Callahan and Mud Lakes Aquatic Plant Management Plan

Callahan - Mud Lakes Protective Association
Hayward, WI

Prepared for:

Callahan - Mud Lakes Protective Association
Hayward, WI

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Aquatic Plant Management Plan

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Purpose Statement

Callahan and Mud Lakes currently have nuisance stands of Eurasian water milfoil (EWM). The purpose of the Aquatic Plant Management Plan (APMP) is to outline a strategy to control EWM, protect native plant populations, and prevent the introduction of additional invasive species.

Goal Statement

The goal of the APMP is to control EWM and protect the native plant populations. In so doing the recreation on the lake will be maintained as well as the quality of the aquatic habitat and property values. The following specific goals are hoped to be achieved on Callahan and Mud lakes.

- Reduce the EWM to the percentage of lake surface as follows:
    - Less than 10% in Zones 1 and 2,
    - Less than 20% in Zones 3, 4 and 5
    - Less than 30% in Zones 6, 7 and 8
- Protect and expand the native plant populations.
- Protect the musky and other fish spawning habitat.
- Protect water quality and natural shoreline.
- Prevent the introduction of other aquatic invasive species.
- Educate the lake users on lake protection, aquatic invasives.

Inventory: Lake Information

Callahan and Mud lakes are drainage lakes on the North Fork Chief River located in Sawyer County in Sections 27, 28, 33, and 34, T 41 N, R 7 W. The lakes are formed by a water control structure located on the east end of Callahan Lake. The lakes are between Tiger Cat Flowage upstream and the Chippewa Flowage downstream. Mud Lake is 464 acres with a maximum depth of 15 feet and a mean depth of 6 feet. It flows south into Callahan Lake through several channels. Callahan Lake is 138 acres with a maximum depth of 18 feet and mean depth of 11 feet. The substrate of the lakes is predominately sand, muck and mucky sand. Callahan flows through the water control structure at the east end into North Fork Chief River. Figure 1 shows the locations of the lakes. A bathymetric maps of Callahan and Mud Lakes are included as Figures 2 and 3.

Watershed Description

The total drainage area contributing to Mud and Callahan Lakes is approximately 3,100 acres or 4.7 square miles. The total surface area of the lakes is 602 acres. The watershed contributing to the lake is relatively large compared to the size of the lake. The vast majority of the

watershed is forested; 2290 acres covering 74% of the watershed. The land use for the watershed is shown in the following table:

Table 1
Land Use in Watershed

Land Use	Area - ac	% of Watershed
Forested	2290.3	73.9
Agriculture	38.5	1.2
High Density Residential	8.9	0.3
Low Density Residential	55.6	1.8
Grass/Pasture	103.7	3.3
Lake	602	19.4
Total	**3099**	

Management History

Callahan and Mud Lakes have been actively managed for EWM since Fall 2007. They have been treated three times with 2-4,D granules. A concentration of 150 lbs/ac was used for each treatment. Table 2 lists the treatment date, area that was treated and treatment location.

Table 2
EWM Treatment History

Date	Area	Location
Fall 2007 (Sept 14)	2 ac	East shoreline Callahan near outlet
Spring 2008 (June 16)	16 ac	East half of Callahan - North and South shore.
Spring 2009 (June 1)	23 ac	South-central Mud and Northwest Callahan near islands
Total	**41 ac**	

Approximately 41 acres of EWM have been treated in 2007 through 2009. According to the survey completed in 2008 108 acres of EWM remains in the lake. Figure 4 - EWM Density and Treated Areas - Callahan Lake and Figure 5 - EWM Density and Treated Areas - Mud Lake indicate the sample locations where EWM was found, the density rating of EWM and locations that have been treated. The sample locations and EWM Density rating are based on the information provided in the 2008 aquatic plant survey. The density of the EWM was rated based on the amount that was collected with a rake. A rating of 1 indicates low density (few plants on rake) and a rating of 3 indicates high density (rake completely covered). The treatment locations shown in Figures 4 and 5 were located using GPS coordinates and hand drawn maps.

The EWM treatments using 2,4-D have been found to be very effective on these lakes. Both the fall and spring treatments were found to be equally effective. A visual survey was conducted after each treatment by the Sawyer County Aquatic Invasive Species (AIS) Coordinator. According to these visual surveys very few EWM plants were found in the treated areas. Joe Lewandowski of the Association also conducted weekly visual monitoring of the treated areas in 2009 and led a team of visual plant observers in 2008.

