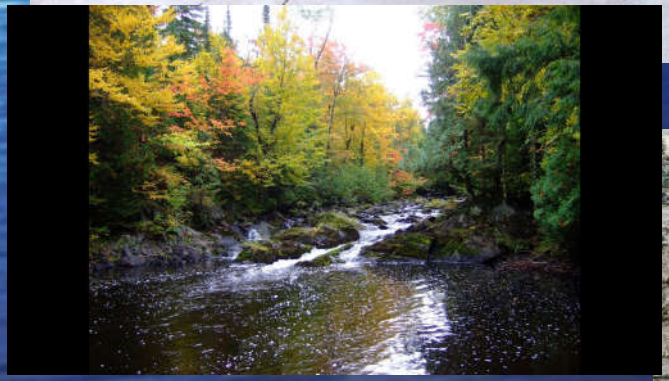
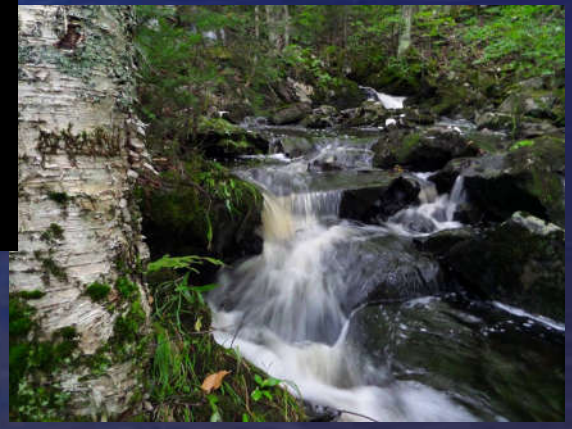
# How to be SMART about Citizen Water Quality Monitoring

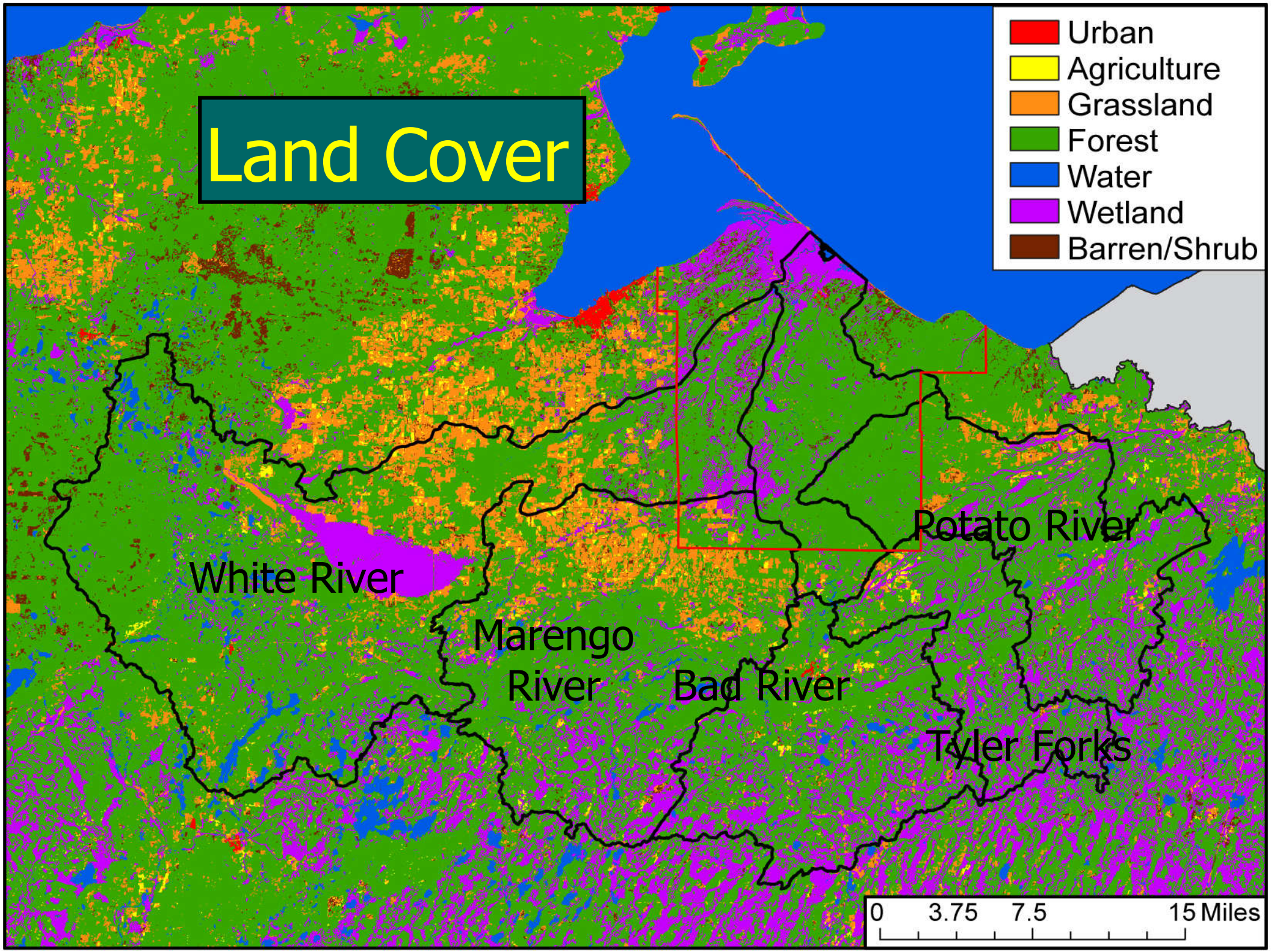
Case Study of the Bad River Watershed Association

