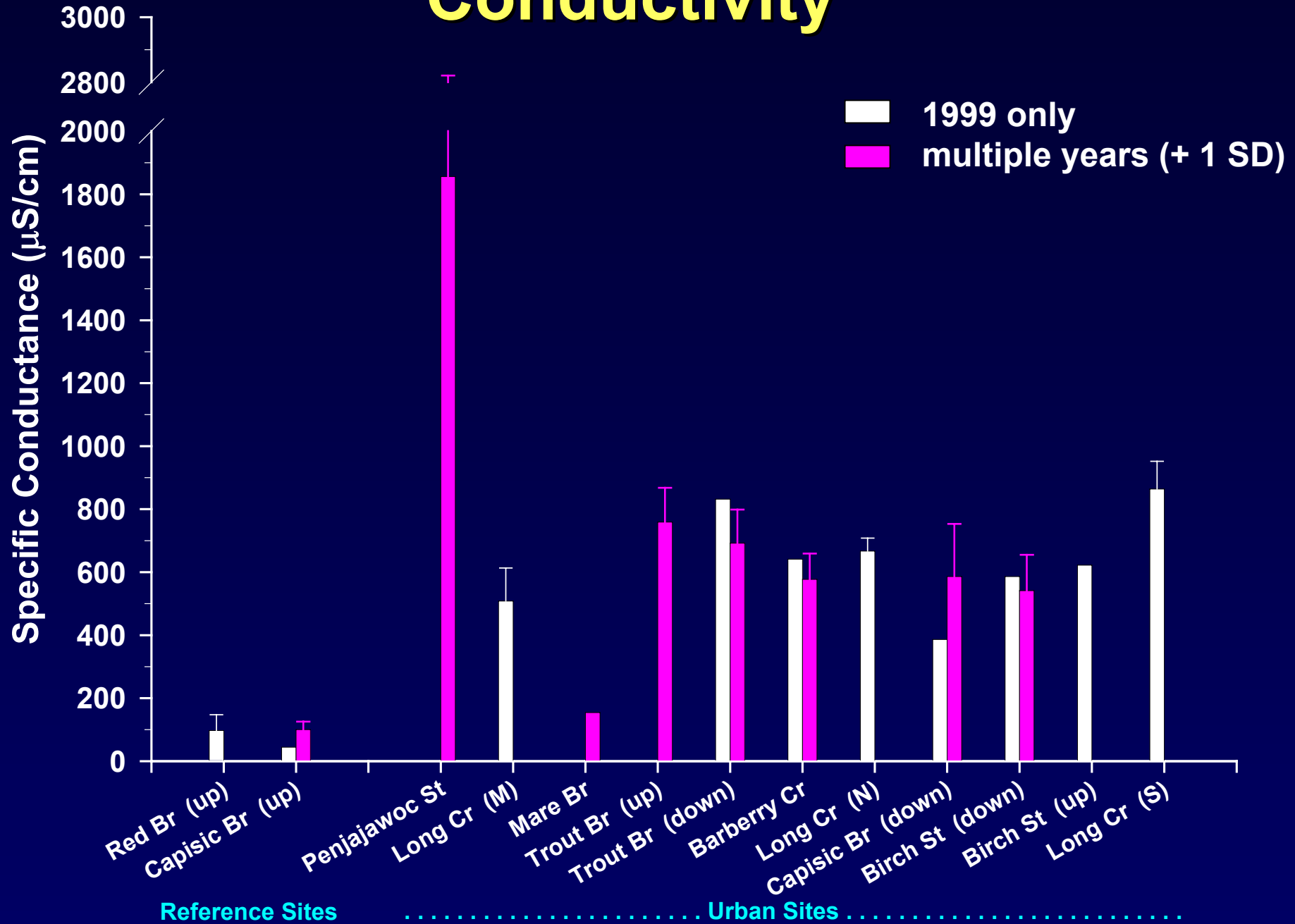
Birch Stream (down △)

Penjajawoc Stream (●)

Dissolved Oxygen Concentration (Early Morning)