Plant Community

An aquatic plant survey was completed by Jeremy Williamson in August 2008. The following information was taken from this report. The report is included in Appendix A.

A total of 28 species were identified in the survey. Table 3 below lists the aquatic plants found in the survey in the order of abundance:

The Floristic Quality Index (FQI) was used to assess the lake quality using the plants that were found in the survey. This index is commonly used by biologist to evaluate the integrity of a plant community. This value is calculated using the number of species found then giving each species a rating called the coefficient of conservatism (C). The C value indicates how typical this plant is of pristine conditions; the higher the C value the more pristine the conditions and the higher the FQI the better the lake quality. Plants found only in clear, low nutrient, undisturbed conditions have a high rating of 10; plants found in nutrient rich, disturbed waters have a lower value (0 is the lowest value). Wisconsin lakes generally have a FQI between 3.0 and 44.6 with 22.2 being the median. Lakes located in the Northern Lakes and Forests region of the state have a median FQI of 24.3 (Nichols, 1999). Callahan and Mud lakes have a FQI of 29.8, which is above both these median values. This indicates higher floristic integrity with relatively little disturbance. There were several species found in the lake that had a high C value of 10. Table 3 shows the C value of each plant species found in the lake. All but 2 species had a value equal to or greater than 5. The common plants, coontail and common waterweed, have a value of 3. Robbins spike rush and floating leaf bur-reed have a value of 10.

Table 3
Aquatic Vegetation in Callahan and Mud Lakes
August 2008

Species	Common Name	Relative Frequency	C Value
Potamogeton robbinsii	Robbins pondweed	18.7	8
Elodea canadensis	Common waterweed	15.0	3
Potamogeton zosteriformis	Flat-stem pondweed	12.7	6
Potamogeton amplifolius	Large-leaf pondweed	10.9	7
Ceratophyllum demersum	Coontail	9.5	3
Vallisneria americana	Wild celery	6.5	6
Potamogeton pusillus	Small pondweed	5.4	7
Myriophyllum spicatum	Eurasian watermilfoil	3.7	NL
Potamogeton praelongis	White-stem pondweed	3.3	8
Myriophyllum sibericum	Northern water-milfoil	2.5	7
Najas flexilis	Bushy pondweed	2.2	6
Megalodonta beckii	Water marigold	1.6	8
Potamogeton richardsonii	Clasping-leaf pondweed	1.4	5

Potamogeton gramineus	Variable pondweed	1.1	7
Brasenia schreberi	Watershield	0.9	7
Nymphaea odorata	White water lily	0.9	6
Nuphar variegata	Spatterdock	0.7	6
Utricularia vulgaris	Common bladderwort	0.7	7
Chara	Muskgrasses	0.6	7
Spirodela polyrhiza	Large Duckweed	0.6	5
Zosterella dubia (*Heteranthera dubia*)	Water stargrass	0.4	6
	Filamentous algae	0.3	NL
Pontederia cordata	Pickerelweed	0.1	9
Potamogeton natans	Floating-leaf	0.1	5
Eleocharis robinsii *	Robbins' spike-rush	0.0	10
Sparganium fluctuans	Floating-leaf-bur-reed	0.0	10
Sparganium angustifolium	Narrow-leaved bur-reed	Visual - 2 sites	9
Polygonum amphibium	Water smartweed	Visual - 1 site	5

NL – not listed
* State Special Concern species

Figures 4 and 5 show the locations of the vegetation sample points and the types of plants at each point. The plants are broken into four categories: floating leaf, emergent, submergent and EWM. The symbols on the map indicate the type of plant found at each sample point.

A mixture of submergent and emergent plants was found. Eighteen species of submergent plants, four species of floating-leaf, four species of emergent plants and two species of free-floating plants were found. The submergent plants were found throughout Mud Lake and throughout Callahan Lake where the water was generally less than 17.5 feet deep. The substrate was generally muck, sand and sandy muck. The emergent plants were found along the shorelines in shallow water. Tables 4 and 5 (located in Tables Section) list the statistics that were calculated using the collected data. Figures 6 and 7 show the locations of the EWM, emergent, submergent, and floating leaf vegetation for Callahan and Mud Lakes respectively.