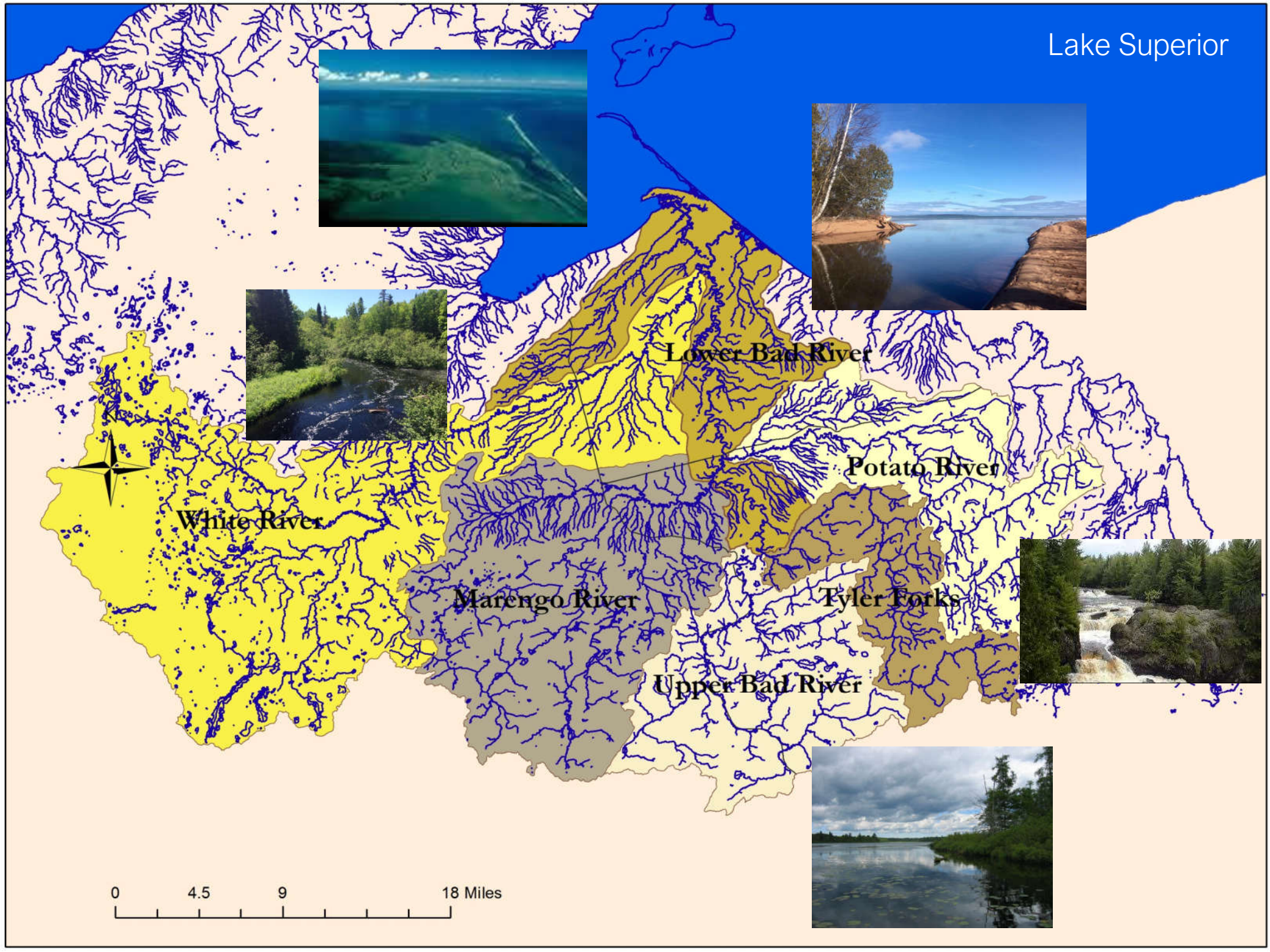
Tracey Ledder, Delaware Engineering

# Once Upon A Time……




Land Cover
Urban
Agriculture
Grassland
Forest
Water
Wetland
Barren/Shrub
White River
Marengo River
Bad River
Potato River
Tyler Forks
0
3.75
7.5
15 Miles


Lake Superior
Lower Bad River
Potato River
White River
Marengo River
Tyler Forks
Upper Bad River
0
4.5
9
18 Miles

# SMART

Acronym for Planning and Objectives

Specific

Measurable

Achievable

Relevant/Realistic

Time Bound

# Planning Process

- "We thought the water quality was generally pretty good, but we didn't really know"
- History – large impacts from cut over, erosion and incision
- Why monitor? No data on north WI since the 1970s, area mostly forested, small urban areas, AND community involvement (get their feet wet)
- What to monitor? Basic watershed health
- Where to monitor? Assigned sites, chosen for safe access and the information they provided
- Who will want the data?


- How to monitor? Chemistry = snap shot, macroinvertebrates= long-term view; is the site tidal?

WATER QUALITY STANDARDS

- ➢ Designated uses
  - Fish and Aquatic life, recreation, etc
- ➢ Criteria to protect use
  - Narrative and numeric
- ➢ Antidegradation
  - Categories ORW, ERW
  - Policy and procedure

# Objectives of Water Quality Monitoring Program

The overall objective of the BRWA Water Quality Monitoring Program is to establish at least a ***FOUR-YEAR BASELINE*** of water quality on the streams and rivers within our service area. The baseline data will be used to determine the overall health of watersheds and troubled spots will be investigated. The Bad River Watershed Association and other data users can then make more informed decisions on supporting proposals concerning land use, conservation efforts and other projects to preserve the vital habitat and water quality of the watersheds. Continual monitoring should then be able to detect changes to water quality in the future.

There are ***TWO MAIN SUB-OBJECTIVES*** to the Bad River Watershed Monitoring Plan.

- Objective 1 – to collect baseline data on several points of the major tributaries. Data to be collected consists of basic water chemistry (temperature, pH, dissolved oxygen, chloride and turbidity), biological assessment using macroinvertebrates, and physical characteristics.
- Objective 2 – to get local citizens involved with their watershed by monitoring water quality.

The plan is built to meet these objectives and to extend the sampling being carried out by the Bad River Natural Resources Department (BRNRD). That sampling plan involves 24 points on the exterior boundary of the Reservation and downstream to the mouth. The major subwatersheds are sampled at several possible locations on the major tributary – headwaters, mid-length and near its mouth. This plan enables the capture of minimal water quality data. As the program expands and volunteers are added, more sites are added. The sampling sites have been chosen according to the information the site can give about the watershed (headwaters, below confluences, upstream/downstream of possible sites of impact) and the possibility of safe convenient access for the volunteers.