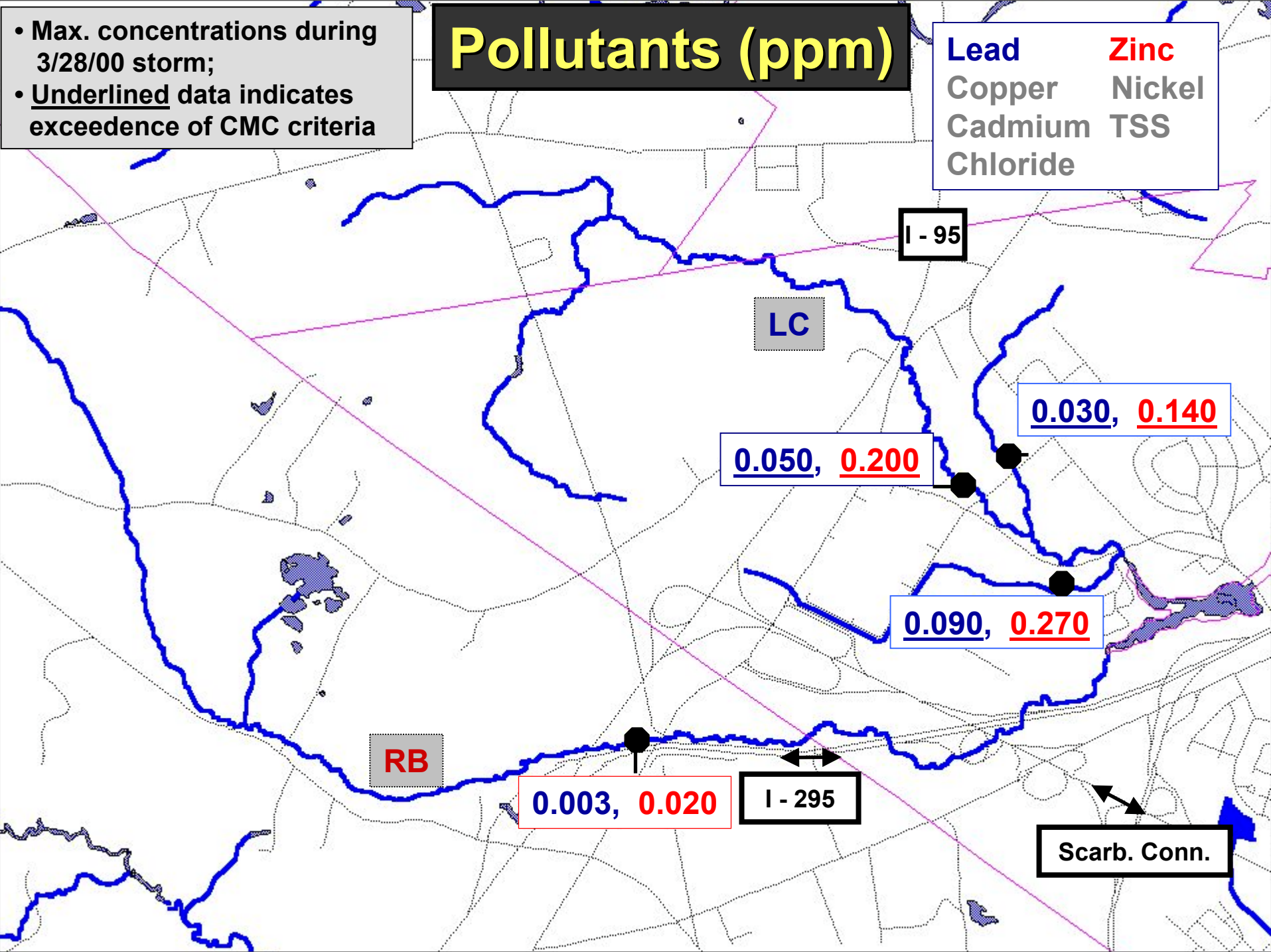
Conductivity



- Max. concentrations during 3/28/00 storm;
- Underlined data indicates exceedence of CMC criteria

