Data-Driven Decision-making: Enhanced use of Data Quality Objectives In New Hampshire's Comprehensive Water Monitoring Strategy

National Water Quality Monitoring Conference
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NH Water Monitoring Strategy

- A planning tool for using water monitoring data for public decisions
- **What's the same as it always was**
  - Clean Water Act framework
  - WQ standards
  - 305(b) process for assessment and reporting
- **What's different**
  - Data-driven decision making
  - Integration among diverse monitoring groups
  - Watershed approach
  - Relevance for local decision-making

UNDERLYING PRINCIPLES

1) ***Water quality management decisions should be should be data-driven, and framed on a watershed basis.***

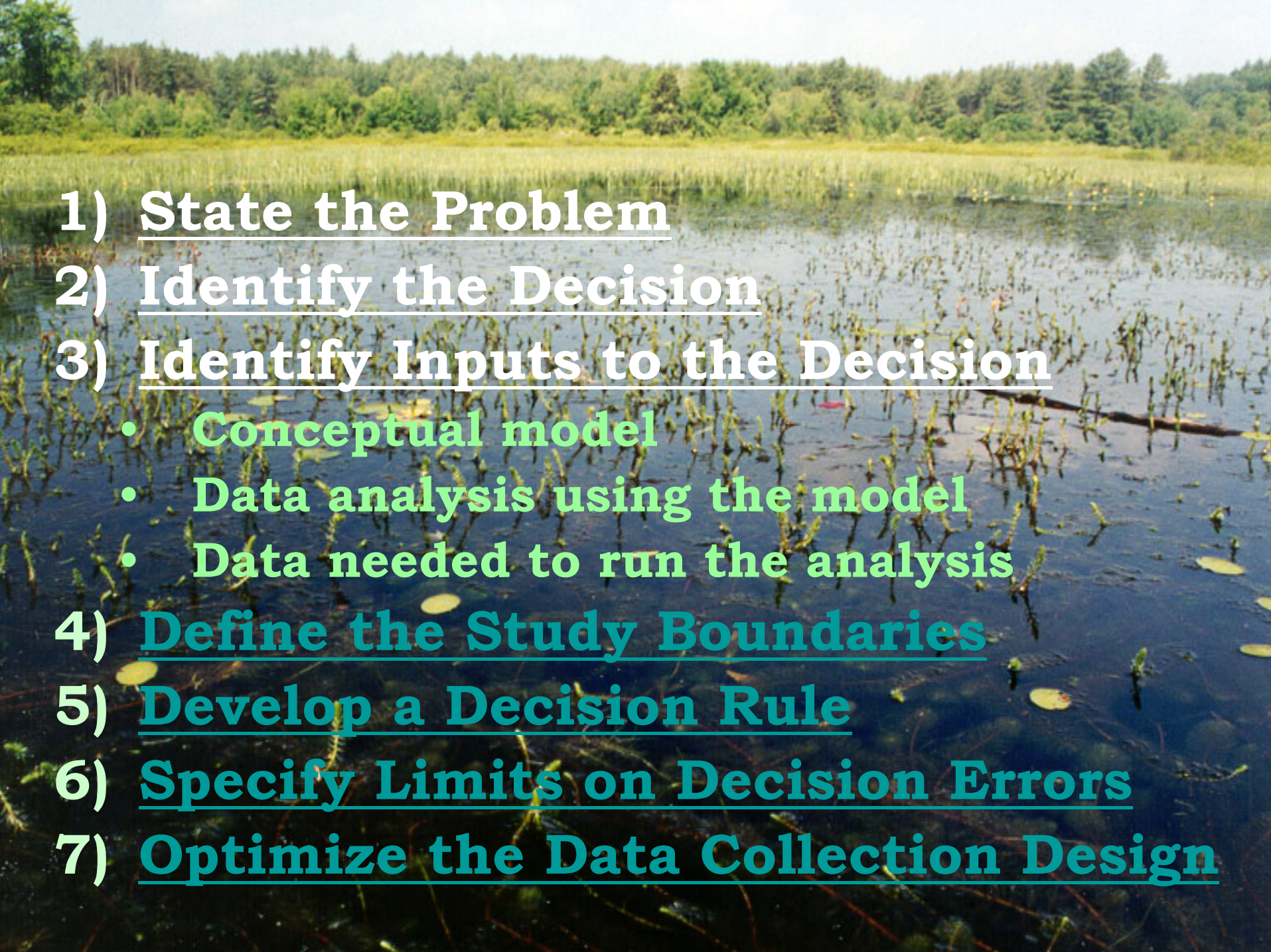
2) ***The purpose for collecting water data should be clearly understood.***

