Aquatic Plant Management Plan

White Ash and North White Ash Lakes

White Ash Lake Protection and Rehabilitation District

MAY 2017

AQUATIC PLANT MANAGEMENT PLAN
WHITE ASH AND NORTH WHITE ASH LAKES

MAY 2017

Prepared for:

White Ash Lake Protection and Rehabilitation District

Prepared by:

Flambeau Engineering, LLC
PO Box 273
Park Falls, WI 54552

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Tiffiney Kleczewski, PE

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1.0 Executive Summary

The White Ash Lake Protection and Rehabilitation District (The District) was formed in 1976 to address resource management concerns on White Ash and North White Ash Lakes. The District has been active in a number of lake management activities on White Ash and North White Ash Lakes including aquatic plant management, invasive species monitoring and control, habitat improvements, boat landing monitoring and community education activities. The District contracted Flambeau Engineering, LLC. to update the aquatic plant management (APM) plan for White Ash and North White Ash Lakes. The White Ash and North White Ash Lakes APM Plan includes a review of available lake information, aquatic plant surveys, fishery assessment, water quality evaluation and an evaluation of current management techniques. The APM plan recommends specific management activities for aquatic invasive species (AIS) in the lake systems, which are discussed below.

Flambeau Engineering completed aquatic plant surveys on White Ash and North White Ash Lakes in 2016. An early season survey was completed in May on each lake to accurately assess the curly-leaf pondweed (CLP) location and density. A second set of surveys was completed in August to assess the native vegetation. CLP was widespread in North White Ash and in isolated beds in White Ash. The density and area of coverage appears to have decreased in both lakes indicating the current management is effective.

RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

One aquatic invasive plant was observed during the aquatic plant survey in 2016; curly-leaf pondweed (*Potamogeton crispus* – CLP). This species had been previously identified within the lake and actively managed since 1976. Management of the AIS has improved recreation on both lakes and may be improving water quality on both lakes. The following Recommended Action Plan focuses on AIS control and public education.

The following Active Goals form the structure of the White Ash and North White Ash Lakes Aquatic Plant Management Plan:

Active Goal: Effectively manage CLP to improve recreation, increase recreational opportunities and rehabilitate native plants.

Active Goal: Continue harvesting of CLP and native vegetation to improve navigation.

Active Goal: Control and manage existing aquatic invasive species in and around the two lakes.

Active Goal: Determine what impact aquatic plant management has on surface water quality.

Active Goal: Protect wild rice beds on both lakes.

Active Goal: Evaluate the success or failure of the activities included in this APM Plan.

2.0 Introduction

The White Ash Lake Protection and Rehabilitation District (The District) was formed in 1976 to address resource management concerns on White Ash and North White Ash Lakes. The District has been active in a number of lake management activities on White Ash and North White Ash Lakes including aquatic plant management, invasive species monitoring and control, habitat improvements, boat landing monitoring and community education activities.

White Ash and North White Ash (North) Lakes are located in Polk County. The lakes are connected by a channel; the Apple River enters this channel and flows through White Ash Lake. See Figure 1 for the layout of the lakes. The lakes are shallow with a maximum depth of 9 feet and average depth of 5-6 feet.

The shallow lakes are very rich in nutrients and are listed as hypereutrohpic (White Ash) and eutrophic (North). The water quality has shown signs of degradation over the years reflected in the reduced secchi readings. Both lakes have nuisance stands of curly leaf pondweed (CLP) that is managed by harvesting. The North White Ash also has nuisance stands of native vegetation that is management by harvesting. The lakes offer a wide variety of recreational activities and are very accessible to the public at multiple locations.

The lakes have been actively managed by the White Ash Lake Protection and Rehabilitation District (the District) since 1976 when the district was formed. The heavy plant growth has posed problems on the lakes since this time and was documented in a 1980 WDNR Lake Study which stated the dense aquatic plant growth was interfering with the riparian owners and lake users. The results of this study and feedback from the District indicated that large-scale plant harvesting was the best option to pursue for managing CLP and the native aquatic plants. At that time the plants were harvested by a contractor and in 1985 a harvester was purchased by the District. In 1996 the District contacted WDNR to obtain funds for purchasing a new, larger harvester; at that time the District was informed it needed an Aquatic Plant Management Plan to be eligible for the funds. In 1998 a new plan was completed and approved by WDNR and the new harvester was to implement the new plan.

The District sought matching funds (**66% State and 33% District shares**) from the Wisconsin Department of Natural Resources (WDNR) Large Scale Lake Planning Grant program to update the APM Plan to recommend treatment and control of CLP and to educate the public on AIS.

This document is the APM Plan for White Ash and North White Ash Lakes and discusses the following:

- Historical aquatic plant management activities
- Stakeholder's goals and objectives
- Aquatic plant ecology
- 2016 aquatic plant survey
- Feasible aquatic plant management alternatives

- Selected suite of aquatic plant management options

Two public meetings were held to discuss the APM Plan. The first was held on May 14, 2016 to kickoff the project and explain to the attendees the purpose of the project. A component of the presentation was AIS education. Attendees were given a refresher on both plant and animal AIS identification and impacts to lake resources. A second meeting was held in August 26, 2016 to present the APM Plan and to gather public input.

3.0 Baseline Information

3.1 Lake History and Morphology

White Ash and North White Ash Lakes are located in the Town of Apple River in Polk County as shown on the attached map. The Apple River flows through White Ash Lake. The watershed of North is very small (700 acres) when compared to the large watershed of White Ash (21,000 acres) which includes the Apple River upstream of the lakes. The land use in the White Ash watershed is mostly forest and wetland with a small amount of agriculture. The watershed of North contains significantly more agriculture. The land immediately surrounding both lakes is heavily populated with homes and cabins. The fishery is classified as warm water and consists of northern pike, bass and panfish. An NHI search of the area indicated two fish species (least darter and banded killifish), two bird species (eagles and osprey) and one community (Northern Dry Mesic).

The following summarizes the lake's physical attributes:

Table 1 – White Ash and North White Ash Physical Attributes

Lake Name	**White Ash**	**North White Ash**
Lake Type	Drainage	Drainage
Surface Area (acres)	147	116
Maximum depth (feet)	9	9
Mean depth (feet)	6	5
Volume (ac-ft)	924	600
Watershed:Lake Ratio	143:1	6:1
Shoreline Length (miles)	2.53	2.11
Public Landing	Yes	Yes

Source: Wisconsin Lakes, WDNR 2005 and WDNR Lake Survey map, 1969

There is ample opportunity for public access on the lakes: White Ash has three landings, North has one landing and three public access points; both lakes may be accessed from the Apple River. The lakes offer the following recreational opportunities and extended benefits for visitors and the local community:

- Recreational, pontoon boating
- Fishing, wildlife viewing
- Non-motorized watercraft use
- Aesthetic beauty
- Important habitat for fish and wildlife
- Swimming
- Snowmobiling
- Cross country skiing/snowshoeing
- Revenue for local and surrounding communities including real estate taxes and tourism dollars

Figures 2 and 3 (included in Figures Section) illustrates the lakes bathymetry.

3.2 Water Quality

The following data was used in creating the White Ash and North White Ash Lakes APM Plan. WDNR Lake Water Quality Database indicates that the following water quality information is available:

- Water clarity (Secchi depth)
- Total phosphorus
- Chlorophyll a

These parameters are commonly used to determine water quality. Higher Secchi depth readings indicate clearer water and deeper light penetration. Total phosphorus is a measure of nutrients available for plant growth. Chlorophyll a is green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae suspended in the water column of a lake, higher chlorophyll a values indicate lower water quality.

The above parameters are used to evaluate the trophic status of a lake. The trophic state index (TSI) ranges along a scale from 0-100 and is based upon relationships between secchi depth and surface water concentrations of chlorophyll a, and total phosphorus. The higher the TSI the lower the water quality of the lake. The TSI of White Ash and North White Ash Lakes indicate eutrophic conditions. All of the water quality parameters mentioned above are further discussed in subsequent sections of this report.

3.3 Summary of Lake Fishery

Both lakes have an excellent warm water fishery according to Aaron Cole, WDNR Fishery Biologist. Surveys were completed on the lakes in 1975, 1986, 1993 and again in 2015, data is available for the 1993 and 2015 surveys for a comparison. The results indicate moderate largemouth bass catch rates with excellent size structure. Catch rates of bluegill were high in both lakes and their size structure was good. Stocking of northern pike was done in 1987 and 1993, no further stocking has been completed and is not recommended based on the excellent fishery. Results of the surveys are included in the following sections of the report.

3.4 Lake Management History

Both lakes have been actively managed since 1976 to control CLP in both lakes and nuisance native vegetation in North White Ash. The following excerpt is from the 2010 APM Plan that details the history of management.

Large-scale harvesting of CLP and later season native plants has been occurring on the lake since 1980. The WALPRD owns its own harvester and the necessary equipment to transfer and dump the vegetation removed from the lake. In 1998, an APM Plan was implemented that set the following goals:

- *improve navigation through areas containing dense plant beds,*
- *improve recreational attributes of the lakes,*
- *remove or limit the growth of current exotic plants (CLP),*
- *preserve native species and prevent introduction of additional exotic species,*

- *preserve and/or improve fish and wildlife habitat*
- *protect and/or improve quality of the resources for all to enjoy*
- *minimize disturbance of sensitive areas*
- *reduce long-term sedimentation from decaying macrophytes (Barr Eng, 1998)*

The 1998 Plan (Barr Engineering, 1998) recommended a large-scale harvesting plan for both lakes. Harvesting activity on the South Lake was originally designed to provide 20-ft wide navigation channels for lake-users living adjacent to very dense areas of plant growth. Total native vegetation removed was around 5.3 acres. Harvesting on the North Lake was to provide a 20-ft wide navigation channel around the lake and additional channels throughout the lake to facilitate fishing and boating, and to provide a swimming area for interested lake users. The total acreage to be harvested on the North Lake was around 8.7 acres.

Later, around 2002 at the request of lake users, recommendations made in the 1998 plan were modified to include harvesting of several 200-ft wide navigation/recreational channels running side to side across the North Lake and a 400-ft wide recreational channel running end to end through the middle of the North Lake. Within these areas, the harvesters could run the cutting blade at its full depth of approximately 5-ft. The navigation channel around the lake was increased from 20 to 100-ft wide providing even more relief. In addition, the channel between the two lakes was to be kept open with harvesting up to a 20-ft width.

On the South Lake, navigation channels were extended to additional areas of the lake. These channels remained 20-ft wide. Harvesting records since 2003 for the two lakes combined show an interesting trend. Both the amount of time spent harvesting and the total number of acres covered by the harvesting is increasing, but the number of loads is actually decreasing. This suggests that the harvesting has been effective at reducing the amount of vegetation in the lakes, so much so that in recent years the harvester has put in more time and has covered more acres, and still the number of annual loads harvested is going down.

In 2004, the WALPRD installed a GPS tracking unit on their harvester. This unit allows harvesting to begin earlier in the season as the harvester does not have to visually see the results of the cutting swath in order to make the next cut. The GPS identifies where the last pass ended and the new pass begins. Because of this additional information, CLP harvesting in the current plan, which begins on the South Lake, can start much earlier. At this time, the harvester not only cuts what he can see, but also that which he can't see. A couple of weeks is generally spent on the South Lake in mid to late May taking out CLP in many areas of the lake before it reaches the surface of the lake where it can cause navigation and lake use issues. Then several weeks are spent in the North Lake before coming back to the South Lake to harvest new areas of CLP growth, and to re-cut much of the previously cut area. This change in the harvesting process very likely explains the increased amount of time and total acreage covered. Since much of the CLP cut in the South Lake has not reached its peak biomass in either the first or second cutting, total loads would be down, but time and acreage up.
The WALPRD currently off-loads harvested weeds at the 163rd Street public access on the South Lake, and at the public access off of 180th Ave on the north end of the North

Lake. Harvested plants from the South Lake are dumped by agreement onto the George Sumner (currently Dan Richter) *property off 163rd Street and in a lot in the White Ash Subdivision off 168th Street. Harvested plants from the North Lake are dumped by agreement on the Fred Norlund* (currently Jim Boch and Adam Majeski) *property off 180th Ave and Hwy E. These sites have been previously approved by the WDNR, and dumping will continue.*

At the present time, no chemical treatment of CLP or native plant species later in the season is completed. Riparian owners do participate in physical removal of vegetation by hand- pulling and raking. They also spend a fair amount of time raking up harvesting escapees that wash into shore.

3.5 Goals and Objectives

The objective of this project is to update the APMP and to collect data to determine if the current management techniques are reducing CLP, increasing native vegetation in White Ash and improving the water quality and recreational use of the lakes. Many of the tasks listed in the 2010 APMP have been implemented and the data collected will be analyzed to determine if the harvesting continues to have a positive effect on the lakes. The two lakes have very different vegetation characteristics and are managed accordingly. Both have nuisance stands of CLP that cause problems with navigation, recreational use and aesthetics. White Ash has little native vegetation; after dense stands of CLP die off there is little plant growth and algae dominates. It creates conditions that inhibit plant growth due to low water clarity. North has dense stands of CLP and native vegetation that cause navigation and recreation problems throughout the year. Navigation lanes are cleared and widespread skimming is used for access and aesthetics throughout the summer season.

The District identified the following goals for aquatic plant management on White Ash and North White Ash Lakes.

Active Goal: Effectively manage CLP to improve recreation, increase recreational opportunities and rehabilitate native plants.

Active Goal: Continue harvesting of CLP and native vegetation to improve navigation.

Active Goal: Control and manage existing aquatic invasive species in and around the two lakes

Active Goal: Determine what impact aquatic plant management has on surface water quality

Active Goal: Protect wild rice beds on both lakes

Active Goal: Evaluate the success or failure of the activities included in this APM Plan

4.0 Project Methods

To accomplish the project goals, the District needs to make informed decisions regarding APM on the lake. To make informed decisions, the following is proposed:

- Collect, analyze, and interpret basic aquatic plant community data
- Recommend practical, scientifically-sound aquatic plant management strategies

Offsite and onsite research methods were used during this study. Offsite methods included a thorough review of available background information on the lake, its watershed, and water quality. An aquatic plant community survey was completed onsite to provide the data needed to evaluate aquatic plant management alternatives.

4.1 Aquatic Plant Survey and Analysis

The aquatic plant community of the lakes was surveyed twice; the first on May 27, 2016 and again on August 3, 2016 by Flambeau Engineering with assistance from the District. The first survey was to document the curly-leaf pondweed (CLP) and the second was to document all vegetation in the lakes. The surveys were completed according to the point intercept sampling method described by Madsen (1999) and as outlined in the WDNR draft guidance entitled "Aquatic Plant Management in Wisconsin" (WDNR, 2005).

WDNR research staff determined the sampling point resolution in accordance with the WDNR guidance and provided a base map with the specified sample point locations. The map showing these points is Figure 4 and 5 included in the Figures Section. Latitude and longitude coordinates and sample identifications were assigned to each intercept point on the grid. Geographic coordinates were uploaded into a global positioning system (GPS) receiver. The GPS unit was then used to navigate to intercept points. At intercept points plants were collected by a specialized rake on a pole. The rake was lowered to the bottom and twisted to collect the plants. All collected plants were identified to the lowest practicable taxonomic level (e.g., typically genus and species) and recorded on field data sheets. Visual observations of aquatic plants were also recorded. Water depth and, when detectable, sediment types at each intercept point were also recorded on field data sheets.

The point intercept method was used to evaluate the existing emergent, submersed, floating-leaf, and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

- **Taxonomic richness** (the total number of taxa detected)
- **Maximum depth of plant growth**
- **Community frequency of occurrence** (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- **Mean intercept point taxonomic richness** (the average number of taxa per intercept point)

- **Mean intercept point native taxonomic richness** (the average number of native taxa per intercept point)
- **Taxonomic frequency of occurrence within vegetated areas** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)
- **Taxonomic frequency of occurrence at sites within the photic zone** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)
- **Relative taxonomic frequency of occurrence** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)
- **Mean density** (the sum of the density values for a particular species divided by the number of sampling sites)
- **Simpson Diversity Index (SDI)** is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. SDI = 1-(Σ(Relative Frequency^2) Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.
- **Floristic Quality Index (FQI)** (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species.
  FQI = mean C * sqrt N
  C= coefficient of conservatism
  N= number of native species
  This formula combines the conservatism of the species present with a measure of the species richness of the site.

5.0 Discussion of Project Results

5.1 Aquatic Plant Ecology

Aquatic plants are vital to the health of a water body. Unfortunately, people all too often refer to rooted aquatic plants as "weeds" and ultimately wish to eradicate them. This type of attitude, and the misconceptions it breeds, must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants (macrophytes) are extremely important for the well being of a lake community and possess many positive attributes. Despite their importance, aquatic macrophytes sometimes grow to nuisance levels that hamper recreational activities. This is especially prevalent in degraded ecosystems. The introduction of certain aquatic invasive species (AIS), such as CLP, often can exacerbate nuisance conditions, particularly when they compete successfully with native vegetation and occupy large portions of a lake.

When "managing" aquatic plants, it is important to maintain a well-balanced, stable, and diverse aquatic plant community that contains high percentages of desirable native species. To be effective, aquatic plant management in most lakes must maintain a plant community that is robust, species rich, and diverse. Appendix C includes a discussion about aquatic plant ecology, habitat types and relationships with water quality.

5.2 Aquatic Invasive Species

Aquatic Invasive Species (AIS) are aquatic plants and animals that have been introduced by human action to a location, area, or region where they did not previously exist. AIS often lack natural control mechanisms they may have had in their native ecosystem and may interfere with the native plant and animal interactions in their new "home". Some AIS have aggressive reproductive potential and contribute to a decline of a lake's ecology and interfere with recreational use of a lake. Common Wisconsin AIS include:

- Eurasian Watermilfoil
- Curly-leaf Pondweed
- Zebra Mussels
- Rusty Crayfish
- Spiny Water Flea
- Purple Loosestrife
- Phragmites
- Banded and Chinese Mystery Snails

White Ash and North White Ash contain the following AIS: curly-leaf pondweed, rusty crayfish, phragmites, purple loosestrife, Chinese and Banded mystery snail. The following link on the WDNR website has detailed information on AIS in Wisconsin http://dnr.wi.gov/lakes/invasives/BySpecies.aspx. Appendix C2 provides additional information on these AIS.

5.3 2016 Aquatic Plant Survey

The full vegetation survey was completed on August 3, 2016 on both lakes. On White Ash of the 273 sites 112 were visited and vegetation was documented at 60 of these points. The remaining points were deeper than vegetation grows on this lake or the vegetation was too thick to enter (north end). On North White Ash of the 240 mapped points, 224 were sampled and vegetation was documented at 215 of these points. The remaining points could not be accessed due to thick vegetation (north and south end). The aquatic macrophyte community of both lakes included submersed, floating-leaf and emergent communities.

The following data represents the conditions of the aquatic plant community at the time of the survey conducted in 2016. The following table lists the taxa identified during the 2016 aquatic plant survey.