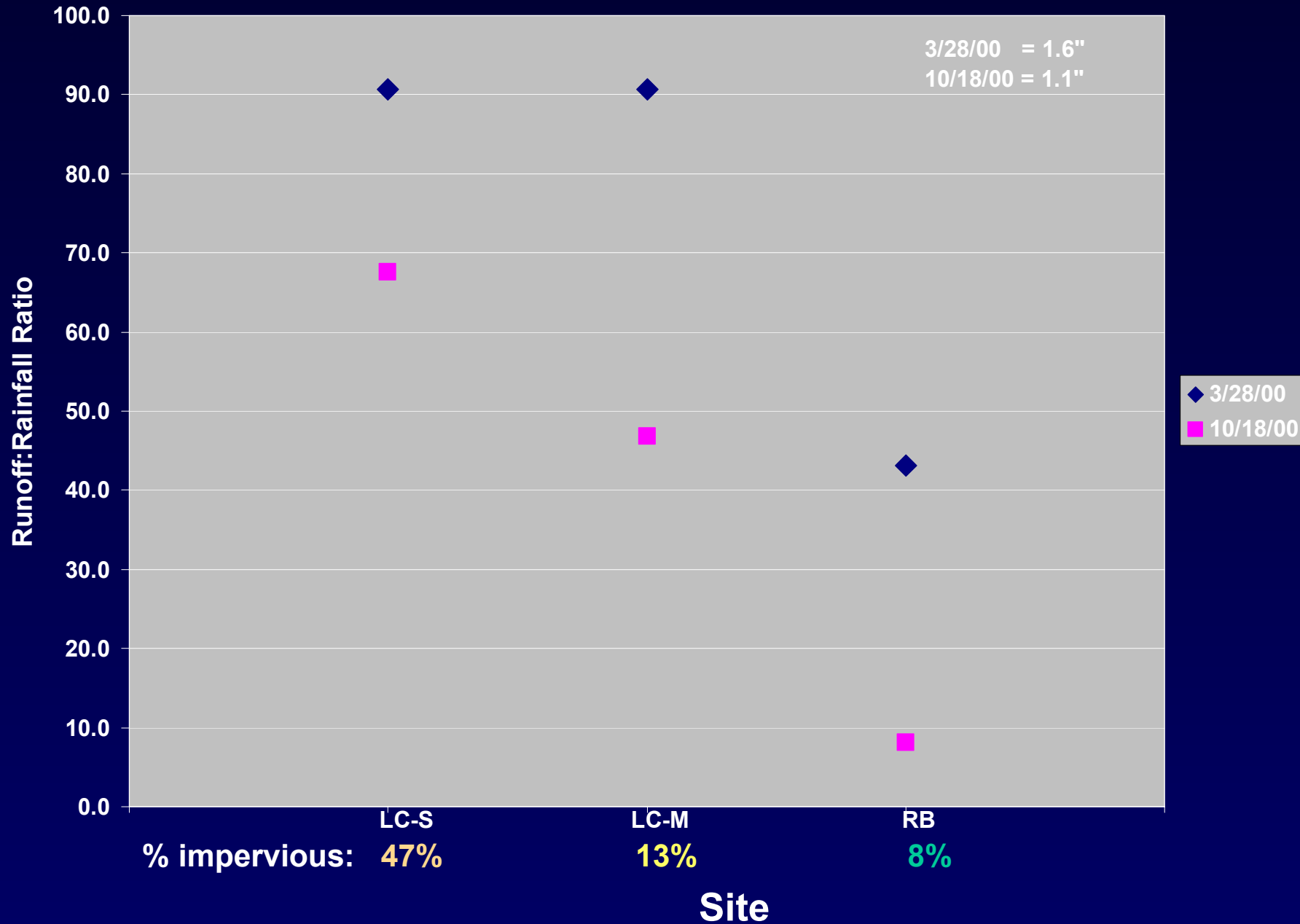
Pollutants (ppm)

