USING AQUATIC PLANT SURVEYS TO EVALUTE LAKE QUALITY

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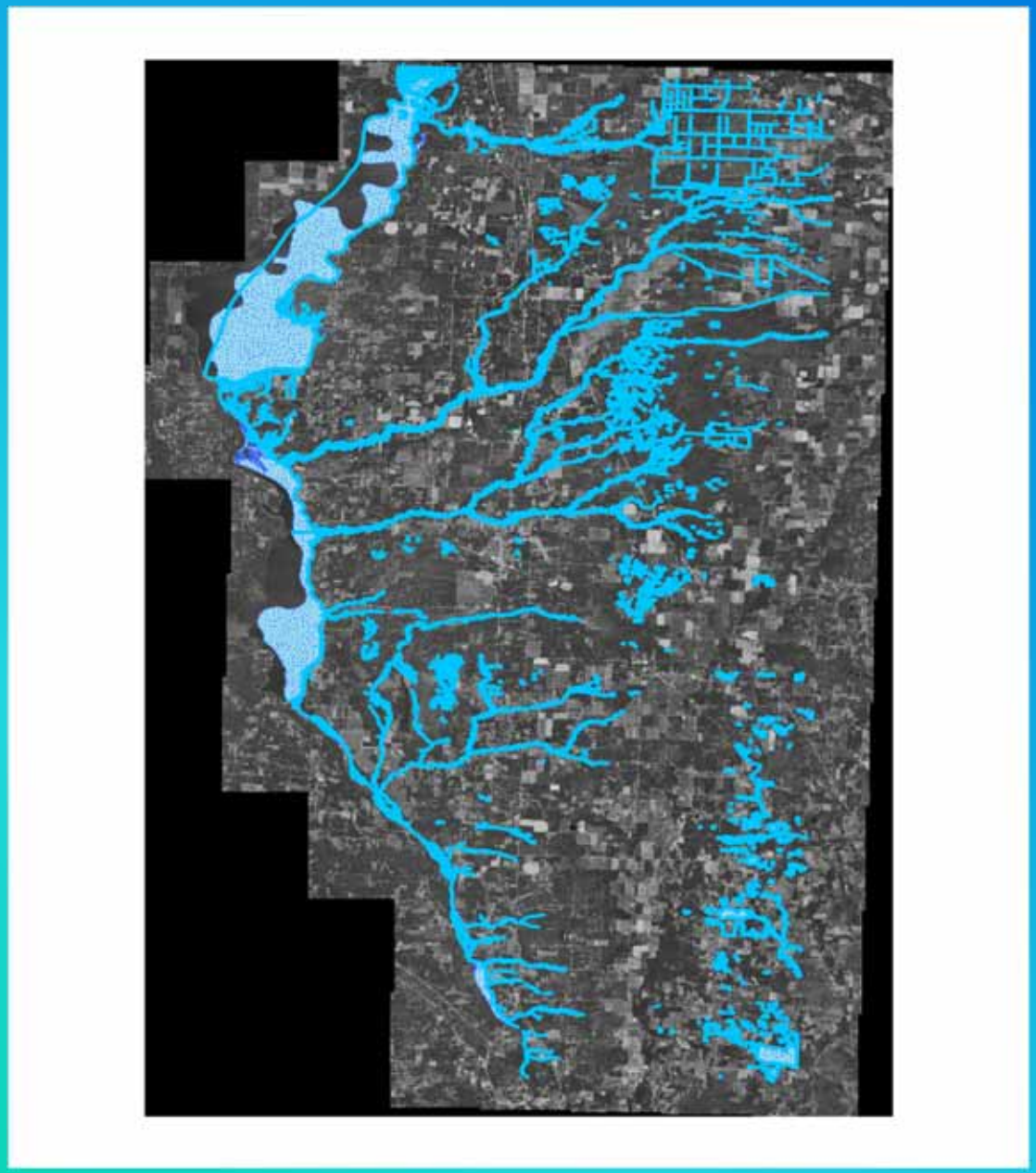


Water is an important part of the natural resources in Adams County.

