Amacoy Lake Aquatic Plant Management Plan

Contents

Preface

This publication is for all the people who live in the Amacoy Lake community, who enjoy Amacoy Lake and are concerned with the well-being of Amacoy Lake. This is a living document that will set guidelines and goals in order to restore and strengthen the lake ecosystem, protect and improve the natural beauty of the area, and to maintain the water-based recreational activities.

Contributors

Funding for this project was provided by the Wisconsin Department of Natural Resources through the Aquatic Invasive Species Control Grant program, grant #AEPP- 353-12.

The Amacoy Lake Aquatic Plant Management Plan Committee was made up of the following individuals who generously donated their time and energy towards this project:

Alex Smith—Wisconsin Department of Natural Resources

Anna Mares—Beaver Creek Reserve Citizen Science Center

Art Dixon—Town of Stubbs Board Chairman

Bob Johnson—Amacoy Lake Property Owners Association

Bob Lorkowski—Amacoy Lake Property Owners Association

Kathy Clark—Amacoy Lake Property Owners Association

Cece Tesky—Rusk County Land &Water Conservation Department

Dave LaFontaine—Amacoy Lake Property Owners Association

Jeff Schierer—Wisconsin Department of Natural Resources

Lesa Cramer—Amacoy Lake Property Owners Association

Phil Swanson—Amacoy Lake Property Owners Association

Overview

The Amacoy Lake Property Owners Association (ALPOA) working in collaboration with Beaver Creek Reserve Citizen Science Center (CSC), Wisconsin Department of Natural Resources (WDNR), Rusk County Land & Water Conservation Department (LWCD), the Town of Stubbs and other area stakeholders have developed a management plan for improving the habitat, aquatic plant community and water quality of Amacoy Lake. The Amacoy Lake Aquatic Plant Management Plan (APM) has been designed to be a living document, to be used as a tool and altered as necessary to assist in future management decisions. Initial concerns about water level and quality issues on Amacoy Lake were raised in the 1960s and 1990s. Based on the results of the Current Status of Lake Amacoy, WI (1993) and other studies, the main issues affecting water quality were found to be:

- Higher stages in the Chippewa River which caused property damage to Amacoy residents and resulted in the placement of control structures on the outlet of Amacoy.
- Changes in the fish community.
- A perceived change in water quality over time.
- And the invasion of the plant species curly-leaf pondweed (*Potamogeton crispus*).

In 2012, the Amacoy Lake Aquatic Plant Management Plan Committee formed. Over the next year the committee met with lake enthusiasts and specialists to gain an overview and seek guidance to determine these main issues and how to best proceed on managing them. The committee sought input from ALPOA members to see what issues were important to them. From these meetings comprehensive goals were developed to serve as a foundation for the Amacoy Lake APM.

Lake Management Plan Summary

Purpose Statement:
Amacoy Lake has a rich tradition of angling, recreation and aesthetic value, which is linked to good water quality and a healthy plant and animal community. Recent studies of Amacoy Lake indicate the presence of curly-leaf pondweed, degradation to shoreline habitat, erosion, blue-green algae, a loss of water quality, and issues with development pressure. As the lake is widely used by recreators and thus susceptible to further infestations, degradation, and safety issues, an aquatic plant management plan is needed.

Goal Statement:
The goal of the Amacoy Lake Aquatic Plant Management Plan is to implement a strategy focusing on continuing control of aquatic invasive species, monitoring water quality, and continuing a program of education to increase awareness of lake issues and recommended action to improve Amacoy Lake.

Goals:

1. Have a healthy and diverse aquatic plant community while controlling invasives and preventing new ones from entering the lake.
2. Maintain and improve shoreline habitat for residents and wildlife.

3. Monitor and improve Amacoy's good water quality.
4. Maintain and improve in-lake habitat for wildlife and residents.
5. Provide diverse and encourage safe recreation opportunities
6. Improve the effectiveness of ALPOA to better serve the needs of the Amacoy Lake community

Background

Amacoy Lake is a drainage lake located in Rusk County, four miles south of the town of Bruce in north-west Wisconsin (Figure 1.). The relatively shallow lake (Table 1.) is supplied with water from several tributaries.

Figure 1. Location of Amacoy Lake in Rusk County, Wisconsin. (Image courtesy of Rusk Co. LWCD)

Description of the Watershed and Major Tributaries

The Amacoy Lake watershed lies within the Soft Maple/Hay Creek watershed (Figure 2.). Amacoy Lake watershed is approximately 4,512 acres in size or 4,795 acres if the lake itself is included. Roughly 31% of the watershed is used for agriculture, but wetland (24%) and forest (31%) also comprise significant portions of the watershed. Almost 40% of the watershed is

Table 1. Basic information about Amacoy Lake.

Table 1. Amacoy Lake's basic data	
Watershed Area	4,512 acres
Lake Area	283 acres
Shoreline	3.66 miles
Maximum depth	20 feet
Mean depth	13 feet
Bottom	75% sand, 20% gravel, 0% rock, 5% muck
Number of beaches	0
Number of parks	0-1
Number of boat landings	1
Additional access points	3
Source: Amacoy Facts and Figures. WDNR website. http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2359700&page=facts	

coved by sandy soils and the remainder by more poorly-drained, hydric soils (USDA – Soil Conservation Service). Amacoy Lake receives water primarily from one tributary INL-1 (inlet #1) and two other small intermittent streams INL-2 (inlet #2) and INL-3 (inlet #3) that are shown in Figure 3.

INL-1. INL-1 includes most of the drainage from the watershed, including Adam's Lake, and enters Amacoy in the northwest bay.

INL-2. INL-2 has flow during periods of precipitation and enters Amacoy Lake in the bay north of the boat landing. In years prior to 1994, INL-2 emptied directly from an animal feed lot, bringing a high nutrient and fecal coliform load to the lake. Efforts were made to limit runoff through the feedlot when this issue was discovered in 1993. Future rain event samples could show the effectiveness of these efforts.

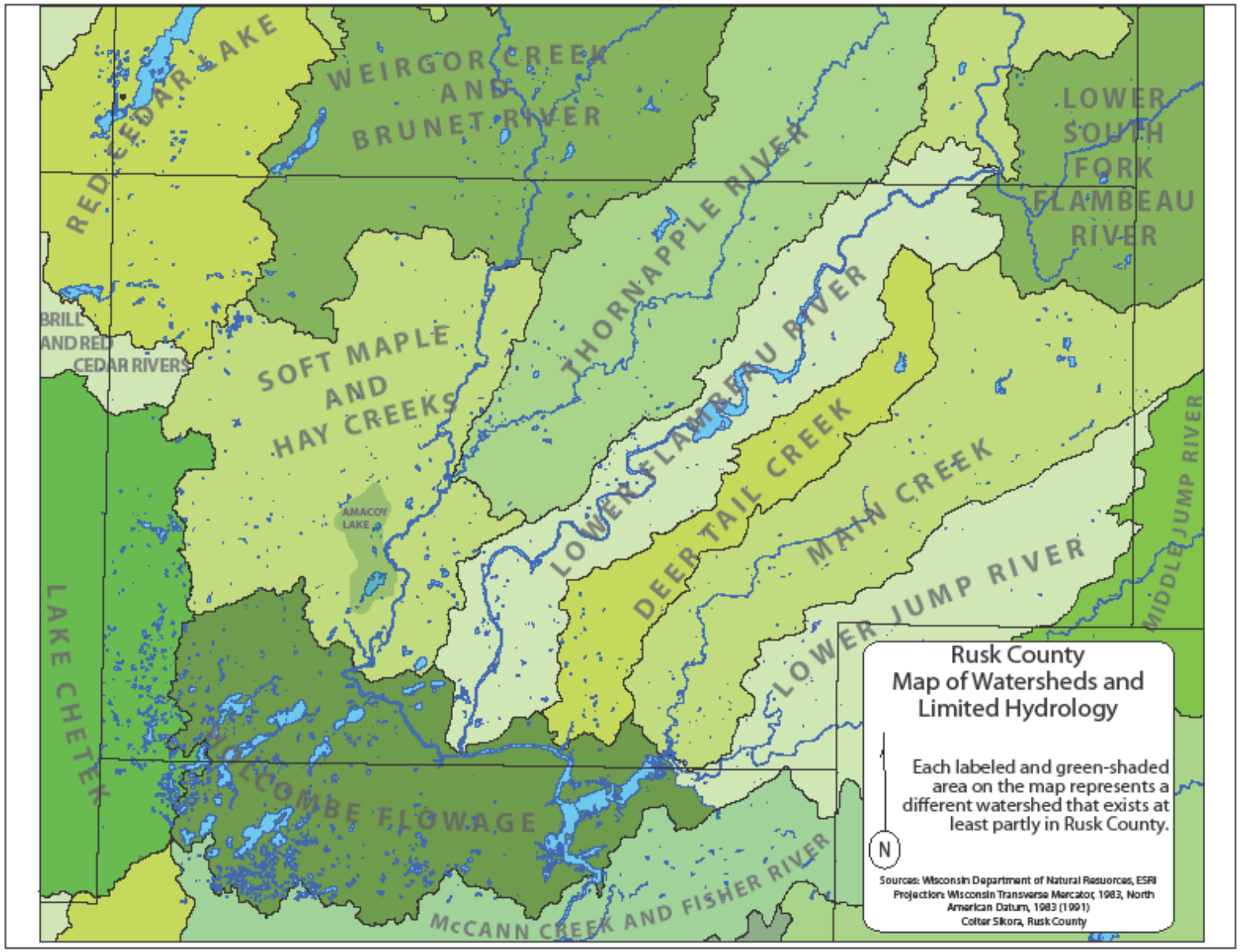

Figure 2. Amacoy Lake watershed as part of the larger Soft Maple and Hay Creeks Watershed in western Rusk County. Modified WDNR image by CSC.

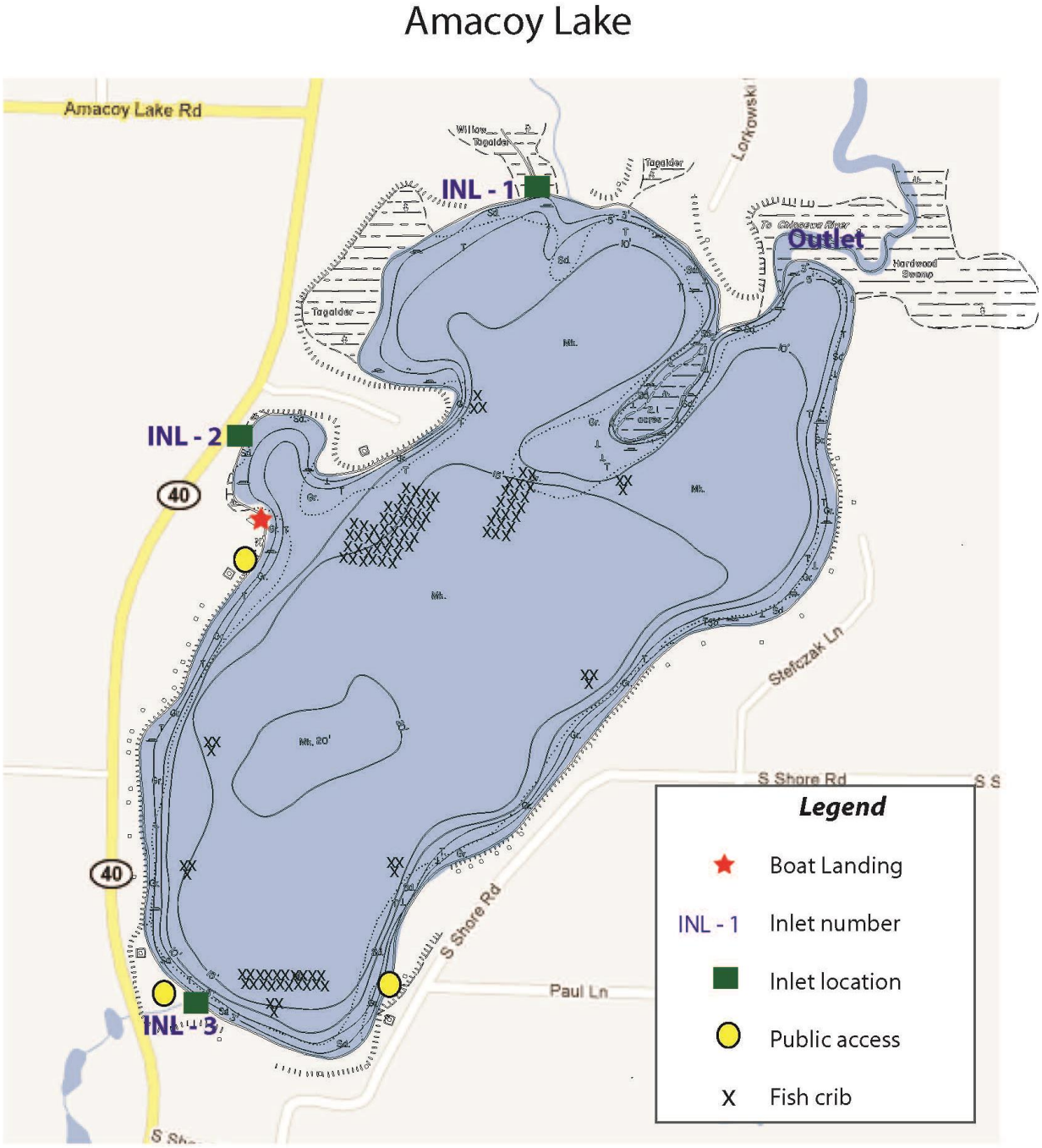

Figure 3. Locations of inlets, outlet, boat landing and public access points on Amacoy Lake.

INL-3. INL-3 at one time entered directly over land into Amacoy Lake from the southwest. Currently, water travels under Hwy 40 from the west and then over land until 20 meters from the lake and then goes below ground through a culvert and resurfaces 3 meters from the lake and enters the lake (see *Appendix A* for photos). It appears that this inlet is intermittent, depending on precipitation.

Chippewa River. Historically the Chippewa River had the ability to back up into Amacoy Lake during periods of flooding, allowing higher nutrient water to flush the lake. Since 1967, a flood control structure has been in place at the intersection of the outflow and River Road to prohibit this process. Chippewa River water no longer enters the lake unless the flood gates fail, as they did in 1991.

Assessing the problems and needs of the community.

Amacoy Lake is a popular recreational place for residents and visitors. It is also home to both aquatic and riparian dwelling wildlife. Because of its importance to people and wildlife it is imperative that this area is managed properly, so it can be enjoyed by future generations. The difficulty of this management plan lies within the delicate balance of protecting and improving the ecosystem, while balancing the needs and wants from all the different stake holders in the area.

Amacoy Lake and Habitat Status

Aquatic Plants and Invasive Species

Currently, curly-leaf pondweed and Chinese mystery snails are the only known AIS to inhabit Amacoy Lake. Other AIS common to WI (zebra mussels, banded mystery snails, rusty crayfish, purple loosestrife, and Eurasian water-milfoil) have not been found in Amacoy.