Table 2 - White Ash - Taxa Identified in 2016 Aquatic Plant Survey

Plant Species	Frequency of Occurrence	Relative Frequency of Occurrence	No. Sites	Rake Fullness	No. of Visual Sitings
Ceratophyllum demersum, Coontail	45.54	39.32	46	1.5	4
Elodea canadensis, Common waterweed	23.76	20.51	24	1.1	
Vallisneria americana, Wild celery	11.88	10.26	12	1.3	2
Potamogeton crispus,Curly-leaf pondweed	9.90	8.55	10	1.1	2
Najas flexilis, Slender naiad	4.95	4.27	5	1.4	
Zizania sp., Wild rice	4.95	4.27	5	2.6	
Myriophyllum sibiricum, Northern water-milfoil	3.96	3.42	4	1.5	
Potamogeton zosteriformis, Flat-stem pondweed	3.96	3.42	4	1.0	1
Lemna trisulca, Forked duckweed	1.98	1.71	2	1.0	
Nuphar variegata, Spatterdock	1.98	1.71	2	1.0	4
Potamogeton richardsonii, Clasping-leaf pondweed	1.98	1.71	2	1.5	
Nymphaea odorata, White water lily	0.99	0.85	1	2.0	1
Filamentous algae	0.99		1	1.0	

The most abundant aquatic plant identified during the aquatic plant survey was coontail, followed by common waterweed and wild celery. These three species were by far the most dominant in the lake but did not cover a large area of the overall lake. Less than 25% of the lake supports vegetation.

Vegetation was identified to a maximum depth of 8 feet (photic zone). Aquatic vegetation was detected at 59% of photic zone intercept points. A diverse plant community inhabited the lake during 2016. The Simpson Diversity Index value of the community was 0.78, taxonomic richness was 12 species (including visuals), and there was an average of 1.07 species identified at points that were within the photic zone. There was an average of 1.95 species present at points with vegetation present. The following table summarizes these overall aquatic plant community statistics.

Table 3 - White Ash - Summary of Aquatic Plant Survey Statistics

Statistic	Total
Total number of points sampled	112
Total number of sites with vegetation	60
Total number of sites shallower than maximum depth of plants	101
Frequency of occurrence at sites shallower than maximum depth of plants	59.41
Simpson Diversity Index	0.8
Maximum depth of plants (ft)	8
Number of sites sampled using rake on Rope (R)	0
Number of sites sampled using rake on Pole (P)	234
Average number of all species per site (shallower than max depth)	1.07
Average number of all species per site (veg. sites only)	1.95
Average number of native species per site (shallower than max depth)	0.97
Average number of native species per site (veg. sites only)	1.91
Species Richness	12
Species Richness (including visuals)	12

The following table lists the species found in North White Ash in 2016.

Table 4 - North White Ash - Taxa Identified in 2016 Aquatic Plant Survey

Plant Species	Frequency of Occurrence	Relative Frequency of Occurrence	No. Sites	Rake Fullness	No. of Visual Sitings
Nymphaea odorata, White water lily	0	0	0	0	3
Elodea canadensis, Common waterweed	82.33	30.57	177	1.89	1
Ceratophyllum demersum, Coontail	81.40	30.22	175	1.78	1
Potamogeton amplifolius, Large-leaf pondweed	37.21	13.82	80	1.40	
Filamentous algae	20.93	7.77	45	1.36	
Lemna trisulca, Forked duckweed	16.74	6.22	36	1.17	
Potamogeton richardsonii, Clasping-leaf pondweed	16.74	6.22	36	1.06	
Potamogeton zosteriformis, Flat-stem pondweed	15.35	5.70	33	1.00	
Vallisneria americana, Wild celery	11.16	4.15	24	1.25	
Myriophyllum sibiricum, Northern water-milfoil	1.86	0.69	4	1.00	
Lemna minor, Small duckweed	0.93	0.35	2	1.00	
Najas flexilis, Slender naiad	0.93	0.35	2	2.00	
Nitella sp., Nitella	0.93	0.35	2	1.00	
Sparganium sp., Bur-reed	0.93	0.35	2	1.00	
Utricularia vulgaris, Common bladderwort	0.93	0.35	2	1.00	
Zizania sp., Wild rice	0.93	0.35	2	1.00	
Bidens beckii, Water marigold	0.47	0.17	1	1.00	
Lemna perpusilla, Least duckweed	0.47	0.17	1	1.00	

The most common species found was common waterweed followed by coontail and large-leaf pondweed. Both common waterweed and coontail were found at over 80% of the sites with vegetation making these highly dominant in the lake. This lake is heavily vegetated with dense stands of submersed vegetation throughout the entire lake. Curly-leaf pondweed was not found on the rake at the individual sample points but it was observed throughout the lake. Later in the season CLP dies back and is not typically found during the point-intercept plant surveys although it is still present in isolated locations.

Vegetation was identified to a maximum depth of 9 feet (photic zone). Aquatic vegetation was detected at 96% of photic zone intercept points. A diverse plant community inhabited the lake during 2016. The Simpson Diversity Index value of the community was 0.78, taxonomic richness was 16 species (17 including visuals), and there was an average of 2.58 species identified at points that were within the photic zone. There was an average of 2.69 species present at points with vegetation present. The following table summarizes these overall aquatic plant community statistics.

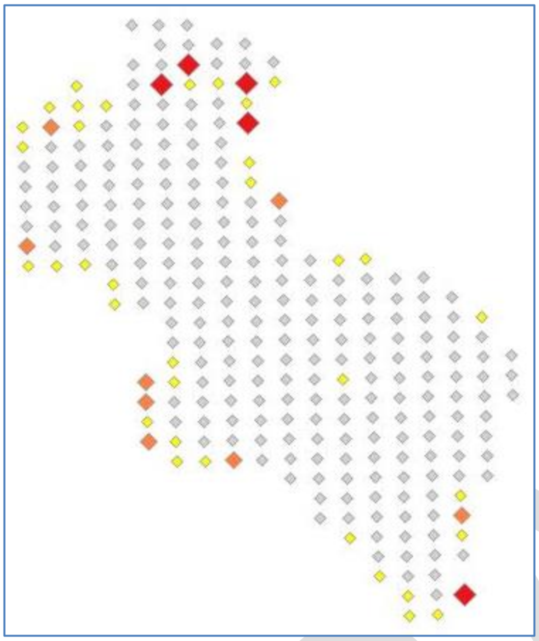
Table 5 - North White Ash -Summary of Aquatic Plant Survey Statistics

Statistic	Total
Total number of points sampled	224
Total number of sites with vegetation	215
Total number of sites shallower than maximum depth of plants	224
Frequency of occurrence at sites shallower than maximum depth of plants	96.0
Simpson Diversity Index	0.8
Maximum depth of plants (ft)	9
Number of sites sampled using rake on Rope (R)	0
Number of sites sampled using rake on Pole (P)	234
Average number of all species per site (shallower than max depth)	2.6
Average number of all species per site (veg. sites only)	2.7
Average number of native species per site (shallower than max depth)	2.6
Average number of native species per site (veg. sites only)	2.7
Species Richness	16
Species Richness (including visuals)	17

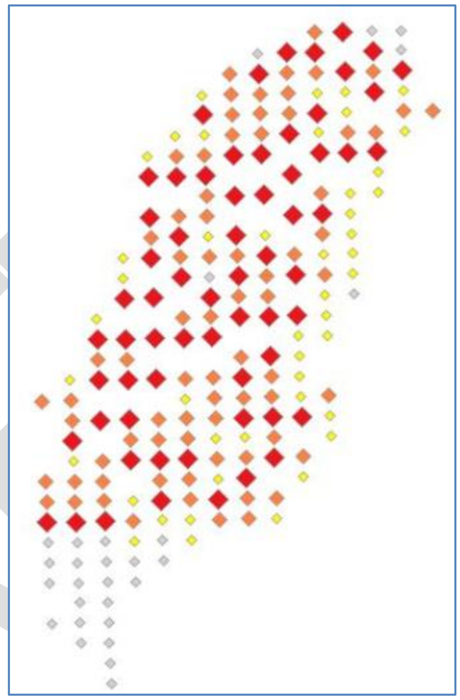
The following figures show the coverage and density of vegetation found during the 2016 surveys.

Figure 6 - Aquatic Plant Coverage and Density 2016

White Ash



North White Ash



The RED symbols indicate high density vegetation (3 rake fullness), ORANGE - medium density (2 rake fullness) and YELLOW - low density (1 rake fullness). White Ash has few stands that are very dense and the vegetation is scattered around the perimeter of the lake. North White Ash has very dense stands throughout the lake with nearly 100% coverage of the lake.

5.3.1 Floating-Leaf Plants

The following floating-leaf aquatic plant species were identified during the 2016 aquatic plant survey.

White Ash

- *Nuphar variegata* (spatterdock)
- *Nymphaea odorata* (white water lily)
- Lemna trisulca, Forked duckweed
- Vallisneria americana, Wild celery

North White Ash

- Lemna minor, Small duckweed

- Lemna perpusilla, Least duckweed
- Lemna trisulca, Forked duckweed
- Nymphaea odorata, White water lily
- Vallisneria americana, Wild celery

5.3.2 Submersed Plants

The following submersed aquatic plant species were identified during the 2016 aquatic plant survey.

White Ash

- Potamogeton crispus,Curly-leaf pondweed
- Ceratophyllum demersum, Coontail
- Elodea canadensis, Common waterweed
- Myriophyllum sibiricum, Northern water-milfoil
- Najas flexilis, Slender naiad
- Potamogeton richardsonii, Clasping-leaf pondweed
- Potamogeton zosteriformis, Flat-stem pondweed

North White Ash

- Bidens beckii, Water marigold
- Ceratophyllum demersum, Coontail
- Elodea canadensis, Common waterweed
- Myriophyllum sibiricum, Northern water-milfoil
- Najas flexilis, Slender naiad
- Nitella sp., Nitella
- Potamogeton amplifolius, Large-leaf pondweed
- Potamogeton richardsonii, Clasping-leaf pondweed
- Potamogeton zosteriformis, Flat-stem pondweed
- Utricularia vulgaris, Common bladderwort
- Filamentous algae

5.3.3 Emergent Plants

The following emergent plants were found in the 2016 surveys.

White Ash

- Zizania sp., Wild rice

North White Ash

- Sparganium sp., Bur-reed
- Zizania sp., Wild rice

5.3.4 Wild Rice

Wild rice is well established in both lakes. The south end of North White Ash, the north end of White Ash and the Apple River between the two lakes and exiting White Ash has extensive beds of wild rice. Wild rice is very beneficial to the lake ecosystem but can cause navigation problems. The following photos were taken from the GLIFWC website that show the wild rice beds on the lakes and the Apple River.

North White Ash and White Ash

Apple River exiting White Ash

Wild rice is a protected species and cannot be manually removed. Individual property owners may keep navigation lanes opens by continued travel with a motor boat.

The following text discusses the importance of wild rice. This excerpt is taken from WDNR website (http://dnr.wi.gov/topic/outdoorrecreation/activities/rice.html)

Though recognized as a prized food source for Native Americans, both historically and today, few people are aware of the importance of wild rice to many of Wisconsin's wildlife species. Capable of producing over 500 pounds of seed per acre, wild rice provides a nutrient-rich food source, offers refuge from predators and increases the overall vegetation structure on the landscape, in turn enhancing biodiversity.

Wild rice is most-often known for its importance to fall-migrating waterfowl. Mallard, blue-winged teal, ring-necked duck and wood duck consume wild rice, as do many other waterfowl species. In fact, a study conducted in wild rice country found the plant to be the most important food source for mallards during fall migration. In addition to a food source, wild rice provides several species of breeding ducks, Canada geese and trumpeter swans with a place to roost and loaf, and offers brood cover for their young. Because wild rice tends to occur in areas of gently flowing water, spring melt tends to expose these areas first, and the rice seed bank and associated invertebrate populations serve as a valuable food source for waterfowl during spring migration.

Common loons, red-necked grebes and muskrats commonly use wild rice for nesting materials. Muskrats forage heavily on the green shoots of wild rice during the spring. The presence of muskrats enhance the use of rice beds by some waterfowl species due to the small openings created amid dense cover. Additionally, muskrat houses are used as nesting sites by trumpeter swans and Canada geese, as perching sites for herons and eagles, and as sunning areas for turtles. Other species that forage on wild rice include beaver, white-tailed deer and moose.

A rich community of insects—both terrestrial and aquatic—is found among wild rice, providing a bountiful food source for blackbirds, bobolinks, rails and wrens. Wild rice is also a source of food for amphibian and fish populations, which in turn attract loons, herons and mink.

Wild rice beds exist as places of high biological diversity with numerous benefits that extend throughout the food chain. Protecting important areas where wild rice thrives will help ensure the persistence of many of Wisconsin's wildlife for all to enjoy.

5.3.5 Curly-leaf Pondweed

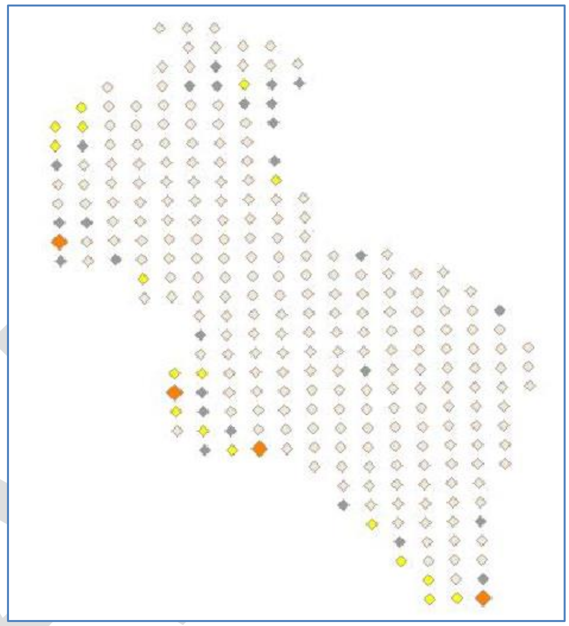
CLP is an aquatic invasive species that can grow in thick beds and become a nuisance by hampering navigation, swimming and fishing. It is a submersed plant that grows in 3 to 10 feet of water and tolerates high turbidity and often invades disturbed areas. CLP begins growing very early in the spring and is one of the first plants to appear. It also dies quickly and by June or early July is not visible in the lake. If it grows in thick, large beds it can cause low dissolved oxygen when it dies due to the large influx of decaying plant material at the bottom of the lake and contributes high nutrient loading. CLP reproduces through rhizome spread and turions. Turions are hardened tips of plants, that fall to the sediment and produce a new plant in one to several years later; a single turion can lead to the production of several thousand turions in one season. To effectively control CLP it must be harvested before turion production to reduce new growth.

The CLP surveys were completed on both lakes on May 27, 2016. On White Ash Lake 105 points were visited of the 273 mapped points, CLP was documented at 21 sites with an additional 27 visual sitings. The average rake density was 1.4. The following figures show the locations of the beds and rake density.

Figure 7 White Ash - CLP Bed Locations

Location of CLP

Density of CLP

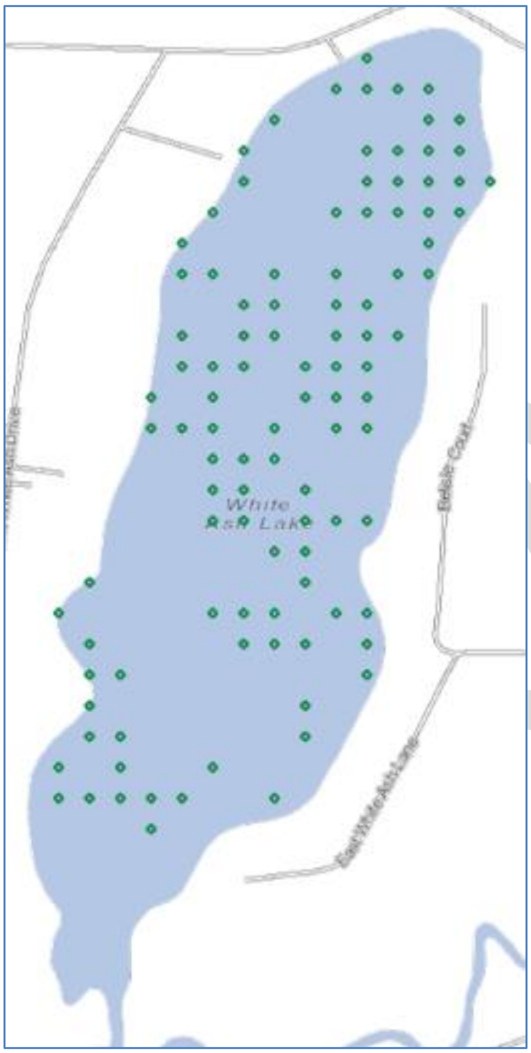


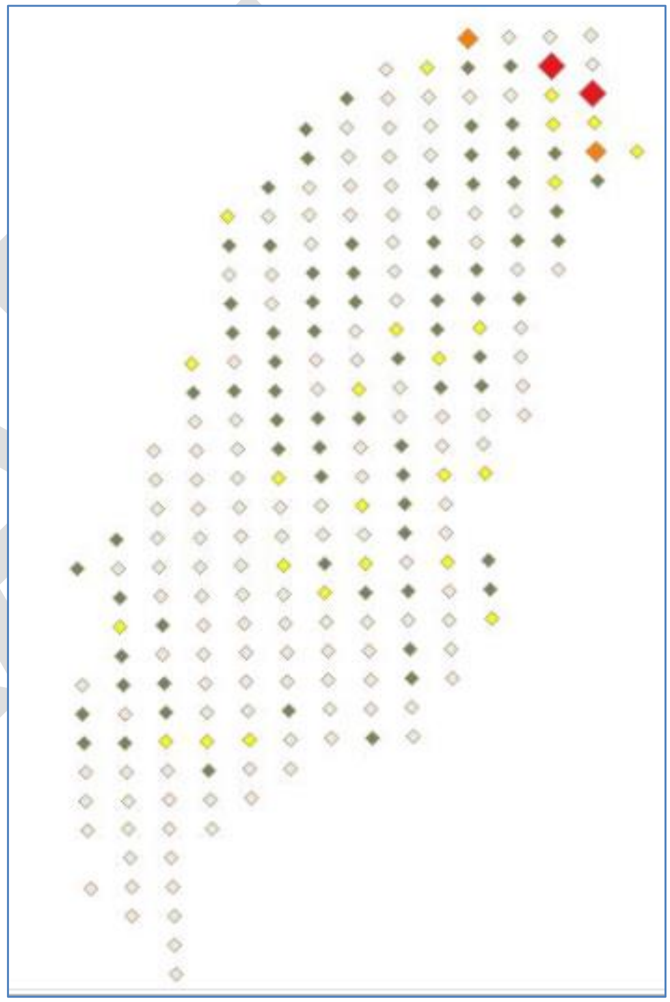
Symbols: gray – visual, yellow - low density, orange – medium density, red – high density

On North White Ash 215 points were visited of the 240 mapped points; CLP was documented at 29 sites with collected samples and an additional 75 visual sitings. The average rake density was 2.23. In North White Ash CLP was found scattered throughout the lake ranging from single plants to dense beds. The densest beds were located on the north end of the lake. The following map shows the locations of the CLP.