Lead	Zinc
Copper	Nickel
Cadmium	TSS
Chloride	

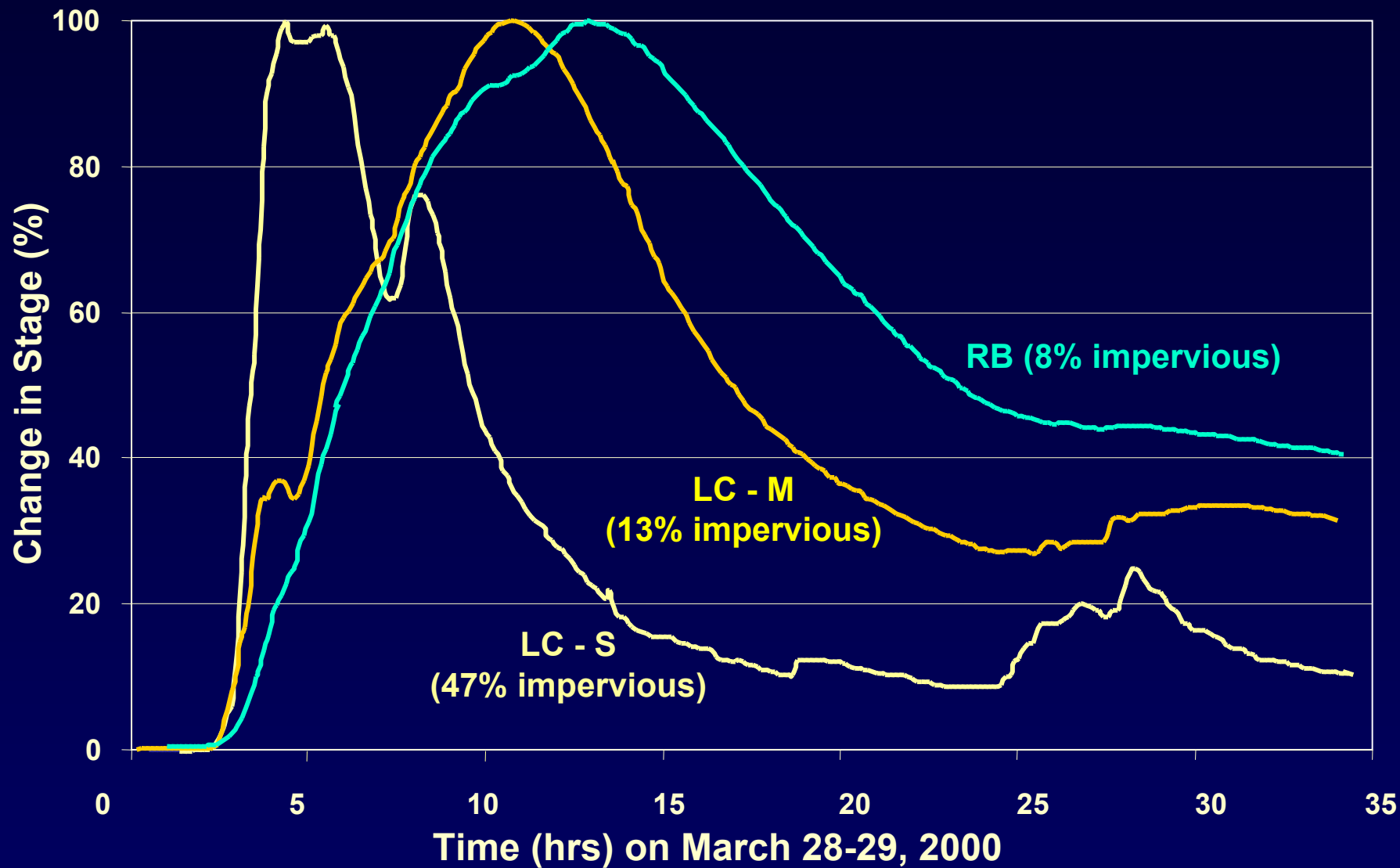


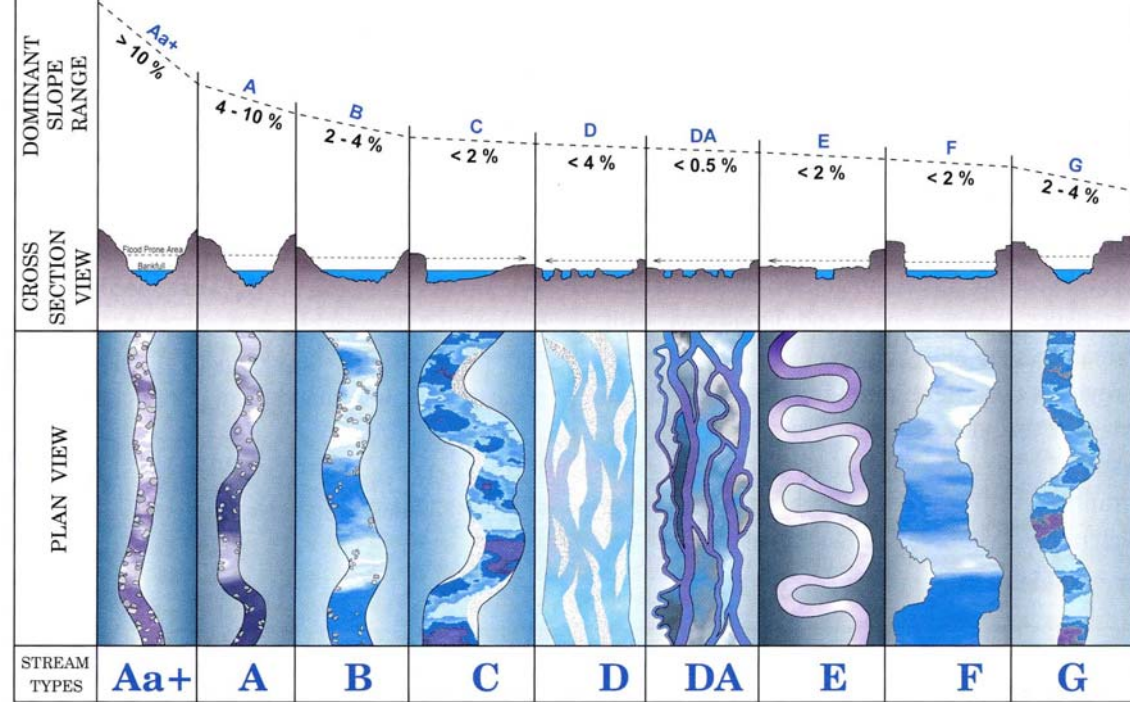
Hydrology and Habitat Data