Several survey methods have been used to assess aquatic plants in Amacoy. The transect method involves evenly spacing line transects around the lake that radiate from the shallow shore to the deeper portion of the lake. Four rake samples are taken at four different depth increments along the transect. Point intercept (PI) surveys were designed in the 2000's and involve a grid (see Appendix C) of evenly spaced sample points, depending upon lake size and shoreline shape, where only one rake sample per point is taken.

The first known aquatic plant survey on Amacoy was conducted in the summer of 1994 by the WDNR. The transect sampling method, popular at that time, was employed with a total of 13 transect sites spread out around the lake (see *Appendix B*). In the summer of 2008, Beaver Creek Reserve conducted a PI aquatic plant survey, the most current sampling method, of Amacoy Lake at the request of ALPOA. Between 2010 and 2013, various other targeted plant surveys occurred on the lake. The lake again had a full PI survey done in the summer of 2013.

1994 Survey

Twenty-six species of macrophytes, aquatic plants, were found. The most abundant species in descending order were wild celery (*Vallisnernia americana*), bushy pondweed (*Najas flexilis)*, coontail (*Ceratophyllum demersum*), fern-leaf pondweed (*Potamogeton robbinsii*), curly-leaf pondweed (*Potamogeton crispus*), northern water-milfoil (*Myriophyllum sibiricum*), and waterweed (*Elodea nutallii*). The plant community was found to be diverse and dominated by high value species, with an average density at each transect location. The maximum rooting depth was 8 feet and the plants covered approximately 25% of the area of the lake. (Roesler, 1995)

2008 Survey

Sixteen species were recorded as present with 136 sites that were sampled for plants. It was found that 59.6% of the littoral zone was vegetated with the following plants being the most dominant: *Potamogeton zosteriformis* (flat-stem pondweed, 58%), *Ceratophyllum demersum* (54%), *P. crispus* (45%), *P. robbinsii* (35%), *Myriophyllum sibericum* (19%), and *P. richardsonii* (clasping-leaf pondweed, 16%) of vegetated sites. The max rooting depth was 13 feet. The FQI (Floristic Quality Index – closeness to an undisturbed condition) was 25 with a state average of 16-27. The report also noted a decrease in secchi disc readings (a measure of water clarity) and an increase in shoreline development.

2010-2013 surveys

In 2010, one visual plant survey was completed on Amacoy to assess the distribution of curly-leaf pondweed in the lake. Several areas around the lake were becoming densely covered in vegetation, impeding navigation or fishing in those areas. CLP was found to be the plant causing most of the issue and that due to its abundance, curly-leaf would need to be managed. A rapid response grant was applied for and received so that chemical applications could take place starting in the spring of 2011 and continue through spring of 2013. Aquatic plants were monitored in the treatment areas prior to and after chemical treatments each of the three years. Changes in the acreage and density of CLP are shown in Table 2. Maps of *P. crispus* presence for each of these surveys can be found in *Appendix C*.

Table 2. Curly-leaf pondweed densities and acreage in spring surveys from 2010-13.

Year	Density	Acreage
2010	1	7.5
	2	1.3
	3	12.4
	total	21.2
2011	1	7
	2	0
	3	0
	total	7
2012	1	11
	2	0
	3	0
	total	11
2013	1	6.3
	2	0
	3	0
	total	6.3

2013 SURVEY

The July 2013 PI survey was completed by the CSC as part of the ALPOA Rapid Response grant to reduce CLP in the lake. With the use of chemicals or any management strategy it is important track changes in the plant community. A total of 27 plant species were documented at sample sites during the survey with approximately 67% of the littoral zone being vegetated. The most abundant species in descending order were *Ceratophyllum demersum* (71.64% of vegetated sites), *Vallisneria americana* (56.72%), *Nymphaea odorata* (43.28%), *Nuphar variegata* (41.79%), *Najas gracillima* (20.9%), and *Najas flexilis* (19.4%). Five additional species were seen in the lake but were not on the sample rake, including: *Potamogeton amplifolius, P. crispus, P. epihydrus, P. zosteriformis* and *Utricularia vulgaris (*see *Appendix J).* The max rooting depth was 10 feet. The FQI was calculated at 30.

INVASIVE CURLY-LEAF

Curly-leaf pondweed was first thought to be documented during the 2008 PI survey. Upon further investigation into old reports for this APM, it was discovered that the Roesler (1994) survey had mapped out extensive curly-leaf beds with moderate to high densities (see *Appendix D* for locations).

CHANGES OVER TIME

Direct comparisons cannot be made between results of the transect and PI surveys because the methods are so different from one another. However comparisons can be made between the 2008 and 2013 PI surveys. There was a statistically significant increase in nine different species from 2008 to 2013, while there was a significant decrease in three species, including *P. crispus, P. robbinsii* and *P. zosteriformis* (see *Appendix J*). P. crispus declined significantly year after year except from 2011-2012. It appears that the chemical treatment negatively affected species that are in the same family as the targeted *P. crispus*. In contrast the nine species that increased were possibly able to take advantage of the space newly vacated by *P. crispus*. The species list from 1994 and 2013 more closely resemble one another than that of 2008 and 2013 (*Appendix J*).

Shoreline Habitat

There are 66 homes around the lake, with most being built in the 1940s and a handful built in the last 10 years. The majority of the shoreline is privately owned and zoned residential (Figure 4.), with two properties that have had commercial use in the past as a supper club and vacation rentals, and several areas that have been left natural, providing great habitat for wildlife. The most developed area is along Hwy 40 where the land is steeply sloped and the lots are narrower. Retaining wall permits have been issued in this area to hold sandy soil in place. One site on the eastern shoreline had some restoration work done to lessen wave erosion, but it has been found to be ineffective. There has been a proposed RV camp on the lake which has exposed mixed sentiments on larger scale development of the lake and the negative changes it could bring.

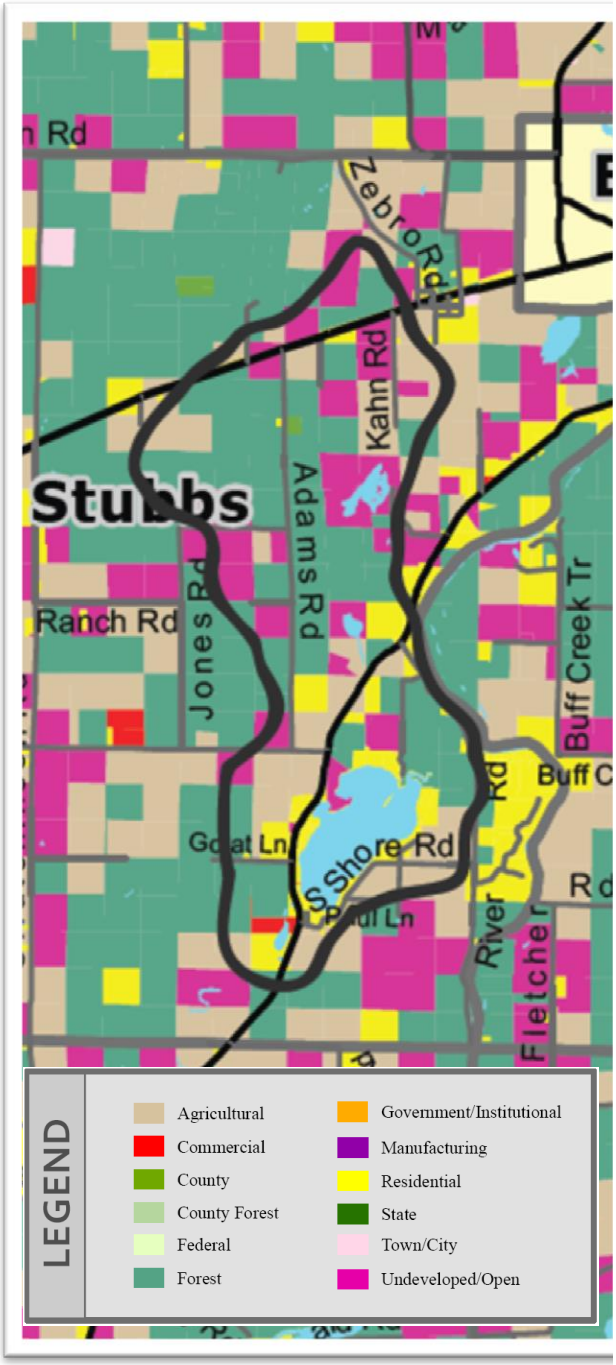

Figure 4. Land use within the Amacoy Lake watershed.

Water Quality

Due to Amacoy's proximity and connection to the Chippewa River, it has been flooded by it consistently over the last century. With this flooding has come property damage and water quality issues. There was some contention of whether flushing during flooding was harmful or beneficial to the lake. Both Roesler (1995) and Brakke (1993) are in agreement that flood waters are 2-3 times higher in total phosphorus (TP) than the lake water itself, showing that flood waters add to the phosphorus load of the lake versus flushing it out. For this specific question of water quality, the flood control structure protects the lake.

In 2007 a paleoecological study by P. Garrison was conducted on Rusk Co. lakes, including Amacoy. A core was taken of the lake bottom sediment. The top (current lake times) and the bottom (pre-settlement times) of the core were analyzed for algal fossils, specifically diatoms, which can indicate the water quality condition of the lake. Garrison (2008) found that there was little change in species richness or diversity from the bottom to the top of the core, indicating that the lake was moderately eutrophic historically.

The Citizen Lake Monitoring Network (CLMN) provides lakes residents across the state of Wisconsin with equipment to collect water quality information about their lake while building a database for the state. Secchi readings are the most basic data to collect about the lake. After a year or two of secchi disk readings, lakes can opt to collect water chemistry data as well at no cost to the lake group. The water chemistry samples give more precise estimates of the amounts of TP and chlorophyll *a* in the lake with four samples taken from ice out in the spring until the end of August. The above three parameters are used to measure the trophic status of a lake, helping to determine if it is

oligotrophic, mesotrophic, eutrophic or hyper-eutrophic.

- **Oligotrophic** – lakes characterized by low nutrient inputs and low productivity. They are generally deep with high water clarity.
- **Mesotrophic** – lakes characterized by their moderately fertile nutrient levels. Falls in between the oligotrophic and eutrophic levels of nutrient enrichment.
- **Eutrophic** – Lakes characterized by high nutrient inputs, high productivity, often experiencing algal blooms and abundant weed growth.
- **Hyper-eutrophic** – lakes characterized by very high nutrient levels, severe nuisance algal blooms, low water clarity, and reduced oxygen levels below the surface water

In addition, temperature profiles are taken to see if the lake stratifies (warm upper layer and cool, lower layer of water that do not mix) in the summer.

The first water quality readings were taken on Amacoy Lake in 1986 in the form of secchi disk readings. Water chemistry samples have been taken off and on since 1991. The only year that lacks any water quality data is 2010. Most of the water quality readings have been taken by citizen volunteers under the CLMN program but additional samples have been taken by WDNR staff.

The data collected serves as an indicator of the water quality. Temperature profiles show that the lake stratifies in the summer months and then mixes in the spring and fall of the year. During stratification, the bottom waters of Amacoy become oxygen depleted and release phosphorus back into the water column during spring and fall turnover. TP levels are highest (minimum 17 µg/l, average 36 µg/l, maximum 74 µg/l) in the spring and fall samples compared to summer. With the average Trophic Status Index (TSI) of Amacoy being around 60 (see *Appendix E*), classifying the lake as eutrophic, there is a good chance that the lake will continue to experiences algae blooms in the middle to end of summer. There is also enough TP in the water to support abundant plant growth.

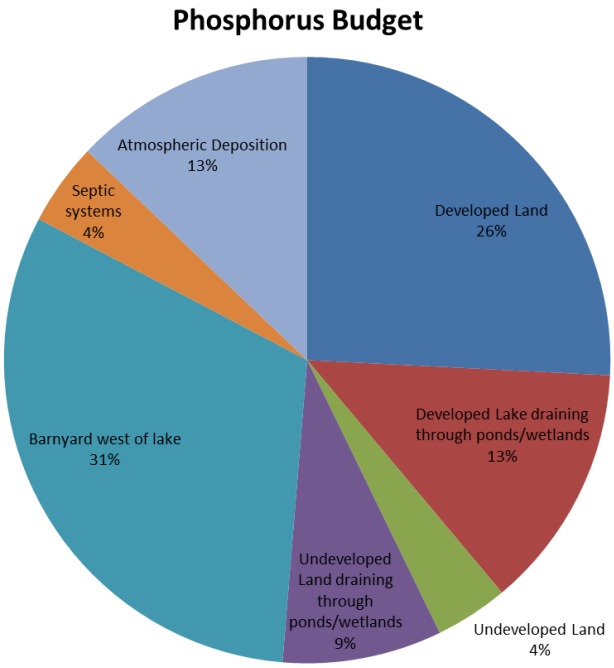

Figure 5. The external loading phosphorus budget of Amacoy Lake watershed includes, in decending order, the following sources: Barnyard (31%), Developed land (26%), Atmosphere (13%), Developed wetlands (13%), Undeveloped wetlands (9%), Undeveloped lands (4%), Septic systems (4%).(Roesler, 1995)

With consistent TP readings above 30 µg/l, Amacoy is a likely candidate to be listed as a 303(d) impaired waterbody by the WDNR. Every two years, the DNR publishes a list of waters considered impaired under the Clean Water Act Section 303(d). Impaired waters do not meet water quality standards and may not support fishing, swimming, wildlife, recreating, or public health and welfare. TP is Amacoy's impairment. The law requires that the WDNR establishes priority rankings for waters on the list and develop TMDLs for those waters with the highest priority. A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. Because Amacoy's readings are on the lower end of the standard limits for listing, it will be ranked low priority for action by the WDNR to correct the issues. The Soft Maple and Hay Creek report found the biggest sources of TP to come from Barnyard runoff and developed land (see Figure 5.). It is important that the CLMN efforts continue on the lake to track changes in TP levels and that property owners do as much as they can to limit phosphorus contributions to the lake.

In-Lake Habitat and fisheries

Amacoy has a rich tradition of angling by both residents and visitors. In 1995, Mead & Hunt conducted a survey on Amacoy to "evaluate the current fishery of Amacoy Lake, to determine the overall structure and composition of the Lake's fishery, and to establish a baseline data set". Mead & Hunt found that nearly 75% of the fish caught in the lake were stunted yellow perch, followed by 13.59% bluegill, golden shiner (3.67%), black crappie (2.41%), white sucker (1.72%), walleye (1.53%), largemouth bass (.64%) and other (1.85%). Mead & Hunt noted that Amacoy was lacking riverine fish species that historically it would have had when the flood control structure was not in place. It was also cited that the muskellunge had lower reproduction rates than in the past.

Figure 6. Fish cribs being installed on Amacoy Lake during the winter.