Figure 8 North White Ash - CLP Bed Locations

Location of CLP **Density of CLP**





Symbols: gray – visual, yellow - low density, orange – medium density, red – high density

5.3.6 Comparison of 2016 Survey to Historic Surveys

There have a been number of aquatic plant surveys completed on the two lakes beginning in 1980. Surveys in 1980 and 1997 were completed using the transect method; this is an older method that has been replaced by the point intercept method.

The results of these earlier surveys are hard to compare to the data collected in the 2016 survey. In 2008 and 2010 surveys using the point intercept method were completed. The August 2016 (full survey) data will be compared to these surveys to determine if the plant community is changing.

The following table lists the statistics of the surveys including the depth of water to which plants were found growing, number of species documented and aquatic plant density.

Table 6 - White Ash - Statistics of Surveys

Summary Stats: South White Ash Lake	2016	2010	1997	1980
# of sites visited	112	273	69	Unknown
# of sites with vegetation	60	75	69	
# sites shallower than max depth of plants	101	181	69	
Frequency of occurrence at sites < than max depth of plants	59.41	41.44	NA	NA
Simpson Diversity Index	0.8	0.92	0.91	0.91
Max depth of plants (ft)**	8	8	8.86	6.56
Number of sites sampled using rake on Rope (R)	0	0	0	0
Number of sites sampled using rake on Pole (P)	234	273	69	Unknown
Ave # of all species/site (< max depth)	1.07	1.67	NA	NA
Ave # of all species/site (veg. sites only)	1.95	4.04	7(transect)	
Ave # of native species/site (< max depth)	0.97	1.64	NA	NA
Ave # of native species/site (veg. sites only)	1.91	4	NA	NA
Species Richness	12	21	23	21
Species Richness (including visuals)	12	25	NA	NA
Median depth of plants (ft)	5	3.5	NA	NA
Ave rakeful all species (2010 1-3 Scale) (1997 1-5 Scale)	2.86	1.54	1.33	Unknown
FQI	18.39	26.4	26.4	NA

** Barr, ERS

A direct comparison to the 2010 survey indicates the areas where plants are growing may have increased based on the increased frequency of occurrence from 41 to 59. The number of species documented decreased; however, the species that were not documented in 2016 but were found in 2010 were found in very low numbers in 2010. These species may still be present but were not detected during the 2016 survey. The density of the vegetation has increased based on the average rake fullness.
The increase in vegetation in White Ash is a favorable change as a goal of the previous plan was to increase native vegetation in hopes of improving water quality.

Table 7 - North White Ash - Statistics of Surveys

Summary Stats: North White Ash Lake	2016	2010	1997	1980
# of sites visited	224	220	60	Unknown
# of sites with vegetation	215	215	60	
# sites shallower than max depth of plants	224	220	220	
Frequency of occurrence at sites < than max depth of plants	95.98	97.73	NA	NA
Simpson Diversity Index	0.8	0.84	0.88	0.86
Max depth of plants (ft)**	9	9	8.86	8.86
Number of sites sampled using rake on Pole (P)	234	220	60	Unknown
Ave # of all species/site (< max depth)	2.58	3.05	NA	NA
Ave # of all species/site (veg. sites only)	2.69	3.12	8 (transect)	
Ave # of native species/site (< max depth)	2.58	2.66	NA	NA
Ave # of native species/site (veg. sites only)	2.69	2.72	NA	NA
Species Richness	16	19	22	17
Species Richness (including visuals)	17	19	NA	NA
Median depth of plants (ft)	7	6	NA	NA
Ave rakeful all species (2010 1-3 Scale) (1997 1-5 Scale)	2.86	1.22	1.42	Unknown
FQI	23.8	22.3	25.2	NA

** Barr, ERS

The statistics on North White Ash appear to be very similar for 2010 and 2016. The only notable change is the density of plants which appears to have increased based on the average rake fullness increase.

A comparative statistical analysis of the data was completed. This indicated there were several species that had a measurable change in each lake as indicated below.

Table 8 - Change in Species Coverage 2010 to 2016

	CHANGE IN SPECIES COVERAGE 2010 TO 2016	
LAKE	**INCREASE**	**DECREASE**
WHITE ASH	Ceratophyllum demersum, Coontail	Lemna trisulca, Forked duckweed
	Vallisneria americana, Wild celery	Nymphaea odorata, White water lily
NORTH WHITE ASH	Elodea canadensis, Common waterweed	Ceratophyllum demersum, Coontail
	Potamogeton amplifolius, Large-leaf pondweed	Lemna trisulca, Forked duckweed
	Potamogeton richardsonii, Clasping-leaf pondweed	Myriophyllum sibiricum, Northern water-milfoil
	Vallisneria americana, Wild celery	Filamentous algae

In White Ash both coontail and wild celery have increased.

The vegetation in North White Ash exhibited a more notable change. Common waterweed, large-leaf pondweed, clasping leaf pondweed and wild celery have increased. This reflects the anecdotal evidence provided by the lake shore residents. The increase in wild celery has caused concern to the residents as it impedes navigation in some areas of the lake. The wild celery is uprooted by the paddle wheels on the harvester; it then forms floating mats that impede navigation. Skimming after August 1 in the southern part of the lake where wild celery is present may reduce/eliminate this problem.

5.4 CLP Comparison

The main goal of the harvesting plan is to reduce CLP. In 2010 early harvesting of CLP was recommended to remove the plants before turions are produced. In time this method will in theory reduce the turions present in the sediment and decrease overall CLP growth. Based on the aquatic plant survey data the coverage and density of CLP has been reduced in both lakes.

The following data compares CLP coverage for the years 1997, 2010 and 2016.

Table 9 - CLP Comparison 1997, 2010, 2016

	2016 Coverage			2010 Coverage			1997 Coverage		
Lake	# of points	% of Lake	Estimated Total Lake Acreage	# of points	% of Lake	Estimated Total Lake Acreage	# of points	% of Sampled Littoral Zone	Estimated Total Lake Acreage
White Ash	21 of 273	14	20.7	144 of 273	52.7	80.7	50 of 69	72.5	75
North White Ash	29 of 240	38	44.3	98 of 240	40.8	48.6	34 of 60	56.7	57

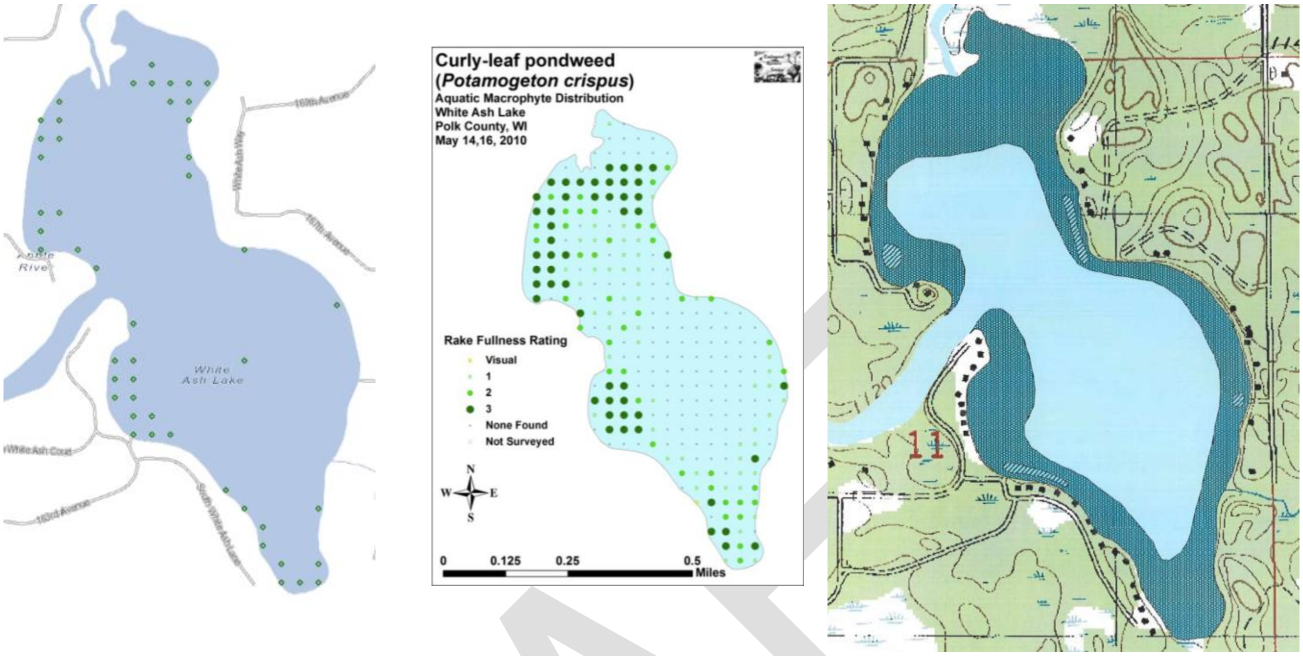
Based on the numbers in the above table the CLP in White Ash has decreased greatly. The coverage declined from 144 to 21 points and the area decreased from 53% to 14%.

North White Ash did not show a significant decrease in CLP coverage. The number of sites with documented CLP decreased from 98 to 29 but the acreage remained about the same. The acreage in 2016 was calculated using both the documented CLP and the visual sitings which gives a more accurate coverage area. Based on the above numbers it appears the density of CLP had decreased but the area it covers in the lake remains about the same.

The following maps shows the location of CLP in the 2016, 2010 and 1997 surveys respectively.

Figures 9 White Ash CLP Comparison

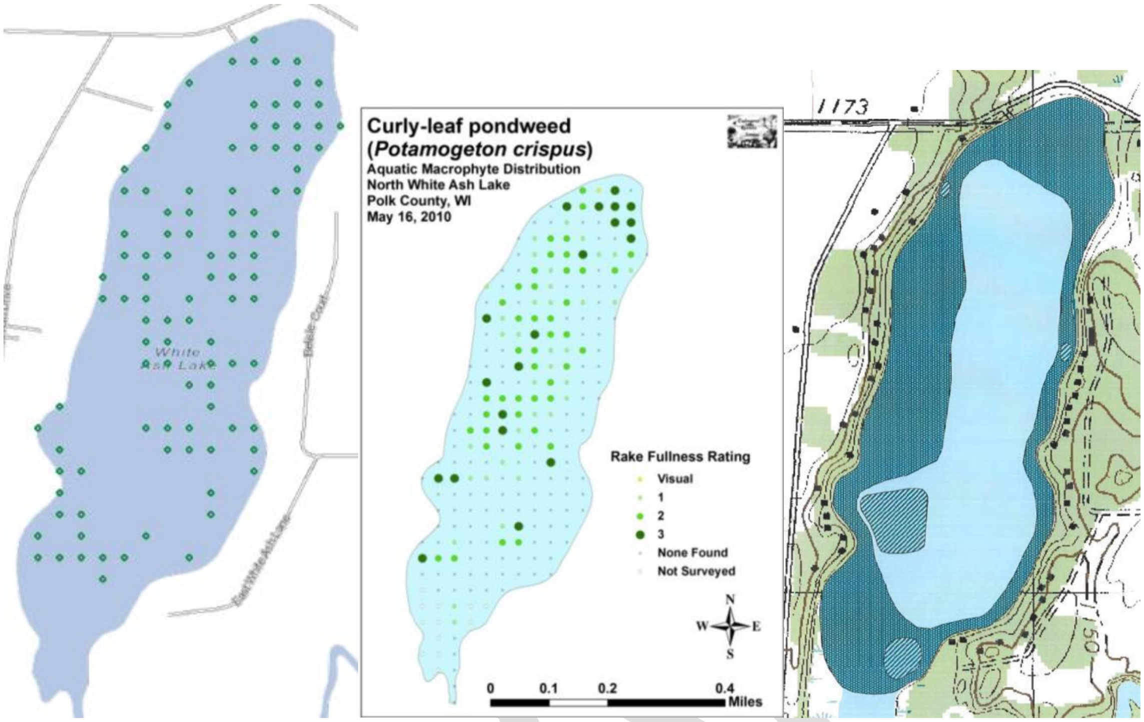
2016 **2010** **1998**



As shown above the most notable areas are in the north and south bays; the coverage and density of CLP has greatly decreased in these areas.

Figures 10 North White Ash CLP Comparison

2016 **2010** **1998**



As discussed above the area where CLP is found in North White Ash is about the same but the density has decreased indicating the harvesting program is effective.

5.5 Floristic Quality Index

Higher FQI numbers indicate higher floristic quality and biological integrity and a lower level of disturbance impacts. FQI varies around the state of Wisconsin and ranges from 3.0 to 44.6 with the average FQI of 22.2 (WDNR, 2005). The FQI calculated from the 2016 aquatic plant survey data was 18.39 for White Ash and 23.8 for North White Ash.

This FQI values are lower than Wisconsin's northern region mean of 24.3 and suggests that White Ash and North White Ash Lakes have a higher level of disturbance when using aquatic plants as an indicator. The FQI in White Ash decreased due to the rare species not being found in 2016. The FQI in North White Ash has stayed relatively steady over the years. The extensive harvesting on North White Ash does not appear to have negatively impacted the FQI.

5.6 Water Quality

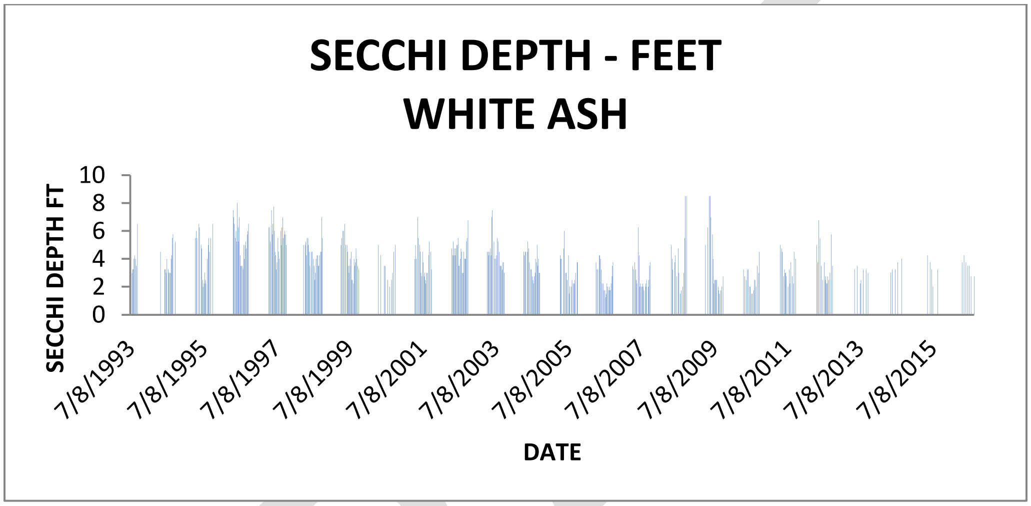
The water quality of the lake indicates eutrophic conditions with high nutrient levels, low water clarity and high productivity of aquatic plants and fish in both lakes. Both lakes remain in the eutrophic category but there were trends noticed in some of the water quality parameters. These are discussed below.

5.6.1 Water Clarity

The historical water clarity average based on Secchi Disk readings in White Ash is 3.9 feet and ranges from 1.25 to 8.5 feet indicating very poor to poor water clarity and eutrophic conditions. The Northeast Wisconsin average Secchi Disk reading in 2004 was 7.4 feet (WI Citizen Lake Monitoring Training Manual). The low water clarity may be in part due to the algae blooms that frequent this lake.

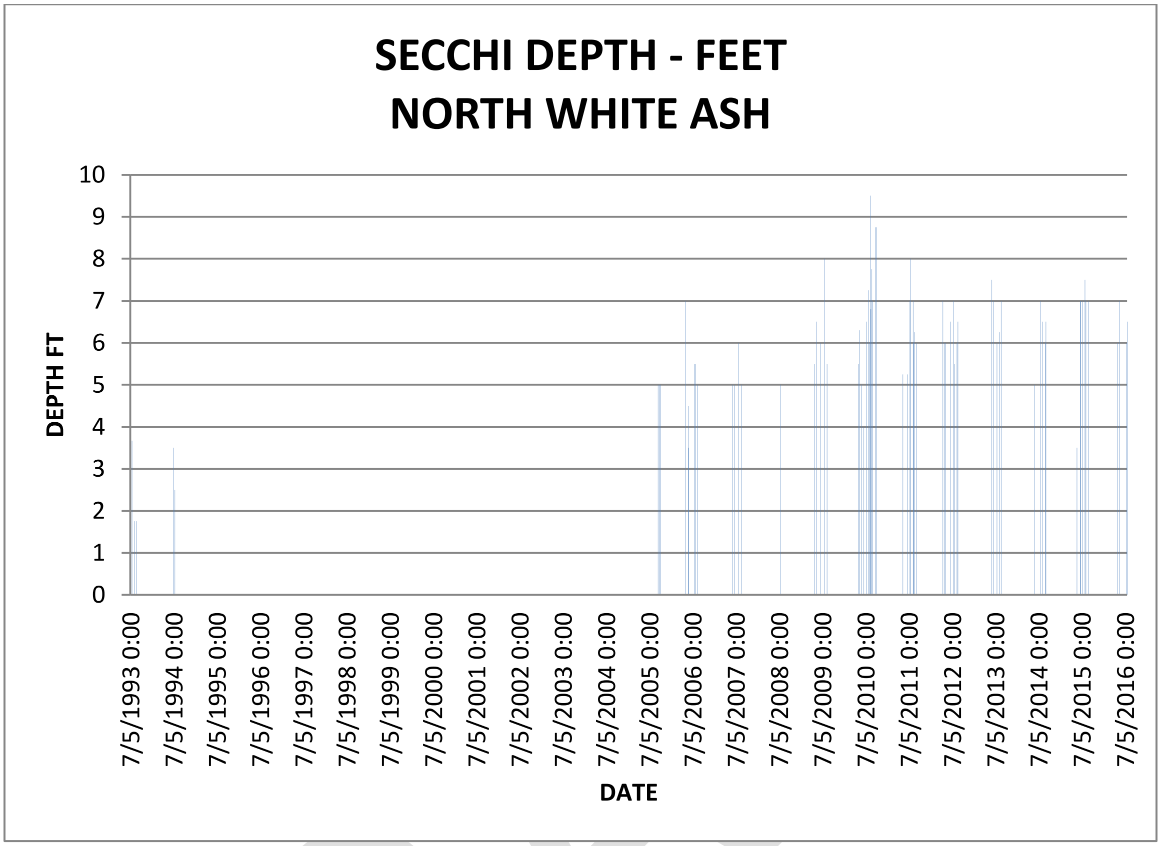
In North White Ash the average clarity is 6 feet, ranging from 1.75 to 9.5 feet indicating poor to fair water quality and mesotrophic conditions. The following graph illustrates the historical water clarity measurements on White Ash and North White Ash Lakes.

Figure 11 - White Ash - Secchi Depth



When the annual averages are graphed a trend of decreasing clarity can be seen on White Ash. In the late 1990's the annual average was about 5.5 feet; since 2010 the annual average has been about 3.5 feet.

Figure 12 - North White Ash - Secchi Depth



The clarity on North White Ash has increased since the early 1990's from an annual average of 2.8 ft to 6.5 feet since 2010.

