Examination of Hydrology and Water Quality Issues in Lake Wausau, Wisconsin

Problems

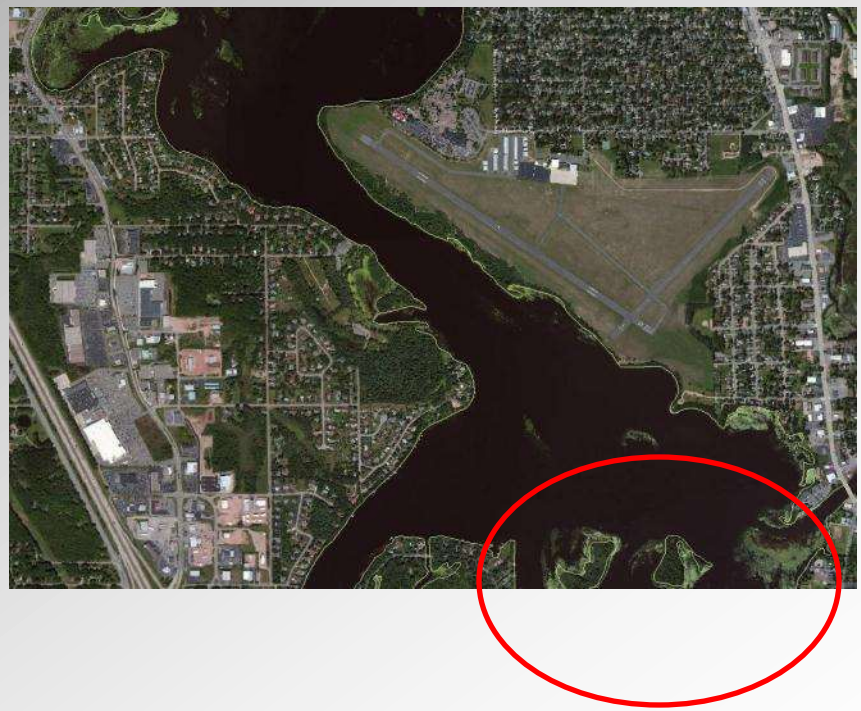
- Braided tributary floodplains with numerous backwater and side channels
  - Lack of flushing and water exchange
  - Poor water quality and dissolved oxygen for fish habitat
- Extensive aquatic plant beds
  - Generally good for water quality and habitat
  - But, they alter flow patterns and exchange of dissolved oxygen
  - Stagnant conditions under plant beds

Rib River Inflow

- Backwaters and side channels
- Critical habitat for spawning and young fish
- Connection to the Rib River has deteriorated
- Little flushing and exchange to replenish dissolved oxygen results in poor habitat

Eau Claire River Inflow

- Extensive aquatic plant beds
- Act as barriers to water exchange
- Actually divert Eau Claire River inflows
- Poor water quality under plant beds for fish and invertebrates



Planning Issues and Needs

- LAKE MAP
- AQUATIC PLANT MANAGEMENT
- SHORELAND HABITAT
- HYDRAULICS
- WATER- QUALITY\FISHERIES HABITAT
- WATER GOVERNANCE
- COMMUNITY VALUES SOCIO\ECONOMIC
- RECREATIONAL USE

Overall Objectives

- Develop management scenarios to improve flushing and water exchanges to susceptible habitats
- Predict impacts of tributary nutrient loading reduction on water quality

Research Tasks

Aquatic Plant Distribution

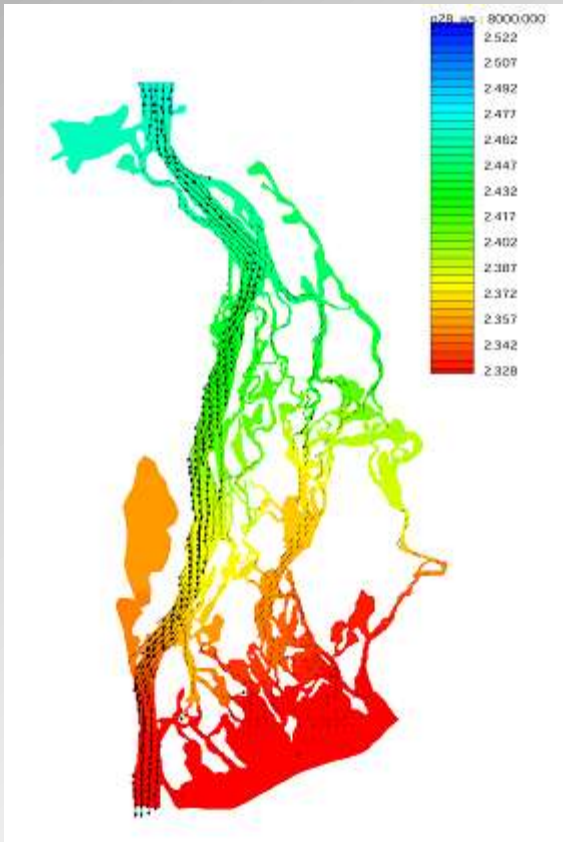
- Current locations of aquatic plant beds
- Identification of exotic/nuisance and unique species
- Diversity and health of the plant community
- Needed for habitat assessment and hydraulic modeling

Shoreland Assessment

- Record health of shoreland habitat
  - Depth of vegetative buffer
  - Erosion
  - Direct drainage
  - Outfalls
  - Sea walls
  - structures
- Document current conditions

Hydraulic Modeling

- Modeling needed to examine and predict current exchanges and flushing
- Calibrated model will be used to predict changes as a result of modifying flow
  - What if diversion structures and channels are put in place
  - What are the best strategies for promoting exchange between river channels and floodplain backwaters
  - Scenarios to divert river inflows to plant beds to improve habitat