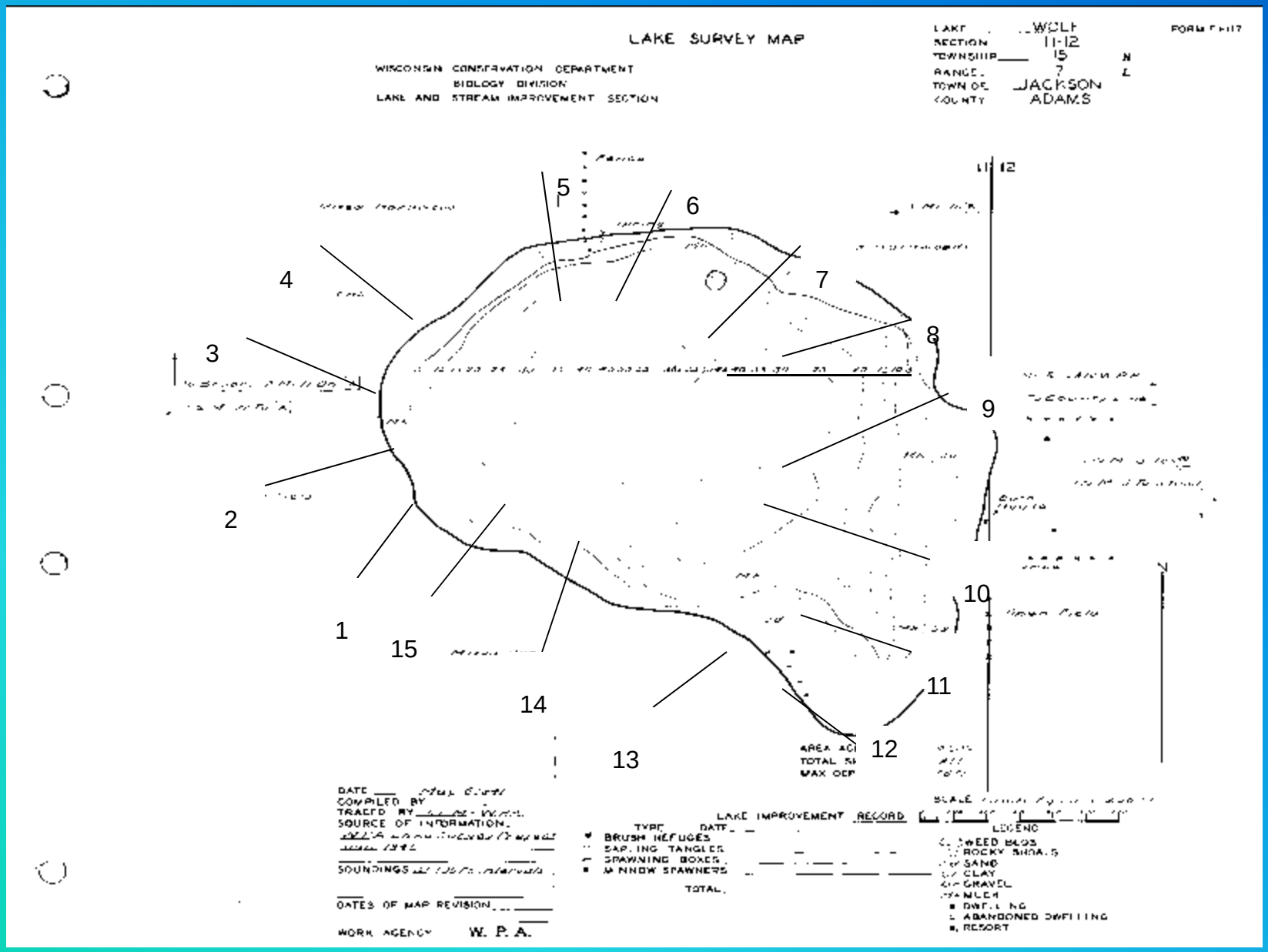
Aquatic Plant Surveys

- In study started in 2004, one part was conducting full aquatic plant surveys on all 20 lakes inland lakes.
- Some of these were an updated aquatic plant survey.
- For many lakes, there was an initial survey done.
- Surveys were done using transect method.
- Survey team was Adams County LWCD staff, plus a lake volunteer, an intern or the aquatic plant specialist from the WDNR.