5.6.2 Total Phosphorus and Chlorophyll *a*

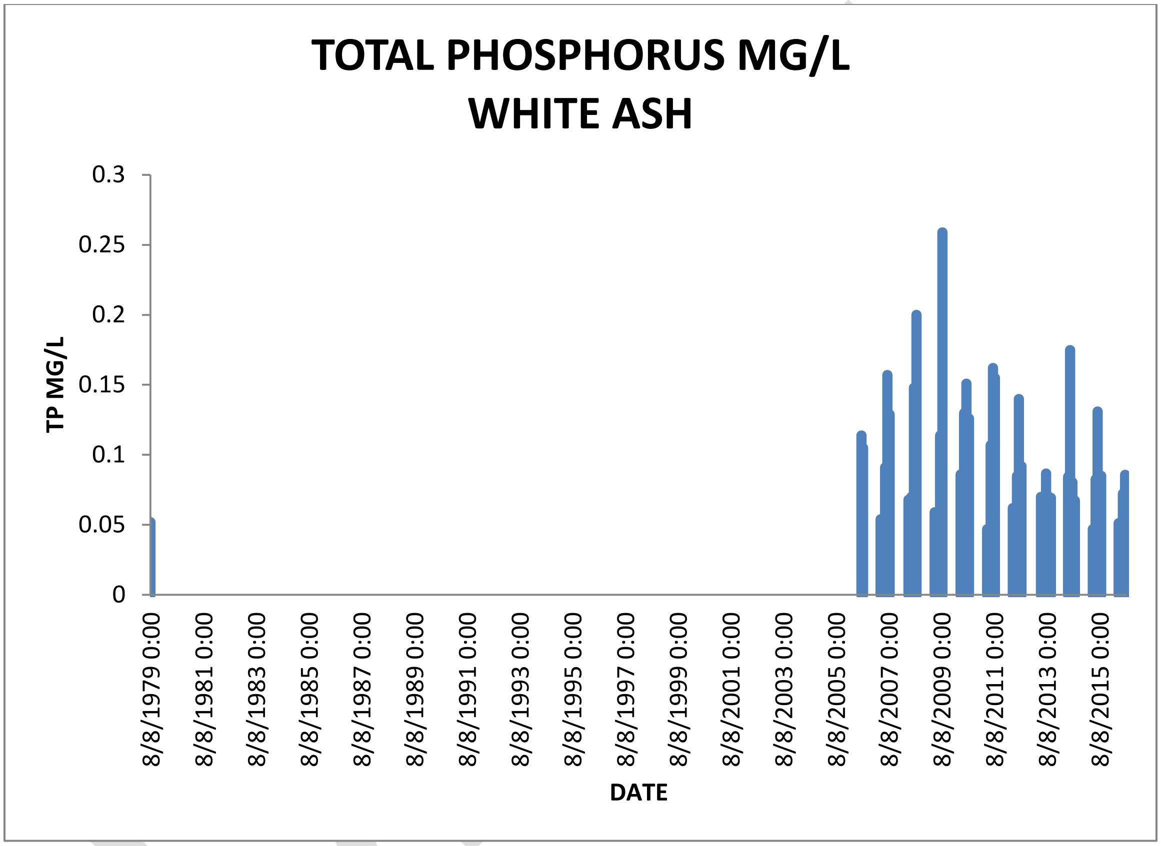
Total phosphorous (TP) and chlorophyll a are parameters that are frequently used to determine water quality in lakes. Following is an explanation of each.

<u>Total Phosphorus (TP)</u> - a measure of nutrients available for plant growth and high concentrations can promote excessive plant growth. In more than 80% of Wisconsin lakes phosphorous is the key nutrient affecting the amount of algae and plant growth. Phosphorous comes from a variety of sources, many of which are human related and include animal and human waste, soil erosion, detergents, septic systems and runoff from agricultural land and lawns. On lakes with high development in the near shore area fertilization of lawns and failing septic systems can contribute high amounts of phosphorous to the water.

<u>Chlorophyll a -</u> is green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae suspended in the water column of a lake. Chlorophyll a is used as a common indicator of water quality; higher chlorophyll a values indicate lower water quality.

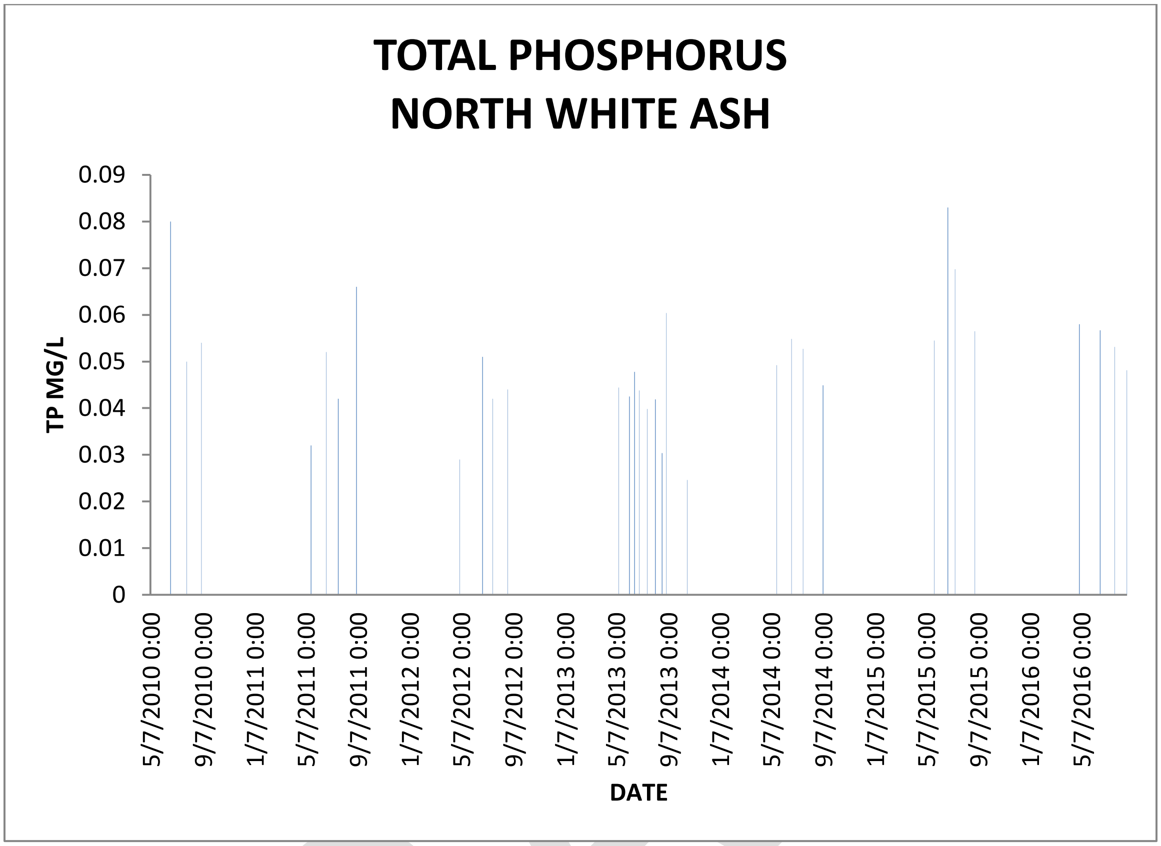
Following is a discussion of the total phosphorous and chlorophyll a concentrations in the lakes over the years of data. Historically, White Ash has had an average phosphorus reading of 100 micrograms per liter (ug/l - parts per billion). The total phosphorus has varied from 47 ug/l to 259 ug/l indicating poor water quality and eutrophic conditions. North White Ash has had an average phosphorus reading of 50 ug/l. The total phosphorus has varied from 25 ug/l to 83 ug/l indicating fair water quality and eutrophic conditions. The following graphs illustrate the historical phosphorus measurements on the lakes.

Figure 13 - White Ash – Total Phosphorous



The graph indicates the TP has been decreasing in recent years.

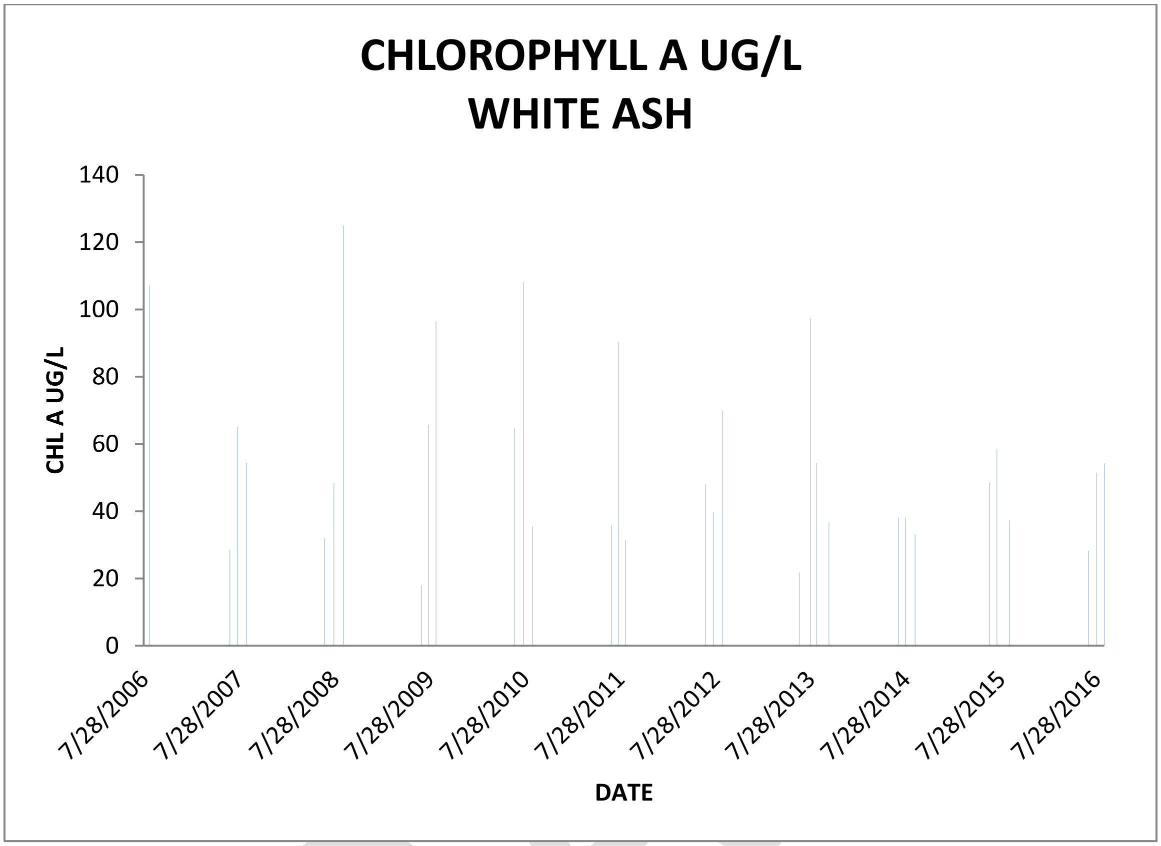
Figure 14 - North White Ash – Total Phosphorous



The TP in North White Ash has remained relativley steady.

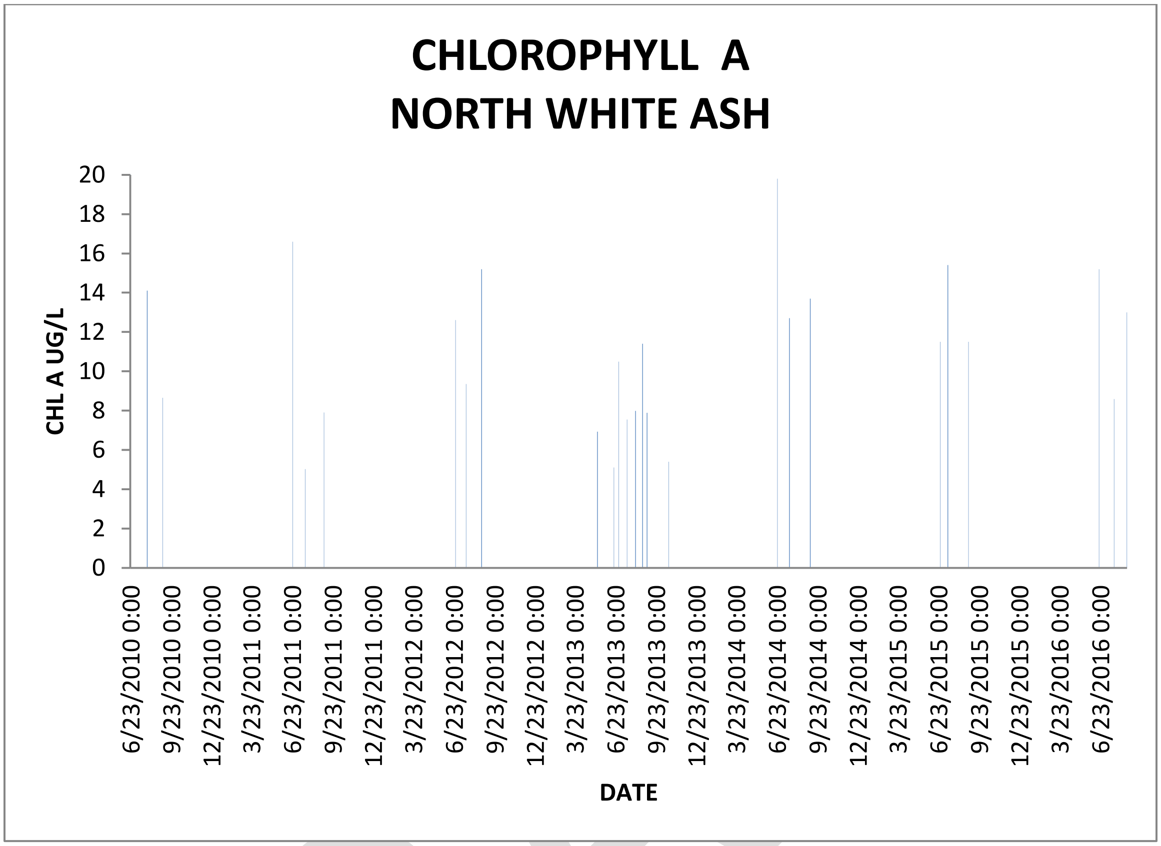
The chlorophyll *a* concentration in White Ash has an average of 55.3 ug/l indicating very poor water quality and eutrophic conditions. The average for Northwest WI lakes is 13 ug/l, values over 30 ug/l indicate very poor water quality. Data ranged from 18 ug/l to 125 ug/l. Chlorophyll a concentrations in North White Ash average 11.5 ug/l indicating eutrophic conditions. Data ranged from 5 ug/l to 26.2 ug/l. The following graphs show the Chlorophyll a concentrations for White Ash and North White Ash lakes.

Figure 15 - White Ash– Chlorophyll a



When the average annual values are graphed it is readily seen that the chl is decreasing in White Ash from about 70 ug/l prior to 2010 to about 50 ug/l in the last couple years. The decrease in chl a should have resulted in fewer algae blooms in the last several years.

Figure 16 - North White Ash– Chlorophyll a



The chl a on North White Ash has stayed relatively steady since 2010.

<u>Water Quality Summary</u>

The two lakes are very different systems based on water quality. White Ash is hyper eutrophic and North White Ash is on the lower end of the scale bordering on mesotrophic. The watershed of White Ash is very large and includes the area drained by the Apple River. This contributes to the high loading of nutrients and the eutrophic conditions of the lake. North White Ash has a very small watershed when compared to White Ash; this attributes to better water quality. The thick vegetation in North White Ash attributes to lower chl a concentrations since the plants take this up to use for growth. The harvesting of the thick vegetation helps to remove all of the nutrients that are stored in the plants so in the fall when the plants die the nutrients are not released back into the water column of sediment.

One of the goals of the 2010 plan was to improve water quality of White Ash and to protect the native vegetation in hopes it would aid in the improvement. The average annual values of Secchi, TP and Chl A were plotted for White Ash to determine if there were any trends in the data. The plots showed a decrease in Secchi depth from 1994 to 2015; indicating a decrease in water clarity. The average dropped from 5 feet in the early 1990’s to 3.5 feet in 2015. TP was variable and a clear trend was not visible. Chl A also trended down with an average of 84 in 2006 to 44 in 2016; indicating increased water quality. This data shows mixed results; continued water quality sampling is highly recommended to collect data for future comparison. It appears that water quality is improving on White Ash but further data is needed.

5.6.3 Trophic State Index

Trophic State Index (TSI) values are assigned to a lake based on total phosphorus, chlorophyll *a*, and water clarity values. The TSI is a measure of a lake's biological productivity. The TSI used for Wisconsin lakes is described below.

Figure 17 - TSI Description

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.	> 24	>7	<6.5
White Ash	**66**	**EUTROPHIC**	**100**	**55.3**	**3.9**
North White Ash	**56**	**EUTROPHIC**	**50**	**11.5**	**6.0**

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et. al.

The data indicates that both lakes are eutrophic.

AQUATIC PLANT MANAGEMENT PLAN – WHITE ASH AND NORTH WHITE ASH LAKES DISTRICT

6.0 Management Alternatives and Recommendations

Based on the goals of the stakeholders as mentioned in section 3.6, several management alternatives are available for this APM plan. Some general alternatives are discussed below. More information on management alternatives is included in Appendix E. Currently, the Northern Region of the WDNR is working under an aquatic plant management strategy that is officially titiled Aquatic Plant Management Strategy, Northern Region WDNR, Summer, 2007 (working draft), or commonly referred to the NOR Region APM Strategy (Appendix H). This strategy lays out an approach for acceptable aquatic plant management in Northern Region lakes. The strategy protects native aquatic plant communities in northern Wisconsin and does not allow permits to control native plants unless documented circumstances of nuisance levels exist. The following management alternatives are based on the approaches described in the NOR Region APM Strategy, and incorporate recommendations of Flambeau Engineering.

6.1 Aquatic Plant Maintenance Alternatives

The maintenance alternative may be used at a lake in which a healthy aquatic plant community exists and invasive and non-native plant species are generally not present. The maintenance alternative is a protection-oriented management alternative because no significant plant problems exist or no active manipulation is required. This alternative can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community. **This is the management that is recommeded for the areas in White Ash that do not contain CLP**. The goal of the previous APM Plan and this current plan is to protect and improve the native vegetation in White Ash Lake. This will create more habitat for fish and wildlife and help to improve water quality. Based on a comparison of survey statistics from 2010 to 2016 it appears that both coverage and density of native vegatation has increased on White Ash. The frequency of occurrence increased along with the density (rakefullness) of native vegetation.

The folloiwng subsets are recommended for both lakes.

6.1.1 Aquatic Invasive Species Monitoring

Several AIS are present in the lakes; Chinese mystery snail, purple loosestrife and curly-leaf pondweed are present in both lakes. Banded mystery snail is present in North White Ash and a rusty crayfish was found in White Ash. In order to monitor existing spread of current AIS and for new AIS in the future a strong Citizen Lake Monitoring program that surveys for AIS is highly recommended. In some lake systems, native aquatic plants "hold their own" and AIS never grow to nuisance levels, in others however, vigilant and active management is required. This can be based on several things including water quality. White Ash and North White Ash Lakes residents should continue Citizen Lake Monitors for AIS.