EWM was found in stands throughout Callahan and Mud Lakes. According to calculations from the 2008 survey approximately 55 acres of EWM was mapped in Callahan and 109 acres in Mud. The EWM covers approximately 40% of the surface area of Callahan and 24 % of Mud Lake. The points where EWM was found were rated on a scale of 1 to 3 for density; 1 being low and 3 being high density of EWM plants. The following table lists the percent rating based on total points with EWM.

Table 6
EWM Density Rating Based on Total Points with EWM

Density	1	2	3
Callahan %	71	19	9
Mud %	91	8	1

The data in Table 6 indicates that the stands of EWM have a low density of plants with a mix of native vegetation in most stands.

Fisheries & Wildlife Habitat

Callahan and Mud Lakes support a warm water fishery. According to Frank Pratt, Jr., DNR fisheries biologist, the fish community is dominated by largemouth bass with a dense population of wild, slow-growing muskellunge. Bluegills are abundant and slow-growing. Also present are pumpkinseed, rock bass, black crappie, white sucker, yellow perch, and black bullhead. A few old, large walleye are present from past stocking events. According to lake users northern pike are present in the lake; DNR has documented northern in the Tiger Cat Flowage. The lake is a popular fishing lake for bass, musky and panfish. The stands of native plants in the lake provide excellent fish habitat.

A recent GIS model was created for the lake that predicts spawning habitat for muskellunge on northern Wisconsin lakes. A map depicting the probability of spawning habitat on the lakes is included in Figure 8. Joel Nohner, a graduate student from University of Michigan, created the map using a GIS model based on habitat preferences of spawning musky in northern Wisconsin lakes. This map is a good tool to use to determine the extent and type of EWM control that may be used.

A review of the Natural Heritage Inventory maps was conducted to determine the presence of endangered resources near/in the lake. The maps indicate at least one aquatic record in sections 33 and 27 and at least one terrestrial record in section 27. Bald eagles are known to nest on the lake. The far north end of the lake is mapped as wolf pack territory. The wooded watershed of the lake provides habitat for an array of woodland plants and animals. The aquatic plant survey that was conducted in 2008 indicated *Eleocharis robinsii,* a State Special Concern species, was present.

Water Quality

Callahan and Mud Lakes are mesotrophic drainage lakes. Limited water quality data is available for the lakes. Two studies were conducted in the past, one on each lake. The first was in July 1979 on Callahan Lake; the second was in August 2007 on Mud Lake. Water quality data was also collected in Summer 2009. Al Zeitlow and Denny Toll were trained by Chris Hanson under the Citizen Lake Monitoring Network in August 2009 to conduct water quality testing. At the deep hole in Callahan Secchi disk, temperature and dissolved oxygen readings were taken and samples were collected for chlorophyll a and phosphorus. The results of all testing as posted on the DNR website are presented below.

Table 7
Water Quality Callahan and Mud Lakes

Lake	Date	TP mg/l	CHL mg/l	SD ft	TP TSI	CHL TSI	SD TSI
Callahan	7-20-79	8	3.23		44	44	
Callahan	7-31-09	21	2.64		52	42	
Callahan	8-30-09	13	2.51		48	42	
Mud	8-7-07	15	2.6	6.4	49	42	50

TP – total phosphorus
CHL – chlorophyll a
SD – Secchi depth
TSI – trophic status index

Temperature and dissolved oxygen (DO) data was also collected on Mud Lake. The data is included in the following table.

Table 8
Dissolved Oxygen and Temperature
Mud Lake August 2007

Depth m	Temp C	DO mg/l
0.5	24.1	7.6
1	24.1	7.6
2	23.9	7.4
3	23.6	6.1
3.5	23.6	6.1

Nutrients

The nutrients that have the greatest impact on vegetation in a lake are phosphorus and nitrogen. Total phosphorus is used to measure the lakes nutrient status. Phosphorus promotes plant growth and is the key nutrient affecting the amount of algae and weed growth. Sources of phosphorus include human and animal wastes, fertilizers, septic systems and decaying plants. Nitrogen is the second most important nutrient in a lake for plant and algae growth. Sources of nitrogen include fertilizer, human and animal waste and groundwater.

Water Clarity

Water clarity is a measure of water quality related to algal abundance and general lake productivity. The following properties can affect the clarity or transparency of water: algae, zooplankton, water color and suspended sediments with algae commonly the most dominant factor in water clarity. Water clarity is commonly measured using a Secchi disk. This black and white disk is lowered into the water until it can no longer be seen from the surface, this depth is then recorded. The Secchi depth in August 2007 for Mud Lake was 6.4 feet indicating mesotrophic status.