Dye Tracing Studies

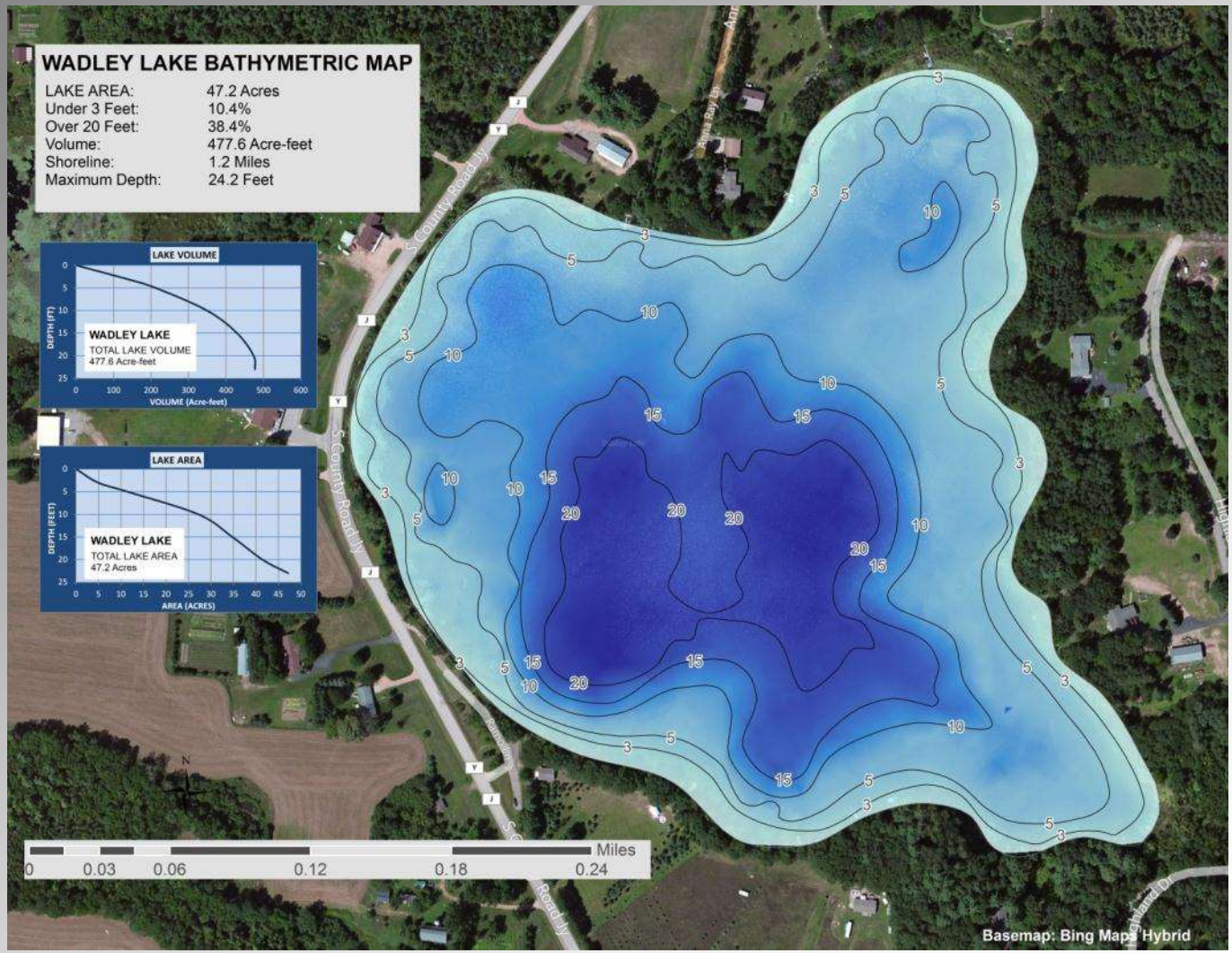
- Needed to better understand flows and exchanges due to plant beds for hydraulic modeling
- Rhodamine WT fluorescent dye
  - Widely used
  - Harmless and rapidly dissipates
- Research will examine Eau Claire River inflows

Lake Map

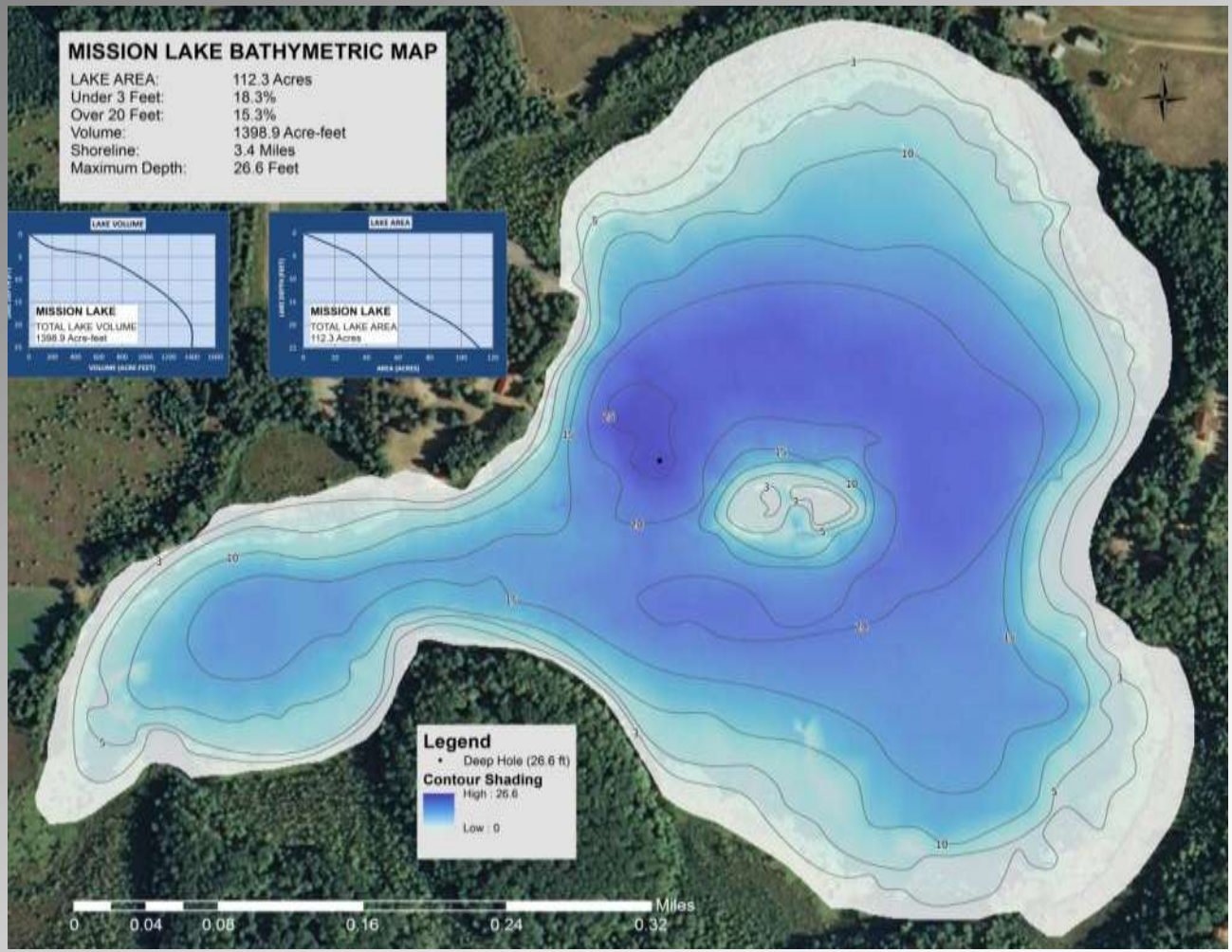
- Updated bathymetric map
  - More detailed channel and backwater depth characteristics
  - Critical for examining and predicting water exchanges
  - And development of scenarios to improve flushing

2011 Field Study

Wadley Lake Bathymetry
Marathon County, Wisconsin



Mission Lake, Marathon County



Traditional Habitat Mapping

Combination of transect lines and quadrat samples at point locations.