The University of Wisconsin-Extension Lake's Program provides training and coordinates the Citizen Lake Monitoring Program. More information about the program is available by contacting Laura Herman, Citizen Lake Monitoring Network Education Specialist, (715) 346-3989, email: lherman@uwsp.edu, website: http://www.uwsp.edu/cnr/uwexlakes/clmn/.

Completing pre and post aquatic plant monitoring in any areas that are actively managed to evaluate management effectiveness is recommended. The protocol for these surveys was created by WDNR and must be followed if the management activities are grant funded. The protocol should be followed even if grant funds are not involved to assess management effectiveness. In general lake-wide aquatic plant surveys are recommended every 5 years to monitor changes in the overall aquatic plant community and the effects of the APM activities. Aquatic plant communities may change with varying water levels, water clarity, nutrient levels, and aquatic plant management actions.

6.1.2 Clean Boats/Clean Waters Campaign

Measures for the prevention of the introduction of new AIS to the lake and containment of existing AIS should be a priority. To prevent the spread of CLP and other AIS out of and other AIS into White Ash and North White Ash Lakes, a monitoring program such as Clean Boats/Clean Waters (CBCW) is an excellent choice. This program is carried out by trained volunteers who inspect the incoming boats at public launches. Signage also accompanies the use of CB/CW to inform lake users of proper identification of AIS and boat inspection procedures. Education of the public, along with private property owners, about inspecting watercraft for AIS before launching a boat or leaving access sites on other lakes could help prevent new AIS infestations. Contact with lake users at this time is a great way to distribute other educational materials. Lake residents participate in the Clean Boats/Clean Waters program. Continuation of this program is recommended and should be promoted by the CB/CW coordinator on the lakes. The busiest landings should be monitored during weekends and holidays to interact with the most lake users. Additional District members should be trained so there are plenty of people to staff the landings. More information and training schedule can be found at http://dnr.wi.gov/lakes/cbcw/.

6.1.3 Aquatic Plant Protection and Shoreline Management

Protection of the native aquatic plant community is needed to slow the spread of EWM, CLP and other AIS from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Additionally, EWM and CLP can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Properties with seawalls, manicured lawn to waters edge and active erosion would be good candidates for shoreland restorations. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the waters edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat, erosion prevention and it may deter geese from entering. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. A relatively new Wisconsin law prohibits the application of turf fertilizer containing phosphorus except in certain circumstances. Phosphorous containing fertilizer may be used when planting a new lawn or when a soil test indicates the soil is low in phosphorous. Fertilizer may not be applied to impervious surfaces or frozen ground under the new law. More information can be found in Wisconsin Statute 94.643. The fertilizers that were commonly used for lawns and gardens have three major plant macronutrients: Nitrogen, Phosphorus, and Potassium. These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are "Phosphorus limited", meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the lake is a good practice. Local retailers and lawn care companies can provide soil test kits to determine a lawn's nutrient needs. Of course, properties with an intact natural buffer require very little maintenance, and no fertilizers.

Another possible source of nutrients to a lake is the septic systems surrounding the lake. Septic systems should be properly installed and maintained in order to prevent improperly treated wastewater, which carries substantial nutrients, from reaching the lake. Property owners who are not sure if their septic system is adding nutrients to the lake should contact a professional inspector and have their system assessed.

6.1.4 Public Education and Involvement

The DISTRICT should continue to keep abreast of current AIS issues throughout the County. The County Land Conservation Department and the WDNR Lakes Coordinator, and the UW Extension are good sources of information. Many important materials can be ordered at the following website:

http://www.uwsp.edu/cnr/uwexlakes/publications/

Appendix G includes resources for further information about public education opportunities.

6.2 Aquatic Plant Manipulation Alternatives

This management alternative may be used when aquatic plants present some sort of problem that must be dealt with or manipulated by human action. **This is the recommended action for CLP in North White Ash and for the nuisance native vegetation and CLP in North White Ash.**

6.2.1 Harvesting

Harvesting is the current method of management for both CLP and native plants on North White Ash and CLP management on White Ash. Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto a transport and taken to the disposal site. Using this method, the CLP is harvested before the turions are produced, which in theory will reduce the density. Harvesting can be used to target specific beds of CLP as is the case in White Ash and leave the native vegetation undisturbed. It can also be used on the entire lake as it is in North White Ash to remove CLP and the nuisance native vegetation. The widespread harvesting in North White Ash reduces the nutrient load in the lake by removing large amounts of vegetation. Continuing the current harvesting management plan is recommended for both White Ash and North White Ash. A detailed harvesting schedule and map are included in Section 7 below.

6.2.2 Manual Removal

This method may be used by individual property owners if vegetation is causing issues near the shoreline. This is a good alternative in the shallow area less than 3 feet deep where the harvester is not allowed.

Manual removal consists of physically removing plants using bodily force and hand tools. Manual removal efforts include hand raking, hand cutting and hand pulling unwanted plants. This method is most effective when plants are pulled or cut as near the sediment as possible and all plant material is removed from the lake. Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water where property owners can weed the aquatic garden. Hiring laborers to remove aquatic vegetation is an option, but also increases cost. Scuba divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include low cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants, and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants include the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significant sized population is quite labor intensive. Again, hiring laborers to remove aquatic vegetation is an option, but also increases cost.

Curly-leaf Pondweed

No permit is required to remove non-native invasive aquatic vegetation, as long as the removal is conducted completely by hand with no mechanical assistance of any kind. All aquatic plant material must be removed from the water to minimize dispersion and re-germination of unwanted aquatic plants. Portions of the roots may remain in the sediments, so removal may need to be repeated periodically throughout the growing season.
CLP should be targeted for removal in the spring or early summer (May/June) before turion production begins. CLP plants should be removed as close to the sediment as possible. When using a rake or weed cutter be sure the head is near the lake bottom. If hand-pulling use even pressure to try and pull up the entire plant and in shallow water pull as close to the lake bottom as possible.

Native Vegetation

Native plants may be found at nuisance levels that inhibit navigation and recreational use in certain areas in the lake. Manual removal of these plants is allowed at individual properties. (**except wild rice in the northern region**), under Wisconsin law, to a maximum width of 30 feet (recreational zone). The intent is to provide pier, boatlift or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the site is **not**

located in a Sensitive Area and maximum width cleared does not exceed the 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot area would require a permit from the WDNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix F). If the site of manual removal is located in a Sensitive Area a permit is required. Manual removal is **cautioned** because it could open a niche for non-native invasive aquatic plants to occupy. If a proposed management area is near a stand of CLP removal of native vegetation is **not recommended**. CLP is known for invading disturbed areas where native plants have been removed. Removal of native plants also destroys habitat for fish and wildlife.

Limited manual removal of native vegetation is recommended for individual property owners where nuisance conditions occur. The area of removal should be kept to a minimum and a width of less than 30 feet is recommended. A navigation lane just wide enough for watercraft used is recommended. If lanes for fishing from the dock are required an area a few feet wide could be cleared to provide casting opportunities.

6.2.3 Additional Options

The following subsets are options that may be considered but are not recommended at this time. The harvesting program is effective on managing the CLP and nuisance native vegetation. It is the most economical as the District already owns a harvester and has a program in place.

Aquatic Invasive Plant Species Chemical Herbicide Treatment

A chemical herbicide treatment may be an appropriate way to treat large areas of AIS to conduct restoration of native plants. Chemical treatments on small, isolated beds of AIS are generally not very effective. In order for herbicides to be effective concentration and contact time need to be maintained; this is difficult to achieve when treating small stands in moving water (such as a flowage). Herbicides are generally not recommended for use in Sensitive Areas; these are areas designated by WDNR that have vegetation offering critical or unique fish and wildlife habitat to the lake. Herbicide application permits may be denied by WDNR if they are for a Sensitive Area. The applicant must demonstrate that the herbicide treatment will not alter the ecological character or reduce ecological value of the area. **Chemical treatment is not recommended at this time for either lake**. White Ash has scattered beds of CLP that make it difficult to effectively treat and North White Ash would require a whole lake treatment that would be costly and difficult to obtain a permit due to wild rice. The current harvesting program appears to be effective at controlling CLP and the native nuisance vegetation. The aspects of chemical treatment are discussed below for informational purposes.

When using chemicals to control AIS it is a good idea to reevaluate the lake and the extent of the AIS conditions before, during and after chemical treatment. The WDNR may require another whole-lake plant survey and will certainly require a proposed treatment area survey. Along with the above mentioned survey, pre and post treatment monitoring should be included for all aquatic plant treatments and is typically a WDNR requirement in their Northern Region.

The science regarding what chemicals are most effective and how they can be used is constantly being updated. Recent studies have shown good to excellent control of CLP using formulations of diquat (Reward) and endothall (Aquathol K). These treatments are effective but only give control in the year applied. Some studies have shown endothall applied early in spring can control CLP and stop turion production. This experimental study has shown control using Aquathol K in 60 degree (F) water early in CLP lifecycle can prevent turion formation.

Chemical treatment is usually a long term commitment and requires a specific plan with a goal set for "tolerable" levels of the relevant AIS. One such landmark might be 10% or less of the littoral area being occupied by aquatic invasive plants. At this time the CLP beds are far less than 10% of the littoral area. WDNR recommends conducting a whole-lake point-intercept survey on a five year cycle. Such a survey may reveal new AIS and at the very least would provide good trend data to see how the aquatic plant community is evolving.

Native Vegetation Management Chemical Herbicide Treatment
Native vegetation is generally not managed in Wisconsin waters. In the case of North White Ash Lakes native vegetation has become so thick in many areas of the lake that it has reached nuisance levels by severely limiting navigation and recreational use. In order for herbicide to be effective a whole lake treatment would be needed to control the nuisance native vegetation and the CLP. This would be an expensive option and would provide short term relief at best. It is difficult to impossible to predict the effectiveness of chemical treatments on lakes and the vegetation will return after an unknown period of time. It would also be very hard to obtain a permit for a whole lake treatment due to the wild rice beds in the lake.

At this time the harvesting program is proven effective and chemical herbicide treatment is not recommended.

7.0 Conclusion and Recommended Action Plan

One aquatic invasive plant was found during the aquatic plant survey in 2016; curly-leaf pondweed, *Potamogeton crispus* (CLP). This species has been previously identified within the lake and has been actively monitored and managed since 1976. The harvesting plan that has been followed since 2010 is effectively managing the CLP in both lakes. It is also managing the native vegetation in North White Ash to provide open water for recreation. This harvesting plan has been modified to meet the current needs of the lakes and is presented below along with other Active Goals to improve the lakes.

7.1 Recommended Active Goals

The recommended action plan includes actions for White Ash and North White Ash Lakes based on the Maintenance Alternative and Aquatic Plant Manipulation Alternative listed above in Section 6. **The goals listed below are meant to be a guideline used to manage the lakes; these goals should to be evaluated and revised as needed to fit the changing needs of the lakes.** Lakes are dynamic systems and flexibility is needed when managing them; **the dates and timelines listed below are guidelines and may change based on conditions**. The District board has approved the following active goals. It will be up to residents of White Ash and North White Ash Lakes and the District to determine the actions, find the funding, and gather the individuals needed to implement the active goals.

<u>Goal One: Continue CLP harvesting program</u>

<u>Objective One</u>: Follow the harvesting schedule below to remove CLP in the lake system and minimize disturbance caused by the harvesting program. Harvest CLP early in the season to remove turions from the system and decrease overall CLP growth.

Action 1: Begin harvesting approximately the 3rd week of May in White Ash Lake (approx 5 days)

- Harvest only those areas with CLP growth visible at or near the surface. See Map 1.

Action 2: Approximately the last week of May, first week of June begin harvesting in North White Ash Lake (approx 20 days)

- Harvest those areas with CLP growth. See Map 2.

Action 3: Begin second harvest approximately second or third week of June in White Ash Lake (approx 5 days)

- Harvest all remaining CLP. See Map 1.

Action 4: Begin second harvest approximately the last week of June on North White Ash Lake (approx of 10 days)

- Harvest all remaining CLP. See Map 2.

Goal Two: Continue Harvesting to Improve Navigation and Recreation

Objective One: Continue harvesting of navigation channels in White Ash and North White Ash Lakes to provide for navigation and recreational use areas in both lakes.

Action 1: White Ash – Limit late season plant harvesting to provide only a 50-ft navigation channel around the periphery of the lake. See Map 3.

Action 2: North White Ash - Continue large-scale harvesting in designated navigational channels and recreational corridors.

- Begin harvesting native plant navigation channels around the periphery of lake; last week of June. See Map 4.
- A navigation channel of 100 ft wide will be maintained around the periphery of the lake for the season.
- A recreational use area of 360 ft wide by 3200 ft long will be maintained in the center of the lake for the season.

Action 3: North White Ash - Allow for surface skimming with harvester outside the designated navigational channels and recreational corridors.

- The area inside of the periphery navigation channel may be skimmed.
- Surface skimming is defined as harvesting to a depth of 18 to 36 inches below the water surface.
- Pick-up of matted vegetation or algae on the surface.
- Must remain outside previously designated sensitive areas.
- Skimming is not allowed in 3-ft of water or less.
- After August 1, skim southern part of the lake where wild celery is present.

Action 4: Maintain navigation between the two lakes.

- Maintain a 20-ft wide open navigation channel running south from North White Ash into the Apple River corridor. See Map 4.
- Maintain the Apple River corridor at 20-ft wide from where the Apple River enters White Ash to the open water on White Ash. See Map 3.
- It may be necessary to begin harvesting this channel in June as growth of wild rice could quickly fill in this channel.
- Maintain a 20-ft wide navigation channel on Apple River downstream of White Ash. Due to safety reasons, this may only be harvested during very low flows.

General Conditions:

- Navigation channels will be established and included in any permit applications each year, regardless of plant density to keep the option of harvesting if necessary open

- Position of navigation channels will vary with lake level, but will generally follow the 3-ft depth contour around the lake
- Harvesting is not allowed in 3-ft of water or less
- Cutting heads may be operated no deeper than 12 inches off the bottom

Goal Three: Control and manage existing aquatic invasive species in and around the two lakes

Objective One: Encourage physical removal of CLP and other aquatic plants according to NR 109 guidelines by land owners in waters 3-ft deep or less

- Does not include wild rice
- Must be in compliance with NR 109 physical removal guidelines

Objective Two: Monitor purple loosestrife and manage as needed. Actions may include:

- Beetle rearing stations
- Work with landowners to identify and train to physically remove pioneering or isolated purple loosestrife plants

Objective Three: Monitor giant reed grass and manage as needed. Actions may include:

- Monitor the spread of giant reed grass annually using GPS technology
- Chemically treat giant reed grass on an annual

Objective Four: Monitoring for Eurasian Water Milfoil

Action 1: implement early response and detection activities

Objective Five: Prevent the introduction of new AIS into the White Ash Lakes system

Action 1: Continue a Watercraft inspection program on both lakes

- Target busy times such as holidays and other high traffic days on the public landings on White Ash and North White Ash.

Action 2: Continue an AIS In-lake monitoring program

- Complete in-lake monitoring of AIS in both lakes following Citizen Lake Monitoring Network AIS monitoring protocols
- A successful AIS program will mean no new AIS in the White Ash Lakes, or at a minimum, an early detection of something new.

Objective Six: Complete AIS education aimed at riparian owners and other lake users

Action 1: Maintain AIS signage at all public accesses including illegal to launch and illegal to transport signage

Action 2: Provide AIS training in identification and monitoring for all interested parties on both lakes

Goal Four: Determine what impact aquatic plant management has on surface water quality

Objective One: Continue to support Citizen Lake Monitoring Network expanded water quality monitoring efforts on both lakes

Action 1: TP (Spring, June- August) and Chlorophyll a (June – August)

Action 2: Secchi, and temperature (every two weeks April – October)

Goal Five: Protect wild rice beds on both lakes

Objective One: Educate lake residents and users as to the value of wild rice is the system

Objective Two: Allow no intentional harvest of wild rice except immediately within the designated navigation channels and recreational corridors

Goal Six: Evaluate the success or failure of the activities included in this APM Plan

Objective One: Improve WALPRD aquatic plant harvesting record keeping

Action 1: Design and set-up a digital record keeping sheet to track harvesting data. Present at annual meeting in August. A hard copy of the hours, loads and area cut are kept for each cutting session.

Objective Two: Complete an assessment of the project activities annually

Action 1: To be completed by the WALPRD and their cooperating consultant

Objective Three: Complete a five-year end-of-project assessment

Action 1: To be completed by the WALPRD and their cooperating consultant

- Apply for grant to update APM Plan
- Due by December 10 of the year following the last year of implementation
- Redo early and mid-season point-intercept aquatic plant surveys on both lakes
- Evaluate water quality in both lakes to determine if trends established in 2010 have continued, were arrested, or were reversed

7.2 Pursue Grant Funding to Implement Actions

There are a number of grants available through WDNR to implement actions outlined in this plan and to complete further research and projects on White Ash and North White Ash Lakes. Following is a brief description of the grants available through WDNR.

Small Scale Lake Management Planning

Funding Amount: $3,000
Local Match: 33%
Purpose: funding to collect and analyze information needed to protect and restore lakes and watersheds.
Application Deadline: Feb 1 and Aug 1
Eligible Projects:

- Lake monitoring such as water quality and aquatic plants
- Lake education such as activities that will collect/disseminate information about lakes to educate public on lake use, lake ecosystem and lake management techniques
- Organization development such as assist management units in formation of goals/objectives for management of lake
- Studies/assessments to implement management goals and expanding monitoring.

Large Scale Lake Management Planning

Funding Amount: $25,000
Local Match: 33%
Purpose: funding to collect and analyze information needed to protect and restore lakes and watersheds.
Application Deadline: Feb 1 and Aug 1
Eligible Projects:

- Gathering and analysis of physical, chemical and biological information
- Describing present and potential land uses in watershed and on shoreline
- Reviewing jurisdictional boundaries and evaluating ordinances that relate to zoning, sanitation or pollution control or surface use
- Assessment of fish, aquatic life, wildlife and their habitats
- Gathering and analyzing information from lake property owners/users
- Developing, evaluation, publishing, distributing alternative courses of action and recommendations in a lake management plan

Lake Protection Grant

Funding Amount: $200,000
Local Match: 25%
Purpose: Funding for large, complex, technical projects for lake protection
Application Deadline: May 1
Eligible Projects:

- Purchase of land or conservation easements
- Restoration of wetlands and shorelands to protect water quality
- Development of local regulations to protect lakes and education activities necessary to implement them
- Lake management plan implementation project recommend in **WDNR approved plan**

- Watershed management projects
- Lake restoration
- Diagnostic feasibility studies

Aquatic Invasive Species Education, Planning and Prevention Grant

Funding Amount: $150,000
Local Match: 25%
Purpose: Educate lake users on AIS
Application Deadline: Feb 1 and Aug 1
Eligible Projects:

- Educational programs including workshops, training or coordinating volunteer monitors.
- Develop prevention and control plans for AIS
- Monitor, map and assess waterbodies for AIS or studies that will aid in prevention AIS
- Watercraft inspection and education projects (CBCW). Inspectors must be trained and staff boat launch facilities a minimum of 200 hours between May 1 and October 30. Limited to $4,000 per boat launch facility.

