Surface Water Quality in the Chequamegon Bay Region

What We Know and What We Don’t

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Broader Context

- **Global**
  - Food demand
    - 50%-110% increase in production by 2050

- **Regional**
  - Water
    - Globally scares, locally abundant
  - Growing season
    - Increasing 3-4 weeks
  - Land price
    - Among the lowest in the region
  - Transportation
    - Local land and water “hubs”
Lake Erie and Water Quality

“...even a great lake can die.” (Time, 1969)
Nutrients Impacts in Lake Erie
Restoring Lake Erie

- Reduce phosphorus runoff to a “background” level

Phosphorus Goal – 12,000 MT
Since then… it's gotten more complicated

- Toledo water quality crisis
- Apostle Islands algal bloom 2012
- Green Bay Dead Zone
Water Quality Management Process

• Clean Water Act (1972)
  – Set water quality standards
  – Assess water quality conditions
  – Identify impaired waters
  – Restore impaired waters
Assessing Water Quality

- Setting Standards
  - Beneficial uses
  - Triennial review

- Condition Assessment
  - WisCALM
    - How many samples?
    - Over what timeframe?
    - How “different” from standard?

Vs.

Graph showing comparison of Northern pike and Black bullhead with a target TSI value.
Managing Water Quality

- **Protect**
  - Antidegradation
  - ORWs and ERWs
  - National Pollutant Discharge Elimination System (NPDES)

- **Restore**
  - Total Maximum Daily Load (TMDL)

Phosphorus Goal – 12,000MT
Limits to the Clean Water Act

- Focused on “point sources” of pollution
- Water quality vs. performance based

Phosphorus Goal – 12,000MT
Formation and Evolution of Aquatic Ecosystems

15000 yrBP

Youth
Valley is steep, v-shaped.

Maturity
Valley is less steep; stream begins to meander.

Old Age
Valley has wide flood plain; stream meanders.
Formation of Water Quality Conditions

- Product of watershed conditions
- Responsive to long-term “averages”
- Annually variable
- Soil nutrient “deficiencies” do not exist
Water Quality and Agriculture

- Runoff
  - Quantity and Quality
- Stream banks
  - Shading and leaf input
Land Use Export of Phosphorus

- TMDL Goals Commonly 0.16-0.33 lb P/acre/year
Water Quality Change is...

- Gradual and often difficult to measure
- Dependent on scale
Instream Phosphorus Concentrations - Chequamegon Bay Tributaries (2014)

- Median
- Standard

Total Phosphorus Concentration (μg/L)

Bay City  |  N. Fish  |  Pine Creek  |  S. Fish (Colby)  |  Souix River  |  Whittlesey  |  Thompson's

Site Name
Watershed Phosphorus Budget

- #1 Net Import
- #2 Import = Export
- #3 “Recycling”
Nutrient Limitation Varies

- Streams are likely limited by phosphorus
- Coastal wetlands are likely limited by nitrogen
- Lake Superior is likely limited by phosphorus
Currents in Chequamegon Bay
Currents in Chequamegon Bay
Precipitation Changes

- More rain, at a greater intensity, than previously thought
Climate Change

Wetter

Warmer
Soil-Water Paradox

- Soil and nutrient runoff benefit very few people
- ...yet soil and nutrient loss from agricultural systems has increased over time
Agricultural Policy Considerations

• Zoning and land use planning
  – Watershed scale
  – Ownership structure

• Data support systems for land owners
  – Private vs. public data access

• Agricultural demand is an important driver of water quality
Summary

1. Agricultural impacts to water are highly variable and dependent on scale

2. Lake Superior and Chequamegon Bay have unique water quality considerations

3. Measuring change in water quality condition is challenging

4. Successful policies benefit both landowners and general public