Missing information between sampling points!

Traditional sampling methods do not provide continuous habitat coverage.

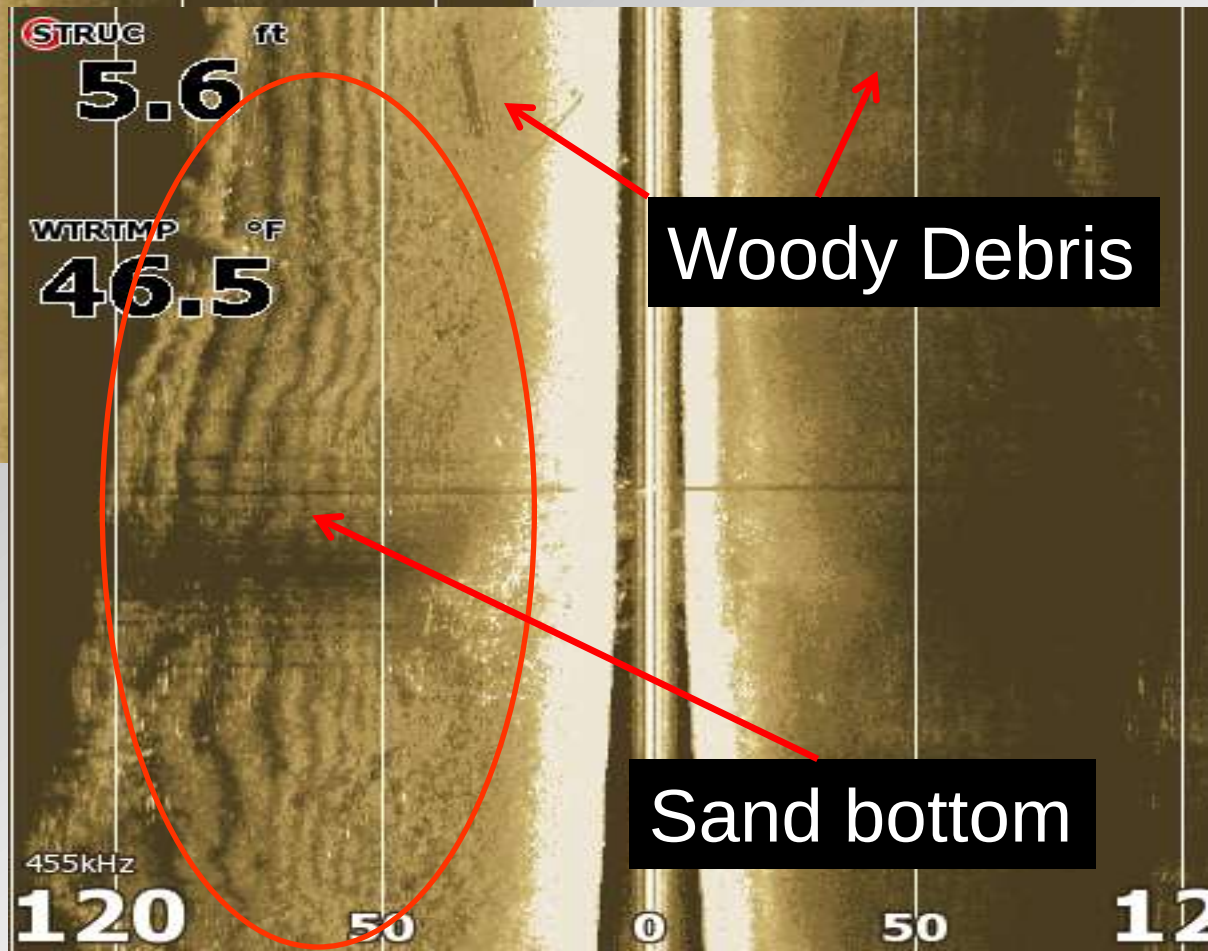
Side-Scan Overview

- Ability to collect continuous coverage of lake bottom surface.
  - 180˚ Swath of lake bottom
  - Range settings 20-250 feet

Image source: http://www.starfishsonar.com/technology/sidescan-sonar.htm

- Shows distinct features in water such as coarse woody habitat and substrate type:
  i.e. Muck, Sand, Gravel, Bedrock