An important example of our water quality data in use occurred in October 2006, when the Wisconsin Department of Natural Resources (WDNR) approved the designation of 44 northern stream segments as Exceptional Resource Waters (ERW) or Outstanding Resource Waters (ORW). Originally, streams in the Bad River Watershed were not considered for these designations due to lack of information. Our macroinvertebrate sample data was submitted to WDNR to demonstrate that many of the waters we sample deserve this special designation. As a result, several rivers in the watershed were added to the ORW/ERW list.

SMART

# Parameters and Benchmarks

| Parameter | Lamotte test | Tests per kit | Surface water Benchmark |
|---|---|---|---|
| pH | Range 3.0 – 10.5 at 0.5 | 100 | 6.5 – 8.5 |
| Nitrate | Range 0 – 4.4 | 50 | 1.0 mg/L |
| Phosphate | Range 0.05 – 1.0 at 0.05, 0.1 and 0.2 intervals | 50 | 0.1 mg/L |
| Dissolved Oxygen | 0 – 10 mg/L at 0.2 intervals | 50 | >5 mg/L, 6 for Trout streams |
| Chloride | 0 – 200 mg/L at intervals of 4 | 50 | Establish baseline |
| Turbidity | 5 – 100 JTU at intervals of 5 | 50 | Establish baseline |
| Fecal coliform | Lab test or kit | | 200 CFU/100 mL (WI) |
| E. coli | Lab test | | 126 (USEPA) |

USGS science for a changing world

NOTE: What are the relevant Water Quality Criteria?
Wisconsin TP Criteria 2010

# Documentation and Quality Control

- Standard Operating Procedures for all methods, QAPPs
- Training in classroom and field, and at each site
- Method QC; bring them to the lab and watch procedures, document, DO agreement = 0.2 mg/L, colorimeter difficult
- Data QC; field sheets submitted, double person entry, firebox
- More training; any time asked

- Care and feeding of volunteers; get them the reagents and supplies they need when they need them, periodic presentations, annual picnic (awards)
  - Organization pyramid; move volunteers up to Board

# QC Session Results

- DO essential parameter for watershed health,
  % saturation, titration +/- 0.2 mg/L average
- pH color comparator, +/- 0.5 SU
- Temp One project used HOBOs
- Chloride Titration, color endpoint +/- 2 mg/L
- P and N began with 0.1 phosphate and 1.0 nitrate that Lamotte could do, when EPA ecoregion criteria were published/WI TP adopted, this method wasn't sufficient, reagents hazardous and $ ➡ nixed
- Equipment ability & limitations, reagents, funding?

# Macroinvertebrate Monitoring

- Same site assignments
- Family level identification
- Train on collection, set sampling windows based on Hilsenhoff, data sheets, flow estimate
- Method based on multi-habitat, 100 individual sample
- All ID checked

# Summary Reports and Presentations

Bad River Watershed Association
Quality Control Lab Results
February 2011
Tracey Ledder, Technical Advisor

This is a follow-up on this year's Quality Control lab sessions. Thank you all for attending. Fourteen people went through QC testing this year, including new and long-term monitors. BRWA really appreciates your efforts at collecting meaningful data we can use to protect our watershed. Thanks to Andy Goyke, Northland College, and Joan Elias, National Park Service, for the use of lab space (again!). Special thanks to Sharon Anthony, Northland College, for providing testing solutions.

For this QC lab, solutions were prepared at the Northland College Chemistry lab by chemistry professor Sharon Anthony and her students. For dissolved oxygen (DO) we all analyzed water from a bucket at the same time and compared the results.

**Safety Note**

Please keep track of your volunteer notebooks with the MSDS sheets in case you should spill any chemicals or someone should be exposed by swallowing or splashing. The poison control center can use the information on those MSDS sheets to help you. The poison control center number is written on the white envelope in the volunteer notebook. Also call Val or Michelle to report any incidents. ALWAYS wash your hands and working surface before and after analyzing your samples.

BAD RIVER WATERSHED ASSOCIATION

## Water Quality Report for Marengo River at Reimer Rd.

The Marengo River is listed as a Class II trout stream* and has an Exceptional Resource Water classification** by the State of Wisconsin. These classifications identify the Marengo River at this location as one of Wisconsin's highest quality waters, with no changes in baseline water quality due to discharges allowed except some human point sources of pollution.