Transect Surveys

Transect Method

- Divide lake into even sections
- Randomly select perpendicular transect in each section
- 4 Depth Zones: 0-1.5 ft; 1.5-5 ft; 5-10 ft; 10-20 ft.
- 4 rakes taken in each depth zone along the transect


LAKE SURVEY MAP
WISCONSIN CONSERVATION DEPARTMENT
BIOLOGY DIVISION
LAKE AND STREAM IMPROVEMENT SECTION
LAKE WOLF
SECTION 11-12
TOWNSHIP 15 N
RANGE 7 E
TOWN OF JACKSON
COUNTY ADAMS
FORM
11 12
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
DATE
COMPILED BY
TRACED BY
SOURCE OF INFORMATION
SOUNDINGS
DATES OF MAP REVISION
WORK AGENCY W. P. A.
LAKE IMPROVEMENT RECORD
TYPE DATE
BRUSH REFUGES
SAPLING TANGLES
SPAWNING BOXES
MINNOW SPAWNERS
TOTAL
LEGEND
WEED BEDS
ROCKY SHORES
SAND
CLAY
GRAVEL
MARL
DWELLING
ABANDONED DWELLING
RESORT

Transect Surveys--2

Each rake evaluated for:

- Identification of all the species on the rake;
- Density of the species on the rake, ranking 1 to 5.

Data then recorded on field survey sheets.

The shoreline is visually evaluated for cover type at each transect:

- Look at approximate area 50 feet laterally from each transect and 35 feet inward;
- Percentage assigned to each shore cover type, based on survey team agreement

Shore Cover

Shores evaluated for both frequency of occurrence and actual coverage of the shore. Information entered on field data sheet.

There are basic types of shore cover, plus space to put in special cover types, such as a recently-planted buffer.

The basic shore cover types included:

- Herbaceous
- Shrub
- Wooded
- Bare Soil
- Eroded area
- Cultivated Lawn
- Hard Structure
- Rock Riprap
- Natural Rock

Example #1

This shore would be evaluated as

- 95% cultivated lawn
- 5% hard structure (seawall)
- Since the trees have been mowed around, the areas aren't counted as wooded.

Example #2

This shore area includes several shore covers:

- 15% cultivated lawn
- 10% hard structure
- 30% herbaceous
- 5% shrub
- 40% wooded

Plant Data Collection

- Depth and soil substrate for each plant site also entered
- Data entered only on plants actually in the water.

The result is a series of spreadsheets identifying each point of collection, along with all species found there & growth density of each species present.

This rake is very full, so would probably be given a 4 or 5 on the transect survey & 3 on PI survey.

Point Intercept Survey

The WDNR has started requiring aquatic plant surveys to be done using the point intercept method.

Based on a calculation of the surface area of a particular lake, a GPS grid of points over the entire lake is developed.