Water Use

The lake is used for recreation such as boating, fishing and swimming. There is one public boat landing located up the Chief River. There is a private boat landing at a resort that gets moderate use on the south east shore of Callahan Lake. There are three resorts on the lake. The majority of the shoreline in Mud Lake is undeveloped and in a natural state. Callahan Lake has higher development but the majority of the shoreline is natural. There are no known uses of potable water or irrigation use from the lake.

Analysis

The objective of the APMP is to protect the native vegetation that exists in the lake and manage the EWM stands that are present. The native plants are important to the lake ecosystem and provide food and habitat to all the aquatic animals and waterfowl that use the lake. Once EWM is in a lake there are a number of methods that can be used to control vegetation based on the density and area of the stands. If individual plants are found they can be hand pulled and disposed of on land. If larger isolated stands are found chemical treatment can be a cost effective, viable method of control. If large areas of the lake are infested a variety of chemical treatment options may be used but can get very expensive. Other methods include harvesting, whole-lake chemical treatments, drawdown, dredging and milfoil weevils. This section will discuss the options that are available based on the information collected above.

Alternative Treatments

Some type of aquatic vegetation management is needed to reach the goals and objectives for these lakes. There are many alternative treatments available to manage vegetation; only the viable alternatives for this lake are discussed below.

There are five treatment options for aquatic plant control: no treatment, mechanical, physical, biological and chemical. These options contain several methods as listed after each option.

No Management – do not actively manage plants.

Pros

- Minimizing disturbance can protect native plants, may limit spread of invasives by protecting natives
- No immediate financial cost
- No system disturbance
- No unintended effects of chemicals
- Permit not required

Cons

- May allow small populations of invasives to become larger and more difficult to control later.
- Excessive plant growth can hamper navigation and recreational use

This is not an appropriate option for these lakes. The EWM has already spread throughout the lake and is causing navigational and recreation issues. Treatment has been proven effective. The area that is affected by EWM is still manageable, not treating will cause the EWM to spread and possibly become too large to treat.

Mechanical Control – plants reduced by mechanical means with a wide range of techniques including handpulling/raking and harvesting.

Pros

- Flexible control
- Can balance habitat and recreational needs

Cons

- Must be repeated often, more than once per season
- Can suspend sediment and increase turbidity and nutrient release

Handpulling/Manual Raking – SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake. Works best in soft sediment.

Pros

- Little to no damage done to lake or to native plants
- Can be highly selective
- Can be done by shoreline property owners without permits where removing exotics
- Can be very effective at removing problem plants post treatment or in early detection.

Cons

- Very labor intensive
- Needs to be carefully monitored
- Roots, runners and fragments will start new plants, need to remove entire plant
- Small scale control only

This is an appropriate option that individual shoreland owners could implement if small stands are detected. It may also be used in areas that have been treated and have a few remaining plants and is recommended in the spawning areas that have light populations of EWM.

Harvesting – plants are mowed at depth of 2-5 feet, collected on a conveyor and off-loaded onto shore.

Pros

- Immediate results
- EWM removed before is has the opportunity to auto fragment
- Minimal impact to lake ecology
- Can remove some nutrients from the lake

Cons

- Not selective in species removal
- Fragments of EWM can re-root

- Can remove small fish and reptiles
- Initial cost of harvester expensive

This is not an appropriate option for these lakes. The EWM is present throughout the lake but not in high densities. Harvesting would likely spread the EWM beyond where it currently is. Harvesting would disturb the native vegetation that may lead to the further spread of EWM.

Biological Control – living organisms eat or infect plants. Techniques include weevils, pathogens, allelopathy, planting native plants.

Pros

- Self-sustaining; organisms will overwinter, resume eating its host the next year
- Lower density of problem plants to allow growth of natives

Cons

- Effectiveness will vary as control agents population fluctuate
- Provides moderate control
- Control response may be slow
- Must have enough control agent to be effective

Weevils – Native weevil prefers EWM to other native water milfoil.