Runoff : Rainfall Ratio

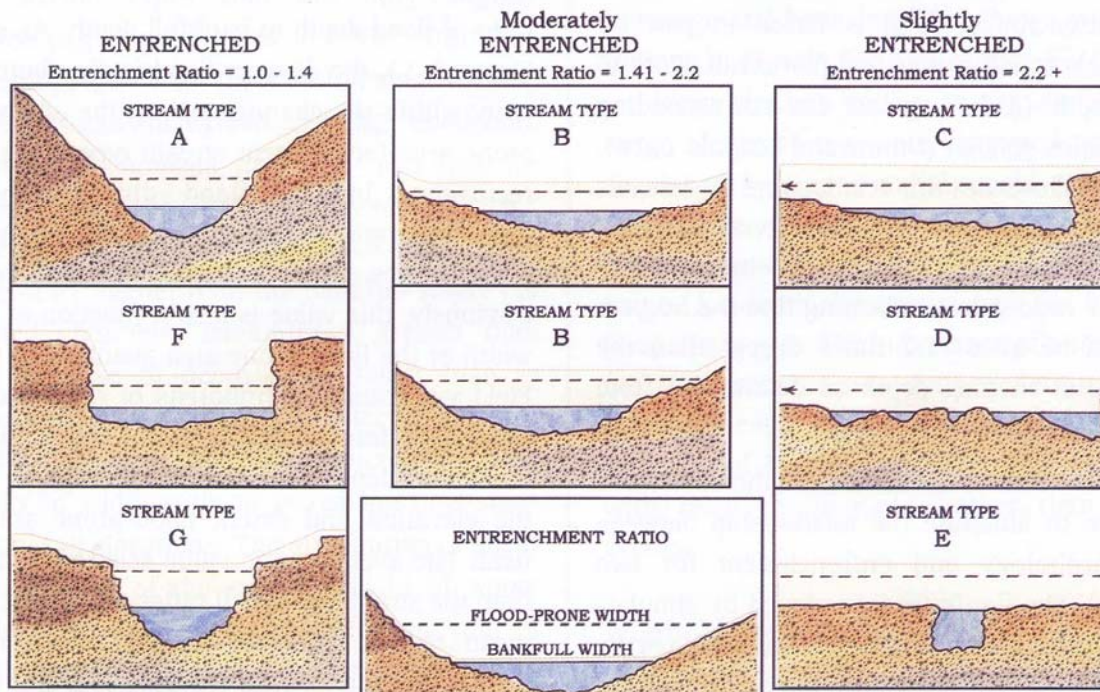


Discharge Data



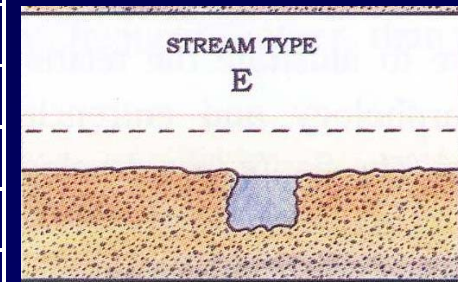
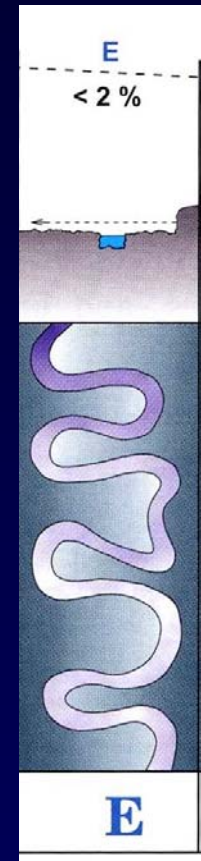