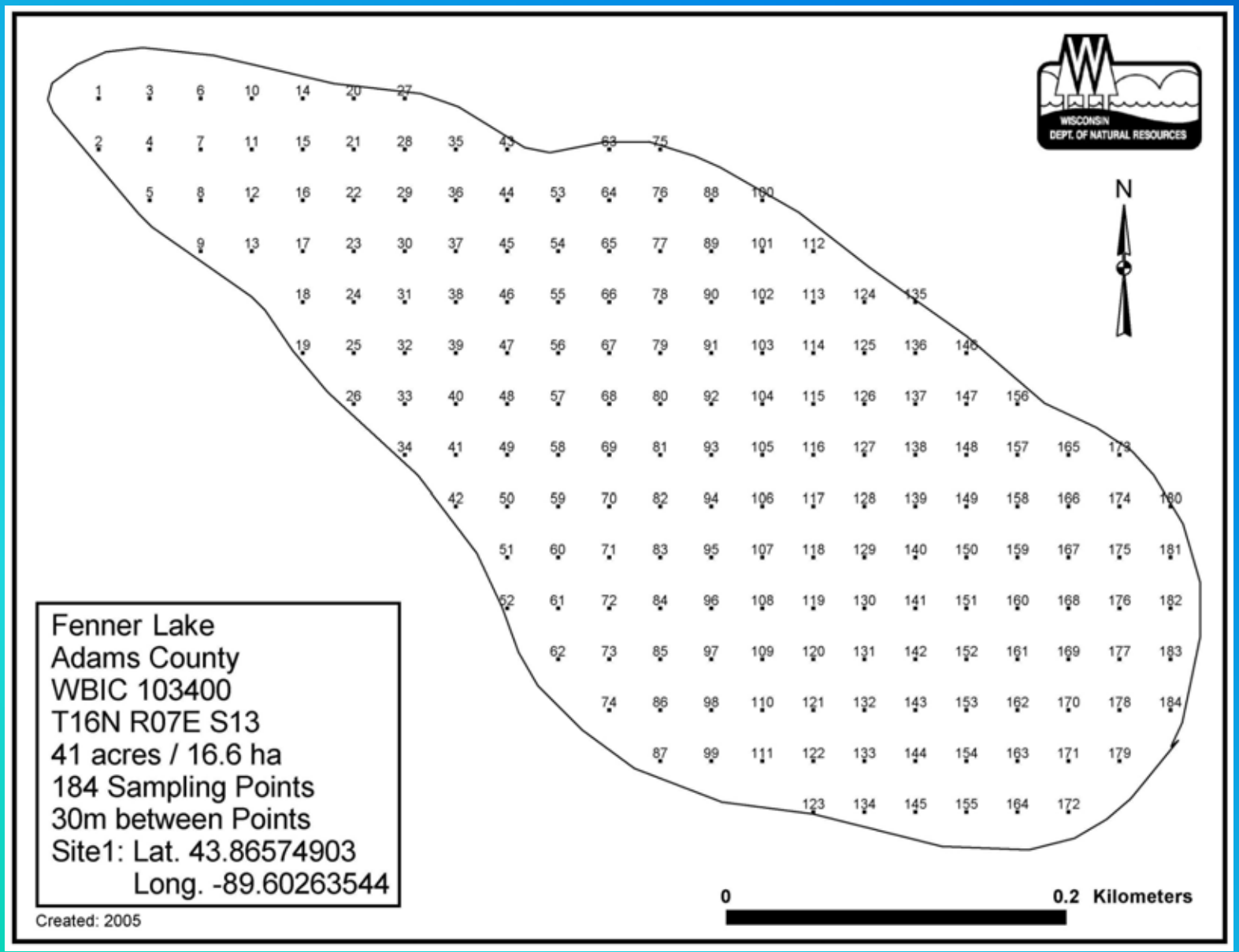
This makes each collection point geo-referenced.

In at least the initial PI survey, one rake is taken at every site, using GPS units to locate each site.

For small lakes, points are generally 30 meters apart. The distance between points expands as the lake size increases.

Point Intercept Survey--2

- Each species on the rake is noted, along with a density rating, using 1 to 3.
- Site depth and soil substrate are also noted.
- Baseline PI surveys have now been done at least one time on all 20 inland lakes in Adams County.
- Near shore sites are sometimes added to the initial grid.


WISCONSIN
DEPT. OF NATURAL RESOURCES
N
Fenner Lake
Adams County
WBIC 103400
T16N R07E S13
41 acres / 16.6 ha
184 Sampling Points
30m between Points
Site1: Lat. 43.86574903
Long. -89.60263544
Created: 2005
0
0.2 Kilometers

Use of Data

Whatever the method of collection used, the information is used to calculate a number of indices that provide information about the health of that particular lake.

Simpson's Diversity Index

- Uses both the occurrence frequency and the growth density of all the plants found during the survey.
- A rating of 1.0 (the most diversity possible) would mean that each plant in the lake was a different species.