3) ***Water data should be accessible and interoperable, with documented data quality and metadata***

THE DATA-DRIVEN PROCESS

- **Based on EPA's Data Quality Objectives guidance (Superfund)**

- **SEVEN STEPS**



1) State the Problem
2) Identify the Decision
3) Identify Inputs to the Decision
   - Conceptual model
   - Data analysis using the model
   - Data needed to run the analysis
4) Define the Study Boundaries
5) Develop a Decision Rule
6) Specify Limits on Decision Errors
7) Optimize the Data Collection Design

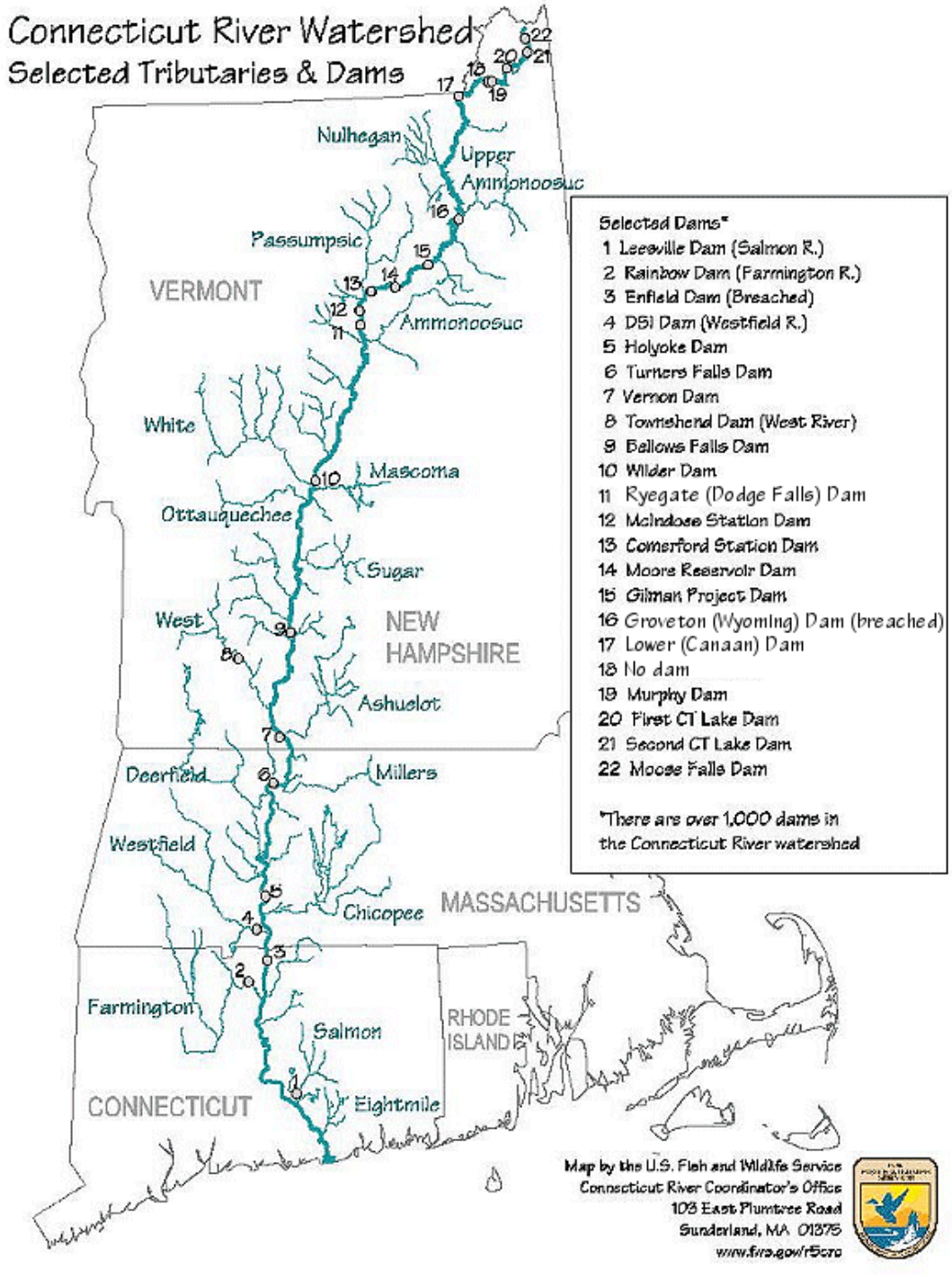
EXAMPLE: CONNECTICUT RIVER

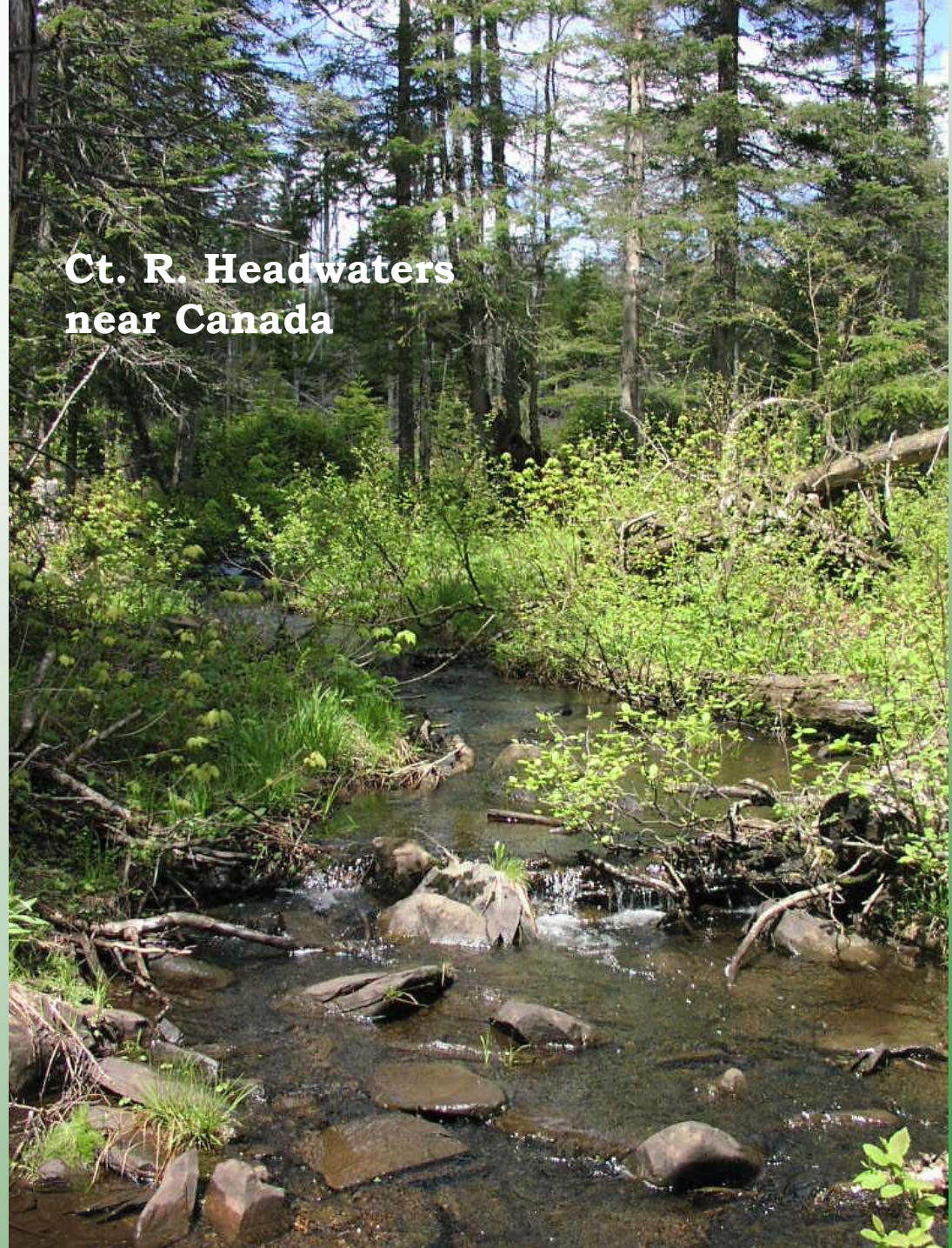
CONNECTICUT RIVER MAINSTEM

270 River Miles (NH/VT)

47 ASSESSMENT UNITS
- **8 Lakes**
- **9 Impoundments**
- **30 River Segments**

CONNECTICUT RIVER JOINT COMMISSIONS (CRJC)_