ALPOA has been committed to trying to improve the in-lake habitat for fish. From 1999 – 2001 eighty-four conventional log fish cribs were installed in deep water at various locations around the lake (Figure 6.). In March 2003, WRA and ALPOA worked together to specifically enhance walleye habitat. They received donated field stone (8-20 inches in diameter) and spread it out along portions of the east shore to increase walleye spawning habitat. This project was approved by the WDNR. Scheirer (2013) noted that "the shoreline rock blanket had no positive effect on walleye reproductive success" due to lack of evidence of walleye recruitment. In 2003, the DNR conducted a

creel survey on the lake. Fishermen were asked what they were fishing for, how much time was being spent and what they were keeping. This survey indicated "that Amacoy Lake receives heavy open-water and ice fishing pressure (69 hours per acre), ranking in the 90th percentile among 185 surveys completed on northern Wisconsin lakes less than 500 acres from 1990 to 2008" (Sheirer, 2013). In addition, it was found that Black crappie was the most sought-after sport fish in Amacoy Lake, attracting 38% of directed effort in 2003 when anglers caught 59 and harvested 32 crappies per acre.

Table 3. Game fish species found in Amacoy Lake according to WDNR fish surveys.

TABLE 3. Game fish species found in Amacoy Lake	
Species	Prevalence
Panfish	Abundant
Largemouth Bass	Abundant
Muskellunge	Common
Walleye	Present
Catfish	Rare
Northern Pike	Rare
Smallmouth Bass	Absent

Source: Amacoy Facts and Figures. WDNR website. http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2359700&page=facts

In fall of 2010 and the spring of 2011, the WDNR surveyed Amacoy Lake's fishery via fyke netting and electro-shocking. The gear, methods and timing of the survey were aimed to characterize the abundance and size structure of sport fish believed to be important to Amacoy Lake anglers, not to provide an exhaustive list of fish species present. This survey found that the fishery could be considered largemouth bass and bluegill dominant. Largemouth bass and black crappie were sampled for growth rate and found to grow significantly slower than the northwest WI average. Bluegills were in high abundance but in mostly the ≤ 6" range making them not the size that anglers are interested in, as with the yellow perch (≤ 8") and black crappie (≤ 9"). Walleye were in surprisingly low numbers considering that the lake was stocked yearly with small fingerlings from 1933-58 and approximately every other year since that time. The survey

Table 4. Advice on fish consumption from Amacoy Lake for population sectors due to the pollutant mercury.

Table 4. Advice on fish consumption from Amacoy Lake.	
Women up to age 45 (child bearing age) and children (under age 15) may safely eat:	
1 Meal Per Week	bluegill, sunfish, bullheads, crappies, inland trout, and yellow perch
1 Meal Per Month	bass, catfish, pike, walleye, all other species and sizes
Do Not Eat	Muskies
All men (15 and older) and older women (45 and older) may safely eat:	
Unrestricted	bluegill, sunfish, bullheads, crappies, inland trout, and yellow perch
1 Meal Per Week	bass, catfish, pike, walleye, all other species and sizes
1 Meal Per Month	Muskies

noted that walleye were not found in the 0-15" and 20-26" size bracket, indicating that there is a problem with recruitment. This is most likely due to predation of the fingerlings by largemouth bass. See *Appendix F* for a complete species list of those found most recently in Amacoy Lake. The prevalence of native game fish (Table 3) have been updated to reflect the most current findings by the WDNR. Also, the advice for fish consumption on Amacoy Lake is the standard statewide advice and can be found in Table 4. (Scheirer, 2013)

Recreational Opportunities

Amacoy Lake is an important recreational lake for Rusk County. In the 1960s it was the heaviest fished lake in the county. Permanent and seasonal residents are the primary recreators on Amacoy Lake, but it is also a popular destination for visitors. The summer months are the most popular time for recreation because over half of the residents are seasonal. Residents like the area for its natural beauty, serenity in comparison to busy city living, and good fishing while visitors prefer the lake for its natural beauty and fishing. Residents and visitors say that fishing is the most important recreational activity, followed by pleasure boating.

ALPOA Effectiveness

Currently ALPOA functions, as many lake groups do, with a smaller core group doing a majority of the work. Meetings are held three times annually, when the most people are at the lake: Memorial Day, July 4th, and Labor Day weekends. While the lake association is able to function, it could do so more effectively and in the process, get greater participation from the group.

The Amacoy APM committee wanted and needed the input of the public in order to help shape the APM by determining what was important to them. The first opportunity was in September 2012 when a brainstorming meeting was held and property owners gave their thoughts on how the lake should look and what issues they see with the lake. ALPOA members were welcome to attend any of the five topic meetings that followed for further input. Public reviews were held for two separate drafts at ALPOA meetings on July 7, and August 31, 2013. Preliminary adoption of the APM plan occurred at the August 31, 2013 meeting and will be officially approved at the May 24, 2014 ALPOA meeting. ALPOA members will be encouraged to take up actions in the plan that fit with their interests.

Project Goals for Amacoy Lake APM

The Amacoy Lake Property Owners Association met with experts on topics of concern, reviewed historical data, prioritized issues and considered public input to devise the following six goals to become part of the Amacoy Lake Aquatic Plant Management Plan:

Goal I.	Aquatic Plants and Invasive Species
Goal II.	Shoreline Habitat
Goal III.	Water Quality
Goal IV.	In Lake Habitat
Goal V.	Recreation
Goal VI.	ALPOA Effectiveness

Aquatic Plants and Invasive Species

Goal: Have a healthy and diverse plant community while controlling invasive species.

The Wisconsin Statute Section 23.22 (1) (c) defines invasive species as any "nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health" (Wisconsin State Legislature 2012). The management and prevention of exotic and invasive species throughout Amacoy Lake is critical to maintaining the integrity of native plant and animal communities. The aquatic invasive species management plan provides guidelines for monitoring of the invasive species currently present and instructions to prevent the introduction of new invasive species. By adding management of aquatic invasive species to this lake management plan, ALPOA will:

1. Continue current monitoring and control efforts.
2. Develop and implement a plan to prevent the introduction of new species.
3. Educate lake property owners, boaters, anglers, and recreators on the impacts of invasive species and the preventive measures that reduce the risk of spreading invasive species.

Known aquatic invasive species to Amacoy Lake include:

- curly-leaf pondweed (*Potamogeton crispus*)
- Chinese mystery snail (*Bellamya chinensis*)

Specifically this plan will focus on controlling curly-leaf pondweed (CLP) but it will discuss other AIS as well. Because Amacoy Lake is a drainage lake, species can easily be transported downstream or to other bodies of water.

Plant Management Methods

Permit Requirements:
The document, Aquatic Plant Management in Wisconsin, explains the permit requirements for aquatic plant control as follows:

The WDNR regulates the removal of aquatic plants when plants are removed manually, mechanically, or chemically in an area greater than thirty feet in width along the shore. Manual removal refers to pulling by hand or hand–held devices that do not rely on external power. Any chemical application requires a permit regardless of the size of the treated area. The WDNR Administrative Code Chapters *NR 107-Aquatic Plant Management* and *NR 109-Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations* establish criteria for the plant management permit program. Nearly all activities used to manage aquatic plants require a permit. There are two general exemptions from permit requirements. Waterfront landowners can manually remove plants or give permission to manually remove plants (with the exception of wild rice) along their shoreline up to a 30-foot corridor. The second exemption states that landowners may manually remove the invasive plants purple loosestrife, Eurasian water-milfoil,

and curly-leaf pondweed along their shoreline.

When developing a control plan for aquatic invasive plants, there are numerous methods to consider and it is important to understand that most management efforts help control the population if AIS versus eradication of it. The Department of Ecology of the State of Washington describes the methods to control the growth and distribution of aquatic invasive plants as follows:

Manual Control

Manual removal includes hand pulling, cutting, or raking. Manual removal is inexpensive, environmentally safe, and effective when removing plants from small areas. This method should be conducted after flowering but before seed head production.

Advantages to Manual Control:

- Manual control methods are easy to use around docks and recreation areas.
- Equipment is inexpensive.
- Hand-pulling allows the flexibility to remove specific aquatic plants.
- Manual control is environmentally safe.

Disadvantages to Manual Control:

- This process may need to be repeated several times each summer.
- Manual control is labor intensive and impractical for large areas or thick weed beds.
- It is difficult to collect all plant fragments.
- Plants with massive rhizomes are difficult to remove by hand.
- Pulling and raking stirs up sediment, and disturbs bottom-dwelling animals.

Use in Amacoy:

Manual control has been employed by lake users after chemical treatments to help tidy up missed CLP plants. This has been helpful and will continue each year until CLP is not found in the lake.

Figure 7. Local youth assisting with manual removal of CLP from Amacoy Lake in 2012.

Mechanical Control

Mechanical Control includes mechanical cutting, harvesting, suction harvesting, and rotovation. Due to the fact that Amacoy Lake is a drainage lake, suction harvesting and rotovation are not appropriate options and will not be discussed in this plan.

Mechanical weed cutters are large floating machines that cut aquatic plants several feet below the water's surface. Plants are collected after cutting is complete. Floating plants and fragments need to be removed using a net or a weed rake.

Advantages to Mechanical Cutters:

- Cutting creates an immediate open area in the water.
- Underwater cutters can work in shallow waters not accessible to larger harvesters.
- Habitats for fish and other organisms can be retained.

Disadvantages to Mechanical Cutters:

- Plants will likely need to be cut several times during the growing season.
- Some species are difficult to cut.
- Cutting creates plant fragments which may quicken the spread of invasive plants.
- Additional labor is required to remove cut fragments.

Mechanical harvesters are large machines that both cut and collect aquatic plants. Cut plants are removed from the water by a conveyor belt and stored on the harvester until disposal. Harvesting usually occurs in late spring, summer, and early fall.

Advantages to Mechanical Harvesters:

- Harvesting results in immediate open areas of water.
- Removing plants from the water removes the plant nutrients, such as nitrogen and phosphorus, from the system.
- Harvesting as aquatic plants are dying for the winter can remove organic material.
- Habitat for fish and other organisms remains undisturbed.
- Harvesting can be targeted to specific locations, protecting designated areas from treatment.

Disadvantages to Mechanical Harvesters:

- Plants will need to be cut several times during the growing season.
- There is little or no reduction in plant density with mechanical harvesting.
- Off-loading sites and disposal areas for cut plants must be available.
- Small fish, invertebrates, and amphibians can be collected and killed by the harvester.
- Harvesting creates plant fragments which may enhance the spread of invasive plants.
- Harvesting may not be suitable for lakes with bottom obstructions (stumps, logs) or that are shallow (3-5 feet of water).

Use in Amacoy:
Mechanical control has not been used in Amacoy Lake due to the smaller sizes of the CLP beds since the first year of chemical applications. Beds would need to be much larger in size, more of them, and have densities of 3 to consider this management option.

<u>Aquatic Herbicides</u>
Aquatic herbicides are specifically formulated for use in water to control aquatic plants. Aquatic herbicides can be sprayed directly onto emergent aquatic plants or applied to the water in a liquid or granular form. Herbicides approved for aquatic use by the Environmental Protection Agency have been reviewed and are considered compatible with the aquatic environment when used according to label directions. WDNR permits are required for herbicide application under Chapter *NR 107*.

Aquatic communities are full of life. The plants, invertebrates, fish, birds and mammals are all interconnected and dependent upon each other. Aquatic weed control can affect an organism, which may in turn affect other organisms, disturbing the

whole community. The risk to other members of the natural community is an important factor to keep in mind when considering the use of aquatic herbicides.

Contact herbicides act quickly, killing all plant material they come in to contact with. This makes contact herbicides more effective with annuals, since the roots, not directly contacted by the herbicide, are left alive and able to regrow. Because the entire plant is not killed, retreatment is necessary.

Systemic herbicides are absorbed by the plant, killing the entire plant. Systematic herbicides are more effective in controlling perennial and woody plants.

Non-selective herbicides will generally affect all plants that they come in contact with. This type of herbicide is generally used to control all or most vegetative species in treatment area.

Selective herbicides are used to control certain plants while not affecting others.

Advantages to Aquatic Herbicides:

- Application can be less expensive than other aquatic plant control methods.
- Aquatic herbicides are easily applied around docks and underwater obstructions.

Disadvantages to Aquatic Herbicides:

- Some herbicides have swimming, drinking, fishing, irrigation, and other water use restrictions (check the label and general permit).
- Herbicides may have unwanted side effects to people using the water and to the surrounding environment.
- Non-targeted plants may be killed, including reduced frequency of occurrence, abundance, and total loss of the species, especially those that are most similar to the target species.
- May require additional applications.
- Herbicide use can be a controversial topic. Consider lake users opinions before deciding to treat plants with herbicides.

Safeguards for fish and wildlife with the use of aquatic herbicides are outlined in APM permits through a combination of the following:

- Herbicide treatment shall occur early in the spring before water temperatures reach 60ºF
- Wind speeds should be <5 mph
- Appropriate dosage using label rates
- Water use restrictions (see Table 5)
- Outlets may need to be blocked to limit downstream flow of herbicide
- Residual monitoring of water for days to weeks after application
- Pre and post monitoring of aquatic plant community for each chemical treatment to track changes to native plants and measure the efficacy of the treatments

Table 5. Water use restrictions after an aquatic application of Aquathol with dosage rates of 0.5-5.0 ppm.

WATER USE RESTRICTIONS OF AQUATHOL	
Active Ingredients: Dipotassium salt of endothall	
Weight % Active Ingredient: 40.3	
EPA Reg. No.	61943-1
	Number of Days
Human Drinking	7
Human Swimming	0
Human Fish Consumption	0
Animal Drinking	7
Turf Irrigation	7 - newly seeded only
Forage Irrigation	0
Food Crop Irrigation	0

Use in Amacoy:
Aquatic herbicides have been used in Amacoy from 2011-2013, with one spring treatment per year. The chemical used was Aquathol, a contact herbicide, with the water use restrictions after application listed in the table above. Aquathol applications have been successful and due to lessening CLP bed size and density, ALPOA plans to suspend the use of aquatic herbicides.

Biological Control

Biological control is the deliberate introduction of a predatory organism to regulate the population of a pest organism.

Advantages to Biological Control:

- Lower overall cost compared to other control methods.
- Longer-term control compared to other methods.
- Plant specific control.

Disadvantages to Biological Control:

- Multiple introductions are required.
- Biological control takes years to take effect.
- Specific environmental conditions necessary for success.

Use in Amacoy: None of the species present in the lake at this time are compatible with biological control. But, if Eurasian water-milfoil or purple loosestrife are introduced to the lake, biological control is a viable option.

CURLY-LEAF PONDWEED

The Wisconsin Comprehensive Management Plan for Aquatic Invasive Species describes curly-leaf pondweed as follows:

"Curly-leaf pondweed can grow under the ice while most plants are dormant, giving it a competitive advantage over native aquatic plant species. By June, curly-leaf pondweed can form dense surface mats that interfere with aquatic recreation. Mid-summer decay creates a sudden loss of habitat. The die-off of curly-leaf pondweed also releases a surge of nutrients into the water column that can trigger algal blooms and create turbid water conditions. In lakes where curly-leaf pondweed is the dominant plant, the summer die-off can lead to habitat disturbance and degraded water quality" (WDNR, U of W-Sea Grant, GLIFWC 2003).

Figure 8. Invasive curly-leaf pondweed found in Amacoy Lake.