Aquatic Invasive Species Established Population Control Project

Funding Amount: $200,000
Local Match: 25%
Purpose: Provide for eradication/substantial reduction and long term control of AIS with goal of restoring native species.
Application Deadline: Feb 1 and Aug 1
Eligible Projects:

- Department approved control activities recommended in control plan
- Experimental or demonstration project in WDNR approved plan
- Purple loosestrife bio-control project

Aquatic Invasive Species Early Detection and Response

Funding Amount: $20,000
Local Match: 25%
Purpose:
Application Deadline: As approved
Eligible Projects: Identification and removal by approved methods of small, pioneer population of AIS. Localized beds must be present less than 5 years and less than 5 acres in size or less than 5% of lake area. Control of recolonization following completion of an established population control project is eligible.

Aquatic Invasive Species Research and Demonstration

Funding Amount: $500,000
Local Match: 25%
Purpose: Funding for cooperative research or demonstration activity

	between sponsor and WDNR
Application Deadline:	Feb 1 and Aug 1

Aquatic Invasive Species Maintenance and Containment

Funding Amount:	full cost of aquatic plant management permit
Local Match:	25%
Purpose:	Funding for department approved management at desired level of AIS where eradication is not possible. Monitoring and reporting are required.
Application Deadline:	continuous

7.3 Closing

This APM Plan was prepared in cooperation with the White Ash Lake Protection and Rehabilitation District. It includes the major components outlined in the WDNR Aquatic Plant Management guidance. The "Recommended Action Plan" section of this report can be used as a stand alone document to facilitate CLP and nuisance native plant management activities for the lakes. This section outlines important monitoring and management activities. The greater APM Plan document and appendices provides a central source of information for the lake's aquatic plant community information, the overall lake ecology, and sources of additional information. If there are any questions about how to use this APM Plan or its contents, please contact Flambeau Engineering, Inc..

This APM Plan should be updated periodically to reflect current aquatic plant problems, and the most recent acceptable APM methods. Information regarding aquatic plant management and protection is available from the WDNR website: http://dnr.wi.gov/org/water/fhp/lakes/aquaplan.htm or from Flambeau Engineering upon request.

8.0 References

While not all references are specifically cited, the following resources were used in preparation of this report.

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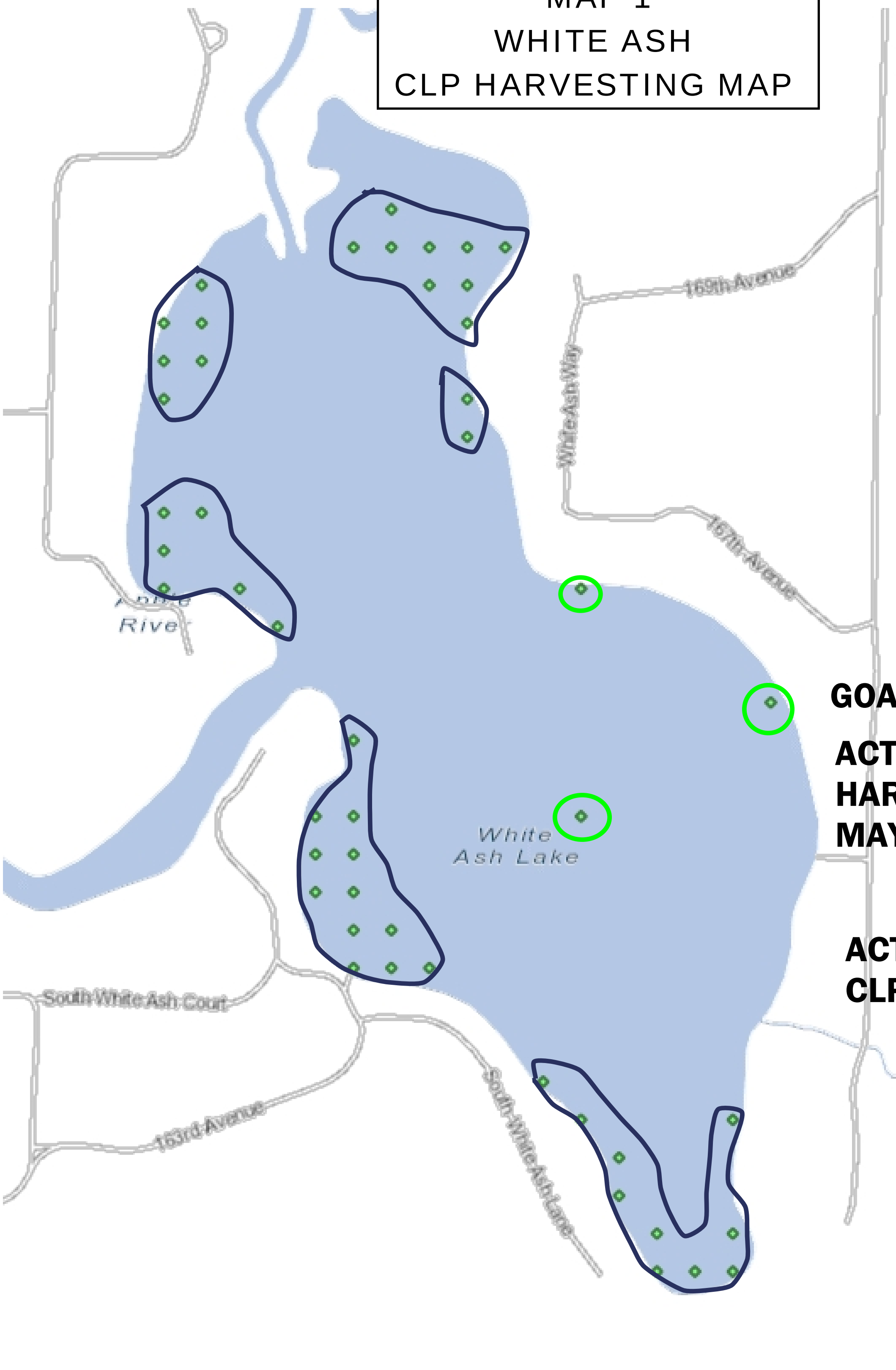
Harvest Maps

2016 CLP WHITE ASH

MAP 1
WHITE ASH
CLP HARVESTING MAP



Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Lakes and Open water

GOAL ONE, OBJECTIVE ONE

ACTION ONE: HARVEST CLP IN MID MAY

ACTION THREE: HARVEST CLP IN MID JUNE

0.3 0 0.13 0.3 Miles

1: 7,920

NAD_1983_HARN_Wisconsin_TM

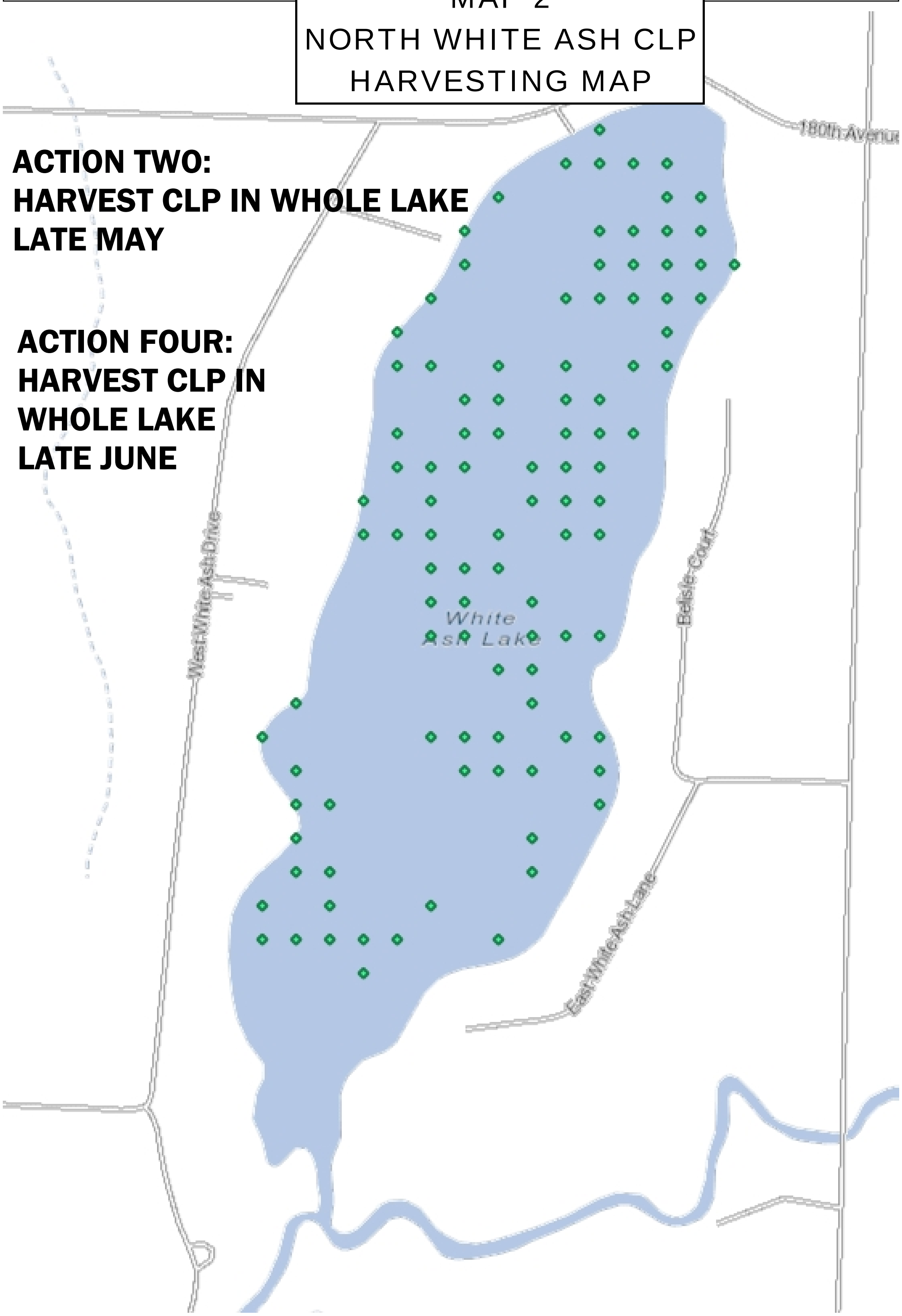
Notes

2016 CLP NORTH WHITE ASH

MAP 2
NORTH WHITE ASH CLP
HARVESTING MAP

ACTION TWO:
HARVEST CLP IN WHOLE LAKE
LATE MAY

ACTION FOUR:
HARVEST CLP IN
WHOLE LAKE
LATE JUNE



Legend

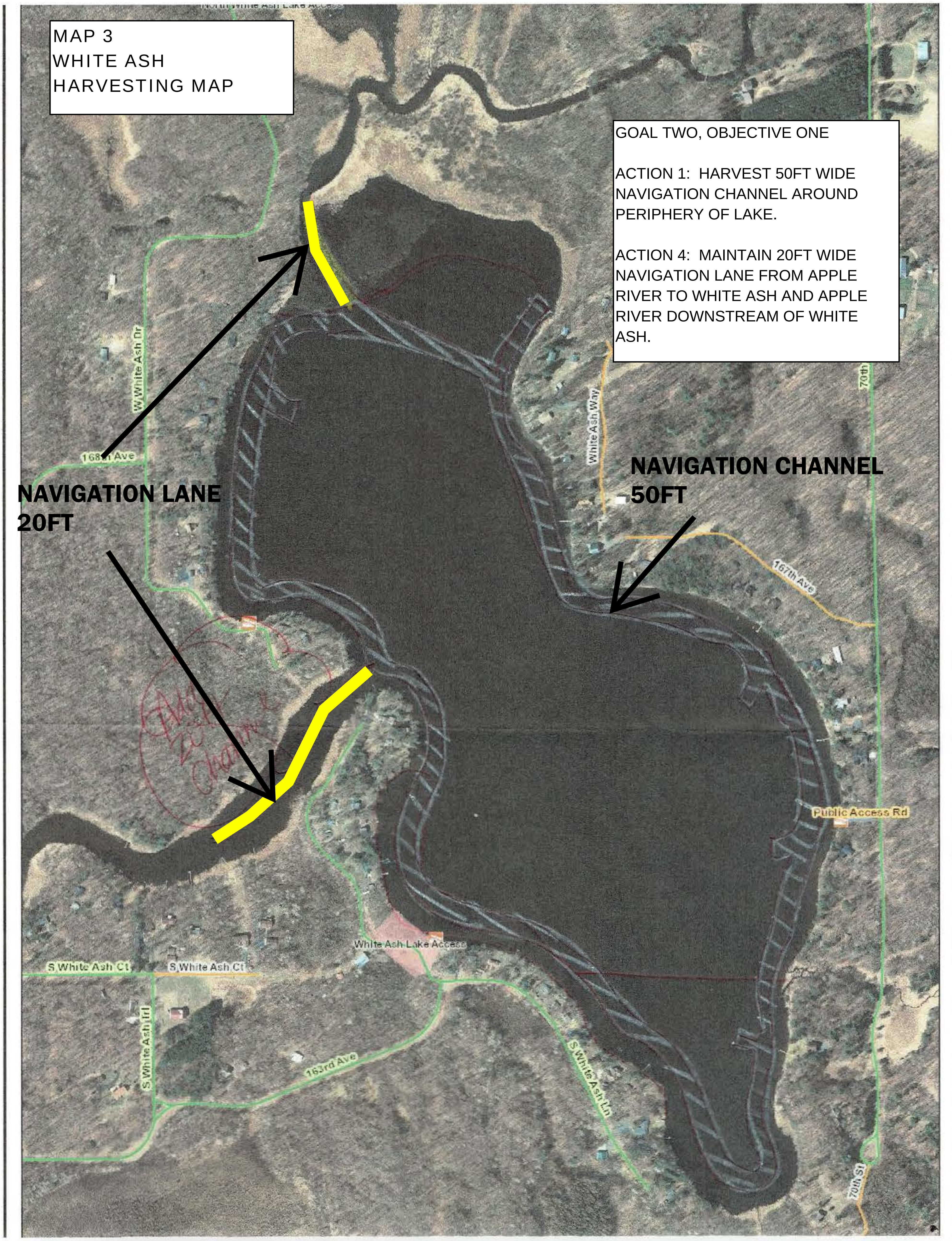
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Lakes and Open water