Muck bottom

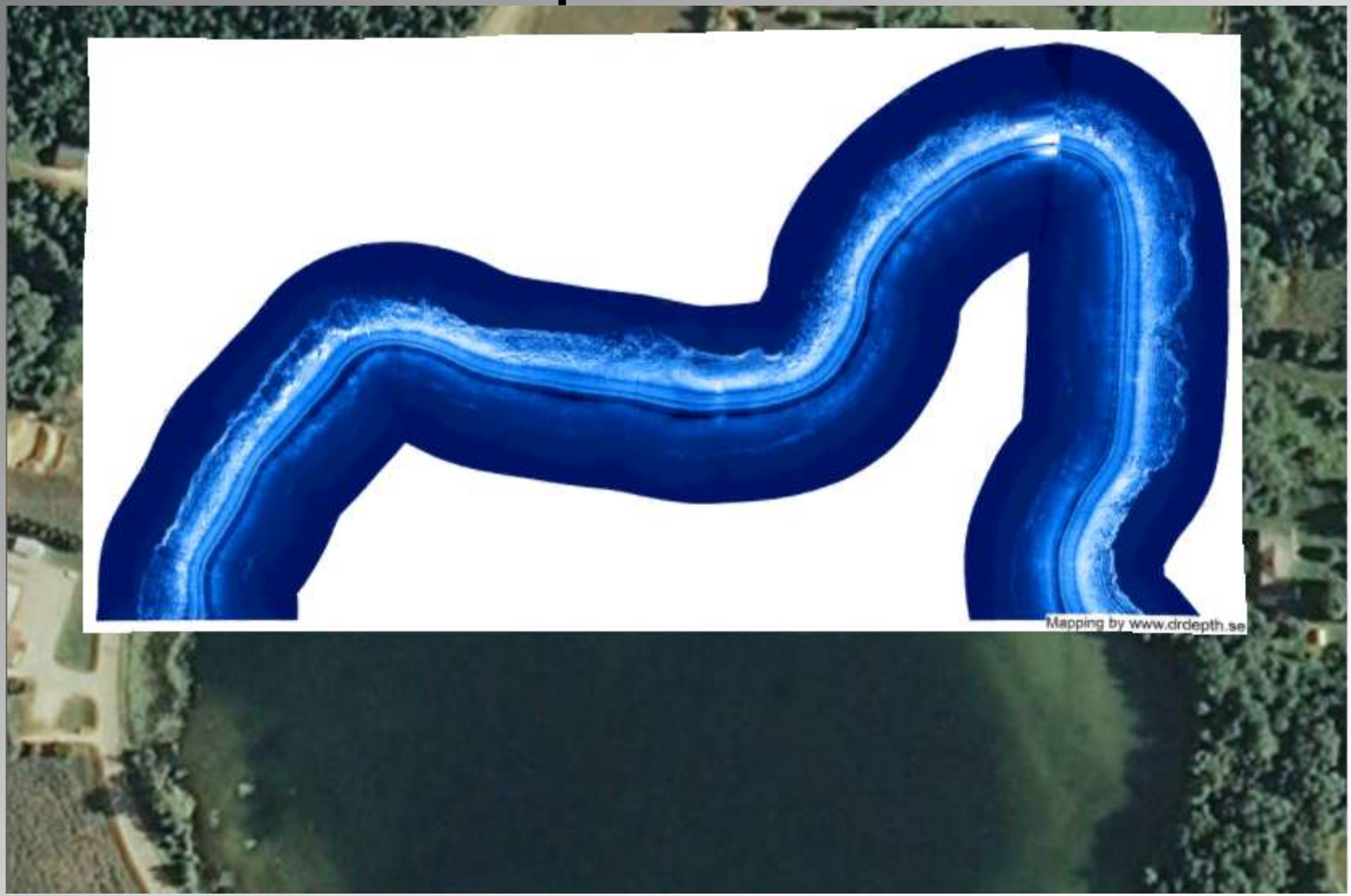


Woody Debris

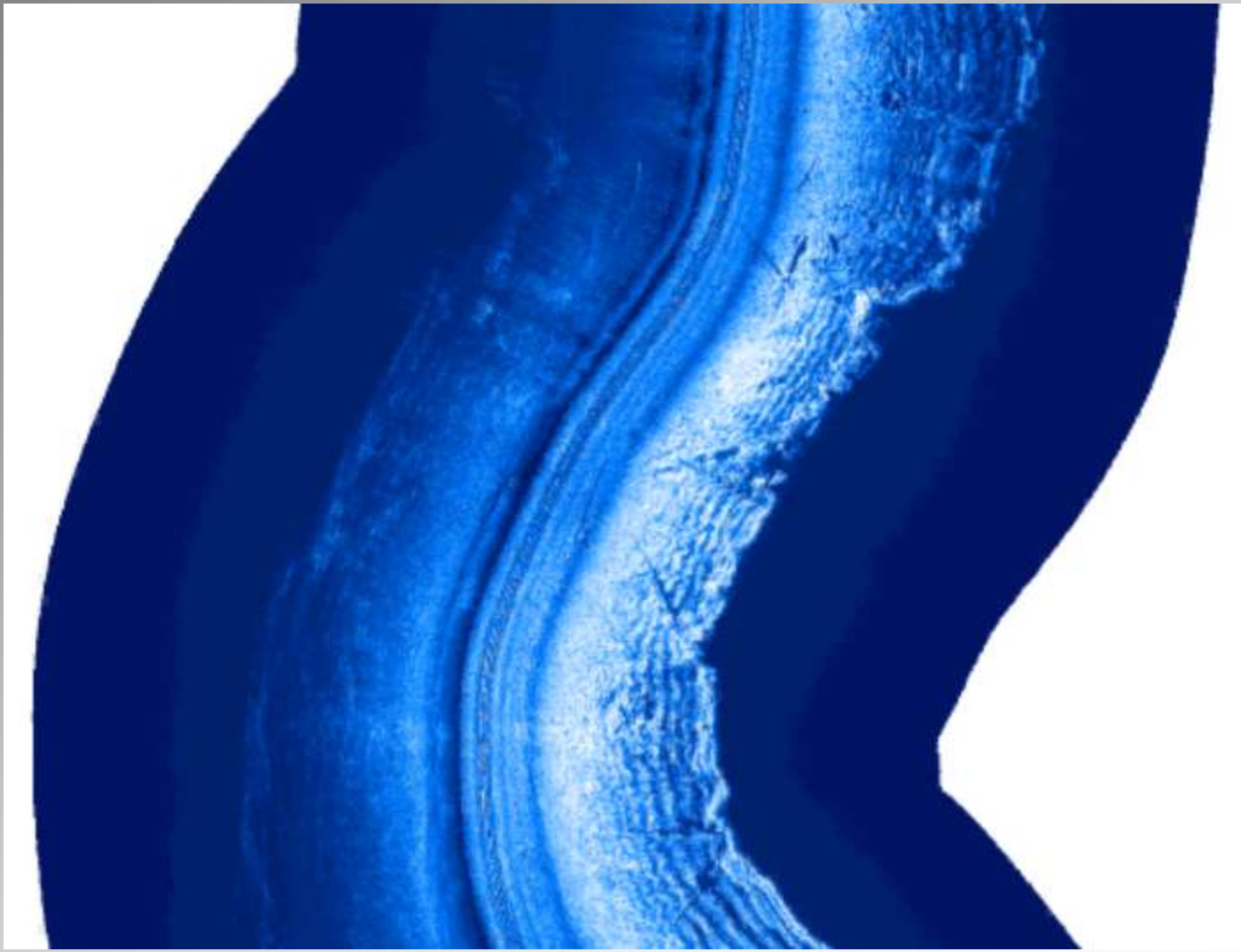
Sand bottom

Images are not rectified

Rectification of Sonar Imagery
Dr. Depth software

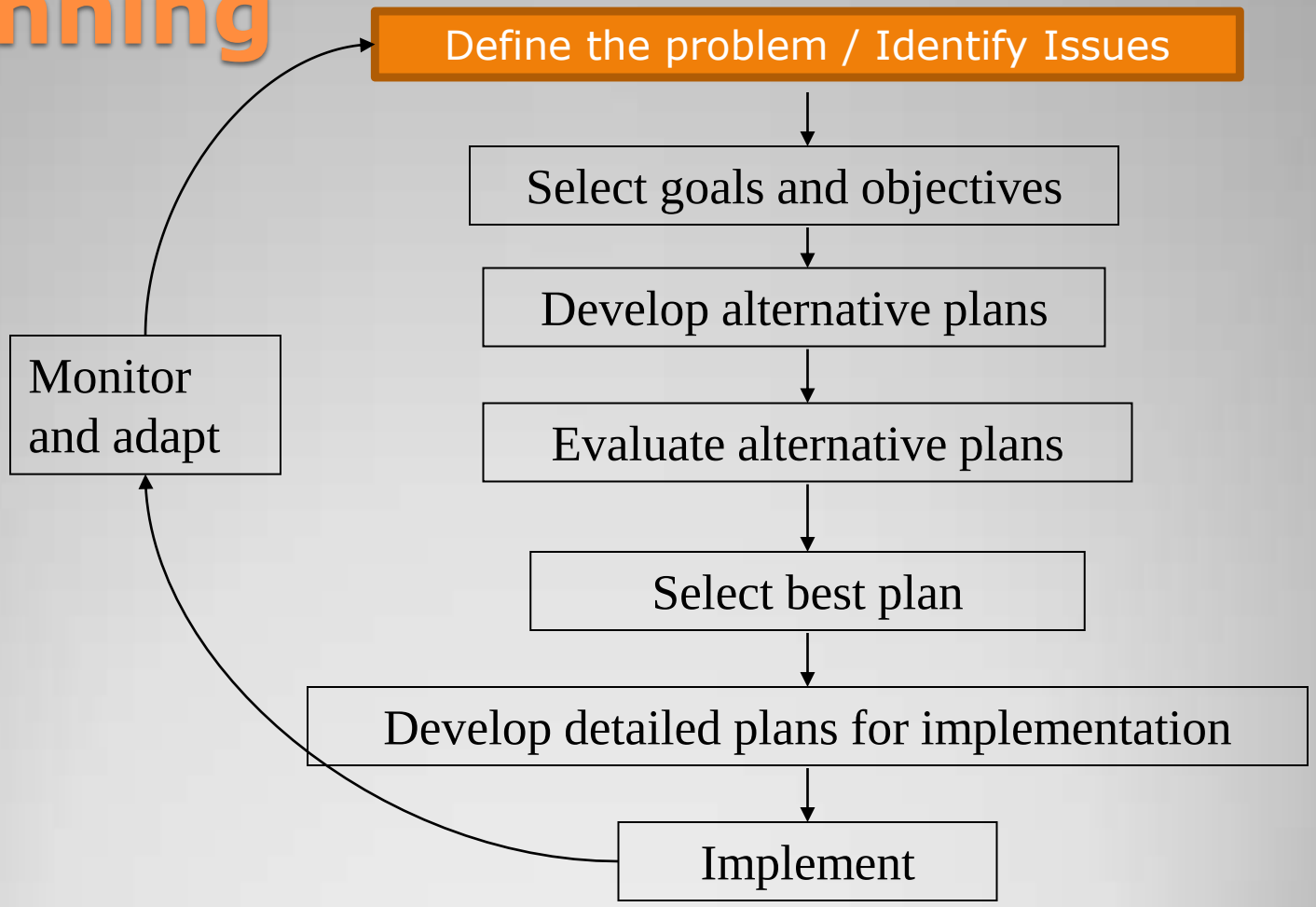


A Closer Look



Social-Economic Assessment for Lake Wausau

Rational Comprehensive Planning



Defining the Problem

- Ecological Data
- Social Data
  - Identifying Strengths and Weaknesses:
    - Water Governance: Background assessment & capacity
    - Community values: Identifying stakeholder perspectives (social and economic)
    - Recreational Use

Phase 1: Existing Governance and Lake Management Priorities

- *Objective 1:* **Evaluate existing community capacity and coordination of management efforts related to Lake Wausau**
  - Content analysis: Background assessment of existing plans, ordinances, and documents relevant to management of Lake Wausau
  - Interviews with key stakeholders to assess capacity, priorities, and assistance needs

Watershed-wide GOVERNANCE & CAPACITY Issues

- **Strengths:** Characteristics of the watershed / community that give efforts a relative advantage for success
  - Example: Active recreation group that uses the waterway has an interest in donating money to establish riparian buffers

- **Weaknesses:** Characteristics of the watershed / community that reduce the likelihood of successful action to address issues
  - Example: Farmers in the watershed have lower levels of BMP adoption relative to other nearby watersheds