Curly-leaf pondweed (Figure 8.) was discovered in Amacoy Lake in 1994, but the lake group was unaware of its presence until 2008. ALPOA will design a plan to:

1. Continue to monitor CLP population.
    a. Use CLMN AIS monitoring – several times yearly – if CLP

is found beds will be mapped and density noted.
   b. Visual surveys of lake by CSC every two years.
   c. Conduct a full PI survey every 5 years by contract.
2. Layout action steps if CLP again reaches levels where it requires more intensive management.
3. Research best possible management strategies if that happens and reference Table 6.
   a. Tentative plans include the use of manual removal by use of staff supplied by Wildlife Restoration Association of Rusk County in May and June on curly-leaf beds that total less than 5 acres in size and are a 2 or less in rake density. When either of these thresholds are crossed, chemical treatments or other management options will again be considered.

Table 6. Costs associated with management options for CLP.

Management Method	Approximate Cost
Manual removal by volunteers	Free labor, $25/rake
Manual removal by paid staff	Staff - 80hrs x 2 staff x $8.00/hr = $1,280; $25/rake
Mechanical removal by hired contractor	$500-$800/acre
Mechanical removal purchase of harvester	$35,000-$100,000; annual maintenance $250
Herbicide application	$600-$1,000/acre

At this point, ALPOA is almost comfortable with the amount of CLP that they have in the lake, 6.3 acres at a density of one. To get below the acreage threshold of five acres, they are tentatively planning to use manual removal of CLP by staff supplied by Wildlife Restoration Association of Rusk County in May and June on curly-leaf beds. If in the future the beds total more than five acres in size and are a two in rake density, chemical treatments or other management options will again be considered. This decision was made due to the lack of available ALPOA funds and what they are willing to have as acceptable levels of CLP in their lake. Even if CLP levels are below five acres and a density of one, some amount of manual removal will be performed.

Chinese Mystery Snail

Chinese mystery snails (CMS, Figure 9.) (*Bellamya chinensis*) were originally sold in Chinese food markets in San Francisco in the late 1800s. Introduction to the wild was likely due to specimens released from aquariums into the Niagara River between 1931 and 1942 (Mills et al.1993). Recent research shows that CMS were present in 50% of lakes surveyed throughout northern Wisconsin (Solomon et al. 2009). Chinese mystery snails were found in Amacoy Lake sometime between 2007 and 2013. At this point, studies have shown CMS to be relatively "benign" with respect to native snails and its potential to influence ecosystems and

Figure 9. Chinese mystery snail, present in Amacoy Lake, is as wide as it is tall.

native species (Mackie 1996). CMS can form large aggregations and there is potential for them to be vectors for the transmission of parasites and diseases (USGS 2012). ALPOA has no current management plans at this time.

Other invasive species

There are several other invasive species that are not currently in Amacoy Lake but could easily be introduced by transient boaters including Eurasian water-milfoil, purple loosestrife, rusty crayfish, banded mystery snails, zebra mussels and spiny waterflea, with each having its own set of impacts on the lake and its users. Eurasian water-milfoil can become very abundant in waters up to 16' deep, causing surface matting and lower native plant diversity. Mechanical (boat motors) or natural (plant self-induced) fragmentation spreads the plant around the lake. Purple loosestrife affects wetland and shoreline areas through overpopulation without creating a benefit to the system such as shelter or a food supply. Rusty crayfish kill off or out-compete native crayfish species and significantly decrease submerged aquatic vegetation in the lake needed by small fish for cover. Banded mystery snails are similar to CMS in that they are considered relatively benign but can become a nuisance to homeowners when they aggregate in large numbers near the shore. Zebra mussels are very efficient filter feeders that remove tremendous amounts of nutrients, including algae, from the water column but do not consume bluegreen algae. They will out-compete and kill native mussels, foul equipment left in the water and can be extremely sharp when stepped on by humans. And lastly, spiny waterfleas augment the zooplankton foodweb with no other zooplankton and few fish that are able to eat them. Lake users will find that they adhere to equipment due to their sticky bodies. All of these invasives listed above should be protected against and primarily by good boater hygiene (Clean Boats, Clean Waters).

CLMN AIS Monitoring

To help monitor aquatic invasive species populations, ALPOA has initiated the CLMN AIS monitoring program. This program encourages local lake users to invest in the protection of their lake. The CLMN AIS Monitoring program:

- Locates all known AIS populations.
- Monitors species growth and expansion.
- Documents new locations.
- Educates local lake users and encourages environmental stewardship.

As part of invasive species control, lake members involved in CLMN AIS Monitoring will:

1. Determine areas to be monitored and at what frequency – estimated four times yearly.
2. Determine a plan on how to record collected data.
3. Locate and mark all known AIS locations with maps and any available GPS units.
4. Follow steps in Amacoy's AIS Rapid Response Plan when/if new infestations are discovered (*Appendix I*).

Shoreline Habitat

Goal: Maintain and improve shoreline habitat for residents and wildlife.

Amacoy Lake has 3.6 miles of shoreline; some of which is developed. Developed shorelines lack adequate buffers, necessary to prevent erosion, absorb excess nutrients, recharge groundwater, promote recreation, provide pleasing aesthetics, discourage Canada geese, and provide terrestrial and aquatic wildlife habitat (Sorge 2012). ALPOA will encourage shoreline habitat stewardship through education and outreach by:

1. Compiling resources that people can use for reference on shoreline zoning and habitat
2. Inventorying Amacoy Lake shoreline to assess areas of concern
3. Improving shoreline where buffers are lacking
4. Improving areas where erosion is happening
5. Keeping aware of the changes that occur with state shoreline zoning law

A shoreline buffer is the unspecified width of shoreline that is covered by a matrix of trees, shrubs, plants, and duff.

Water Quality

Goal: Monitor and improve Amacoy's good water quality.

Maintaining good water quality in Amacoy Lake is critical to maintaining the elements of beauty, recreation, and a healthy aquatic community that lake users value. Amacoy's watershed area to lake ratio is 16:1. Water quality typically decreases as the watershed area to lake area increases (Figure 10.). The greater that ratio is, the greater the amount of nutrients that are entering the system from various sources. The watershed to lake ratio of over 16 to 1 is higher than the average for natural lakes in Wisconsin, and indicates that watershed characteristics have a potentially large impact on water quality in Amacoy Lake. However, the ratio is low enough that water quality improvement can be achieved with a comprehensive package of best management practices (BMPs) and restoration alternatives. The potential for successful lake restoration efforts is generally considered good in cases where the watershed to lake ratio is less than 20:1.

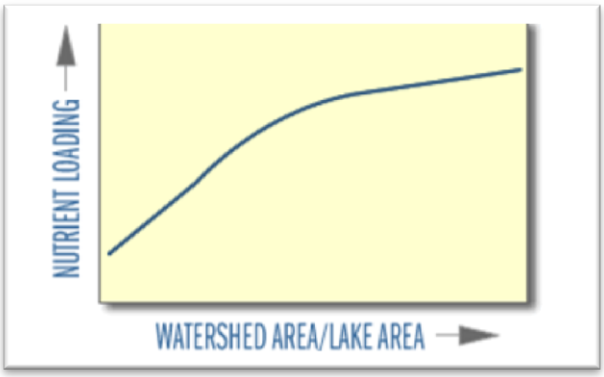

Figure 10. General pattern of nutrient loading associated with increasing watershed size relative to lake area. http://www.waterontheweb.org/

Phosphorous

Phosphorus is a naturally-occurring nonmetal of the nitrogen group. As a mineral, phosphorus is almost always present as inorganic phosphate rocks. Phosphorous is the primary nutrient affecting the growth of aquatic plants and algae in most of Wisconsin's lakes. According to research by the University of Wisconsin Stevens Point and Portage County Staff, phosphorous above levels "30

parts per billion (ppb(µg/l =ppb)) can lead to nuisance aquatic plant growth" (UWSP 2005). Amacoy is consistently averaging above 30µg/l and manifests visually through slight algal issues (blooms) noted by lake residents.

Figure 11. Phil Swanson, a CLMN volunteer of Amacoy Lake, holds a secchi disk used to take water clarity readings.

Phosphorus can naturally occur in a lake or can enter by waste run-off from agricultural use, wastewater treatment facilities, or leaching septic systems. Amacoy lake's higher phosphorous levels are primarily due to barnyard runoff and developed land. Wetlands in the Amacoy Lake watershed also appear to be a factor due to their soft water, iron concentrations, and a minimal amount of calcium. Calcium, aluminum, or iron can immobilize phosphorus, creating poor retention. Iron's phosphorus retention is seasonal, releasing attached phosphorus during times of oxygen loss (Roesler 2012). During the summer, Amacoy's bottom waters do become oxygen depleted, allowing phosphorus to leach out of the sediment and re-suspend back into the water column.

ALPOA will not be able to control the naturally occurring phosphorus in the flowage. Instead, ALPOA must focus on the lesser, but still significant phosphorus contributors. ALPOA would like as a minimum to have water quality stay the same, if not improve by upwards of one foot in clarity. ALPOA will discuss with Rusk County and WDNR water quality concerns and ways to correct them through the following:

1. Leaching septic systems - There has been some interest in monitoring septic systems to determine if septic systems are a contributor to water quality issues.
    a. Methods to monitor septic systems have not yet been determined.
2. Farm to the west of the lake – A grassy swell was put in 1995 to minimize runoff. Its effectiveness has not been monitored:
    a. Take water samples from INL-2 during a time of flow to assess if nutrient load has decreased since the '90s.
3. Input of INL-3 – input for this inlet has not been documented
    a. Take water samples from INL-3 during a time of flow to assess nutrient load
4. CLMN monitoring
    a. Continue to have a volunteer from the lake collect data on Amacoy to assess changes over time
        i. Secchi
        ii. Temperature

iii. Chemistry samples

5. Soft Maple and Hay Creek Watershed
    a. Determine if a repeat of the study is necessary if phosphorus becomes a greater problem in the lake.
        i. Include watershed modeling as part of the study
6. Determine amount of internal TP loading if other actions to limit external TP loading have little impact on Amacoy's water quality
7. Conduct a shoreline inventory to assess if particular properties are contributing to water quality decline
    a. Include restoration plans if an issue is found

In-lake Habitat

Goal: Maintain and improve in-lake habitat for wildlife and residents.

FISHERIES AND FISH HABITAT

Healthy fish populations are important to shoreline land owners, anglers, and tourists. It is desirable to encourage a self-sustaining and diverse population of native fish species in Amacoy Lake. One way to improve upon a good fishery is through increasing habitat. Although Amacoy has been stocked in the past, the most sustainable way to increase fish populations is through habitat enhancement. Incorporating course woody habitat (CWH), such as trees, limbs, branches, and roots to a water body can happen naturally or by human means which create important refuge for foraging and spawning habitat for fish (Hanchin et al 2003, Lawson et al. 2011), aquatic invertebrates, turtles, birds, and other aquatic animals (Engel and Pederson 1998; Sass 2009).

Upon WDNR recommendations, Amacoy is not at the stage in habitat restoration where they are prepared to make decisions about which types of restoration to use or the timelines for them. The WDNR would first like to have a "Fish Visioning Session" with the stakeholders of Amacoy Lake. This Visioning Session would include and accomplish the following:

1. Have approximately 20 lake home owners or local lake users in attendance
2. Take about a half day's worth of time and have lunch provided by ALPOA
3. Nominate fish species as being important
4. Determine people's fish size preference versus number of fish
5. Determine if people would prefer to harvest or catch & release when looking at specific species
6. Develop species goals. Example – A walleye population of moderate density with a moderate proportion of quality size fish.

Possible tools to manage fisheries may include:

Habitat manipulation:

- Tree drops and fish sticks will provide habitat for bass and panfish that are associated with plant beds in shallow water. These methods also provide habitat for waterfowl and turtles. These methods work well in low energy areas or medium depth.
- Half logs create habitat for smallmouth bass. They can be

utilized in shallow areas of high energy.
- Enhancing submergent vegetation will increase spawning habitat for walleye and musky.

Fish Stocking:

- Addition of different sizes (fry, small fingerlings, large fingerlings) and species of fish to the lake.

Fishing Regulations:

- Could ask Amacoy fishermen to voluntarily follow suggested changes in bag and size limits.
- Propose law enforceable changes to bag and size limits through WDNR channels. Can take up to 3-4 years to take place and need to be backed by sound science.

Critical Habitat Designation

Critical habitat is defined as areas that are most important to the overall health of the aquatic plants and animals found in a water body. According to the WDNR, up to 90% of the living organisms in lakes and rivers are found along the shallow margins and shores (WDNR 2013). Wisconsin state law mandates the protection of this type of habitat. Critical habitat areas act as a buffer to protect areas from invasive species. Without the protection of these critical habitat areas, invasive species would have an extreme advantage on the overall habitat.

The selection of waters for Critical Habitat Designation (CHD) as based on:

- Quality of natural resource
- The amount of information the WDNR holds on the water body
- Current and future risks of development and in-lake activities to the resource

Figure 12. Native mussels found in Amacoy including giant floaters, fat muckets, and pond mussels.

After lake selection the process for CHD is as follows:

a. The WDNR compile and review scientific data on the water body.
b. The WDNR conducts field work and surveys public rights features.
c. Data is compiled into a CHD report which is then posted for public review.
d. After feedback from the public comment and completion of the report, the areas of critical habitat are officially designated.

ALPOA will assist with the process by:

1. Contacting the WDNR to schedule a CHD surveying time in 2013 or 2014
2. Assisting with CHD survey if asked by the WDNR.
3. Reviewing and providing comments on report.
4. Adopting CHD into APM plan.

Recreation

Goal: Provide diverse and safe recreation opportunities.

Amacoy Lake is a recreation destination. Due to the large number of groups that utilize the lake, it is important to provide diverse and safe recreation opportunities for all users, residents and visitors alike. Because of this demand it is necessary to include recreation goals as part of this plan.

Public Access

There are four public access points on Amacoy Lake. Prior to the investigations of this APM committee, only one access was known, the public boat launch on the west side of the lake. It was evident that the three other access locations were not widely known, if at all (see *Appendix G*).The private land owner may have an easement running through their property. As years pass, public access points may become lost, overgrown or developed. ALPOA will work to:

1. Alert lake community to public access points
2. Assess the accessibility and viability of access points
3. Respond to viable access points to update and make accessible
4. Assess possible uses of access points

If public access points are found to no longer be viable, an agreement would have to be made between Wisconsin Department of Natural Resources and the Town of Stubbs to abandon that particular access point.

Every five years all public access points will be reassessed (by ALPOA). If there is a problem with a public access point the Town of Stubbs will be responsible for resolving the issue and maintaining the site.

Recreators often use the boat launch area of the lake as a swimming beach. Due to the high use of the lake by boaters, there can sometimes be user conflicts between these two groups. If conflicts continue or increase in frequency, public access points may be considered as alternate sites for a separate public swimming beach.