***Trout Stream Classification (State of Wisconsin)**
**Class I**: Highest quality trout waters. No stocking needed to maintain populations.
**Class 2:** Some natural reproduction, but stocking is needed to maintain a desirable sport fishery.
**Class 3:** No natural reproduction. Populations maintained by stocking.

Brook Trout *Salvelinus fontinalis*

Bad River Watershed Association (BRWA) volunteers have collected 89 water chemistry and 12 macroinvertebrate samples over the past 11 years from Marengo River at Reimer Rd. This site has more than enough data to meet BRWA's objective of at least four years of baseline data for water chemistry and macroinvertebrates. The following are water chemistry and macroinvertebrate summaries for the Marengo River at Reimer Rd. using data through 2012. Future monitoring can be compared to this baseline to see if changes are occurring and whether action may be needed to address pollution sources.

****Water Classification**
Wisconsin's highest quality surface waters are classified as:
**Outstanding Resource Waters (ORW):** Highest quality waters, typically no human point sources of pollution exist, no changes in baseline water quality allowed.
**Exceptional Resource Waters (ERW):** Similar to ORW but some human point sources of pollution exist. No changes in baseline water quality allowed.

### Water Chemistry Data Summary

Water chemistry results are summarized for both the four-year baseline period ("Reimer Rd. Baseline") and an additional seven years of available data ("Reimer Rd. Plus"). They are summarized into seasonal averages and overall averages. The standard deviation (std. dev.) gives an idea of how much the results vary from the reported averages. A description of results for each parameter and overall summary is included.

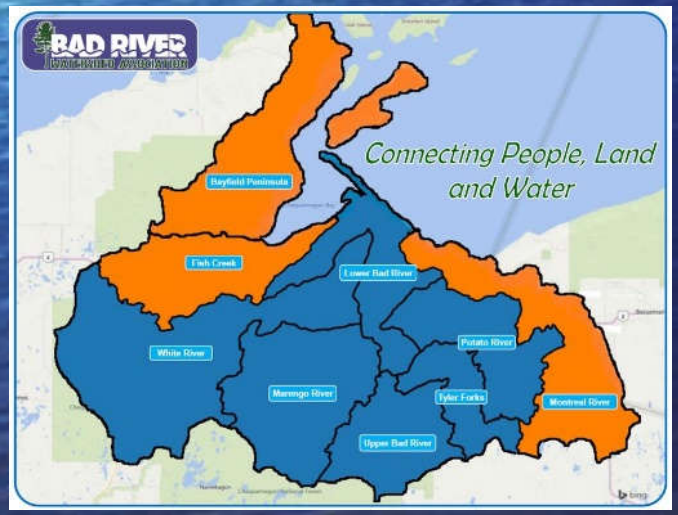
**Data Sharing:** With written procedures, quality control and ID checks the data is more shareable; part of the planning process and SMART

- Bad River Tribal Natural Resources Dept
- SWIMS: CBM 2006, macroinvert. data
  Surface Water Integrated Monitoring System
- Written Data Sharing Agreement

**Expanding our reach- Red Cliff to Michigan**

As we consider the future of the BRWA, we realize the time for growth has arrived. Lake Superior and the Chequamegon Bay region in particular are precious to many. People count on clean water and healthy natural resources for their employment, recreation and daily life. The rivers and streams that empty into the Bay and Lake have an impact on these waters and the resources within, like fish and wild rice.

Expanding our reach around the Chequamegon Bay, out to Madeline Island and east to the state line will allow us to bring our skills and expertise to a greater area, which suffers much of the same lack of data that motivated citizens to start the BRWA so many years ago. Growing the organization in this way we add another 60% of land to the area we cover while increasing the number of people living within our working area by approximately five times. Citizens in this region have always been interested in protecting the water they depend on, and awareness is growing rapidly as new risks to the resource emerge. By bringing our organization to a wider audience, the Association will engage citizens as a community and help develop the ties between individuals and the broader watershed system they depend on.




http://www.badriverwatershed.org/

https://www.superiorrivers.org/

THANK YOU

**QUESTIONS?**