Presentation to IJC on Nutrient Criteria and Load Limits for the Red River of the North

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Who we are and what we do

- Hall & Associates
  - 40 years expertise in Clean Water Act implementation including water quality criteria development, mathematical modeling and pollutant fate/transport
  - 20 years dealing with numeric nutrient criteria across the Country
  - Coordinated Federal Peer Review on Development of EPA Stressor-Response Guidance for Nutrient Criteria (2010)
  - Major role in development/review of MN River and Lake WQS

Nutrient Response Is Complicated

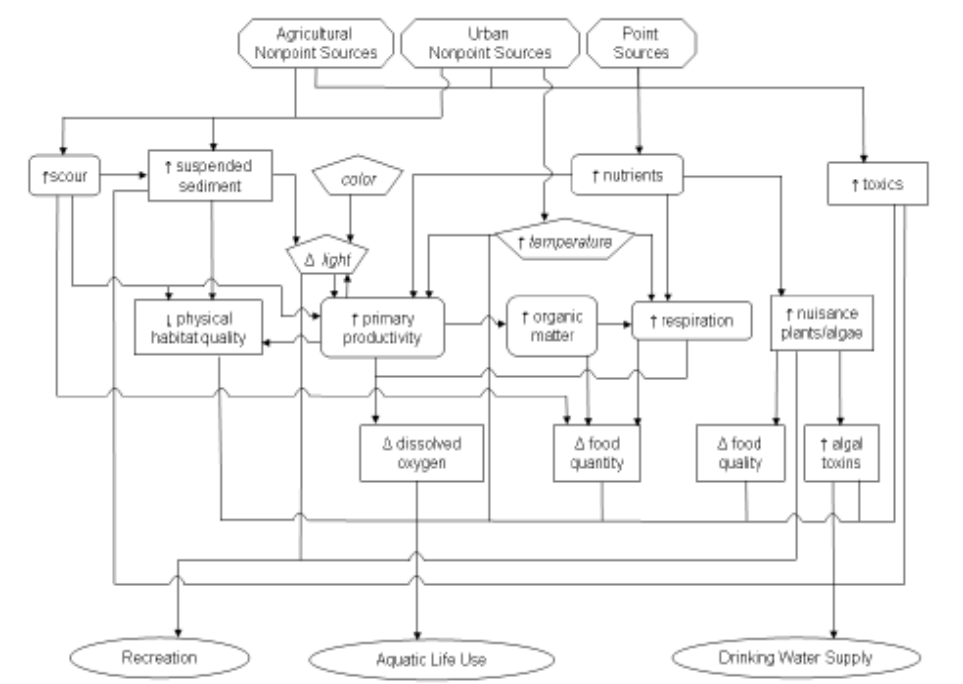


Figure 2-2. Conceptual model diagram for streams. See text for explanation of shapes and symbols.

Take-Away Observations

Nutrients do not directly cause use impairments

Multiple factors influence whether excessive plant growth will occur in response to nutrients

Using Stressor Response Relationships to Derive Numeric Nutrient Criteria – EPA, November 2010

USEPA Guidance on Nutrient Criteria Development and Application

Development and Adoption of Nutrient Criteria into Water Quality Standards - USEPA 2001

"Nutrients, unlike toxics, typically *manifest their effects over an extended period of time, like a growing season or flow year*. Therefore, when evaluating criteria attainment, it is important to ensure that the sampling period and frequency of sampling are adequate to *reflect long term conditions, and to use an averaging period that represents that used for criteria development*…" (p. 18).

Nutrient Criteria Technical Guidance Manual – Rivers and Streams - USEPA, July 2000

When evaluating the relationships among nutrients and algal response within stream systems, it is important to first understand which nutrient is limiting. Once the limiting nutrient is defined, critical nutrient concentrations can be specified *and nutrient and algal biomass relationships can be examined to identify potential criteria to avoid nuisance algal levels*. (at 74)

SAB Recommendations on How to Set Nutrient Targets

For criteria that meet EPA's stated goal of "protecting against environmental degradation by nutrients," the underlying causal models must be correct. *Habitat condition is a crucial consideration in this regard (e.g., light [for example, canopy cover], hydrology, grazer abundance, velocity, sediment type)* that is not adequately addressed in the Guidance.