Slow-No-Wake Zones

The state of Wisconsin has a Slow-No-Wake law that applies to all lakes in the state. Slow-No-Wake is defined as the minimum speed possible while still maintaining steerage (control of boat direction). The purpose of this law is twofold. The main purpose is making lakes safer for recreationalists, people swimming, fishing and recreating near shore. In addition, the Slow-No-Wake law will help to protect shorelines and improve water quality. Boats operating in shallow waters often churn up sediment decreasing water quality. Eliminating near-shore wakes will also reduce large waves which contribute to shoreline erosion. Motors in shallow areas can chop up vegetation, potentially spreading invasive aquatic plant species.

The Slow-No-Wake 100 Foot Rule: While operating a motorboat, Slow-No-Wake speed is required within 100 feet of a raft, pier, buoyed restricted area and lake shore. While operating a personal watercraft, Slow-No-Wake speed is required

when within 100 feet of any other boat, including other personal watercrafts.

The Slow-No-Wake 200 Foot Rule: While operating a personal watercraft, Slow-No-Wake speed is required when within 200 feet of the shoreline.

Aside from the state mandated Slow-No-Wake regulations, Amacoy Lake's Boating-Water Regulation Ordinance declares that "No person shall operate a boat faster than Slow-No-Wake in the waters of Amacoy Lake when the water exceeds elevation 1073 as based on the bench mark located at the public boat landing. This Slow-No-Wake restriction will be posted at all public access points when in effect" (See *Appendix H*). The Town of Stubbs will also post the ordinance when the water is above the top height of the boat ramp.

OUTREACH

The public is expected to be well informed on the rules and regulations of the lake in which they are recreating. ALPOA will provide educational materials for the local community and lake users on lake safety, rules and regulations, and management concerns of Amacoy Lake. Means of outreach could include but are not limited to:

1. Creating new outreach materials.
2. Adding a kiosk at boat landing. Currently no kiosk is present, just signage. ALPOA and the Town of Stubbs will determine if one will be created, where to put the new kiosk, and how to maintain it.
3. Improving the dock at the public boat landing so that it is handicap accessible.
    a. Consider an accessible (ADA-compliant) fishing pier.
4. Developing ordinances if development or lake use becomes too great or if user conflicts occur.

ALPOA Effectiveness

ALPOA would like to keep connected with its current members and get more people around the lake involved. Some of the ways that they can and do so include:

1. A newsletter distributed to members three times per year.
2. Get higher meeting attendance by advertising meetings and subjects.
3. Create an Amacoy Lake specific plant book as an incentive to attend meetings.
4. Keep a copy of Amacoy-related reports on file at the Town of Stubbs for reference.
    a. All reports and files will be available to APLOA members who wish to review them.
5. Create or bring back an annual event such as an ice or summer fishing tournament.
6. Review of APM plan on a consistent basis.
7. Keep the ALPOA website up-to-date and add reports.
    a. APM plan will be added to the APLOA website.
8. Support the WRA and its activities.
9. Add Amacoy Lake to the Town of Stubbs Comprehensive Plan in 2015.

Implementation

To accomplish the goals of the Amacoy Lake Aquatic Plant Management Plan, it is necessary to maintain an adaptable multi-faceted management strategy. A multi-faceted strategy for Amacoy Lake will include, but is not limited to, the management strategies listed below.

Goal 1: Aquatic Plants and Invasive Species *Have a healthy and diverse plant community while controlling invasives.*			
Action Items	Who will implement?	Timeline	Finance
Professional AIS/plant survey	ALPOA - contract with an organization for service	Visual survey every 2yrs, Full PI survey every 5yrs	ALPOA or WDNR grant
CLMN AIS monitoring	Lake residents and ALPOA	Multiple times every year	None necessary
Manual removal of CLP	ALPOA and WRA	Every year	WRA
Chemical treatment of CLP	ALPOA and WDNR	If necessary	ALPOA or WDNR grant
Mechanical removal of CLP	ALPOA and WDNR	If necessary	ALPOA or WDNR grant
Rapid Response Plan for new AIS discoveries	ALPOA/CSC	2013-2014	None necessary
Implement the CBCW program	ALPOA/CSC	Ongoing into the future	Volunteer time
Install new AIS sign at boat landing	ALPOA/CSC	Summer 2013	Volunteer time
Monitoring of water for residue chemicals after chemical applications	ALPOA and WDNR	If necessary	ALPOA or WDNR grant
CLP monitoring/bed mapping	Lake residents & ALPOA	Spring to early summer, yearly	None necessary

Goal 2: Shoreline Habitat Maintain and improve shoreline habitat for residents and wildlife.			
Action Items	Who will implement?	Timeline	Finance
Compile resources that people can use for reference	ALPOA and Rusk Co. LWCD	Summer 2013	Free resources, volunteer outreach
Inventory Amacoy Lake Shoreline to assess areas of concern	ALPOA and WDNR	2014-2015	WDNR budgeted special project
Improve shoreline where buffers are lacking	ALPOA and individual homeowner	If necessary	WDNR grant or out of homeowners pocket
Improve areas where erosion is happening	ALPOA and individual homeowner	If necessary	WDNR grant or out of homeowners pocket
Educate lake residents about shoreline zoning	ALPOA and Rusk Co. LWCD	Summer 2013	Free resources, volunteer outreach

Goal 3: Water Quality Monitor and improve Amacoy's good water quality			
Action Items	Who will implement?	Timeline	Finance
CLMN - continue chemistry and secchi monitoring	ALPOA as part of CLMN program	Ongoing	CLMN program pays for four samples each yr
Take samples at INL-2 to assess if nutrient levels have decreased since 1993	ALPOA with help from Rusk Co. LWCD	2013 or 2014 summer	Small DNR lake planning grant
Determine input level of INL-3	ALPOA	2013 summer	Small DNR lake planning grant
Redo the Soft Maple and Hay Creek watershed survey, including internal and external TP, and watershed modeling,	ALPOA and contracted consultant	None specified	Large scale lake planning grant – not likely monetarily possible
Educate lakefront landowners about nutrient pollution (flyers, emails)	ALPOA	Ongoing	APLOA

Goal 4: In-Lake Habitat *Maintain and improve in-lake habitat for wildlife and residents*			
Action Items	Who will implement?	Timeline	Finance
Inventory of Critical Habitat	ALPOA and WDNR	By end of 2014	DNR budgeted time
Improve areas that have declined in quality (addition of structure or habitat augmentation)	ALPOA and WDNR	If necessary	WDNR Grant
Change in bag limits	WDNR	If necessary	None necessary
Fish surveys	WDNR, ALPOA w/contrator	Every seven years by WDNR	WDNR, or ALPOA if contracted
Fish visioning session with WDNR	WDNR, ALPOA	In 2015	WDNR budget, ALPOA-lunch
Fish stocking	WDNR, ALPOA	If necessary	$2/large fingerlings out of ALPOA pocket

Goal 5: Recreation *Provide diverse and encourage safe **Recreation** opportunities.*			
Action Items	Who will implement?	Timeline	Finance
Alert people to existence of public access sites on Amacoy	ALPOA	Summer 2013	None necessary
Put signs up at Public access points	ALPOA	Summer 2014	Volunteer
Develop ordinances if development pressure becomes too great for the lake community	ALPOA	As needed	None necessary
Distribute literature on slow-no-wake rules on the lake	ALPOA	As needed	None necessary
Install a ADA accessible fishing pier	Town of Stubbs	None specified	None specified
Install a kiosk at the public boat landing	ALPOA	None specified	APLOA, small lake planning grant
Put up “slow-no-wake” ordinance sign when in effect	Town of Stubbs	When necessary	Town of Stubbs
Construct a fish cleaning house	ALPOA	None specified	None specified
Provide a boat washing facility at the public boat launch	ALPOA	None specified	None specified
Assess need for a separate swimming beach and possible locations	ALPOA	When necessary	None specified

Goal 6: ALPOA Effectiveness Improve the effectiveness of ALPOA to better serve the needs of the Amacoy Lake Community			
Action Items	Who will implement?	Timeline	Finance
Get higher meeting attendance by advertising meetings and subjects	ALPOA	Ongoing	ALPOA
Create Amacoy plant book as incentive to meeting attendance	ALPOA	2012-2013	ALPOA
Keep a record of Amacoy reports on file at Town of Stubbs for reference	ALPOA	Ongoing	ALPOA &Town of Stubbs
Create/bring back an annual event such as ice/summer fishing tournament	ALPOA	2014 and then on going	ALPOA
Review of APM plan	ALPOA	Every year	ALPOA
Support WRA projects in the area	ALPOA	Ongoing	ALPOA
Website - keep info up to date and add reports	ALPOA	Ongoing	ALPOA
Add Amacoy Lake to the Town of Stubbs Comprehensive Plan	ALPOA & Town of Stubbs	Will be updated in 2015	ALPOA volunteer

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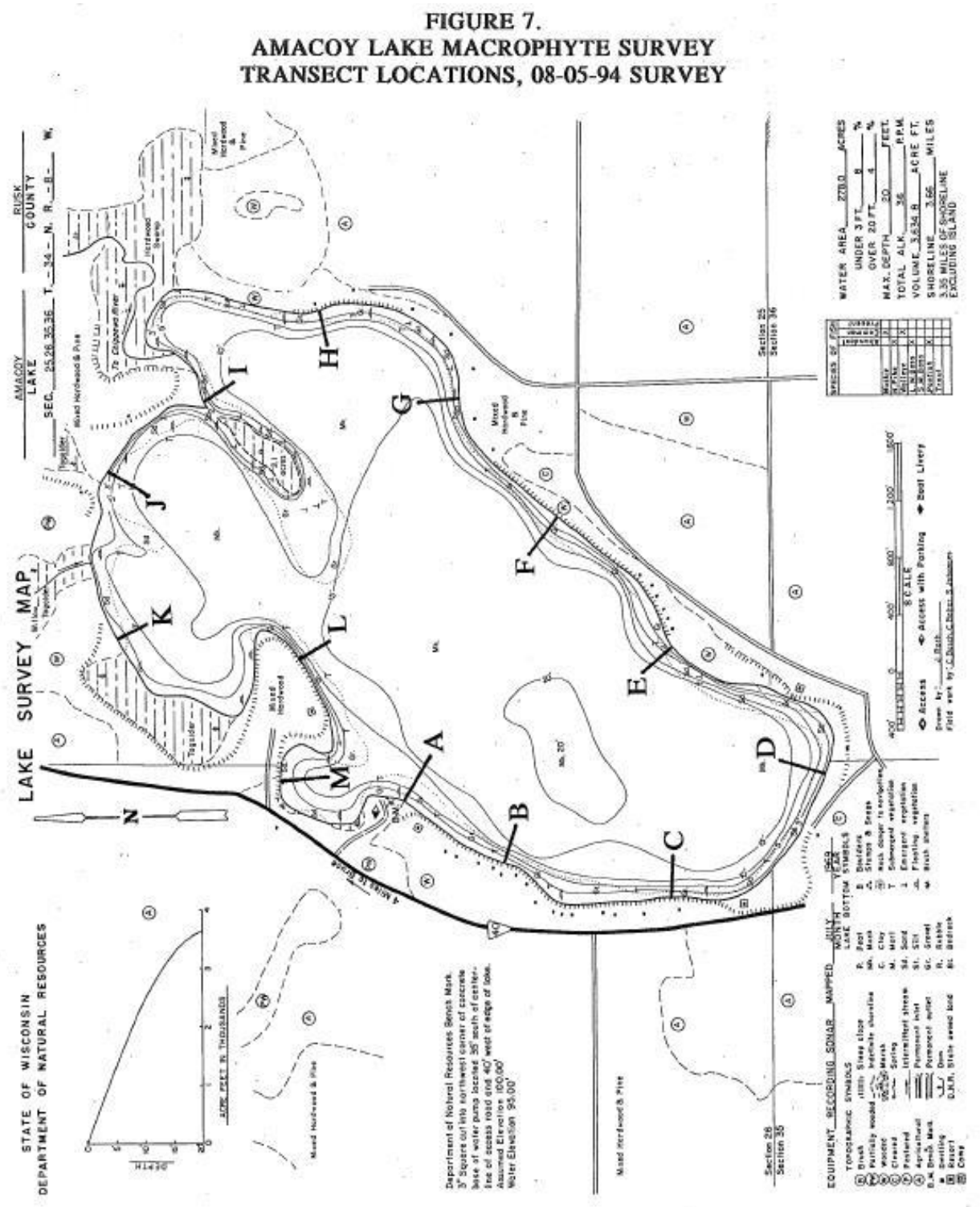
Appendices

Appendix A – Amacoy Inlet #3

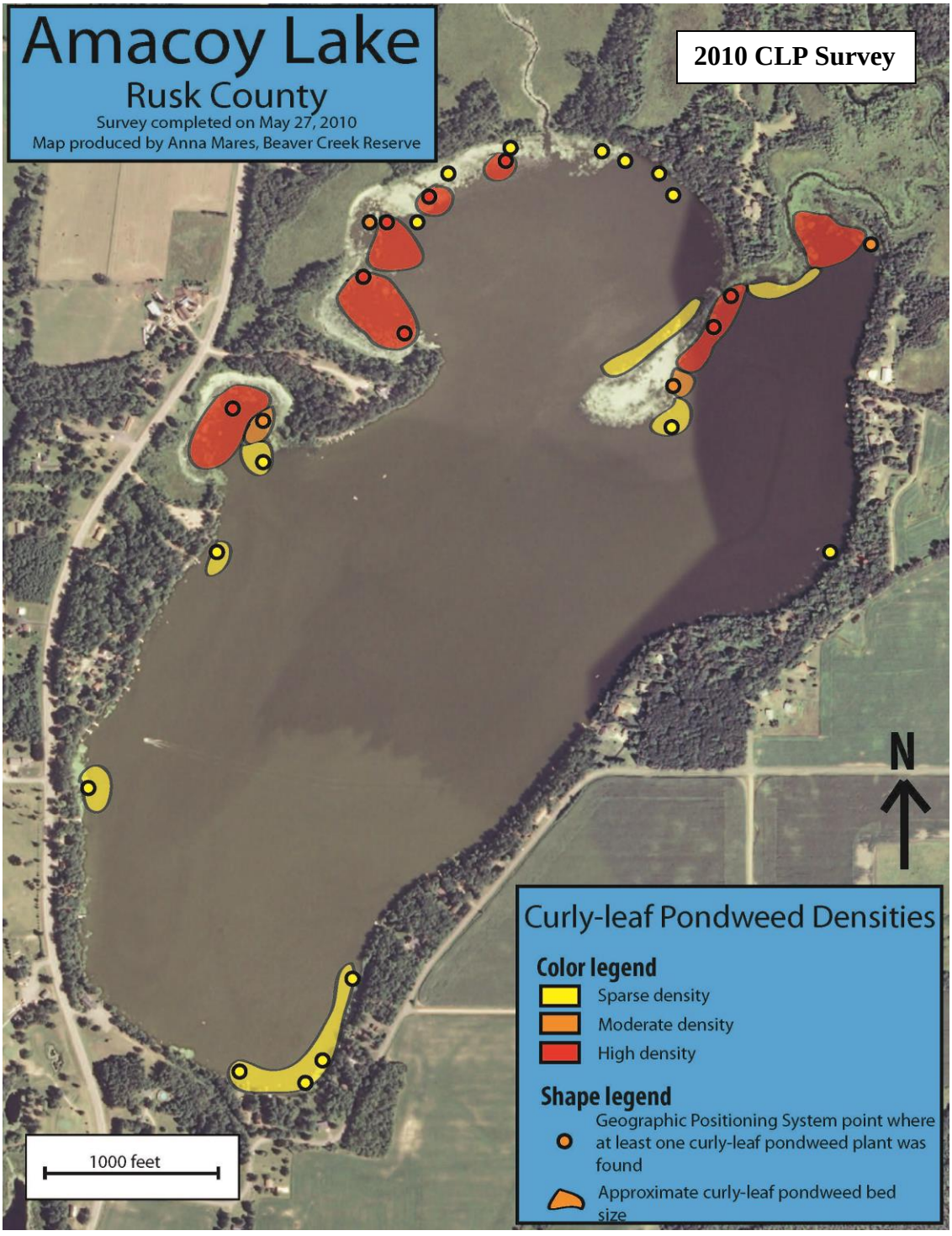
Pictures of INL-3 to Amacoy Lake. Clockwise from upper left: 1.) water runs under Hwy 40 in the distance to an underground culvert at the tree; 2.) water then comes out of the culvert 10 m away from the lake; 3.) water runs above ground in a swellway; 4.) water enters south side of lake above ground.