Simpson's Diversity Index

Research has provided tables of comparison that can be used once a lake's SI is calculated.

- The median SI for all Wisconsin lakes ranges from .80 to .90
- The North Central Hardwoods Region (including Adams County) has a median range of .82 to .90.

If this lake scores .92, it is above the median and in the upper quartile for the region & the state.

Average Coefficient of Conservatism

Stan Nichols of Wisconsin developed two other indices:

- The Average Coefficient of Conservatism (C of C);
- The Floristic Quality Index (FQI).

The C of C is an assigned value between 0 and 10 that measures the probability that the species will occur in an undisturbed habitat.

- Invasive plants score 0
- Native plants likely to be found anywhere may also score 0
- Plants with Coefficients of 8, 9, or 10 are likely to be found only in high quality natural areas and high quality water
- Those scoring 4 to 7 may occur in both degraded and undegraded sites.

Examples

Swamp Pink = 10

Water Hemp = 0

Cattails = 1

Water Smartweed = 5

Floristic Quality Index

The Coefficients of Conservatism in a lake are used to calculate the Floristic Quality Index (FQI). The FQI measures a plant community's closeness to an undisturbed condition. It can also be used to identify areas of high conservation value, monitor sites over time, assess human-caused impacts, and measure the ecological condition of an area.

	C of C Average	FQI Average
	Range	Range
All Wisconsin Lakes	5.5 to 6.9	16.9 to 27.5
NCHR	5.2 to 5.8	17.0 to 24.4
Crooked Lake	5.9	39.25

Aquatic Community Macrophyte Index

- Another index that can be used to draw conclusions about a lake's health, using 7 parameters
- Developed by Stan Nichols, Byron Shaw & others
- Meant to be a multipurpose tool
- Can be used as part of a system to assess overall lake quality

The AMCI study divided Wisconsin into four ecoregions:

- Northern Lakes & Forest;
- North Central Hardwood Forests;
- Southeastern Wisconsin Till Plains;
- Southeastern Driftless Area Lakes/Mississippi Backwater Lakes.

AMCI--2

	AMCI Range
Statewide	**45 to 57**
NLF	**51 to 62**
NCHF	**48 to 57**
SETP	**41 to 51**
SEDM	**27 to 41**

Example

Parameter		2000		2006		2009		2011
Max Rooting Depth	14	8	12	6	15	9	19.4	10
% Littoral Veg	84.6	10	75.2	10	84.6	10	69.3	10
% Submerged	77	9	95	6	87	9	86	9
% Exotic	24	3	8	4	13	4	15	4
% Sensitive	4	4	6	5	7	5	37	10
Taxa #	23	9	16	8	40	10	40	10
SI	0.84	6	0.89	8	0.87	7	0.89	10
total		49		47		54		63

Coefficient of Similarity

When there are a series of aquatic plant surveys done on a lake, another calculation can be done to determine how stable the aquatic plant community may be, and—by implication—how stable the water quality may be.

The Coefficient of Similarity

- A statistical method to compare similarity & diversity of sample sets;
- First developed by Jaccard in 1901;
- Only appropriate if the surveys were done using the same collection method.

Coefficient of Similarity--2

This is calculated by entering the overall frequency of occurrence and relative frequency of each species found into a formula that allows a determination as to how similar the overall aquatic plant communities are. Percentage scores of 75% or more are considered statistically similar.

For example, in 2009, a transect survey was conducted on Arrowhead Lake in Adams County. Similar surveys had been done in 2000 and 2006, using the same transects. The 2009 results were compared to the 2000 and 2006 results.

Coefficient of Similarity--3

Similarity	Freq	Rel Freq
2009 to 2000	86.3%	94.9%
2009 to 2006	92.0%	84.2%
2006 to 2000	92.4%	76.9%

Results of calculation of 3 aquatic plant surveys on Arrowhead Lake.

- **These figures suggest that the aquatic plant community has stayed relatively stable;**
- **For that to occur, the water quality needed to remain relatively stable.**

Uses of the Surveys

These surveys have been used to keep track of the water quality in the county lakes with public access. The information has also been used for several other purposes.