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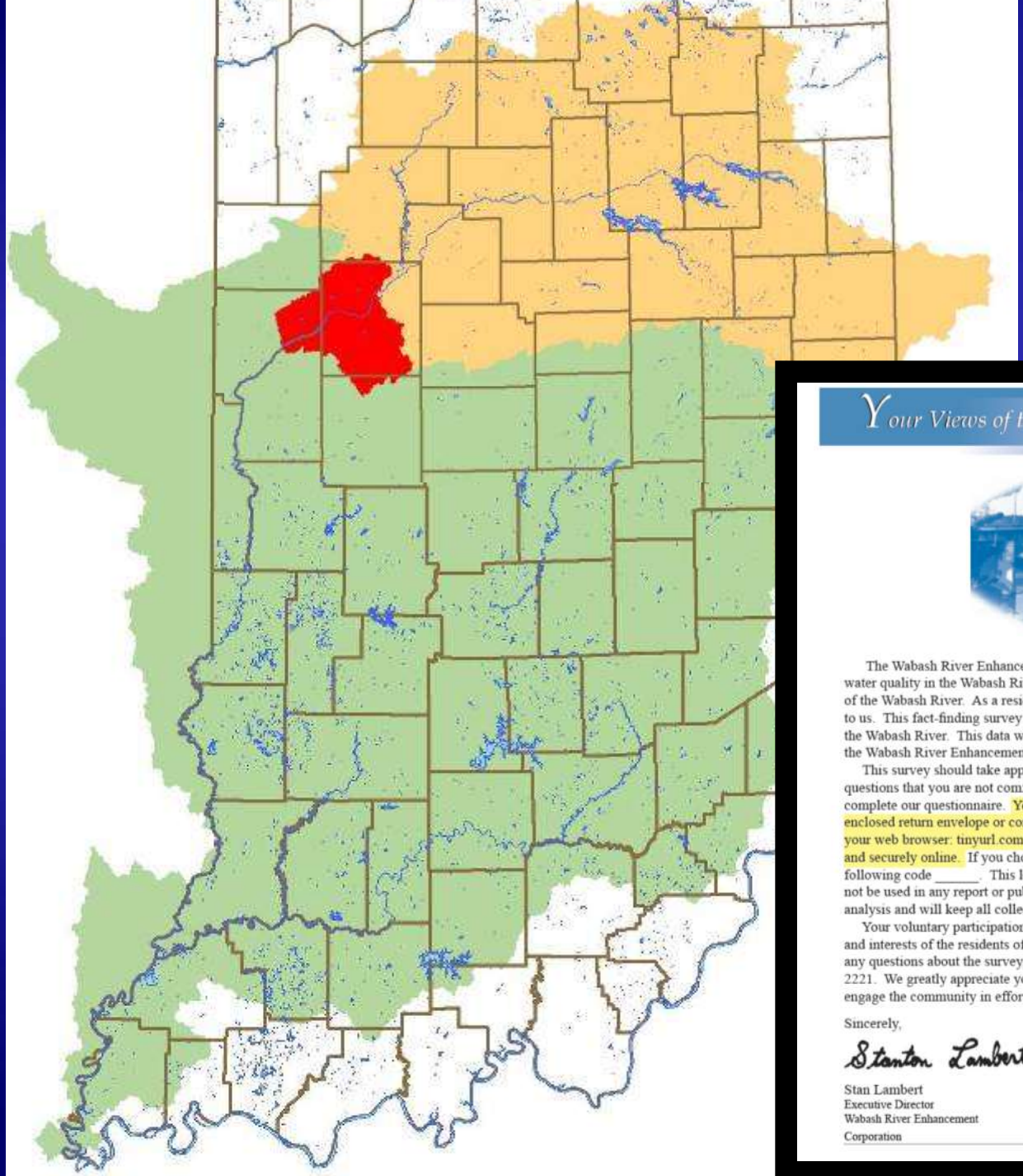
- *Objective 2:* **Identify the different attitudes (social and economic) held by the general public toward Lake Wausau**
  - Survey of Wausau area residents (general public) to assess evolving attitudes toward the lake and the relative importance of economic variables
  - About identifying stakeholders

Wabash River Watershed



Your Views of the Wabash River

The Wabash River Enhancement Corporation and Purdue University are working to improve water quality in the Wabash River in Tippecanoe County. We are interested in your perceptions of the Wabash River. As a resident of Tippecanoe County, your insights are particularly important to us. This fact-finding survey is collecting information about your perceptions and awareness of the Wabash River. This data will be used to help shape the kinds of outreach efforts provided by the Wabash River Enhancement Corporation.

This survey should take approximately 20 minutes to complete and you may skip any questions that you are not comfortable answering. There are two ways in which you can complete our questionnaire. You can either fill out this paper version and return it to us in the enclosed return envelope or complete it on-line by entering the following web site address into your web browser: tinyurl.com/wabashsurvey and providing your responses confidentially and securely online. If you choose to complete the survey on-line, you will need to enter the following code _____. This lets us know that you have completed the survey. Your name will not be used in any report or publication. Researchers at Purdue University will be conducting the analysis and will keep all collected information protected and confidential.

Your voluntary participation in this survey is very important to ensure we understand the needs and interests of the residents of Tippecanoe County. This is your chance to be heard. If you have any questions about the survey, please contact Linda Prokopy at Purdue University at (765) 496-2221. We greatly appreciate your participation in this survey to help us learn how we might best engage the community in efforts related to the Wabash.

Sincerely,

Stanton Lambert

Stan Lambert
Executive Director
Wabash River Enhancement Corporation

Ron Turco
Director
Indiana Water Resources Research Center

Linda S. Prokopy, Ph.D.
Assistant Professor
Purdue University

Categorization of Attitudes toward the Wabash River

Type 1: 61% of respondents

- Positive view of river
- Wabash is a scenic resource
- Condition of river is improving
- Current recreational opportunities are great
- River is symbol of region

Type 2: 18% of respondents

- Don't think about the river
- River is not an important asset for promoting future economic prosperity
- They don't recreate along the Wabash
- Bottom line: they don't care

– *Oral History Project*
  - We would need your support to collect and document the attitudes and perspectives toward Lake Wausau.