Appendix B – 1994 Plant Survey Map

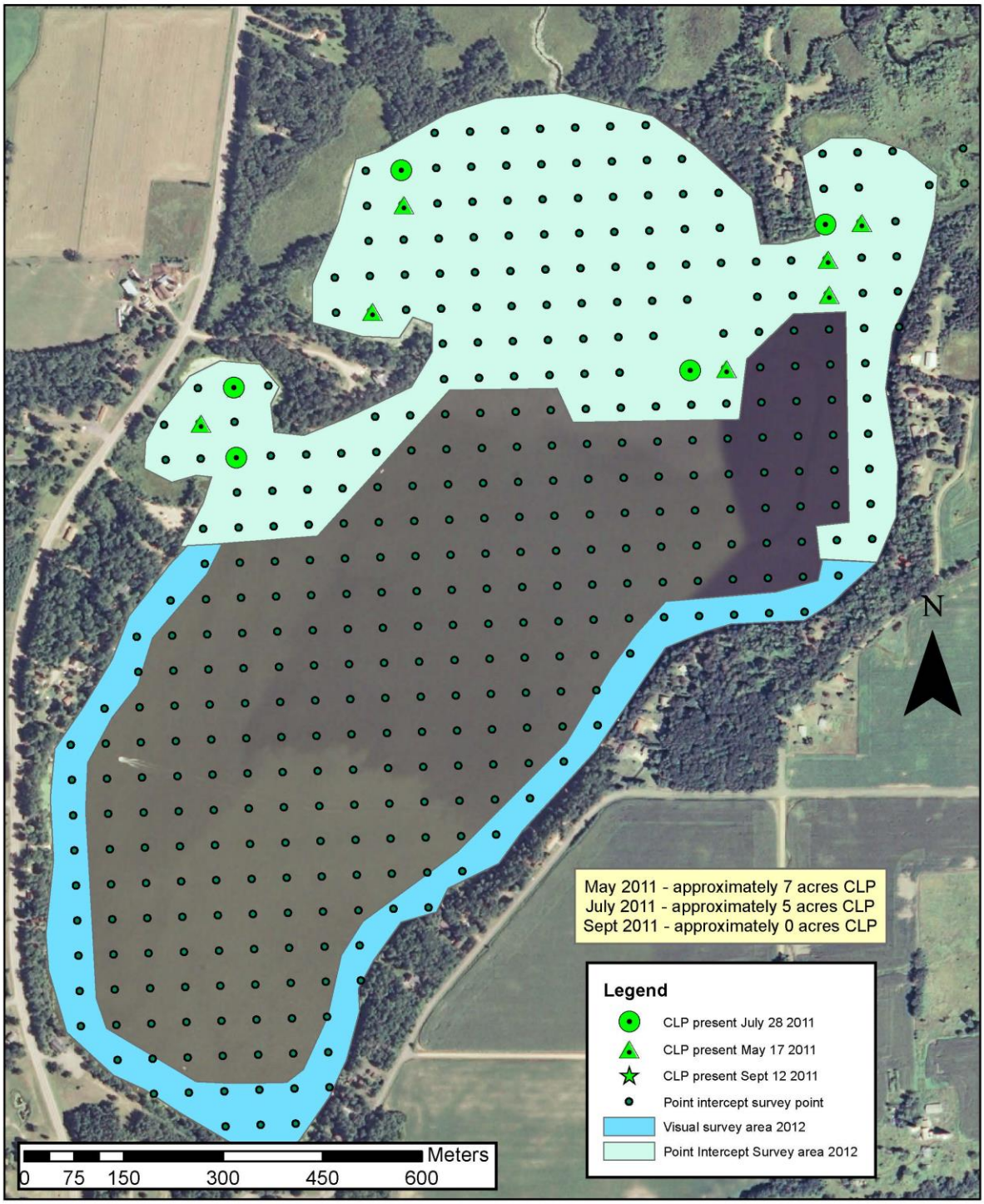
Transect locations of Roesler 1994 aquatic macrophyte survey in Amacoy Lake.



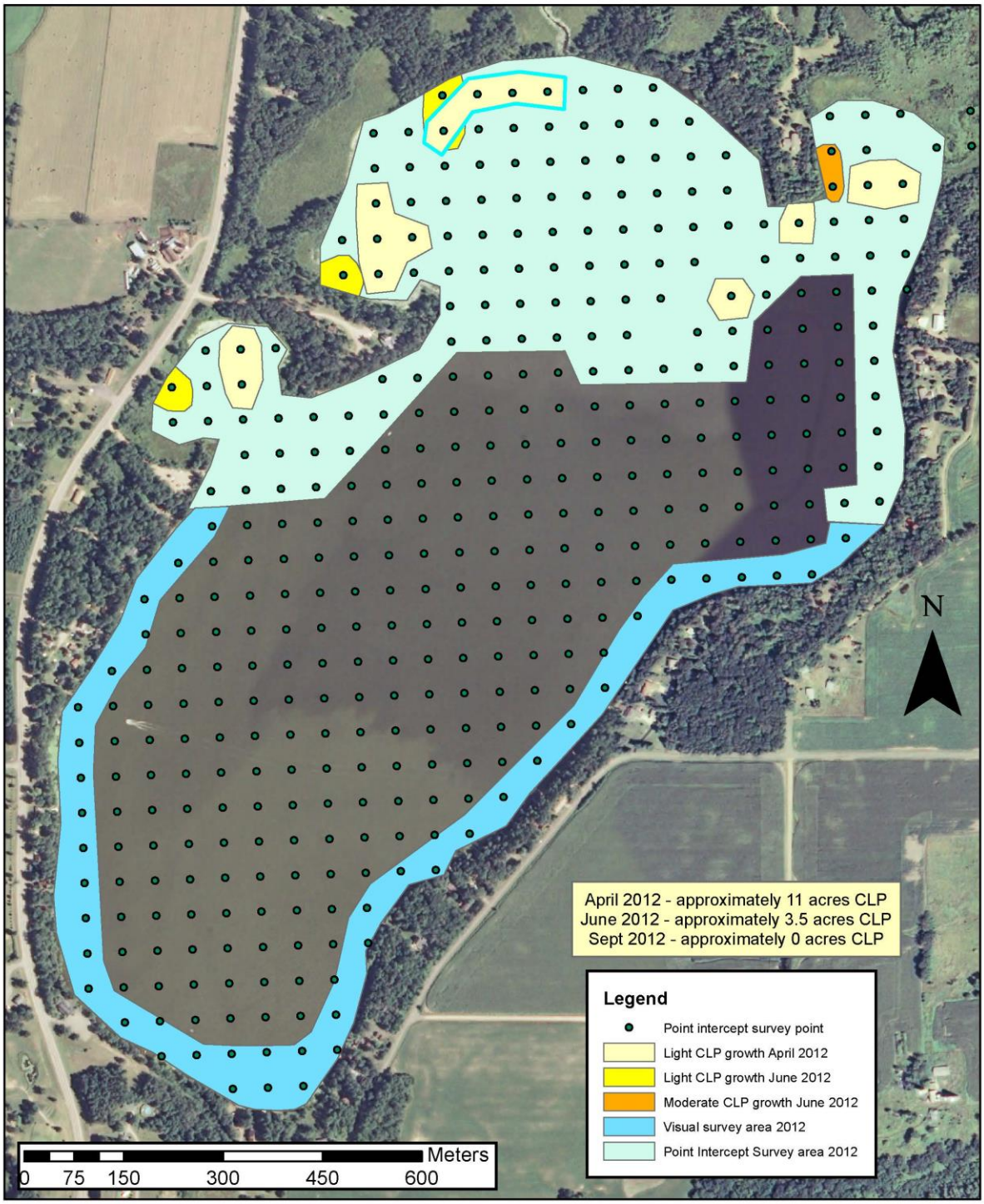
Survey maps of Amacoy in ascending year 2010, 2011, 2012, and 2013 for locations and abundance of curly-leaf pondweed for pre- and post-chemical treatments.



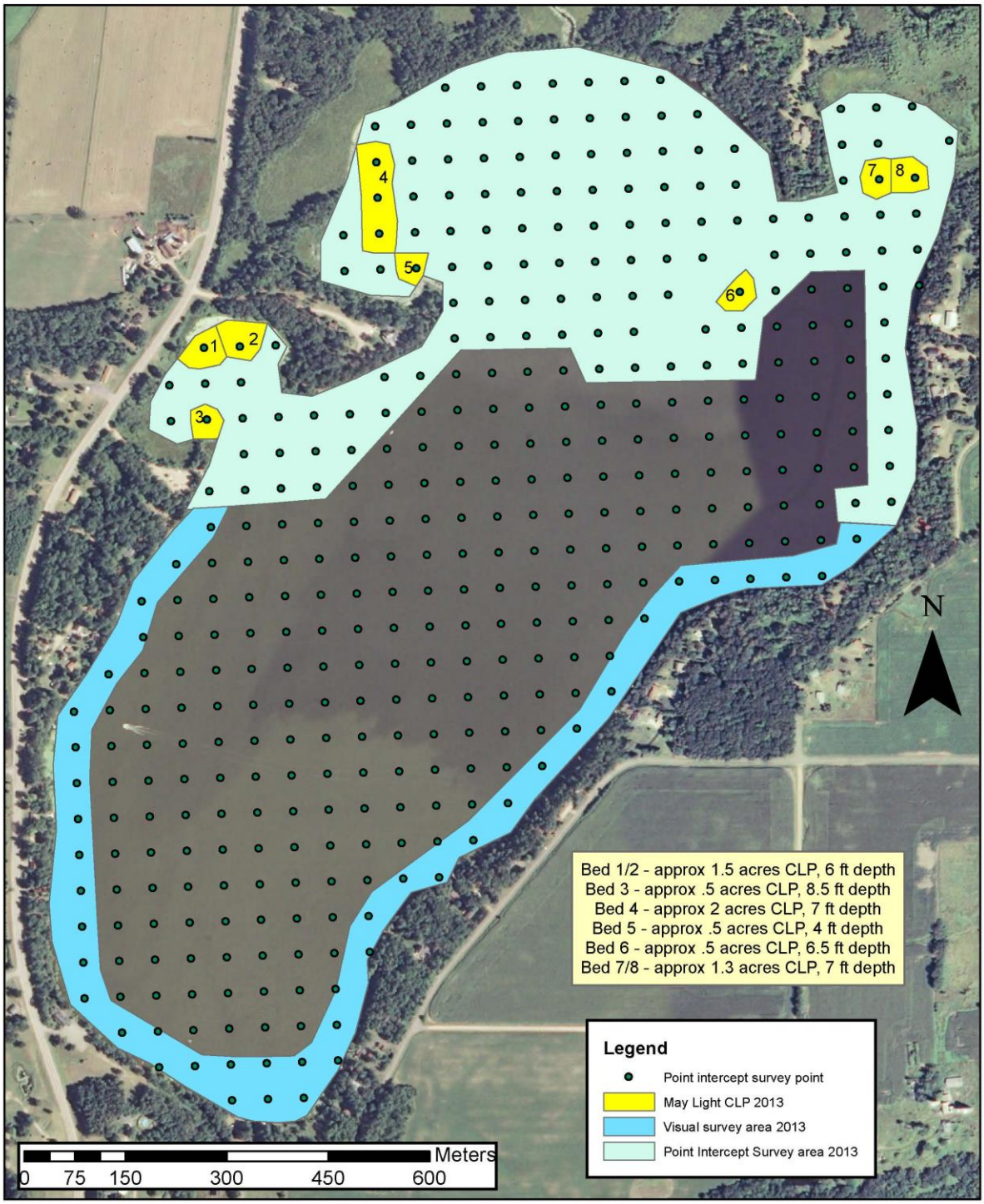
Amacoy Lake, Rusk County, WI
2011 Curly-leaf Pondweed Surveys