The original surveys were used as a starting point for critical habitat evaluations.

Critical Habitat

Critical habitat areas are "areas of vegetation identified by the WDNR as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water."

- **Essential to support the wildlife and fish communities;**
- **Provide mechanisms for protecting water quality within the lake, often containing high-quality plant beds;**
- **Provide the peace, serenity and beauty that draw many people to lakes.**

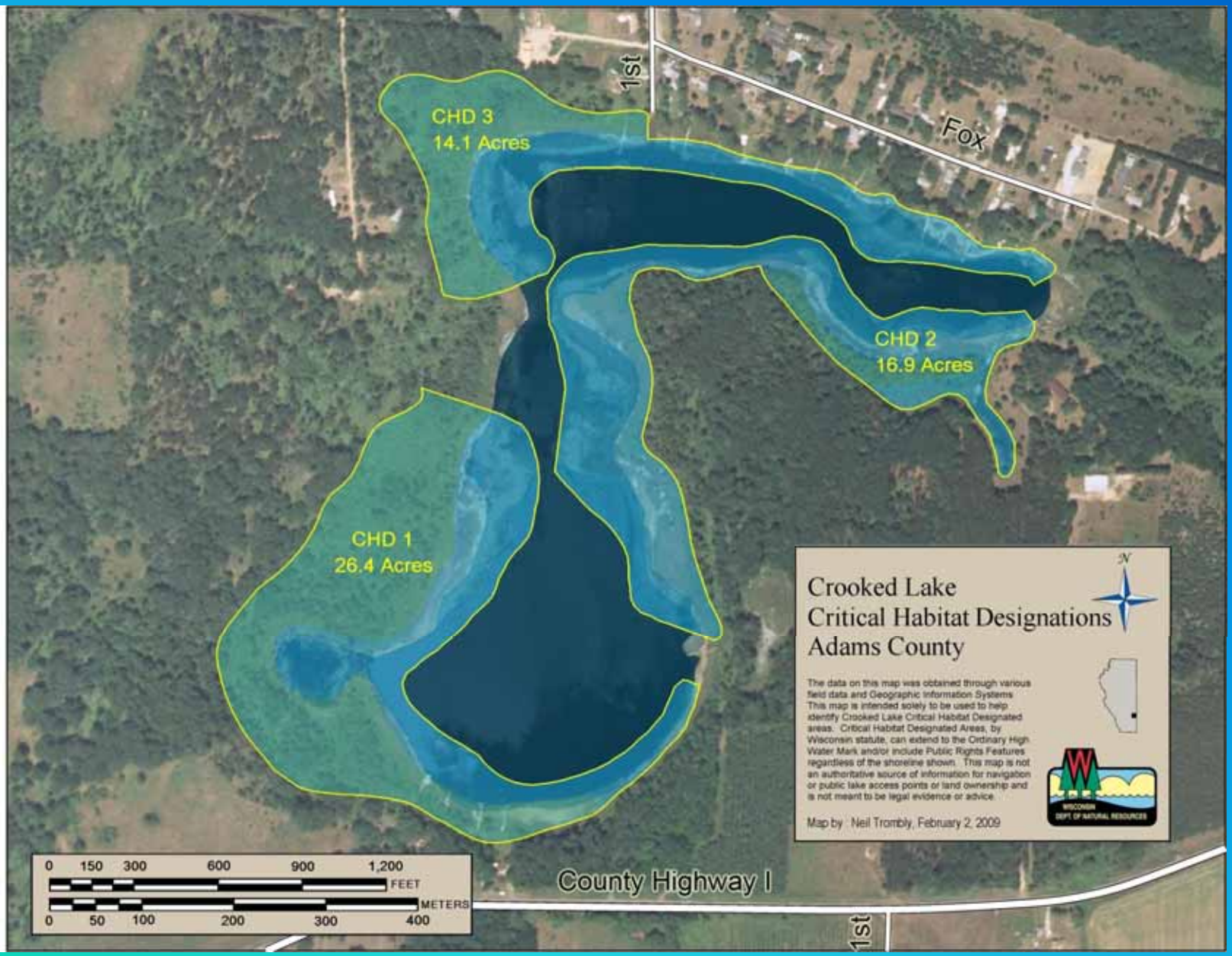


Figure 2. Critical Habitat Designated Areas

Lake Management

The information from the initial surveys were also used in creating lake management plans.