Pros

- Native to Wisconsin, can not escape and become a problem
- Selective control of target species
- Longer-term control with limited management

Cons

- Need to stock large numbers, even if some are already present
- Need good habitat for overwintering on shore
- Bluegill populations decrease density through predation

This may be an appropriate option to use in conjunction with other treatments. This may be a good option in the spawning areas with lower density of EWM. The abundant bluegill population may cause high predation and decimate the weevil population. The undeveloped shoreline would be good habitat for the weevils and ensure survival into the following seasons.

Physical Control – plants are reduced by altering variables that affect growth such as water depth or light levels. Methods include fabric/bottom barriers, drawdown, dredging, dyes, non-point source nutrient control.

Drawdown – lake water level lowered; plants killed when sediment dries, compacts or freezes.

Pros

- Winter drawdown can be effective at restoration, provided drying and freezing occur
- Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction
- Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization and increased water quality
- Success demonstrated for reducing EWM
- Restores natural water fluctuation important for aquatic ecosystem

Cons

- Plants with large seed bank or propagates that survive drawdown may become more abundant upon refilling
- May impact attached wetlands and shallow wells
- Species growing in deep water that survive may increase, particularly if desirable natives are reduced
- Can affect fish in shallow lake if oxygen levels drop
- Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians
- Navigation and use of lake limited during drawdown

This is not a viable option considering the limited drawdown allowed by the current water control structure. The control structure consists of a dike and a spillway with no gates to control water levels.

Chemical Control – granules or liquid chemicals kill plants or cease plant growth. Chemicals include 2,4-D, endothall, diquat, fluridone, glysophate, triclopyr and copper compound.

Pros

- Some flexibility for different situations
- Some can be selective if applied correctly
- Can be used for restoration activities

Cons

- Possible toxicity to aquatic animals or humans
- May kill desirable plant species
- Treatment set-back requirements from potable water sources
- May cause severe drop in dissolved oxygen causing fish kills

2,4-D – systemic herbicide selective to broadleaf plants that inhibits cell division of new tissue. Applied as liquid or granular during early growth phase.

Pros

- Moderately to highly effective, especially on EWM
- Monocots such as pondweeds and many other natives are not affected
- Can be selective depending on concentration and seasonal timing
- Can be used in synergy with endothall for early season EWM treatments
- Widely used aquatic herbicide

Cons

- May cause oxygen depletion after plants die and decompose
- May kill native dicots such as pond lilies and other submerged species
- Cannot be used in combination with copper herbicides
- Toxic to fish

This is an appropriate option for these lakes. 2,4-D has been used in previous treatments with very good success.

Endothall – broad-spectrum, contact, herbicide that inhibits protein synthesis. Applied as liquid or granules.

Pros

- Especially effective on CLP and also effective on EWM
- Can be selective depending on concentration and seasonal timing
- Can be combined with 2,4-D for early season EWM treatments
- Limited off-site drift

Cons

- Kills many native pondweeds
- Not as effective in dense plant beds; requires several applications
- Not to be used in water supplies
- Toxic to aquatic fauna

This is an appropriate option for these lakes. It may be used in conjunction with 2,4-D. Native populations of pondweeds may be impacted; considering the high population of pondweeds in lakes may not be best option. Several applications may be needed to gain control in dense beds.

Diquat – broad-spectrum, contact herbicide that disrupts cell function. Applied as liquid, can be combined with copper treatment

Pros

- Mostly used for EWM and duckweed
- Rapid action
- Limited direct toxicity on fish and other animals

Cons

- May impact non-target plants, especially pondweeds, coontail, elodea, naiads
- Toxic to aquatic invertebrates
- Must be reapplied several years in a row
- Ineffective in muddy or cold water

This is an appropriate option for these lakes. Native populations of pondweeds may be impacted; considering the high population of pondweeds in lakes may not be best option. Several applications may be needed to gain control.

Fluridone – broad-spectrum, systemic herbicide that inhibits photosynthesis. Must be applied during early growth stages. Available with special permit only. Applied at very low concentration at whole lake scale.

Pros

- Effective on EWM for 1 to 4 years with aggressive follow up treatments
- Some reduction in non-target effects can be achieved by lowering dosage
- Slow decomposition of plants may limit decreases in dissolved oxygen
- Low toxicity to aquatic animals

Cons

- Affects non-target plants, including milfoils, coontail, elodea and naiad; even at low concentrations
- Requires long contact time at low doses; 60 to 90 days

This is not an appropriate option for a whole lake treatment. The contact time would be difficult to achieved due to the flowage system. It would also impact the native populations to a great extent.