Numeric nutrient criteria developed and implemented without consideration of system specific conditions (e.g., from a classification based on site types) can lead to management actions that may *have negative social and economic and unintended environmental consequences without additional environmental protection*.

(Science Advisory Board Recommendations on Stressor-Response Evaluations (2010))

To be scientifically defensible, empirical methods must address confounding and co-varying parameters.

USEPA Recommendations for Implementing Nutrient Criteria

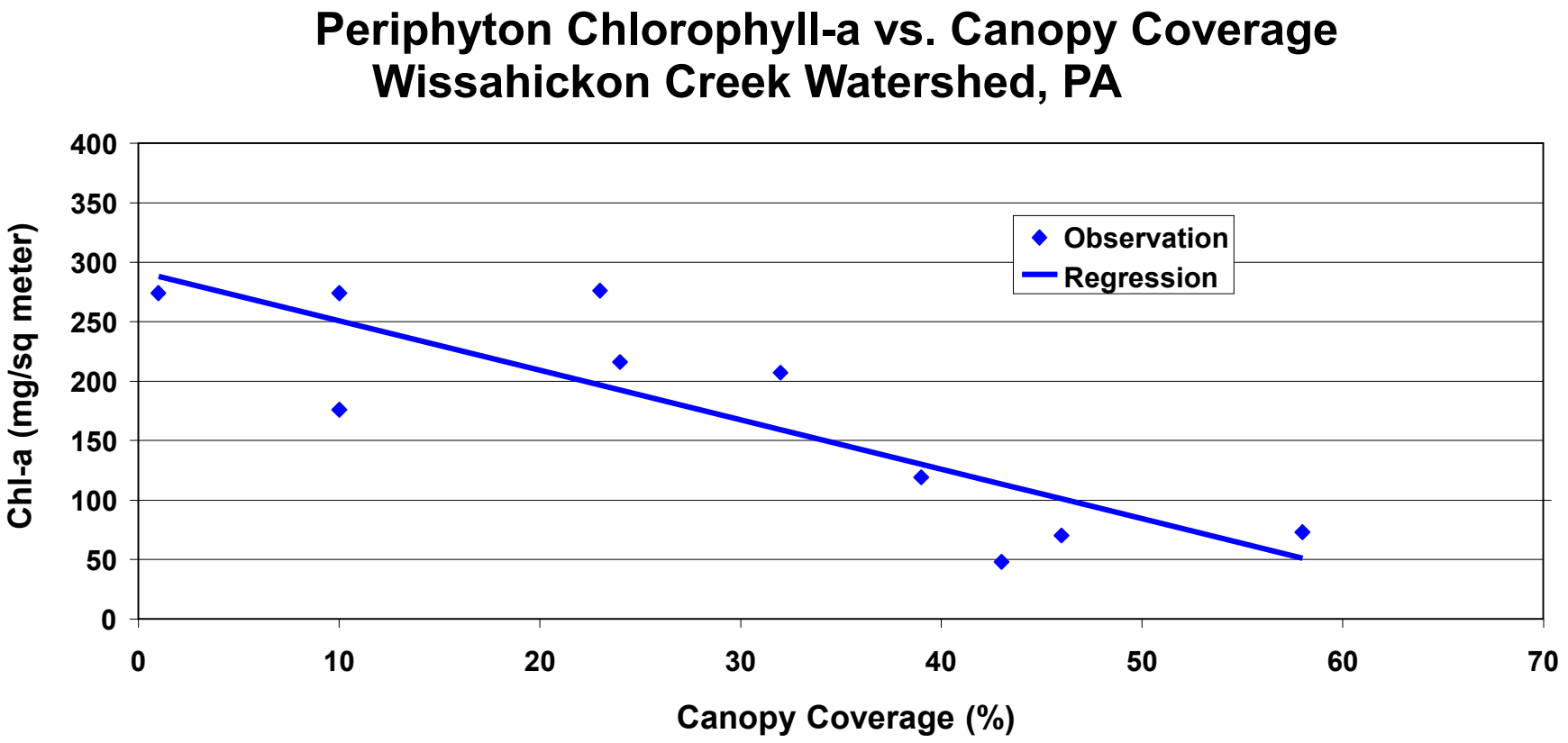
- Pick Proper Response Threshold (Nuisance Algal Level)
  i. Direct Link to Use Impairment
  ii. Anticipated Nutrient Level to Prevent Nuisance Condition
- Use Growing Season Application
- Focus on limiting nutrient
- Account for Actual Stream Response
  i. Mitigating Factors: Turbidity/TSS, Canopy Cover, Scour, etc.