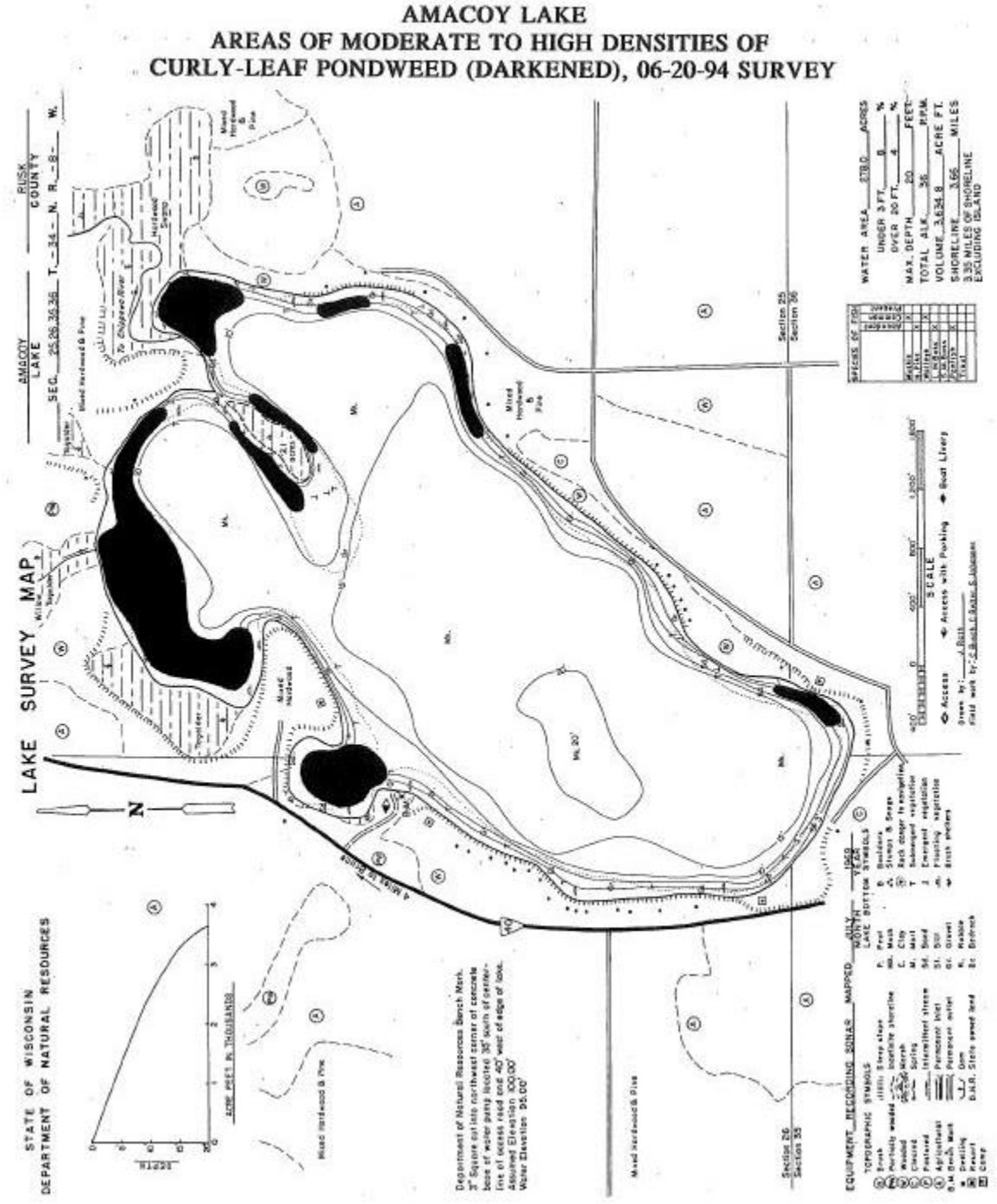
Amacoy Lake, Rusk County, WI
2012 Curly-leaf Pondweed Surveys



Amacoy Lake, Rusk County, WI
May 2013 Curly-leaf Pondweed Survey

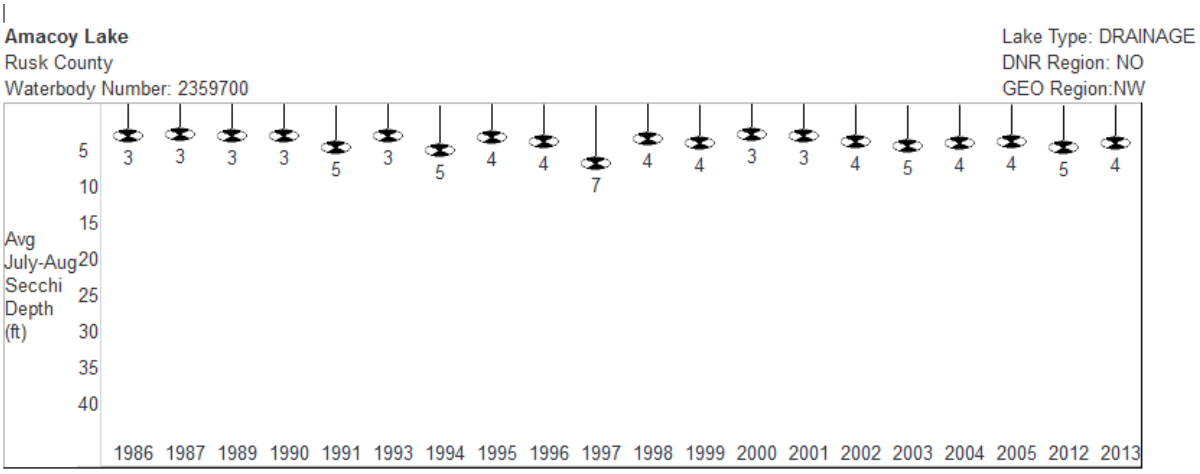


Areas of moderate to high densities of curly-leaf pondweed (darkened), 06-20-94 survey of Amacoy Lake (Roesler, 1995).



Appendix E – Citizen Lake Monitoring Network Data

Citizen Lake Monitoring Network data collected by Amacoy volunteers and WDNR staff over the last 26 years.

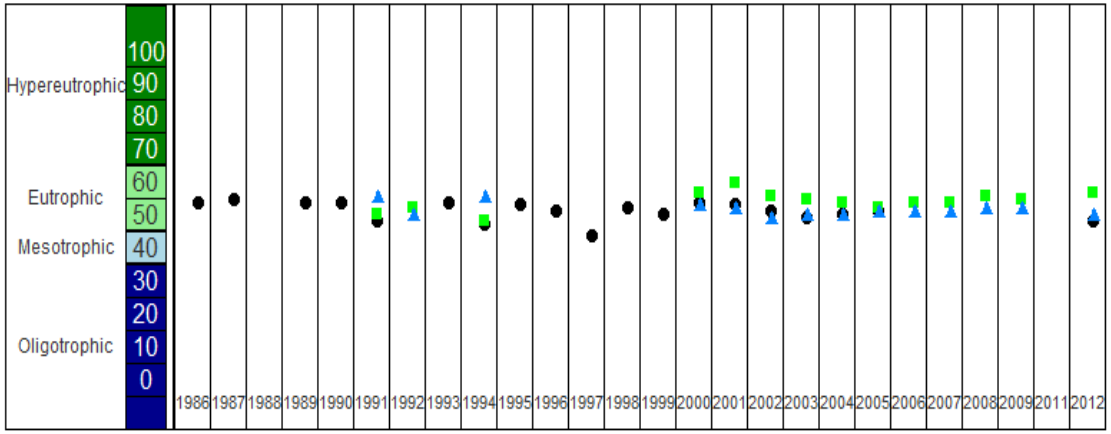


Past secchi averages in feet (July and August only).

Secchi disk readings have been taken over the last three decades by both DNR staff and voluteers from Amacoy Lake. The readings are taken in the same spot each time, the deepest hole of the lake. Only the July and August readings are used to determine the averages and compare between years because that is when algal concentrations are the highest.

The Trophic State Index is a number given to a lake based upon a combination of factors. The secchi disk, chlorophyll a, and total phosphorus readings are put into a mathematical formula to determine the TSI number. The TSI can be a number ranging from 0-100 and depending upon where on that scale the number is, the lake will be determined as hyper-eutrophic, eutrophic, mesotrophic, or oligotrophic, as shown on the next page. On average, Amacoy Lake falls in the 50-60 TSI range making it Eutrophic.

Trophic State Index Graph



Monitoring Station: Amacoy Lake - Deep Hole, Rusk County

Past Summer (July-August) Trophic State Index (TSI) averages.

● = Secchi ■ = Chlorophyll ▲ = Total Phosphorus

TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Trophic state index (TSI) is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator. Visit Bob Carlson's website, dipin.kent.edu/tsi.htm, for more info.

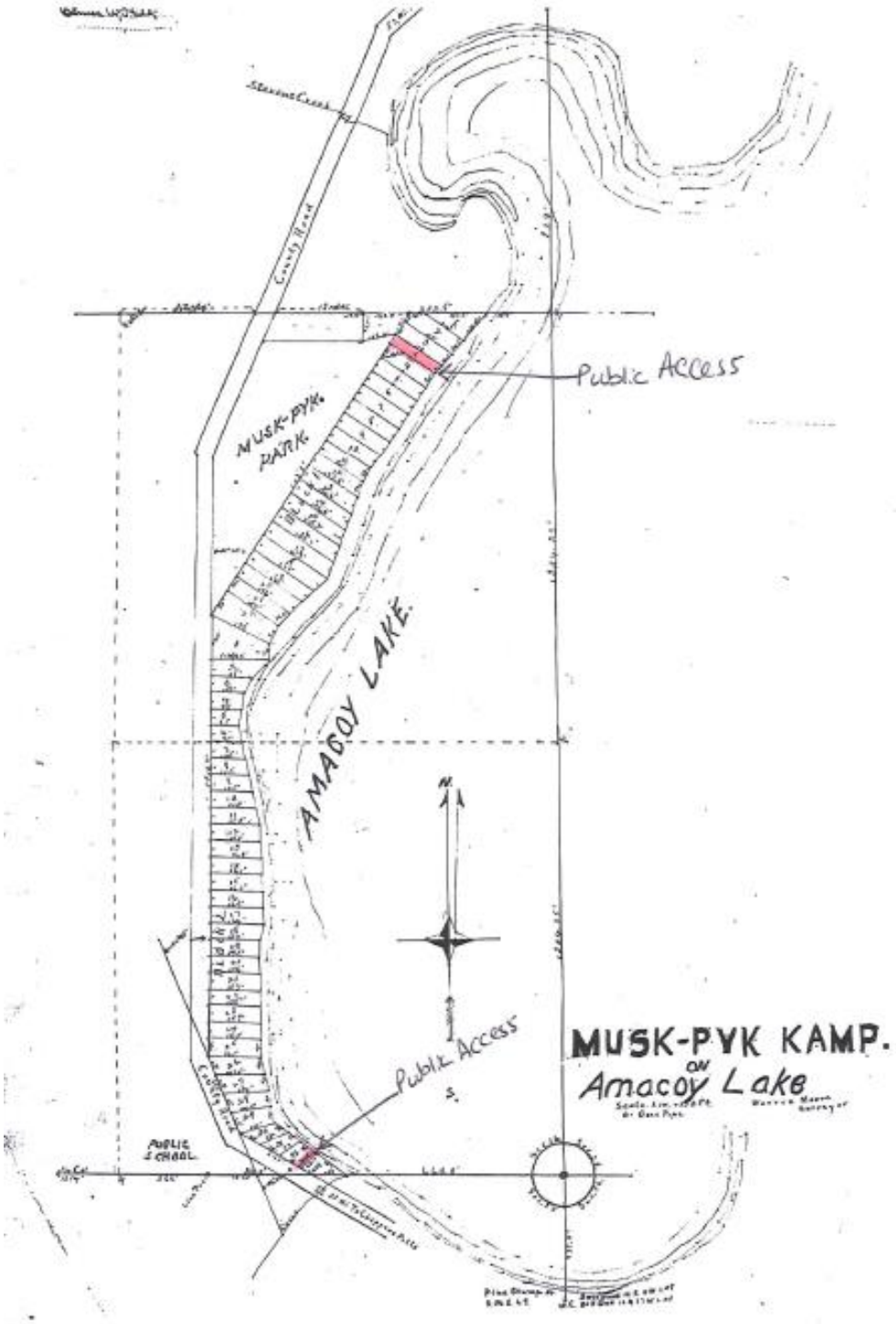
Appendix F – Fish of Amacoy

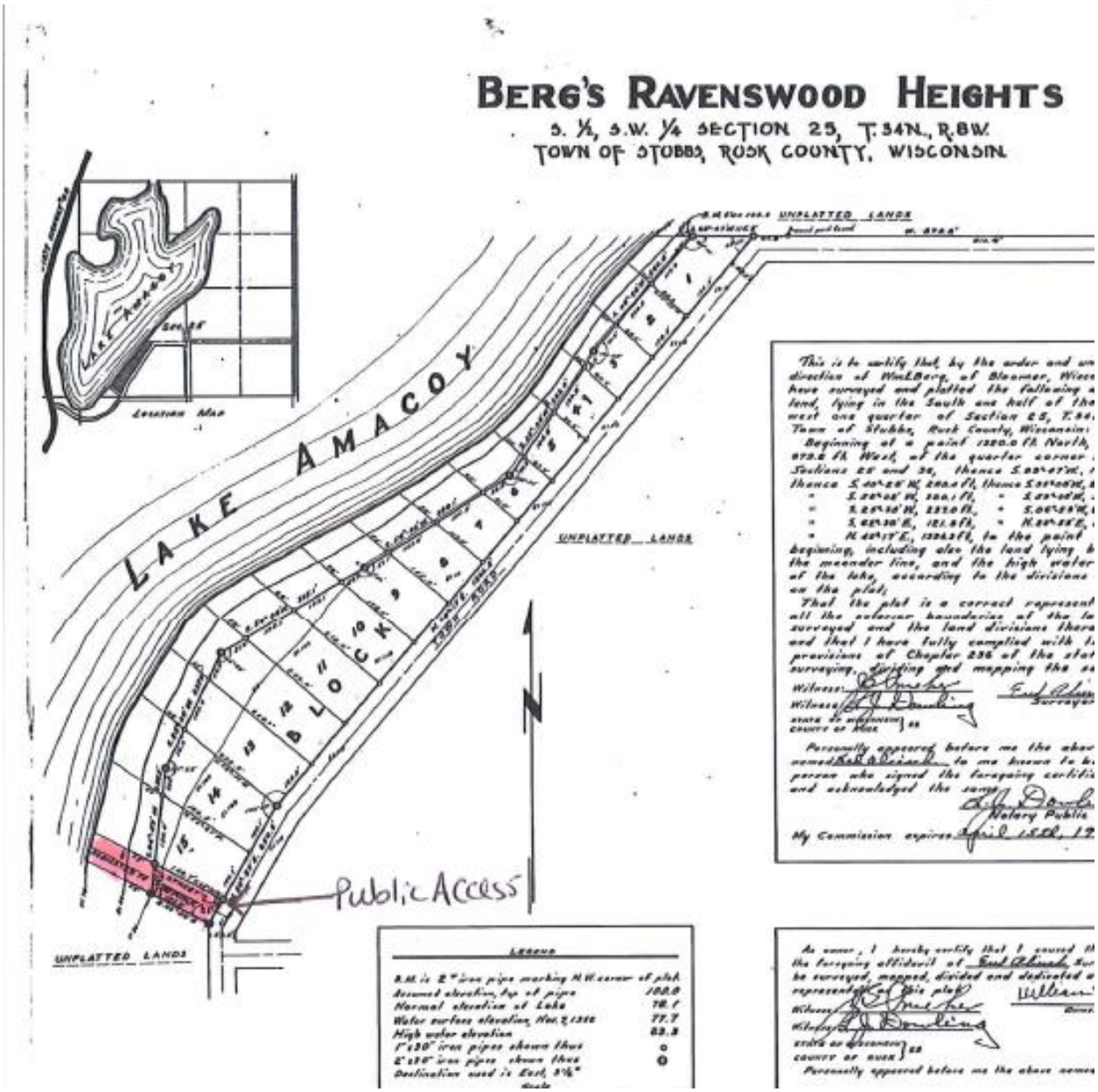
Fish species found in Amacoy Lake via fish surveys by Mead & Hunt (1994) and the WDNR (2010-2011). Species colored blue were only found in the Mead & Hunt survey, green species were found in both surveys and species in yellow were found only in the WDNR (2010-2011) survey. Note, DNR survey not intended as an exhaustive species survey.