All but one of the 20 inland lakes with public access have an approved lake management plan or one written and pending approval by the WDNR.

The remaining lake has no lake organization.

After each survey, maps are prepared showing the distribution of different types of plants—i.e., emergent, submergent, rooted floating-leaf and free-floating.

Distribution maps are also prepared for any aquatic invasives found. This information is used to plan methods and areas of management for AIS.

Aquatic Invasive Species

Regular visits to the lakes, along with the recurring aquatic plant surveys, have allowed the discovery of new AIS invasions very quickly. In some instances, it has allowed almost immediate action that resulted in eradication (one instance) or prevented the spread of a newly-discovered invasive (two instances).

Pre-&-Post-Treatment Surveys

For several lakes, the Adams County LWCD does annual pre-and-post AIS treatment evaluations. This was originally requested by the WDNR area lakes manager, since a grant application listing $10,000 for the pre-treatment evaluation had been received.

PPTS-2

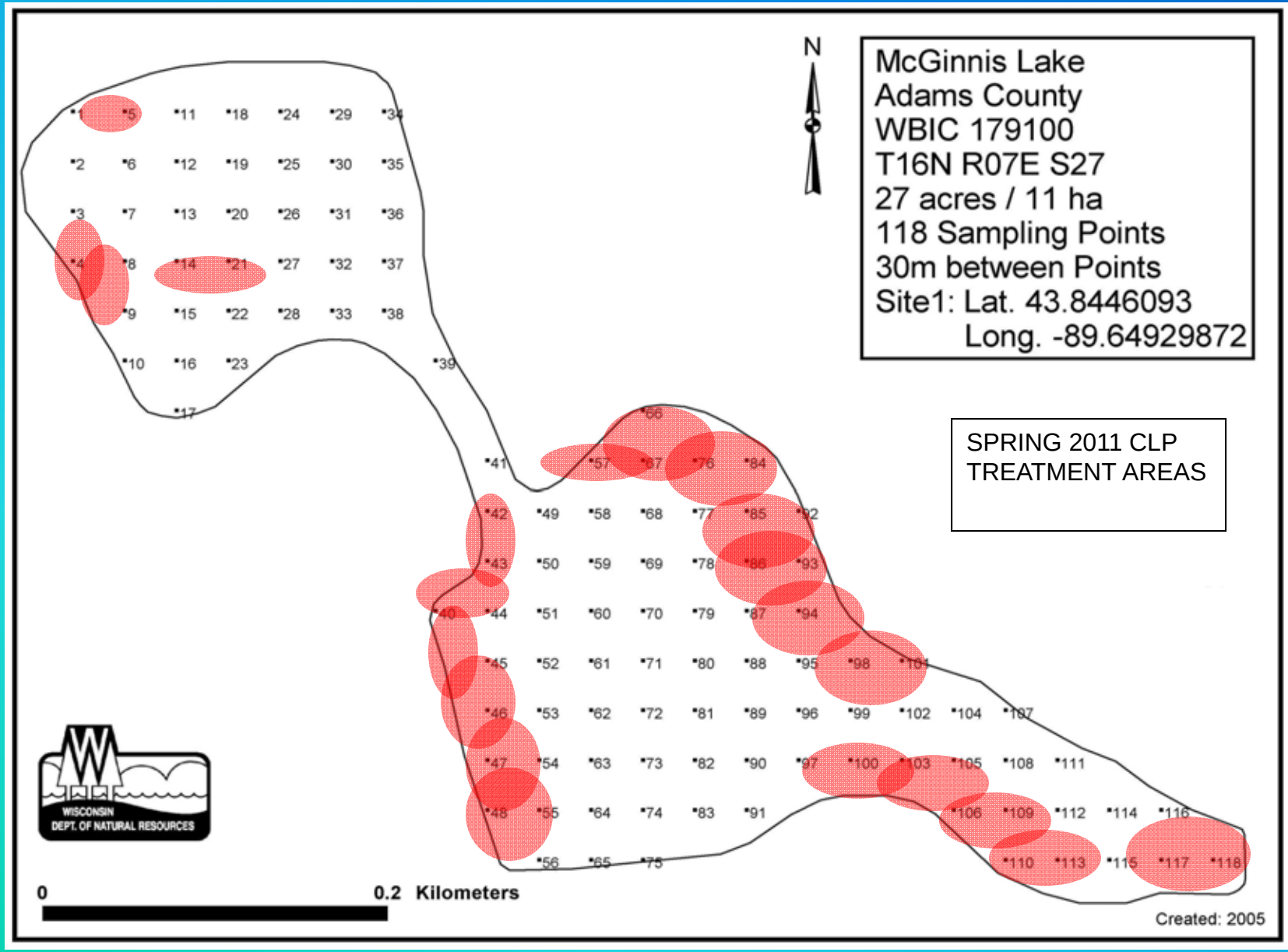
Many of the lake groups have expressed their appreciation at having an “independent” evaluation--i.e., independent of the chemical applicator who has a financial interest providing this information.