Ct. R. Headwaters
near Canada

Upper Ct. R. near
Pittsburg

Upper Ct. R.
near Groveton

Lower Ct. R. near
Northfield, MA

State the Problem

- CRJC was updating the Connecticut R. Corridor Management Plan, & needed:
  - **WQ information**
  - **Identification of WQ issues**
- 270 river miles (47 AUs) but only 16 miles (3 AUs) assessed for 305(b)
- **The Problem:** Assess the Ct. River mainstem for Swimming and Aquatic Life
  - To be incorporated into CRJC Management Plans
  - For next 305(b) report

Identify the Decision

- **Based on water quality assessments, CRJC river corridor management plans will include action items for water quality improvement projects**

Identify Inputs to the Decision

- **Conceptual model:**
  - **Core parameters for ALUS are DO and pH**
  - **Core parameter for swimming is e. coli**
- **Data analysis:**
  - **Use 2004 CALM to assess each AU for ALUS and Primary Contact Recreation**

Data needed to run the analysis (for each Assessment Unit)

- **DO: instantaneous min and daily avg.**
  - **3 to 5 day datalogger run**
  - **Hand-held meter for AM min and logger check**
- **pH:**
  - **3 to 5 day datalogger run**
  - **Hand-held meter for logger check**
- **e. coli: 5 samples (3 min.) for geo mean**
  - **1 sample every 3 weeks**

The rest of the elements: QAPP material

1) **Define the Study Boundaries**

   Ct. River mainstem

2) **Develop a Decision Rule**

   Use 2004 CALM to assess use support

3) **Specify Limits on Decision Errors**

4) **Optimize the Data Collection Design**

Lots of planning, coordination, and logistics!