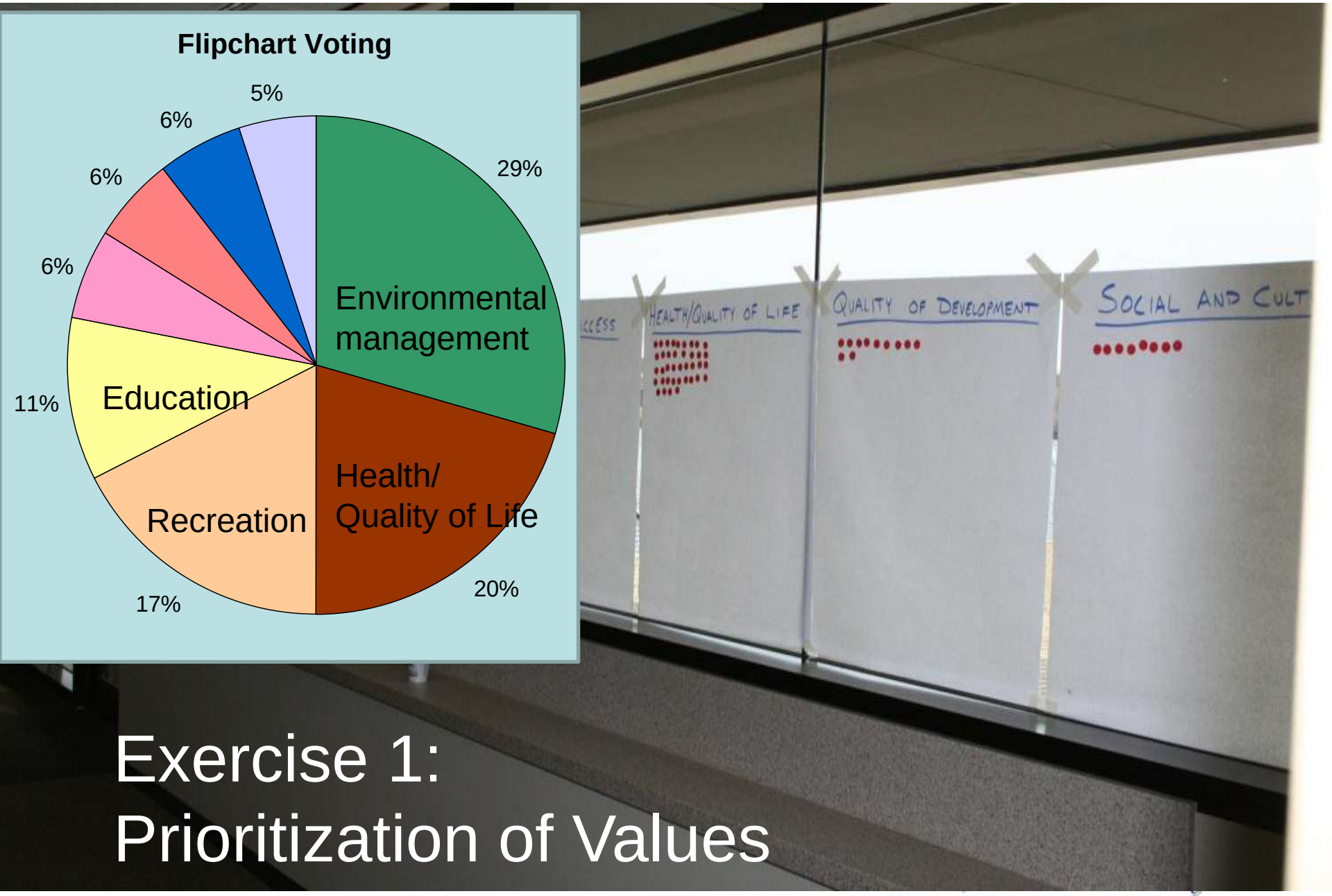
Phase 2: Visioning and Planning

- *Objective 1:* **Utilize community involvement to develop a shared vision for Lake Wausau that reflects the values and desired future conditions of stakeholders**
  - Visioning session(s) with community: A process to engage citizens in the development of the plan for Lake Wausau leading to the development of a written vision for these efforts.

What do you see?

- River Vision - 2006:
  - Community visioning session
    - Engage citizens in a dialogue about the future of the Wabash River
    - Understand citizen priorities
    - Generate ideas
  - More than 100 participants

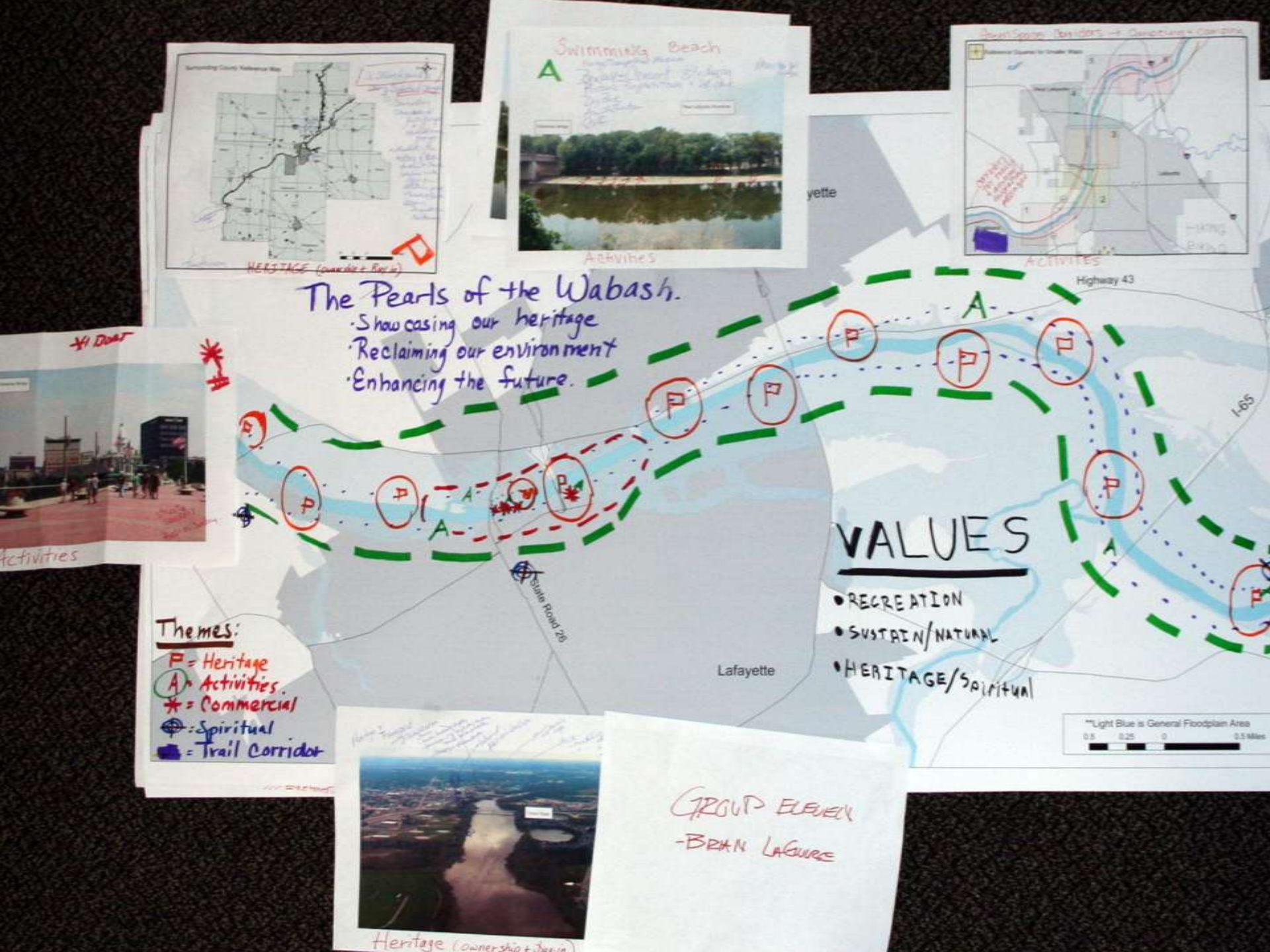
The Wabash.
Our River, Our Community



Exercise 1: Prioritization of Values


Icebreaker!


And then the hard work began. . .