Natural Stream Classification System (Rosgen 1996)



Rosgen Stream Classification

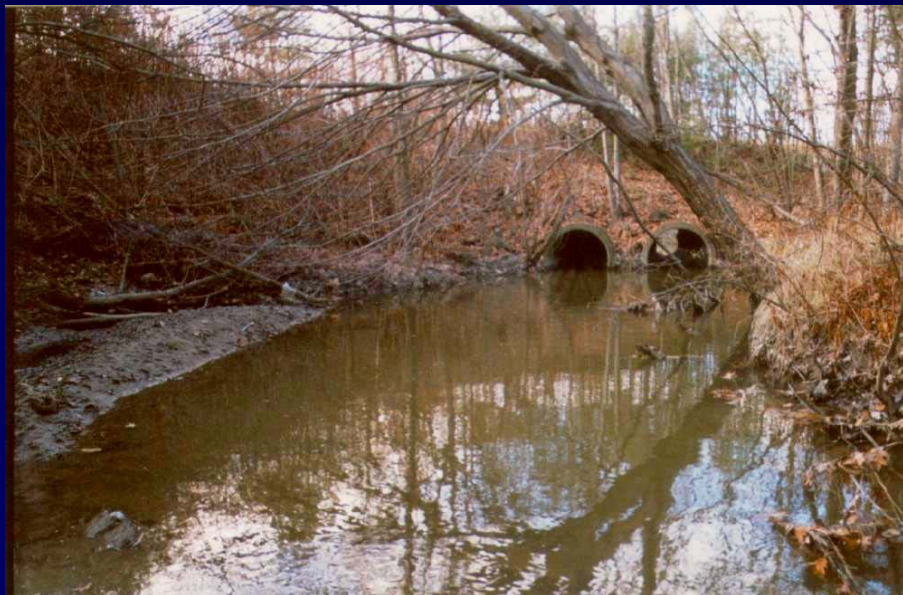
Stream/Site	Rosgen Classification
LONG CREEK SITES	
Jetport Tributary (LC-N)	
LC-N-0.404	C5 (disturbed)
LC-N-0.595	E5 (disturbed)
Main Stem Tributary (LC-M)	
LC-M-0.432	B5c (disturbed)
LC-M-0.603	G6c (disturbed)
LC-M-1.653	E5 (normal)
LC-Mn-2.274	E6 (disturbed)
LC-Mw-2.896	C6 (disturbed)
Maine Mall Tributary (LC-S)	
LC-S-0.220	E5 (disturbed)
LC-S-0.369	E5 (disturbed)
RED BROOK SITES (RB)	
RB-1.434	E5 (normal)
RB-2.119	E5 (normal)
RB-3.961	E5 (normal)



“Normal Channels”