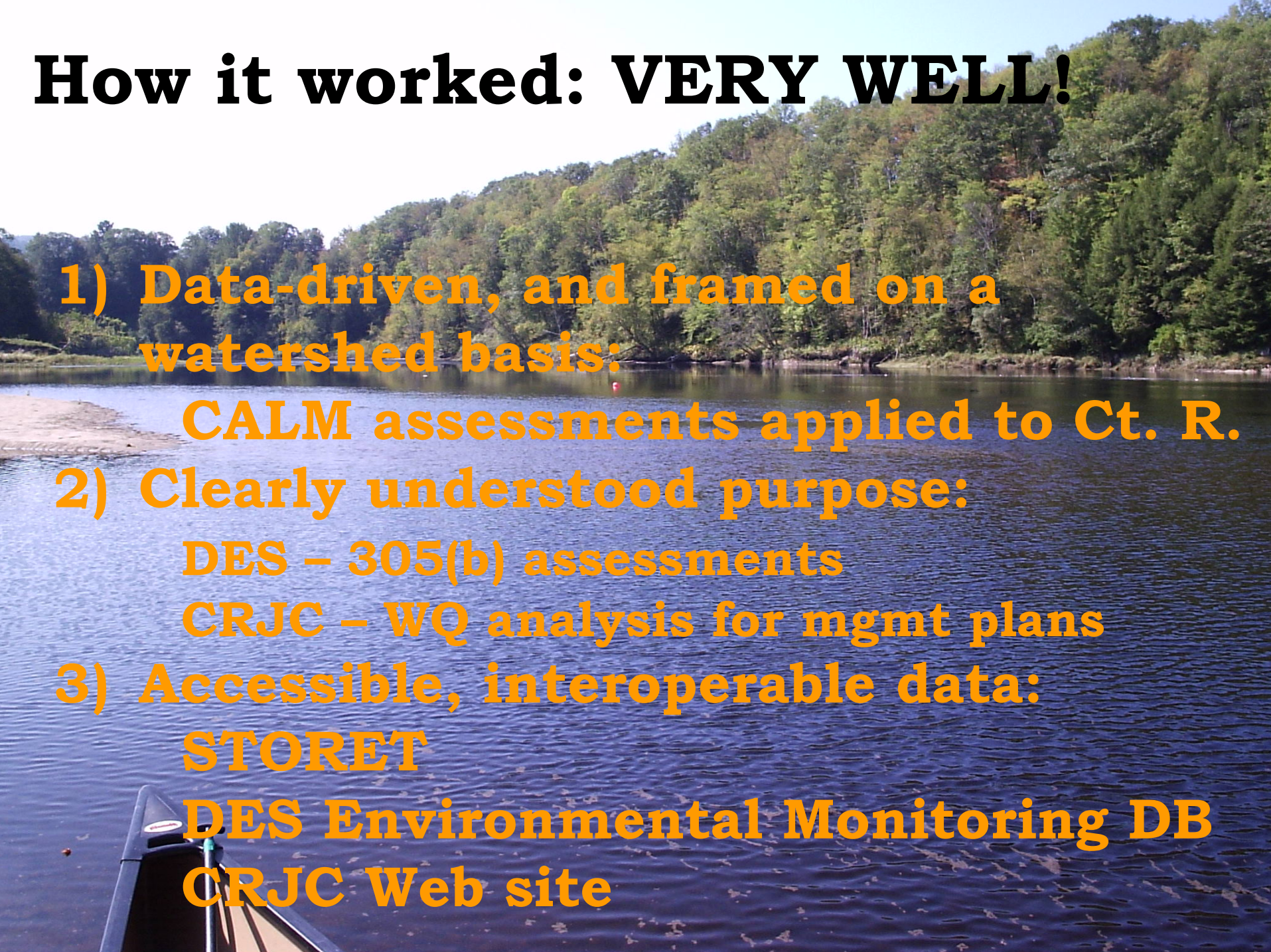
The task!

- 270 River miles
- 47+ datalogger deployments
  - 92+ station visits
- 235 e. coli samples
  - 6 hour hold time
- Plus instrument calibration & repair

How we did it!

- **Ct. R. Joint Commissions**
  - Housing, sample transport, site selection logistics
- **Antioch New England University**
  - Intern team
- **EPA New England**
  - Dataloggers, QA/QC support
  - Funding for bacteria analysis
- **NH Dept. of Environmental Services**
  - Training
  - Instrument calibration & repair
  - Intern transportation
  - Bacteria lab work

How it worked: VERY WELL!