Swimming Beach
A
Activities
HERITAGE (ownership + Rights)
Activities
Highway 43
The Pearls of the Wabash.
·Showcasing our heritage
·Reclaiming our environment
·Enhancing the future.
Activities
Themes:
P = Heritage
A = Activities
* = Commercial
= Spiritual
= Trail Corridor
State Road 26
Lafayette
I-65
VALUES
• RECREATION
• SUSTAIN/NATURAL
• HERITAGE/Spiritual
**Light Blue is General Floodplain Area
0.5 0.25 0 0.5 Miles
Heritage (ownership + Rights)
GROUP ELEVEN
-BRIAN LaGUIRE

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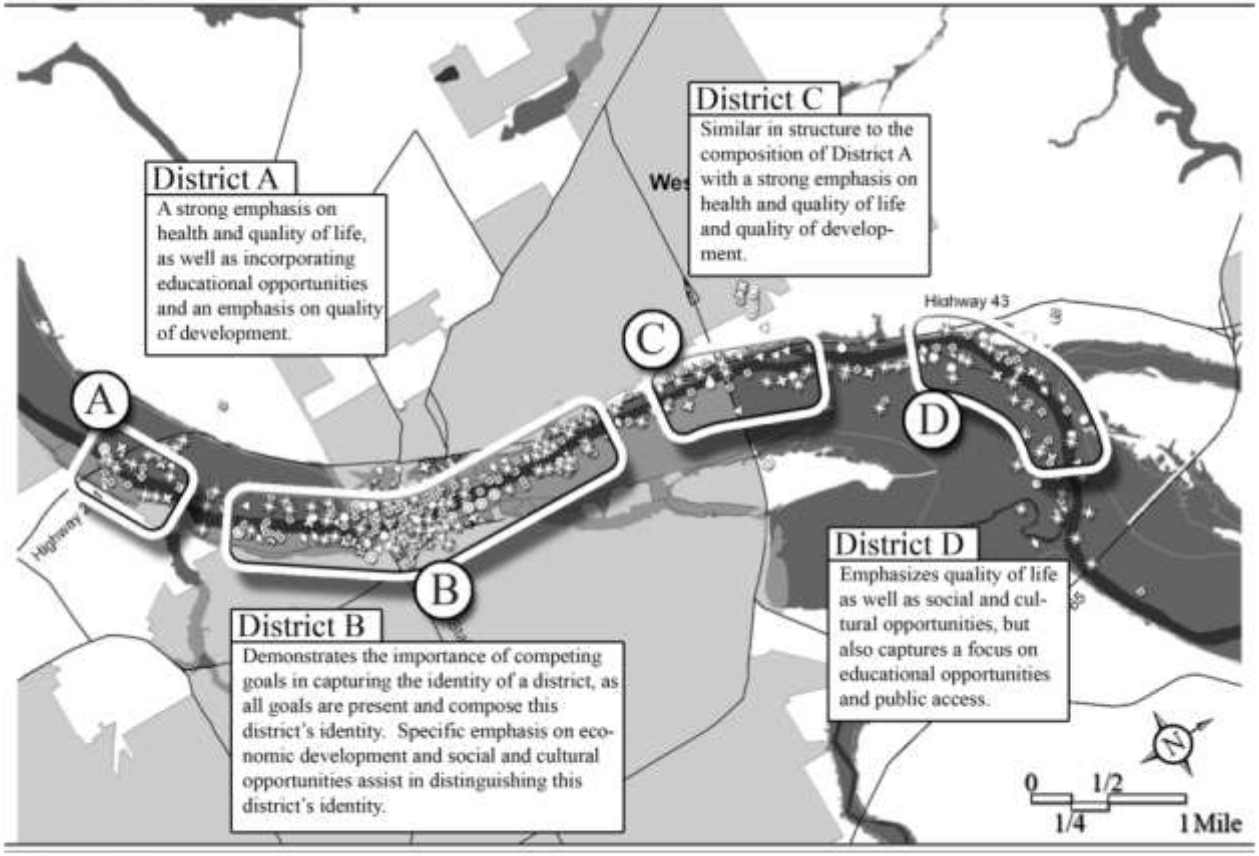
- *Objective 2:* **Create a comprehensive assessment of stakeholders spatial values for Lake Wausau**
  - Spatial values mapping / recreational inventory (public access conflict)

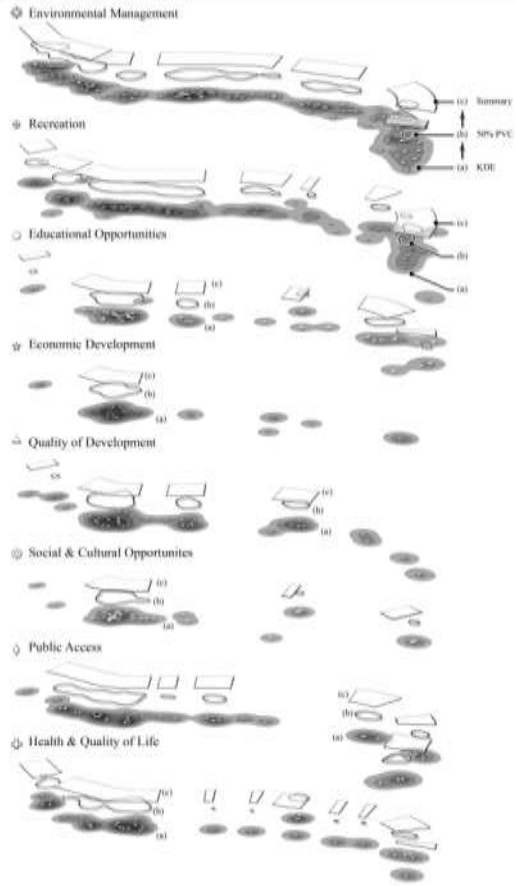
Goal Defined Districts



Legend

- Environmental Management
- Educational Opportunities
- Quality of Development
- Public Access
- Recreation
- Economic Development
- Social & Cultural Opportunites
- Health & Quality of Life

Kernel Density Estimation Analysis



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- *Objective 3:* **Estimate economic use values for current and future conditions of Lake Wausau**
  - Economic analysis of Lake Wausau

Proposed Budget

- 50% cost-sharing with the USACE St. Paul District will be pursued
- Section 22 of the Water Resources Development Act – Planning assistance for States
- *Section 22 cost-sharing will be eligible for tasks 4 and 5

Task	Description	Cost
1	Bathymetry	15
2	Aquatic Plant Survey	12
3	Shoreland Habitat Survey	12
4	Hydrodynamic Modeling	50*
5	Dye Tracer Studies	10*
6	Community Capacity Analysis	12
7	Social and Economic Values Survey	19