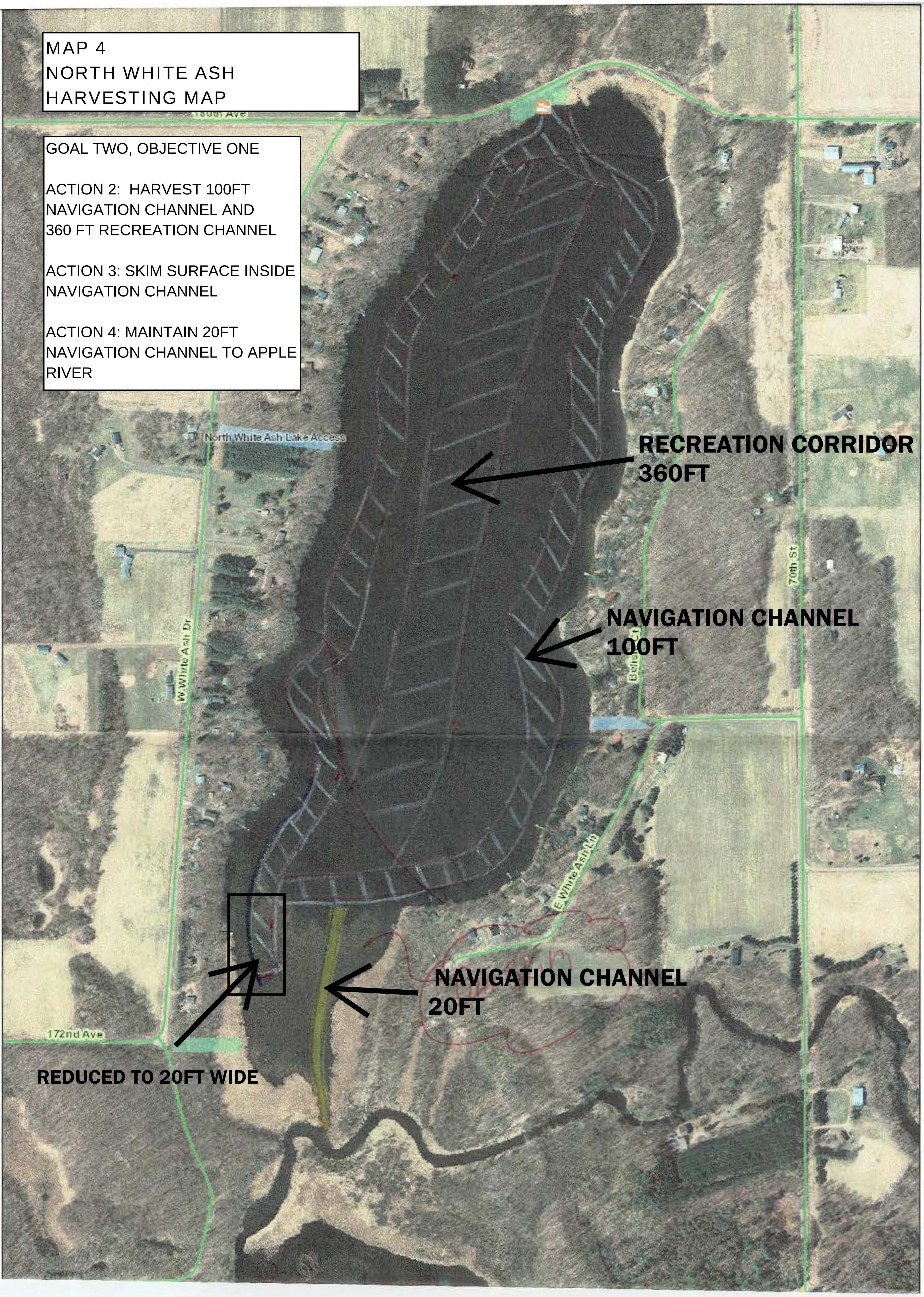
0.3 0 0.13 0.3 Miles

1: 7,920

NAD_1983_HARN_Wisconsin_TM

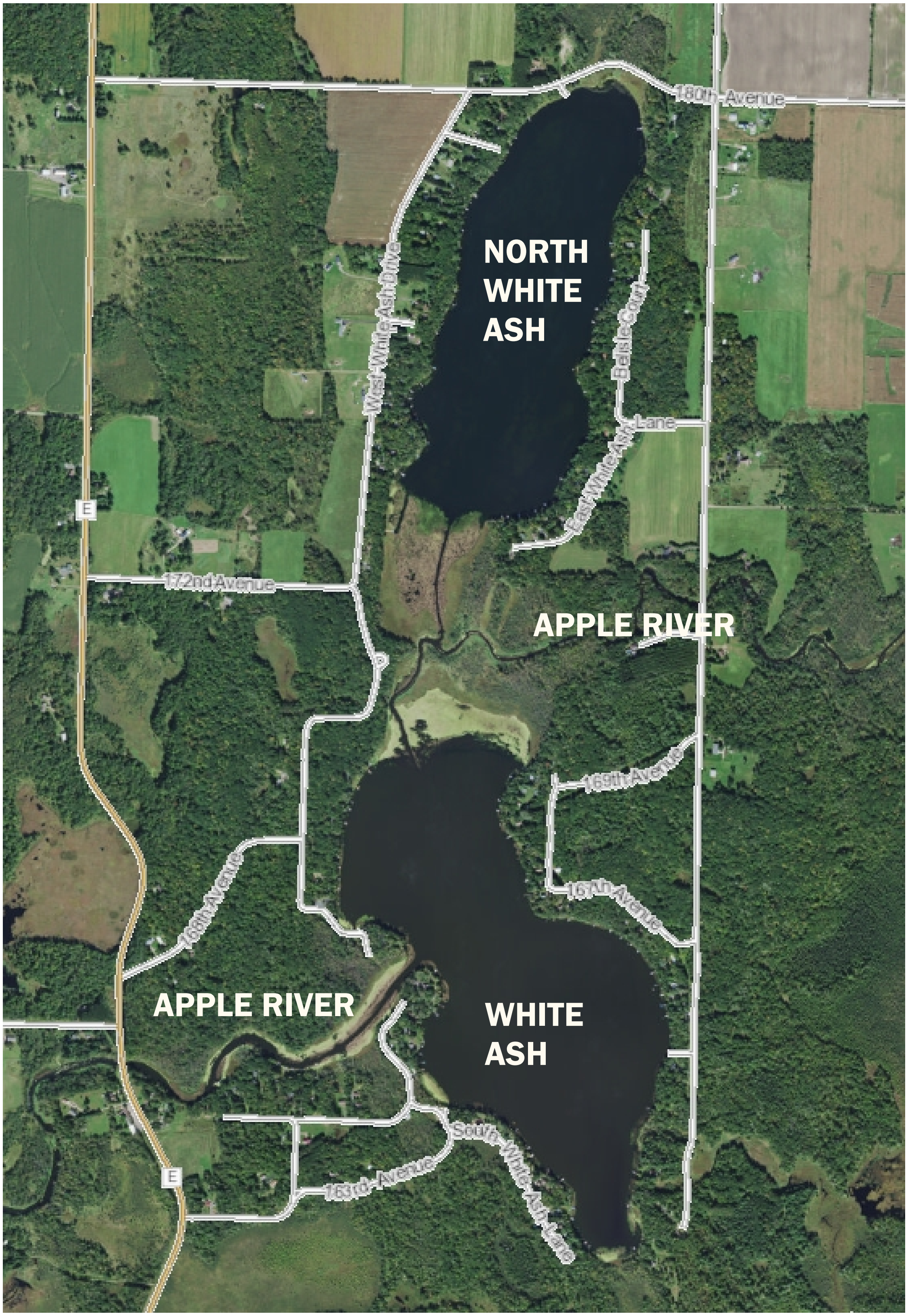
Notes


MAP 3
WHITE ASH
HARVESTING MAP
GOAL TWO, OBJECTIVE ONE
ACTION 1: HARVEST 50FT WIDE NAVIGATION CHANNEL AROUND PERIPHERY OF LAKE.
ACTION 4: MAINTAIN 20FT WIDE NAVIGATION LANE FROM APPLE RIVER TO WHITE ASH AND APPLE RIVER DOWNSTREAM OF WHITE ASH.
NAVIGATION CHANNEL
50FT
NAVIGATION LANE
20FT
W White Ash Dr
White Ash Way
167th Ave
70th
Public Access Rd
White Ash Lake Access
S White Ash Ct
S White Ash Ct
S White Ash Trl
163rd Ave
S White Ash Ln
70th St


MAP 4
NORTH WHITE ASH
HARVESTING MAP
GOAL TWO, OBJECTIVE ONE
ACTION 2: HARVEST 100FT NAVIGATION CHANNEL AND 360 FT RECREATION CHANNEL
ACTION 3: SKIM SURFACE INSIDE NAVIGATION CHANNEL
ACTION 4: MAINTAIN 20FT NAVIGATION CHANNEL TO APPLE RIVER
RECREATION CORRIDOR 360FT
NAVIGATION CHANNEL 100FT
NAVIGATION CHANNEL 20FT
REDUCED TO 20FT WIDE
North White Ash Lake Access
W White Ash Dr
E White Ash Ln
70th St
172nd Ave

Figures

WHITE ASH AND NORTH WHITE ASH LAKES
FIGURE 1 - LAYOUT OF LAKES



Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands

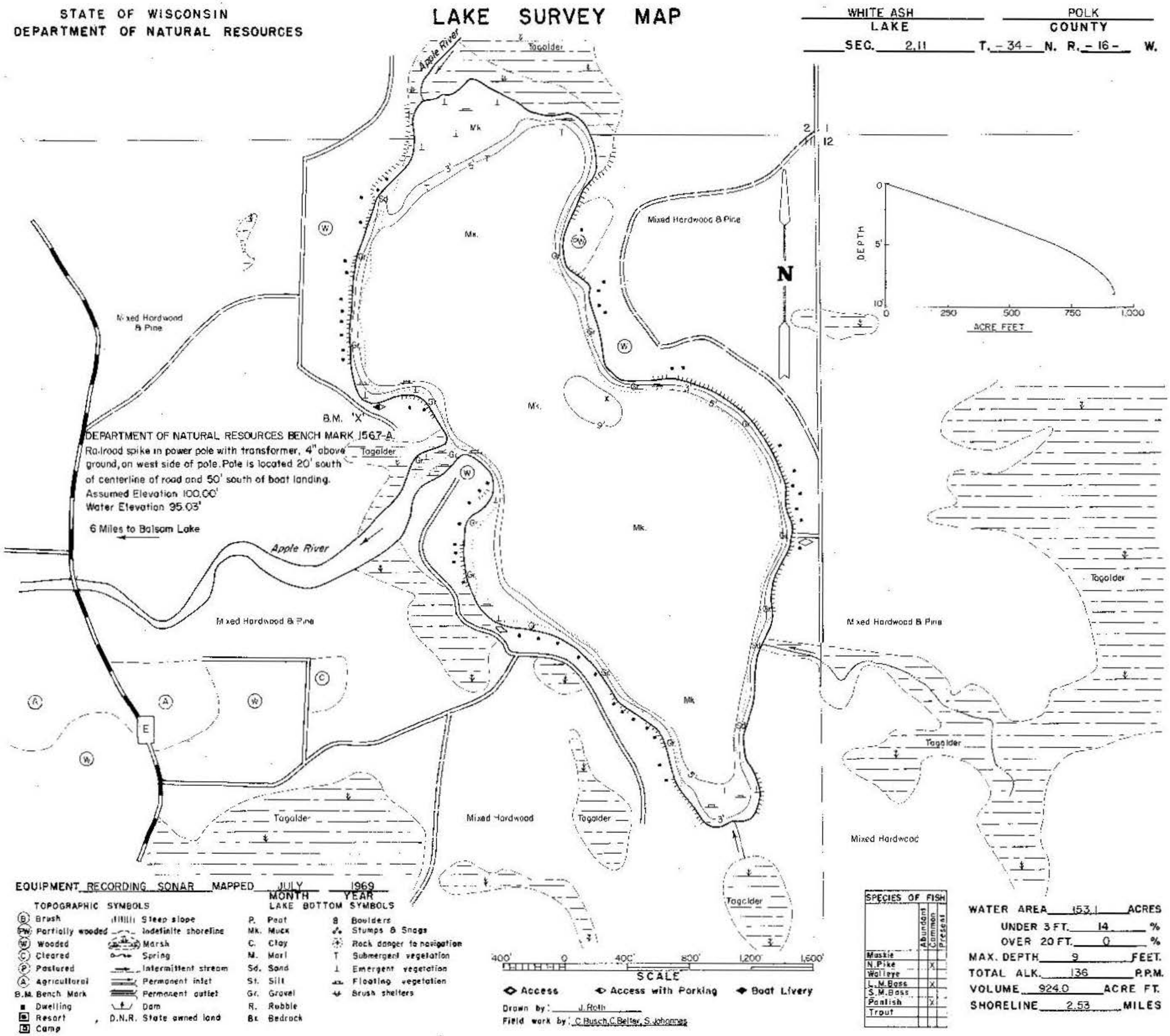
0.5 0 0.25 0.5 Miles

1: 15,840

NAD_1983_HARN_Wisconsin_TM

DISCLAIMER: The information shown on these maps has been obtained from various sources, and are of varying age, reliability and resolution. These maps are not intended to be used for navigation, nor are these maps an authoritative source of information about legal land ownership or public access. No warranty, expressed or implied, is made regarding accuracy, applicability for a particular use, completeness, or legality of the information depicted on this map. For more information, see the DNR Legal Notices web page: http://dnr.wi.gov/legal/

Notes

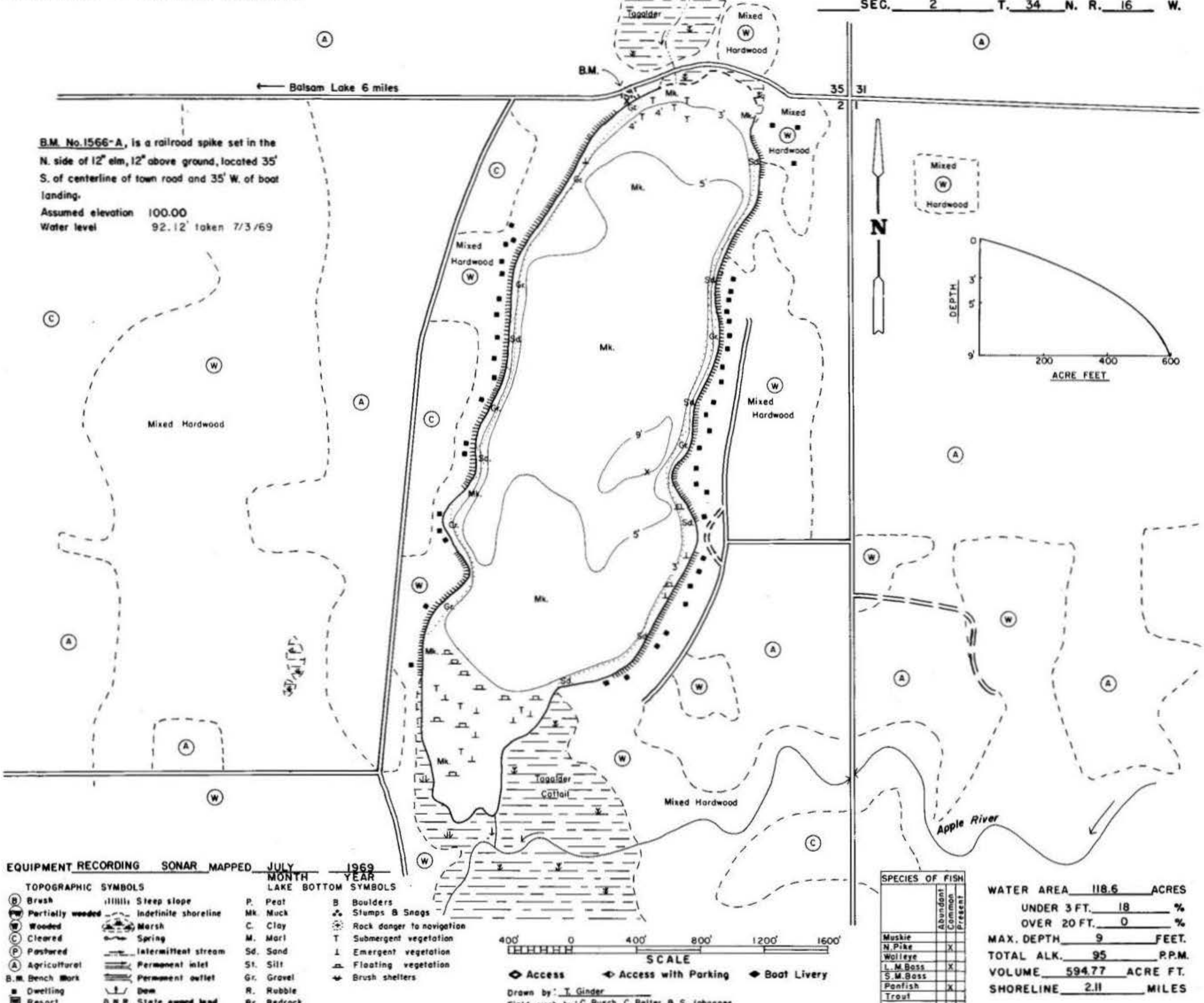

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
LAKE SURVEY MAP
WHITE ASH
LAKE
POLK
COUNTY
SEC. 2,11 T. - 34 - N. R. - 16 - W.
Apple River
Togalder
Mk.
Mixed Hardwood & Pine
N
DEPTH
0
5'
10'
250
500
750
1,000
ACRE FEET
B.M. 'X'
DEPARTMENT OF NATURAL RESOURCES BENCH MARK 1567-A.
Railroad spike in power pole with transformer, 4" above ground, on west side of pole. Pole is located 20' south of centerline of road and 50' south of boat landing.
Assumed Elevation 100.00'
Water Elevation 95.03'
6 Miles to Balsam Lake
Apple River
Mixed Hardwood
E
EQUIPMENT RECORDING SONAR MAPPED JULY 1969
MONTH YEAR
TOPOGRAPHIC SYMBOLS
(B) Brush
(PW) Partially wooded
(W) Wooded
(C) Cleared
(P) Pastured
(A) Agricultural
B.M. Bench Mark
Dwelling
Resort
Camp
Steep slope
Indefinite shoreline
Marsh
Spring
Intermittent stream
Permanent inlet
Permanent outlet
Dam
D.N.R. State owned land
LAKE BOTTOM SYMBOLS
P. Peat
Mk. Muck
C. Clay
M. Marl
Sd. Sand
St. Silt
Gr. Gravel
R. Rubble
Bx. Bedrock
B Boulders
Stumps & Snags
Rock danger to navigation
Submergent vegetation
Emergent vegetation
Floating vegetation
Brush shelters
400' 0 400' 800' 1,200' 1,600'
SCALE
Access
Access with Parking
Boat Livery
Drawn by: J. Roth
Field work by: C. Busch, C. Beltev, S. Johannes
SPECIES OF FISH
Abundant Common Present
Muskie
N. Pike X
Walleye
L.M. Bass X
S.M. Bass
Panfish X
Trout
WATER AREA 153.1 ACRES
UNDER 3 FT. 14 %
OVER 20 FT. 0 %
MAX. DEPTH 9 FEET.
TOTAL ALK. 136 P.P.M.
VOLUME 924.0 ACRE FT.
SHORELINE 2.53 MILES

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

NORTH WHITE ASH LAKE — POLK COUNTY

SEC. 2 T. 34 N. R. 16 W.



EQUIPMENT RECORDING SONAR MAPPED JULY (MONTH) 1969 (YEAR)

TOPOGRAPHIC SYMBOLS

- (B) Brush
- (PW) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- Dwelling
- Resort
- Camp
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam
- D.N.R. State owned land

LAKE BOTTOM SYMBOLS

- P. Peat
- Mk. Muck
- C. Clay
- M. Marl
- Sd. Sand
- St. Silt
- Gr. Gravel
- R. Rubble
- Bc Bedrock
- B Boulders
- Stumps & Snags
- Rock danger to navigation
- T Submergent vegetation
- Emergent vegetation
- Floating vegetation
- Brush shelters

SPECIES OF FISH	Abundant	Common	Present
Muskie			
N.Pike		X	
Walleye			
L.M.Bass		X	
S.M.Bass			
Panfish		X	
Trout			

WATER AREA 118.6 ACRES
UNDER 3 FT. 18 %
OVER 20 FT. 0 %
MAX. DEPTH 9 FEET.
TOTAL ALK. 95 P.P.M.
VOLUME 594.77 ACRE FT.
SHORELINE 2.11 MILES