1) Data-driven, and framed on a watershed basis:
   - CALM assessments applied to Ct. R.
2) Clearly understood purpose:
   - DES – 305(b) assessments
   - CRJC – WQ analysis for mgmt plans
3) Accessible, interoperable data:
   - STORET
   - DES Environmental Monitoring DB
   - CRJC Web site

ASSESSMENT FOR SUPPORT OF PRIMARY AND SECONDARY CONTACT RECREATION

Date	Time of Sample	*E. coli* (CTS/100mL)	Geometric Mean	
7/28/04	9:40	30		
8/03/04	9:12	20		
8/17/04	12:45	30	26	
8/24/04	9:12	20	24	
9/13/04	11:35	20	24	
Total E.coli Single Samples Useable for Assessment				5
Total E.coli Geometric Means Useable for Assessment				3
INTERIM ASSESSMENT STATUS FOR PRIMARY CONTACT RECREATION:				FULLY SUPPORTING
INTERIM ASSESSMENT STATUS FOR SECONDARY CONTACT RECREATION:				FULLY SUPPORTING

2004 Connecticut River Water Quality Assessment

Preliminary Assessment Status

BACKGROUND

IN the summer of 2004, the NH Department of Environmental Services undertook this ambitious study, the most comprehensive river water quality assessment carried out in New Hampshire, at the request of the Connecticut River Joint Commissions, who are engaged with their five local river subcommittees in updating the Connecticut River Management Plan. CRJC learned that the state had little or no information about the safety of swimming and other river recreation or about the quality of aquatic habitat, for over 100 of the 275 miles of river in New Hampshire, and asked for help in filling this knowledge gap. DES responded with a well-organized and intensive effort. The results summarized here are considered preliminary until quality control checks are complete.

Support for the study came from the NH Department of Environmental Services, the US Environmental Protection Agency Region I, and the Connecticut River Joint Commissions. Final results will be posted on DES' Volunteer River Assessment Program website: **http://des.nh.gov/wmb/VRAP**.

AQUATIC HABITAT QUALITY

The study measured these features 12 times at each of 45 locations to assess the quality of water chemistry for aquatic life:

- **dissolved oxygen:** measured using a meter that produces readings for both concentration (mg/L) and percent (%) saturation. For Class B waters in NH (including the Connecticut River), any single dissolved oxygen reading must be greater than 5 mg/L and must have a dissolved oxygen content of not less than 75% of saturation, based on a daily average.
- **pH:** The Class B NH surface water quality standard is 6.5–8.0, unless naturally occurring.
- **specific conductance:** NH surface water quality standards do not contain numeric limits for specific conductance.
- **temperature:** NH surface water quality standards do not contain numeric limits for temperature.

SWIMMING, FISHING, AND BOATING

The study measured for pathogens five times at each of 45 locations to determine the safety of the water for recreation.

- **bacteria** (*Escherichia coli*): For Class B waters, NH surface water quality standards for *E. coli* are:
  —fewer than 406 counts per 100 ml of water, based on any single sample, or
  —fewer than 126 counts per 100 ml of water, based on a geometric mean calculated from 3 samples within a 60 day period.

RESULTS

- **fully supporting:** repeated samples show that the water meets NH state standards and therefore supports that use of the river.
- **insufficient information:** conflicting data or not enough data.
- **not supporting:** repeated samples show that the water does not meet state standards and therefore does not support that use.

NOTES FOR THE TABLE

A) 2004 Connecticut River Project data indicated that water chemistry in this section of river fully supports aquatic life, for pH and dissolved oxygen. However, because this part of the river is smaller than a 4th order stream, state standards require biological data for a full assessment.

B) This is a NH DES "trend station," one of three on the Connecticut River that has been monitored three times each year for a number of years for a long list of contaminants. It was not sampled as part of this project, but data collected here by other DES researchers are given.