	Common Name	Scientific Name
1.)	Golden shiner	Notemigonuscrysoleucas
2.)	Emerald shiner	Notropisatherinoides
3.)	Creek chub	Semotilusatromaculatus
4.)	Central mudminnow	Umbra limi
5.)	Silverredhorse	Moxostomaanisurum
6.)	Shortheadredhorse	Moxostomamacrolepidotum
7.)	Black bullhead	Ameiurusmelas
8.)	Yellow bullhead	Ameiurusnatalis
9.)	Northern pike	Esoxlucius
10.)	Muskellunge	Esoxmasquinongy
11.)	White sucker	Catostomuscommersoni
12.)	Green sunfish	Lepomiscyanellus
13.)	Pumpkinseed	Lepomisgibbosus
14.)	Bluegill	Lepomismacrochirus
15.)	Largemouth bass	Micropterussalmoides
16.)	Black crappie	Pomoxisnigromaculatus
17.)	Yellow perch	Percaflavescens
18.)	Walleye	Stizostedionvitreum
19.)	Warmouth	Lepomisgulosus
20.)	Johnny darter	Etheostomanigrum

Appendix G – Public Access

Maps of public access points that were not widely known until the data gathering of the APM Plan




BERG'S RAVENSWOOD HEIGHTS
S. ½, S.W. ¼ SECTION 25, T.34N., R.8W.
TOWN OF STUBBS, ROCK COUNTY, WISCONSIN
LAKE AMACOY
UNPLATTED LANDS
Public Access
BLOCK
Location Map
LEGEND

Appendix H – Slow No Wake Ordinance

ORDINANCE FOR SLOW- NO- WAKE DURING HIGH WATER PERIODS
A SOLE ORDINANCE TO REGULATE BOATING UPON THE WATERS OF AMACOY LAKE AND PRESCRIBING PENALTIES FOR VIOLATIONS THEREOF.
The Town Board of the Town of Stubbs do ordain as follows:
Section I Applicability and Enforcement
(a) The provisions of this Ordinance shall apply to the waters of Amacoy Lake
(b) This chapter shall be enforced by the officers of the Town of Stubbs. or their designees.
Section II Intent
The intent of this ordinance is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public rights and interests, and the capability of the water resources.
Section III State Boating and Safety Laws Adopted
State boating laws as found in ss. 30.50to 30.71, Wis. Stats. Are adopted by reference.
Section IV Definitions
(a) "Slow-no - wake" means that speed at which a boat moves as slowly as possible while still maintaining steerage control.
Section V Controlled Area
No person shall operate a boat faster than "slow - no- wake" in the waters of Amacoy Lake when the water exceeds elevation 1073 as based on the bench mark located at the public boat landing. This slow-no -wake restriction will be posted at all public access points when in effect.
Section VI Posting Requirements
The Town of Stubbs shall place and maintain a synopsis of this ordinance at all public access points within the jurisdiction of the Town of Stubbs pursuant to the requirements of NR 5.15 Wis. Admin. Code.
Section VII Penalties
Wisconsin state boating penalties as found in Wis. Stat. 30.80 and deposits as established in the Uniform Deposit and Bail Schedule established by the Wisconsin Judicial Conference, are hereby adopted by reference and all references to fines amended to forfeitures and to references to imprisonment deleted.
Section VIII Severability
The provisions of this ordinance shall be deemed severable and it is expressly declared that the Town of Stubbs Board would have passed the other provisions of this ordinance irrespective of whether or not one or more provisions mat be declared invalid. If any provision of this ordinance or to the application to any person or circumstances is held invalid, the remainder of the ordinance and the application of such provisions to other persons or circumstances shall not be affected.
Section IX Effective Date
This section will become effective upon passage and the day after publication.
Passed this 8th day of September 2003.

Amacoy Lake Action Plan - Aquatic Invasive Species Introduction

Adopted 31 August, 2013

The purpose of this plan is to have a comprehensive program in place *just in case* a new aquatic invasive species(AIS) is found growing in Amacoy Lake. Amacoy Lake is located in south western Rusk County along Highway 40. Presently, the lake group has reduced the size of several curly-leaf pondweed (CLP) beds from heavy densities to light densities. Portions of step 3, in this plan, could be used to eradicate CLP infested areas as well.

This plan has three separate and distinct components. They are:

1) **Monitor boat traffic at all public landings.** The Clean Boats, Clean Waters program should continue to be implemented by the Amacoy Lake Property Owners Association and other Amacoy Lake property owners so that the public boat landing is manned with volunteers on summer holidays (Memorial Day, July 4th, and Labor Day). Additional weekends during the boating seasons would be preferred but Holidays will be the focus dates. Volunteers will check boats for aquatic plants before and after they leave Amacoy Lake and fill out appropriate data sheets for the people that they contact. Additionally, volunteers should handout informational cards to boaters to educate the boating public on the dangers of AIS. This will be done periodically throughout the boating season.

2) **Implement a lake survey program.** Rake samples will be taken from at least 12-15 locations in Amacoy Lake on a monthly basis starting in May and ending in September. Locations will be chosen based on previous locations used in plant surveys and they will be evenly spaced around the lake. Volunteers will be trained how to identify AIS so that they can report any suspicious findings to the Amacoy Lake Board. These volunteers should be regular boaters on Amacoy Lake that are familiar with the water depthand common lake characteristics. Shoreline sweeps from a boat in 2-7 feet of water around the perimeter of the lake would also be helpful for the early detection of AIS. The sweeps should be done in conjunction with the rake samples. The shoreline could be split between several survey boats to lessen the work load.

3) **Implement the Rapid Response Plan.** This plan will expedite the process of dealing with the AISonce it is found. This plan has six steps:

    a) The Amacoy Lake Board should establish an AIS Remediation Team ***now***. This step would include identifying appropriate consultants, WDNR officials and Amacoy Lake Board personnel that will contact the consultants and officials if an AIS is discovered. The specific objective of the AIS Remediation Team would be to consult

the aquatic plant management plan that would address treatment of infested area(s) and to investigate what types of costs would be involved with said treatment methods.

b) Geo-locate AIS populations in Amacoy Lake. Once a suspicious plant is discovered, a member of the Remediation Team shall accompany the individual(s) that discovered the AIS to the site and GPS the location. The location and approximate plant bed size shall then be communicated to the Amacoy Lake Board. The Amacoy Lake Board would then contact the DNR.

c) An Amacoy Lake Board representative would accompany the DNR to the specific location to positively identify the suspicious plant. If an AIS is positively identified, then the infested area would be marked with buoys to keep boaters out.

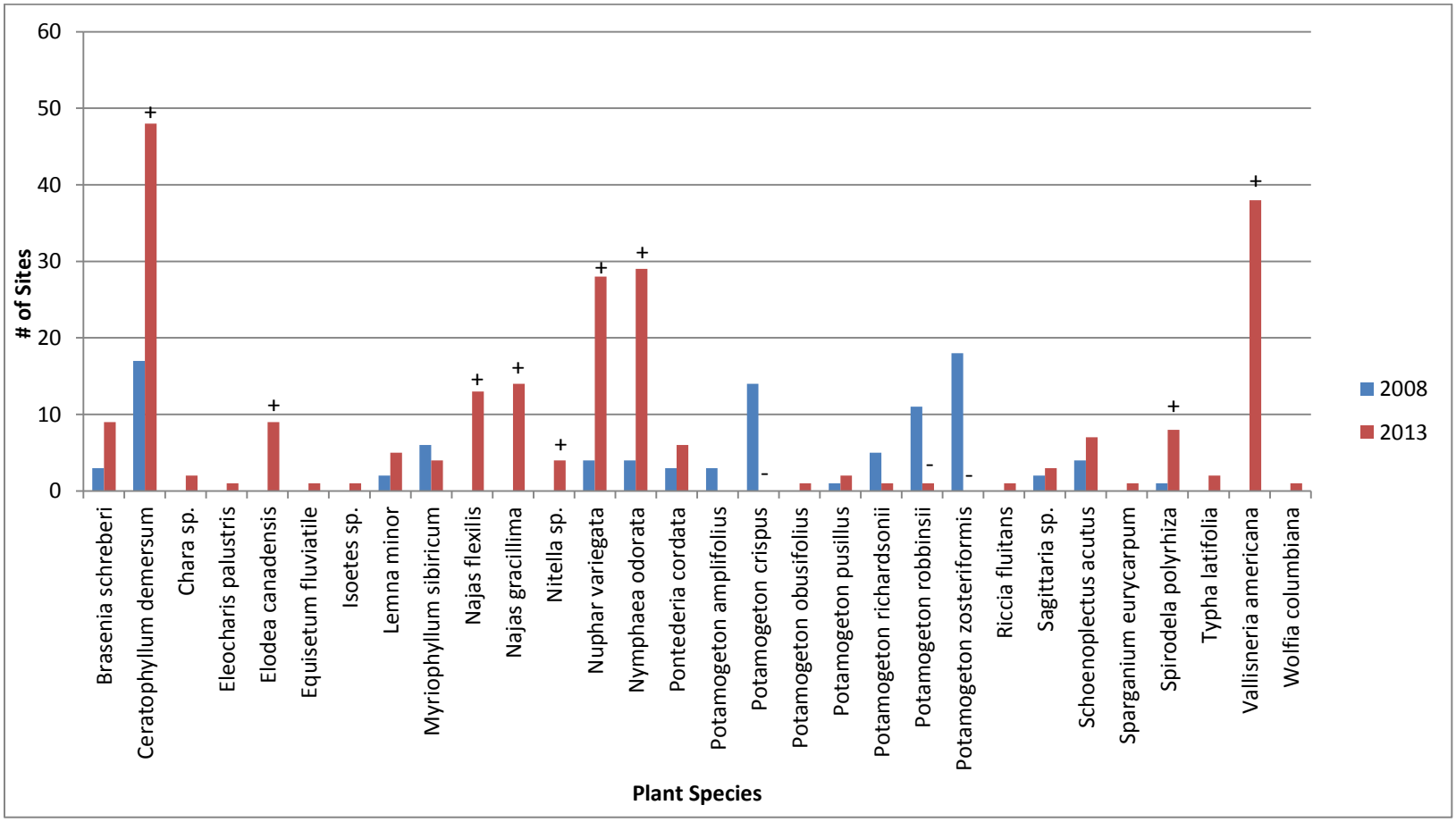
d) One or two individuals shall be appointed to fill out and submit permit and grant applications for the control of the AIS. This exact process should be understood so that it could be completed expeditiously.

e) An Amacoy lake Board representative will assist the Remediation Team when manually removing a small population of AIS, or actually applying any recommended chemical(s) to the infested area. Chemicals need to be applied by a licensed chemical applicator.

f) An Amacoy Lake representative will actively work with the Remediation Team to assess the effectiveness of the chosen treatment method. A plant survey will be conducted approximately one month after the treatment and again in the Fall or Spring, whichever is closer. Then, it will be determined what ongoing maintenance needs to be done to control AIS.

Amacoy Lake residents should be notified once step b) is completed. Part of this notification should include what exactly is being done to control/eradicate the AIS. Periodic updates should also be provided at appropriate times.

Plant species found in Amacoy Lake during 2008 and 2013 point intercept surveys. A + above nine species denotes that a statistically significant increase was seen from 2008 to 2013. A – above three species denotes that a statistically significant decrease was seen from 2008 to 2013.Lack of annotation indicates that no statistically significant change was noted from 2008 to 13. (Mares, 2013)



Changes in curly-leaf frequency at survey sites pre-chemical (April/May) and post-chemical (June/July) treatment in Amacoy Lake from 2011 to 2013. (Mares, 2013)

	# of Sites CLP Found at		
Year	**Pre-treatment**	**Post-treatment**	**Change in frequency**
2011	7	5	negative, **NOT** statistically significant
2012	13	4	negative, statistically significant
2013	10	0	negative, statistically significant

Changes in curly-leaf frequency at survey sites from year to year during chemical treatments. Comparisons are made using data only from June/July plant surveys that are post-chemical treatments, with the exception of 2008 when no chemical treatment occurred. (Mares, 2013)

	# of Sites CLP Found at		
Comparison Years	**Former Year**	**Later Year**	**Change in Frequency**
2008 to 2011	14	5	negative, statistically significant
2011 to 2012	5	4	negative, **NOT** statistically significant
2012 to 2013	4	0	negative, statistically significant
2008 to 2013	14	0	negative, statistically significant

Changes in the Amacoy Lake aquatic plant community composition from 1995 to 2013. 1995 data is shown as relative abundance while 2008-13 data is shown as frequency of occurrence within vegetated areas (%). Present indicates that species was not seen on a rake sample but somewhere else in the lake. A *zero* shows that species was not seen anywhere in the lake during the survey. The top five most common species in a given survey year are highlighted. 1995 data was collected in August while 2008-13 was collected in June or July. (Mares, 2013)

	1995	2008	2011	2012	2013
Species	Relative abundance	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence within vegetated areas (%)
Brasenia schreberi	6	9.68	10.71	15.69	13.43
Ceratophyllum demersum	30	54.84	67.86	66.67	71.64
Chara sp.	0	0	0	0	2.99
Eleocharis palustris	0	0	0	0	1.49
Eleodea nutallii	16	0	0	0	0
Elodea canadensis	present	0	5.36	5.88	13.43
Equisetum fluviatile	0	0	0	0	1.49
Eriocaulon septangulare	2	0	0	0	0
Isoetes sp.	1	0	0	0	1.49
Lemna minor	0	6.45	14.29	7.84	7.46
Myriophyllum sibiricum	18	19.35	3.57	3.92	5.97
Najas flexilis	0	0	0	11.76	19.4
Najas gracillima	0	0	21.43	19.61	20.9
Najas sp.	52	0	0	0	0
Nitella sp.	2	0	19.64	21.57	5.97
Nuphar variegata	3	12.9	28.57	21.57	41.79
Nymphaea odorata	8	12.9	55.36	62.75	43.28
Polygonum amphibium	0	0	1.79	0	0
Potamogeton amplifolius	present	9.68	7.14	present	present
Potamogeton crispus	19	45.16	8.93	7.84	present
Potamogeton epihydrus	0	0	0	0	Present
Potamogeton gramineus	present	0	1.79	0	0
Potamogeton obtusifolius	0	0	0	0	1.49
Potamogeton pussilis	0	3.23	0	0	2.99
Potamogeton richardsonii	7	16.13	0	3.92	1.49
Potamogeton robbinsii	25	35.48	8.93	1.96	1.49
Potamogeton spirillus	8	0	0	0	0
Potamogeton vaseyi	9	0	0	0	0
Potamogeton zosteriformis	8	58.06	3.57	present	Present
Pontederia cordata	2	9.68	5.36	9.8	8.96
Riccia fluitans	0	0	0	0	1.49
Sagittaria sp.	10	6.45	3.57	3.92	4.48
Schoenoplectus acutus	1	12.9	17.86	7.84	10.45
Schoenoplectus tabernaemontani	present	0	0	0	0
Sparganium eurycarpum	0	0	1.79	3.92	1.49
Spirodela polyrhiza	0	3.23	17.86	7.84	11.94
Typha latifolia	0	0	0	0	2.99
Utricularia vulgaris	0	0	0	0	Present
Vallisneria americana	85	0	39.29	35.29	56.72
Wolfia columbiana	0	0	3.57	5.88	1.49