FIGURE 4 - PI LOCATIONS WHITE ASH

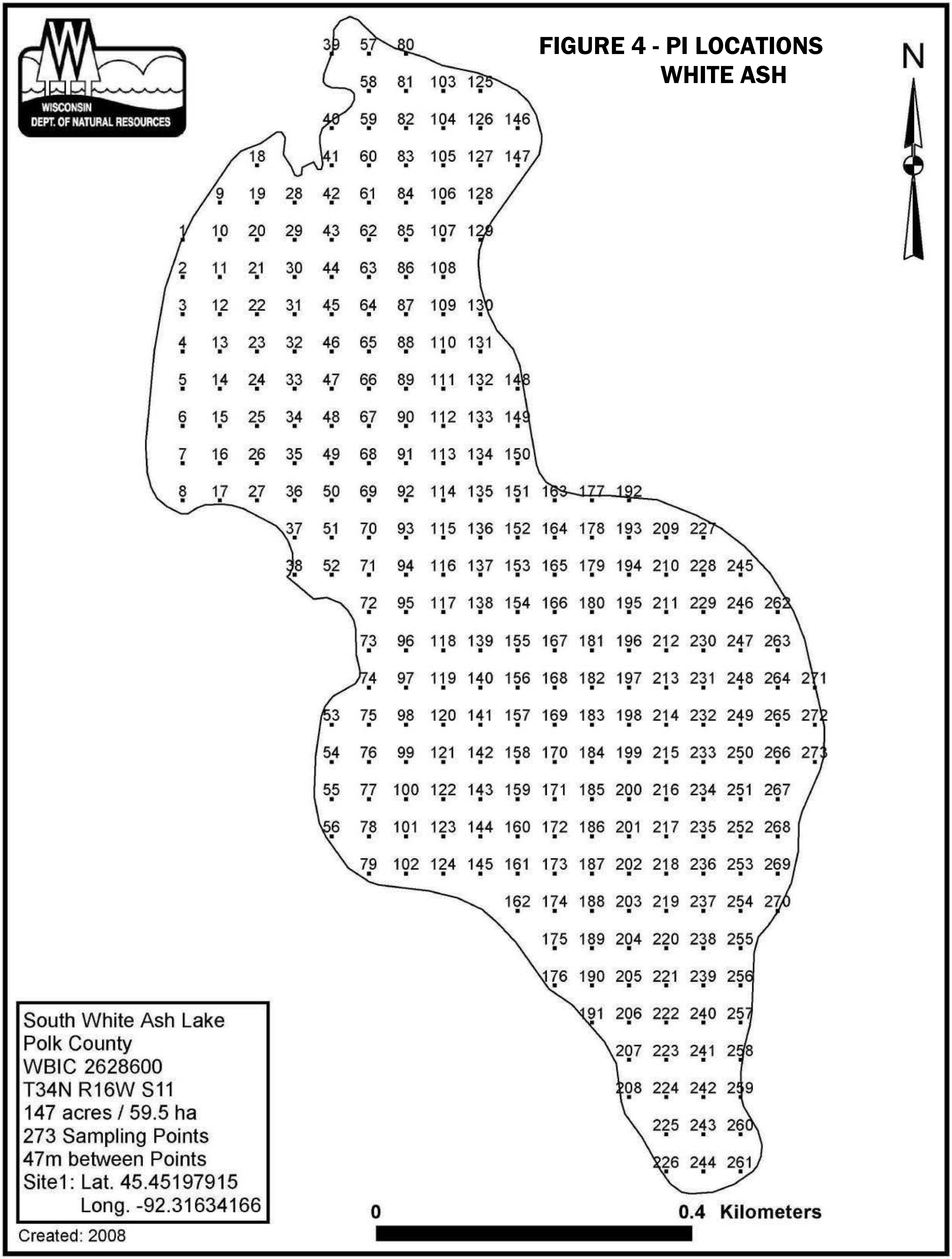
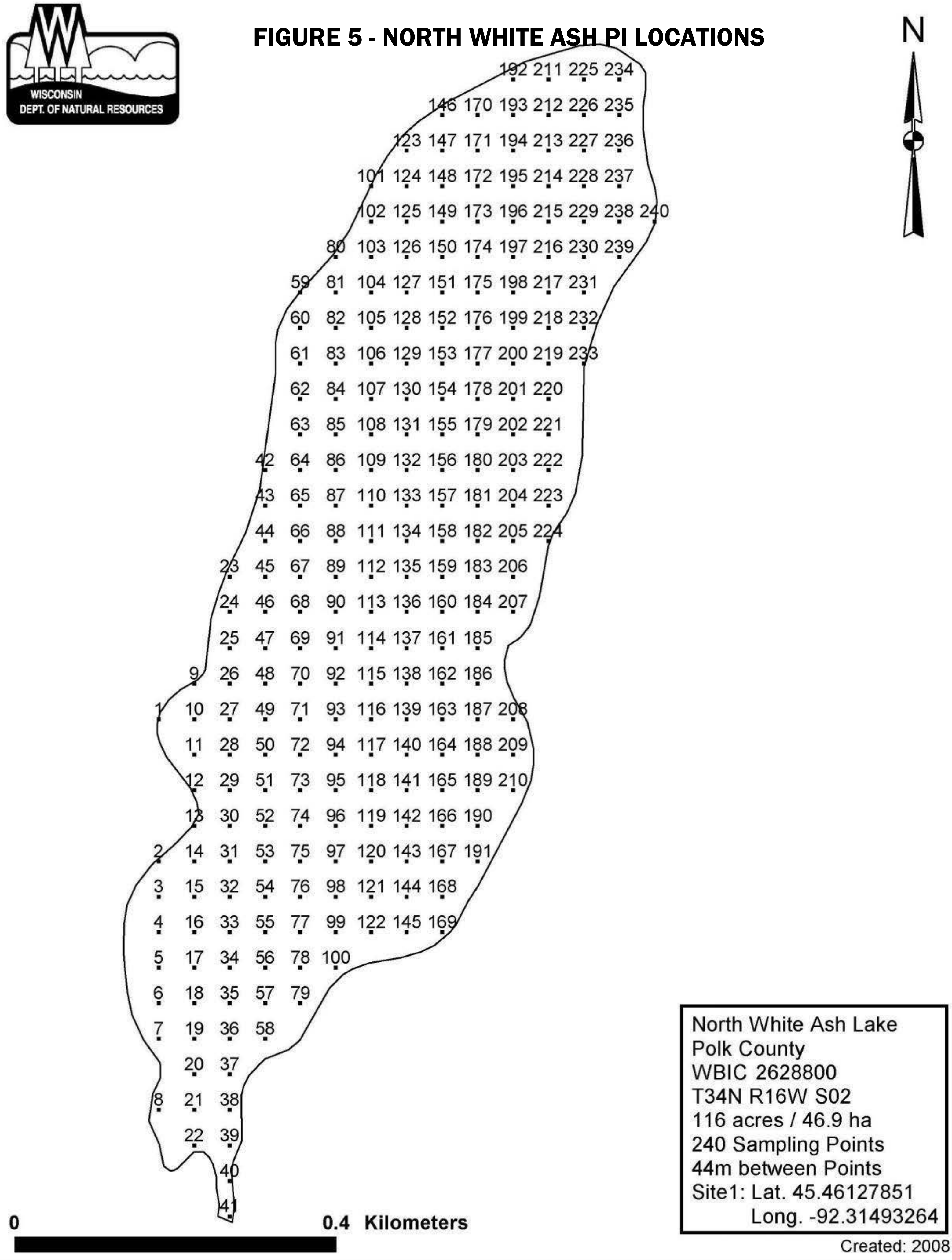


FIGURE 5 - NORTH WHITE ASH PI LOCATIONS



Tables

	A	B	C	E	Q	AC	AS	BA	BD	BM	BN	CL	CQ	EE	EK	EN	EZ	FA
1		**WHITE ASH PI STATS** **STATS**	Total vegetation	*Potamogeton crispus*, Curly-leaf pondweed	Ceratophyllum demersum, Coontail	Elodea canadensis, Common waterweed	Lemna trisulca, Forked duckweed	Myriophyllum sibiricum, Northern water-milfoil	Najas flexilis, Slender naiad	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton richardsonii, Clasping-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Vallisneria americana, Wild celery	Zizania sp., Wild rice	Filamentous algae		
2	**Lake**	SOUTH WHITE ASH																
3	**County**	POLK																
4	**WBIC**	2628600																
5	**Survey Date**	08/03/16																
6		**INDIVIDUAL SPECIES STATS:**																
7		**Frequency of occurrence within vegetated areas (%)**		16.67	76.67	40.00	3.33	6.67	8.33	3.33	1.67	3.33	6.67	20.00	8.33	1.67		
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		9.90	45.54	23.76	1.98	3.96	4.95	1.98	0.99	1.98	3.96	11.88	4.95	0.99		
9		**Relative Frequency (%)**		8.5	39.3	20.5	1.7	3.4	4.3	1.7	0.9	1.7	3.4	10.3	4.3			
10		Relative Frequency (squared)	0.22	0.01	0.15	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00			
11		**Number of sites where species found**		10	46	24	2	4	5	2	1	2	4	12	5	1		
12		**Average Rake Fullness**	2.86	1.10	1.46	1.13	1.00	1.50	1.40	1.00	2.00	1.50	1.00	1.25	2.60	1.00		
13		**#visual sightings**		2	4					4	1		1	2				
14		**present (visual or collected)**		presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	present		
15																		
16		**SUMMARY STATS:**																
17		**Total number of sites visited**	**112**															
18		**Total number of sites with vegetation**	**60**															
19		**Total number of sites shallower than maximum depth of plants**	**101**															
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**59.41**															
21		**Simpson Diversity Index**	**0.78**															
22		**Maximum depth of plants (ft)****	**8.00**															
23		**Number of sites sampled using rake on Rope (R)**	**0**															
24		**Number of sites sampled using rake on Pole (P)**	**234**															
25		**Average number of all species per site (shallower than max depth)**	**1.07**															
26		**Average number of all species per site (veg. sites only)**	**1.95**															
27		**Average number of native species per site (shallower than max depth)**	**0.97**															
28		**Average number of native species per site (veg. sites only)**	**1.91**															
29		**Species Richness**	**12**															
30		**Species Richness (including visuals)**	**12**															
31																		
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**																

	A	B	C	H	Q	AC	AO	AR	AS	BA	BD	BI	BN	BU	CL	CQ	DO	ED	EE	EK	EN	EZ
1		NORTH WHITE ASH PI STATS **STATS**	Total vegetation	Bidens beckii (formerly Megalodonta), Water marigold	Ceratophyllum demersum, Coontail	Elodea canadensis, Common waterweed	Lemna minor, Small duckweed	Lemna perpusilla, Least duckweed	Lemna trisulca, Forked duckweed	Myriophyllum sibiricum, Northern water-milfoil	Najas flexilis, Slender naiad	Nitella sp., Nitella	Nymphaea odorata, White water lily	Potamogeton amplifolius, Large-leaf pondweed	Potamogeton richardsonii, Clasping-leaf pondweed	Potamogeton zosteriformis, Flat-stem pondweed	Sparganium sp., Bur-reed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Zizania sp., Wild rice	Filamentous alga	
2	**Lake**	NORTH WHITE ASH																				
3	**County**	POLK																				
4	**WBIC**	2628800																				
5	**Survey Date**	08/03/16																				
6		**INDIVIDUAL SPECIES STATS:**																				
7		**Frequency of occurrence within vegetated areas (%)**		0.47	81.40	82.33	0.93	0.47	16.74	1.86	0.93	0.93		37.21	16.74	15.35	0.93	0.93	11.16	0.93	20.93	
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		0.45	78.13	79.02	0.89	0.45	16.07	1.79	0.89	0.89		35.71	16.07	14.73	0.89	0.89	10.71	0.89	20.09	
9		**Relative Frequency (%)**		0.2	30.2	30.6	0.3	0.2	6.2	0.7	0.3	0.3		13.8	6.2	5.7	0.3	0.3	4.1	0.3	7.8	
10		Relative Frequency (squared)	0.22	0.00	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00		0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
11		**Number of sites where species found**		1	175	177	2	1	36	4	2	2		80	36	33	2	2	24	2	45	
12		**Average Rake Fullness**	2.86	1.00	1.78	1.89	1.00	1.00	1.17	1.00	2.00	1.00		1.40	1.06	1.00	1.00	1.00	1.25	1.00	1.36	
13		**#visual sightings**			1	1							3									
14		**present (visual or collected)**		presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	presen	present	
15																						
16		**SUMMARY STATS:**																				
17		**Total number of sites visited**	**224**																			
18		**Total number of sites with vegetation**	**215**																			
19		**Total number of sites shallower than maximum depth of plants**	**224**																			
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**95.98**																			
21		**Simpson Diversity Index**	**0.78**																			
22		**Maximum depth of plants (ft)****	**9.00**																			
23		**Number of sites sampled using rake on Rope (R)**	**0**																			
24		**Number of sites sampled using rake on Pole (P)**	**234**																			
25		**Average number of all species per site (shallower than max depth**	**2.58**																			
26		**Average number of all species per site (veg. sites only)**	**2.69**																			
27		**Average number of native species per site (shallower than max depth)**	**2.58**																			
28		**Average number of native species per site (veg. sites only)**	**2.69**																			
29		**Species Richness**	**16**																			
30		**Species Richness (including visuals)**	**17**																			
31																						
32		****SEE "MAX DEPTH GRAPH" WORKSHEET TO CONFIRM**																				

Appendix A –

Appendix B

Appendix C1 – Importance of Aquatic Plants to Lake Ecosystem

AQUATIC PLANT TYPES AND HABITAT

Aquatic plants can be divided into two major groups: microphytes (phytoplankton and epiphytes) composed mostly of single-celled algae, and macrophytes that include macro algae, flowering vascular plants, and aquatic mosses and ferns. Wide varieties of microphytes co-inhabit all habitable areas of a lake. Their abundance depends on light, nutrient availability, and other ecological factors.

In contrast, macrophytes are predominantly found in distinct habitats located in the littoral (i.e., shallow near shore) zone where light sufficient for photosynthesis can penetrate to the lake bottom. The littoral zone is subdivided into four distinct transitional zones: the eulittoral, upper littoral, middle littoral, and lower littoral (Wetzel, 1983).

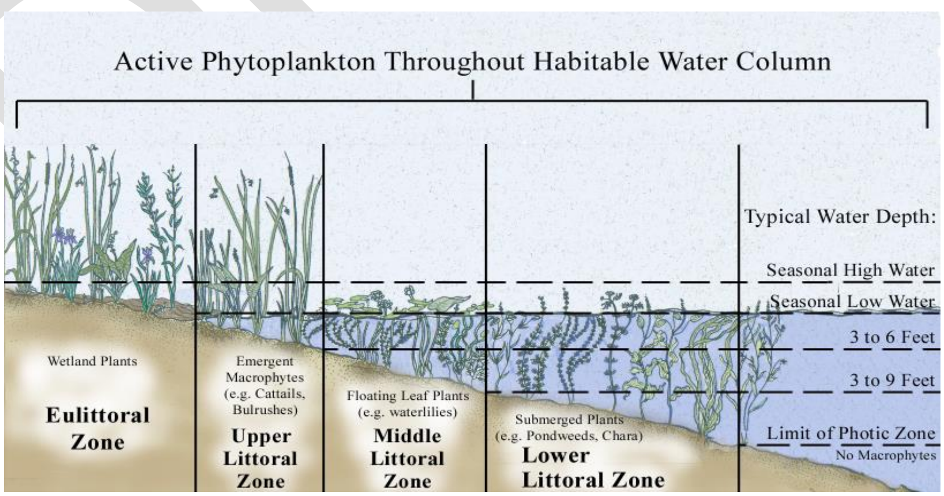
Eulittoral Zone: Includes the area between the highest and lowest seasonal water levels, and often contains many wetland plants.

Upper Littoral Zone: Dominated by emergent macrophytes and extends from the shoreline edge to water depths between 3 and 6 feet.

Middle Littoral Zone: Occupies water depths of 3 to 9 feet, extending deeper from the upper littoral zone. The middle littoral zone is often dominated by floating-leaf plants.

Lower Littoral Zone: Extends to a depth equivalent to the limit of the photic zone, which is the maximum depth that sufficient light can support photosynthesis. This area is dominated by submergent aquatic plant types.

The following illustration depicts these particular zones and aquatic plant communities.



Aquatic Plant Communities Schematic

The abundance and distribution of aquatic macrophytes are controlled by light availability, lake trophic status as it relates to nutrients and water chemistry, sediment characteristics, and wind energy. Lake morphology and watershed characteristics relate to these factors independently and in combination (NALMS, 1997).

AQUATIC PLANTS AND WATER QUALITY

In many instances aquatic plants serve as indicators of water quality due to the sensitive nature of plants to water quality parameters such as water clarity and nutrient levels. To grow, aquatic plants must have adequate supplies of nutrients. Microphytes and free-floating macrophytes (e.g., duckweed) derive all their nutrients directly from the water. Rooted macrophytes can absorb nutrients from water and/or sediment. Therefore, the growth of phytoplankton and free-floating aquatic plants is regulated by the supply of critical available nutrients in the water column. In contrast, rooted aquatic plants can normally continue to grow in nutrient-poor water if lake sediment contains adequate nutrient concentrations. Nutrients removed by rooted macrophytes from the lake bottom may be returned to the water column when the plants die. Consequently, killing too many aquatic macrophytes may increase nutrients available for algal growth.

In general, an inverse relationship exists between water clarity and macrophyte growth. That is, water clarity is usually improved with increasing abundance of aquatic macrophytes. Two possible explanations are postulated. The first is that the macrophytes and epiphytes out-compete phytoplankton for available nutrients. Epiphytes derive essentially all of their nutrient needs from the water column. The other explanation is that aquatic macrophytes stabilize bottom sediment and limit water circulation, preventing re-suspension of solids and nutrients (NALMS, 1997).

If aquatic macrophyte abundance is reduced, then water clarity may suffer. Water clarity reductions can further reduce the vigor of macrophytes by restricting light penetration. Studies have shown that if 30 percent or less of a lake areas occupied by aquatic plants is controlled, water clarity will generally not be affected. However, lake water clarity will likely be reduced if 50 percent or more of the macrophytes are controlled (NALMS, 1997).

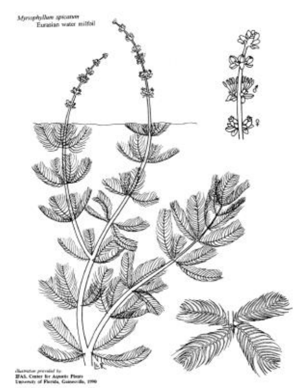
Aquatic plants also play a key role in the ecology of a lake system. Aquatic plants provide food and shelter for fish, wildlife and invertebrates. Plants also improve water quality by protecting shorelines and the lake bottom, improving water quality, adding to the aesthetic quality of the lake and impacting recreational activities.

Appendix C2 – Aquatic Invasive Species

INVASIVE AQUATIC PLANTS

Invasive species have invaded our backyards, forests, prairies, wetlands, and waters. Invasive species are often transplanted from other regions, even from across the globe. "A species is regarded as invasive if it has been introduced by human action to a location, area, or region where it did not previously occur naturally (i.e., is not native), becomes capable of establishing a breeding population in the new location without further intervention by humans, and spreads widely throughout the new location " (Source: WDNR website, Invasive Species, 2007). AIS include plants and animals that affect our lakes, rivers, and wetlands in negative ways. Once in their new environment, AIS often lack natural control mechanisms they may have had in their native ecosystem and may interfere with the native plant and animal interactions in their new "home". Some AIS have aggressive reproductive potential and contribute to ecological declines and problems for water based recreation and local economies. AIS often quickly become a problem in already disturbed lake ecosystems (i.e. one with relatively few native plant species). While native plants provide numerous benefits, AIS can contribute to ecological decline and financial constraints to manage problem infestations.

Eurasian Watermilfoil *(Myriophyllum spicatum)*



EWM is the most common AIS found in Wisconsin lakes. EWM was first discovered in southeast Wisconsin in the 1960's. During the 1980's, EWM began to spread to other lakes in southern Wisconsin and by 1993 it was common in 39 Wisconsin counties. EWM continues to spread across Wisconsin and is now found in the far northern portion of the state including Vilas County.

Unlike many other plants, EWM does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist (WDNR website, 2007).

Once established in an aquatic community, EWM reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, EWM is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of EWM provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl (WDNR website, 2007).

Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms of infested lakes (WDNR website, 2007).

Curly-leaf pondweed *(Potamogeton crispus)*

Curly-leaf pondweed (CLP) spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making CLP one of the first nuisance aquatic plants to emerge in the spring.

The leaves of curly-leaf pondweed are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early July.

CLP becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out-compete native plants in the spring. CLP forms surface mats that interfere with aquatic recreation in mid-summer, when most aquatic plants are growing, CLP plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches (WDNR website, 2007).

Purple Loosestrife (Lythrum salicaria)

Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth form. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers. Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months (WDNR website, 2007).

OTHER AQUATIC INVASIVE SPECIES

The following AIS are not plants, but are mentioned here because they also can significantly disrupt healthy aquatic ecosystems.

Rusty Crayfish *(Orconectes rusticus)* are large crustaceans that feed aggressively on aquatic plants, small invertebrates, small fish, and fish eggs. They can remove nearly all the aquatic vegetation from a lake, offsetting the balance of a lake ecosystem. More information about this invader can be found at http://dnr.wi.gov/invasives/fact/rusty.htm.

Zebra Mussels *(Dreissena polymorpha)* are small freshwater clams that can attach to hard substrates in water bodies, often forming large of thousands of individual mussels. They are prolific filter feeders, removing valuable phytoplankton from the water, which is the base of the food chain in an aquatic ecosystem. More information about this invader can be found at

http://dnr.wi.gov/invasives/fact/zebra.htm.

Spiny Water Fleas (*Bythotrephes cederstoemi)* are predatory zooplankton (tiny aquatic animals) that have a barbed tail making up most of their body length (one centimeter average). They compete with small fish for food supplies (zooplankton) and small fish cannot swallow the spiny water flea due to the long spiny appendage. More research is being completed to determine the potential impacts of the spiny water flea. More information about this invader can be found at

http://dnr.wi.gov/invasives/fact/spiny.htm.

Appendix D – Descriptions of Aquatic Plants

Appendix E – Summary of Aquatic Plant Management Alternatives

Appendix F – NR 107 and NR 109 Wisconsin Administrative Code

Appendix G – Resource for Additional Information

Appendix H – Aquatic Plant Management Strategy