C) Samples gave conflicting information. Geometric means met the state standard, but one sample was above the single sample standard for bacteria.

D) Two geometric means were above the state standard for bacteria.

E) One geometric mean was above the state standard for bacteria.

F) A more detailed analysis of the data is required.

G) Data collected in the 2004 project indicated that this section of river fully supports swimming and other recreational use, but due to the presence of combined sewer overflows that discharge to this section, the state will continue to list this section as not supporting this use.

H) Data collected in the 2004 project indicated that water chemistry in this section of river fully supports use as aquatic habitat, but due to the presence of exotic species (milfoil), the state will continue to list this section as not supporting this use.

Connecticut River Joint Commissions
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Connecticut passes the test

Study: River's water quality measures up

By **ERIKA COHEN**
Sentinel Staff

It took more than 10,000 miles of driving and a couple thousand samples to come to one simple conclusion: Last summer, all 275 miles of the Connecticut River in New Hampshire were safe for swimming, boating and aquatic life.

Such a study is the perfect example of the scientific method at work.

The results are simple, but the science behind them took months of planning, sampling and analysis.

"All this means nothing unless the data is good, unless we're confident in it," said Edward M. Walsh, sitting at a table covered with charts showing data for pH, dissolved oxygen, conductivity, water temperature and bacteria counts for 56 spots along the Connecticut River, the state's longest.

Walsh, the coordinator for the Volunteer River Assessment Program at the N.H. Department of Environmental Services, said the water quality study of the Connecticut River, from Hinsdale to Pittsburg, was the most comprehensive study the department has ever done.

This does not surprise Beth L. Ross, who visited every one of the 56 spots at least once last summer while collecting data for the study.

Sometimes in a canoe, sometimes knee-deep in muck, sometimes in the rain, she and fellow graduate student Ghuihong Zhang of Antioch New England Graduate School in Keene collected samples.

"Repeat is the name of the game," Ross said. "I hadn't really put it together before, all the checks and balances so you know the data is sound. It's one thing to know, it's quite another to do it every day."

Walsh, Ross and three others did most of the sampling for the project. They gathered five bacteria samples at each location and 12 to 14 readings for dissolved oxygen, pH, conductivity and water temperature.

The bacteria count measured e-coli as an indicator of the safety of the river for swimming and boating. Conductivity, water temperature, pH and dissolved oxygen show whether the river can support fish, plants and other forms of aquatic life.

In total, the team gathered nearly 3,000 different samples and pieces of data.

While overall results showed a healthy river, there was one spot at the river's northernmost region in Pittsburg with high bacteria counts. Walsh said the spot was far from people and likely due to animal waste washed into the river from a nearby wetland inhabited by beavers and birds.

He also stressed the study did not

See **RIVER'S** on Page 16

How safe is the Connecticut?

Following are the results of seven sampling spots along the Connecticut River, from Hinsdale to Charlestown.

Sampling spot	dissolved oxygen*	bacteria (colonies/ml)	temperature (° Celcius)	conductance#	pH
Route 11 Bridge Charlestown	8.13	27	21.5	110	7.43
Arch Street Bridge Walpole	8.89	30	18.3	102	7.09
Vilas Bridge Walpole	8.85	44	20.7	120	7.38
Route 123 Bridge Walpole	8.67	30	19.3	126	7.10
Cheshire County jail Westmoreland	7.72	25	16.6	135	7.21
Route 9 Bridge Chesterfield	7.87	27	20.3	131	7.19
Route 119 Bridge Hinsdale	8.31	44	20.6	128	7.10

*Oxygen measured in milligrams/liter. #Conductance measured in microsiemens/centimeter.
All numbers are averages except pH, which is a median.

Source: N.H. Department of Environmental Services

SPARKPLUG PEOPLE

- CRJC: Adair Mulligan
- EPA: Dan Burke
- Antioch: Guihong Zhang
- DES: Ted Walsh