Currently, the LWCD does at least six lakes annually.

Pre-treatment evaluation:

- Allows up-to-date mapping of locations of AIS beds;
- May determine that treatment is not appropriate nor required.

The WDNR Aquatic Plant Manager usually follows our recommendations.


N
McGinnis Lake
Adams County
WBIC 179100
T16N R07E S27
27 acres / 11 ha
118 Sampling Points
30m between Points
Site1: Lat. 43.8446093
Long. -89.64929872
SPRING 2011 CLP
TREATMENT AREAS
WISCONSIN
DEPT. OF NATURAL RESOURCES
0
0.2 Kilometers
Created: 2005

PPTS-3

The post-treatment survey

- Is done 6 weeks to 3 months after the chemical treatment;
- Again maps any AIS found.

Discussion with the WDNR Aquatic Plant Manager helps determine whether further treatment that year is necessary and may also be used to target areas for the next year.

In 2009, this pattern allowed us to discover that the spring treatment for EWM had not been successful on one lake. The treatment timing and application strategy was changed for 2010 and 2011, based on that discovery. Response to the chemical treatments in 2010 & 2011 was more satisfactory.

PPTS-4

These surveys also led to the discovery that on one local lake, EWM matured earlier at the east end of the lake than at the west end. Thus, when the Lake District waited until the west end EWM was ready, it was wasting its money at the east end, since the EWM there was past the appropriate treatment time.

Their lake management plan was then amended to reflect two different treatments, one for the east end and one for the west end.

USES

Regular aquatic plant surveys have proved a valuable tool in our county in managing the lakes:

- Tracks changes in shore, including violations of shore zoning rules;
- Identifies areas of shore subject to runoff or erosion or other potential areas of damage to water quality;

Uses--2

- Provides way to compare quality of lake to others in state and region;
- By identifying type of aquatic plants and their density, allows basis for conclusion about water quality health;
- Tracks changes in lake water quality and lake ecosystem by tracking changes in plants, their occurrence frequencies, and their density.
- Helps identify areas of high conservation value, such as critical habitat areas;
- Provides information that can be used in developing lake management plans;
- Identifies aquatic invasive species, including their type and location;
- Allows quick discovery of new invasions;
- Tracks success (or non-success) of management activities, including AIS treatment.

Questions

- **THE AQUATIC PLANT COMMUNITY OF**
- **GOOSE LAKE, ADAMS COUNTY, WI**
- **2006 to 2011**

- **Presented by Reesa Evans**
- **Certified Lake Manager, Lake Specialist**

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This is the front page of the report for one of the lakes I did a survey on in 2011—there were 92 aquatic plant species found there, and I'm sure I missed some of the bog plants, since vegetation was too thick to get through with my canoe!

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