Problems Predicting Periphyton Response in Streams

Highly Variable Periphyton Growth on Clark Fork River, Montana - 2009

TP = 18 µg/L (median) in all locations

Light Limitations Restrict Periphyton Growth



Source: Everett and West (DEP staff), 2002

Periphyton:Nutrient Relationship (EPA Experts)

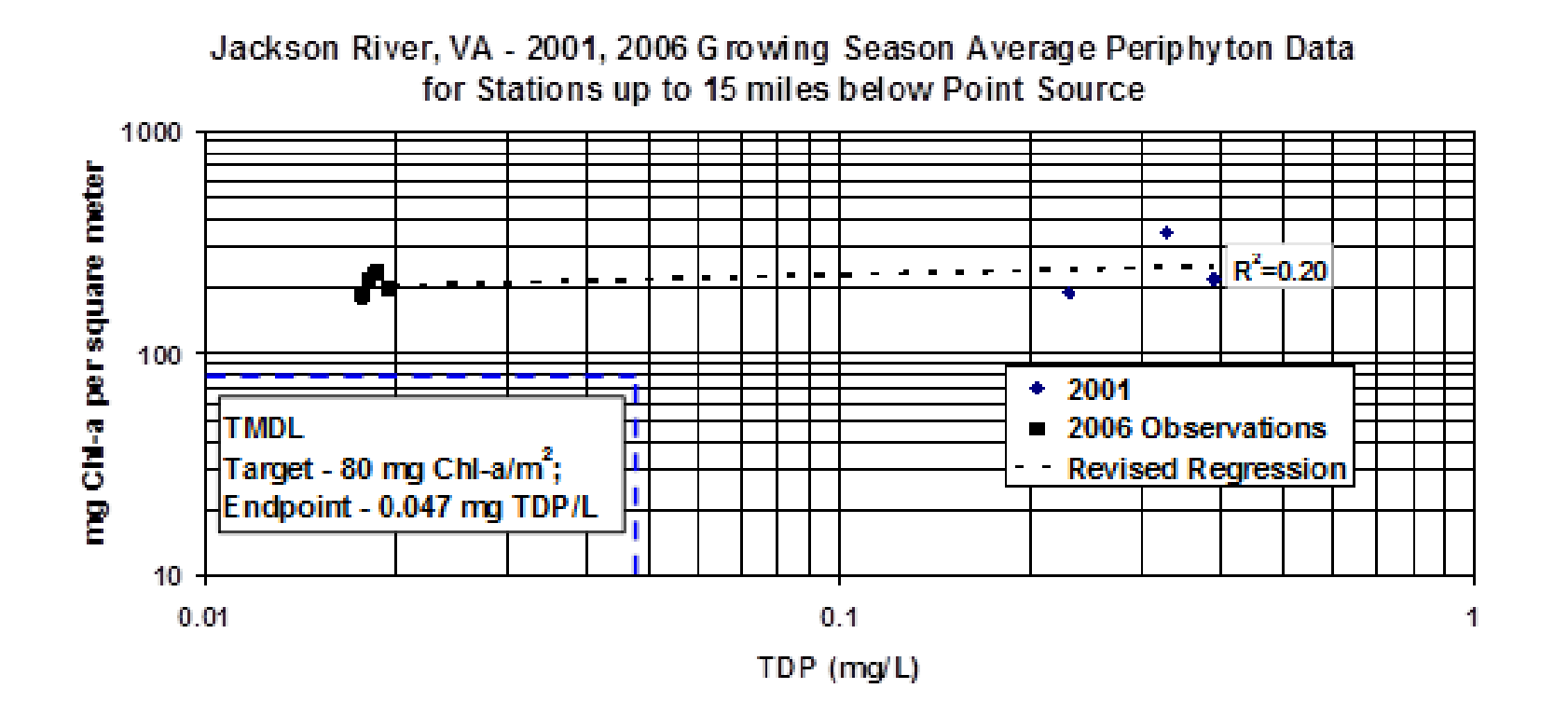
Dodds et al., 2006:

Attached algae might be able to attain impressive bio-mass in nutrient-poor water because periphyton can use the small amounts of nutrients that continuously flow by.

Paul and Zheng, 2007:

The highest algal biomass [in PA targeted watersheds] occurred at sites where TP concentrations were relatively low (14 – 35 µg/L). [Upstream of POTWs]

Jackson River, VA: Post-TP Reduction Impact



MPCA 2015 Conclusion on Regulating Periphyton In Streams

- Above 150 mg-chl-a/m^2 over growing season may be excessive
- Not apparent that TP concentrations can control such growth, must do site-specific evaluation.
- The Red River of the North is <u>not</u> nutrient impaired

What is the scientific basis for a different conclusion here?

Background on IJC/IRRB Focus

- Necessary to Protect Environment/International Waters
- Use Best Science Available to develop endpoints
- Seek Enforcement of Recommendations in Future Regulatory Actions

For Example Great Lakes Phosphorus Limits

Primary RESPEC Report Conclusions

- TP – 0.15 mg/L
- TN – 1.15 mg/L
- No Recommendations on Response Endpoint (e.g. phytoplankton or periphyton growth)
- No Load Limits Specified

Red River Basin Municipal Objectives

Evaluate the Technical Basis and Ecological Justification for Recommended Nutrient Criteria:

- Are the procedures used to develop the proposed criteria reasonable/scientifically defensible?
- Do the applied methods address real world concerns?
- Do the available data support the conclusions?
- Do the analyses confirm TN control is required in addition to TP controls?

RESPEC Report Scope of Work

1. Develop Conceptual Model
2. Identify data/data gaps
3. Evaluate data, suggest statistical approaches for stressor-response modeling
4. Fill in data gaps
5. Complete stressor-response modeling
6. Identify biological thresholds along stressor gradient

Concerns with RESPEC Report

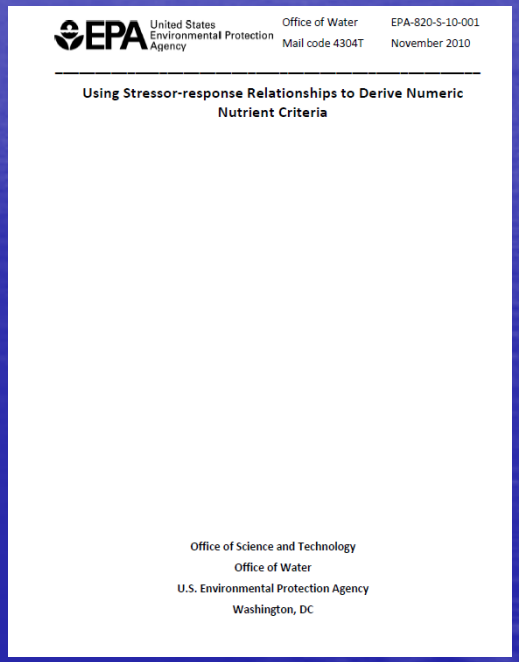
Figure 6-4. Grouping of Periphytometers Shortly After Deployment by the Minnesota Pollution Control Agency Staff.