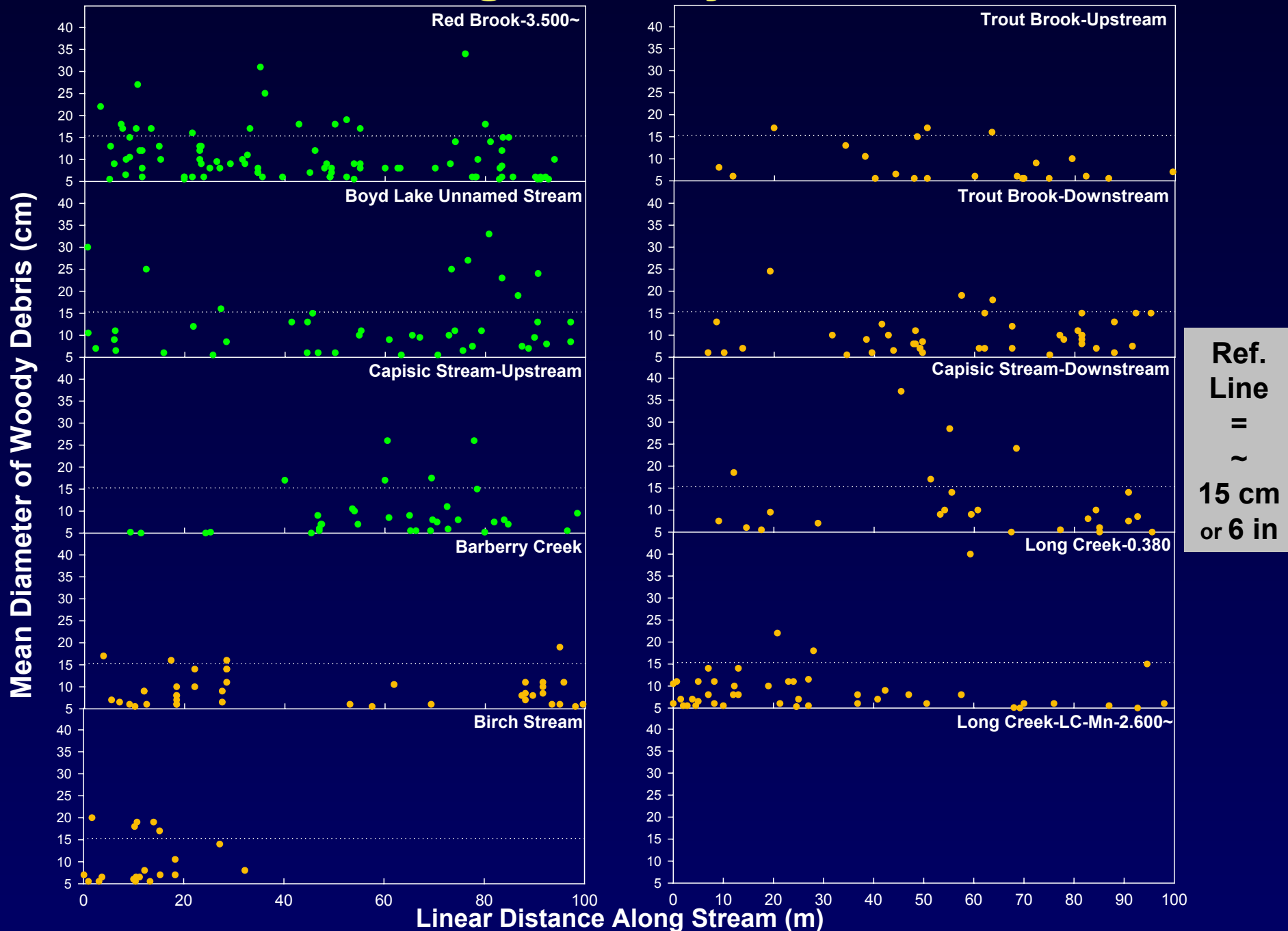
“Disturbed Channels”



Large Woody Debris



Large Woody Debris



Summary

- Urban streams generally do not meet their assigned Water Quality Class while reference streams do
- Biological communities (macroinvertebrates, fish, algae) are altered with a shift to more tolerant species in urban streams
- Physical and chemical parameters (temperature, early morning DO, conductivity, pollutants) are usually degraded in urban streams
- Habitat parameters (runoff:rainfall ratios, discharge, channel structure, large woody debris) are in worse condition in urban streams
- ***But*** - not all is lost, most urban streams have something still going for them (low temperature, riparian buffer, concerned citizen groups), and there still are bugs and fish there

Where We Go From Here

- **Urbanization degrades streams in Maine**
[MDEP Studies; Other Studies: Morse (2001), Woodcock (2002), Guay (2002), South Portland Engineering (1995) / Planning (1983)]
- **Likely restoration priorities:**
 - in-stream / riparian / floodplain restoration
 - stormwater system retrofits
- **Disturbed urban streams: complicated & difficult to restore**
- **Urban streams are valuable resources that should be protected/restored**
- **Planning can help prevent future “heavily degraded” situations in Maine**

THANK YOU'S

- MDEP Biomonitoring Unit (Leon Tsomides, Tom Danielson, Susan Davies)
- SWAT (Surface Water Ambient Toxics) Program
- Brunswick Naval Air Station
- Others (Jeff Dennis, Chandler Morse, Mike Smith, John Field, John Reynolds)
- MDEP Staff, Interns and Volunteers