Plant growth artificially stimulated (not representative of actual conditions in the River)

Concerns with RESPEC Report

Doesn't Reflect EPA Stressor-Response Guidance:

- No impairment threshold identified
- No confounding factors evaluation
- No Evaluation along Nutrient Gradient
- No Evaluation showing TP *and* TN control necessary


EPA United States Environmental Protection Agency
Office of Water
Mail code 4304T
EPA-820-S-10-001
November 2010

Using Stressor-response Relationships to Derive Numeric Nutrient Criteria

Office of Science and Technology
Office of Water
U.S. Environmental Protection Agency
Washington, DC

SUMMARY
What is Missing from RESPEC Report

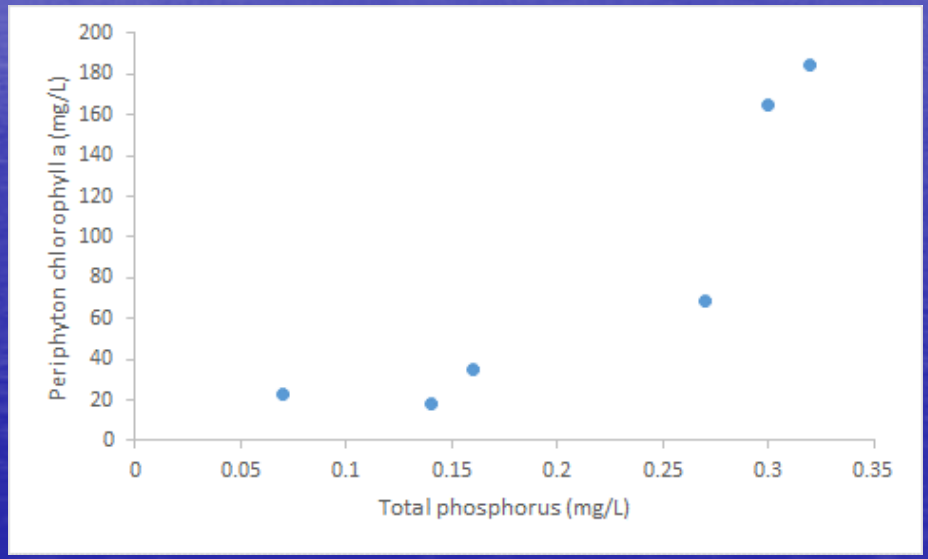
- Endpoints not linked to any recognized use impairment
- Evaluations based on artificial conditions, not actual conditions in the Red River
- Stressor-Response evaluation not developed
- Need for TN control not demonstrated
- Updated scientific literature on control of periphyton growth not considered

Consensus Report (IRRB Peer Review)

- Confirmed no biological thresholds identified
- Confirmed no stressor-response evaluation along nutrient gradient developed
- Created new assessment that was also flawed based on assumed lower system turbidity

Consensus Report (Peer Review)

- Recommend simple *correlation* to support conclusions, but ignored
  - Attached algae able to attain impressive biomass in nutrient poor waters (Dodds, 2006)
  - TP/TN concentrations not growth limiting, something else is controlling – TSS (RESPEC at 50)



Growth not limited at TP > 0.02 mg/L.

Dr. Chapra Independent Peer Review

- Concerns Raised by Hall & Associates on RESPEC Report well based
- Peer Review (Consensus Report) did not address Key Issues
- “Simple Relationships” not Defensible for Nutrient Criteria Derivation
- No Justification for TN Control

Proposed Lake Winnipeg Load Limits

- First Identified in Public Hearing Notice
  - TP draft criterion – 0.05 mg/L; 1,400 tonnes/year
  - TN draft criterion – 0.75 mg/L; 9,525 tonnes/year
- No Opportunity for Review/Comment on Draft Nutrient Load Targets for RRoN
- TN Requirements Contrary to Historic IJC Great Lakes Approach

Issues with TN Endpoint

- Standard Practice: First control TP, then assess whether TN control is necessary
- Will TP control obviate the need for TN control?
- How will TN control affect occurrence of cyanobacteria in Lake Winnipeg?

Request to IJC/IRRB

- Independent Scientific Peer Review of RESPEC to confirm:
  - Are real-world impacts being addressed?
  - Are the nutrient targets based on a biological endpoint necessary to avoid ecological harm?
  - Is TN regulation necessary in addition to TP regulation?
  - Is additional data collection needed to reach scientifically defensible recommendations?
- Opportunity to review and comment on Lake Winnipeg nutrient load reduction targets.