EWM in Callahan and Mud Lakes

Eurasian watermilfoil (EWM) is an exotic invasive aquatic plant species that can cause a variety of problems on lakes. It is an aggressive plant that out competes native vegetation thereby displacing these populations. EWM grows in dense stands that form thick mats that reduce or eliminate navigation and provide cover too heavy and thick for many fish species. EWM grows quickly in early spring and shades the slower growing native plants, thereby stunting their growth and displacing them. Small patches of EWM can quickly grow into large stands if left untreated. Once EWM is in a lake it is there to stay, it can not be eradicated.

According to the aquatic plant survey completed in 2008 there is approximately 108 acres of EWM in the lakes. Over the last several years (2007 to 2009) 41 acres have been treated. The average cost of treating one acre of EWM with 2,4-D pellets is approximately $650/ac. At this rate the amount of funding needed to treat the EWM in the lake as of 2008 is $70,289. Since the Association does not currently have the funding to treat the entire lake at once the lake has been divided into zones and ranked for treatment.

The lake has been divided into eight zones; they are listed in the order in which they should be considered for treatment. Ranking was based on a number of factors including amount of use, type of use, location, potential to spread EWM, and lake user input. The zones that receive the most use and traffic were ranked near the top. The following table lists the zones that contain EWM and should be considered for treatment.

Table 9
Proposed EWM Treatment Zones

Zone	Area (ac) EWM 2008	Cost
1	5.9	$3,811
2	9.0	$5,874
3	17.4	$11,327
4	36.3	$23,577
5	1.7	$1,105
6	11.4	$7,400
7	26.5	$17,194
8		
Total	**108.1**	**$70,289**

Figure 9 - Callahan and Mud Lake Priority Zones indicate the zones and the EWM locations.

Recommendations

Ensuring a successful APMP requires planning and organization. The following general recommendations will help the process to go smoothly.

- Conduct regular meetings to inform the lake users and collect input.
- Form committees to oversee planning, treatment and finances.
- Contact DNR and County AIS Coordinator to discuss grants, actions and each party's responsibilities.
- Appoint a regular contact for the chemical applicator and divers to discuss treatments.
- Apply for grants to fund treatments, have fund raisers to support projects, prepare budget including tasks and costs for each years proposed activities/treatments. Since treatments will likely be needed each year and grant funding may not be obtained on an annual basis funds should be set aside for a continuing maintenance control program.
- Educate lake users by keeping website up to date with activities, send regular newsletters, and provide training for monitoring.

The following specific recommendations are made for this lake. These will aid in the control of EWM and education of the lake users.

Continue 2-4,D (Navigate) applications to gain control of EWM

EWM is currently widespread throughout the lake. Treatments using 2,4-D have been used with great success over the last several years (2007-2009). A total of 41 acres of EWM has already been treated with 2,4-D. Great results have been seen in many treatment areas with nearly 100% kill rate of EWM; these treatment areas now have thick stands of native vegetation with few scattered EWM plants. The Sawyer County AIS Coordinator and the chemical applicator do not regularly see this high level of control on area lakes using this method. Since this has been so effective on this lake it is recommended that this treatment continue.

The zone table below prioritizes the treatment locations. Each year prior to planning treatment an aquatic plant survey should be conducted to determine the extent of the EWM in the lakes at that time. This survey will be conducted by the Association/Sawyer County AIS Coordinator/Consultant based on available funding. The zone table should be updated with EWM areas to determine which zones can be treated based on the budget. The zones are a guide to aid in determination of which areas should be treated and where attention should be focused. The actual areas that will be treated will be determined annually based on funding and the locations/density/nuisance level of the EWM stands. If funding is obtained through a grant several zones may receive treatment. If funding is not obtained through a grant the Association plans to treat a maximum of 10 acres; the actual acreage treated will be based on the available funding for that year. The Association will decide which areas will be treated based on locations/density/nuisance level of the EWM stands. The treatments may be conducted in the Spring or Fall; both have been proven successful on these lakes.

Table 10
Recommended Treatment Zones

Zone	Zone Area (ac)	EWM 2008 Area (ac)	Current EWM % Area	Goal EWM % Area	Goal EWM Area (ac)	Cost 2,4-D Treatment for Goal
1	53	6	11	10	5	$650
2	78	9	12	10	8	$650
3	60	17	29	20	12	$3,250
4	77	36	47	20	15	$13,650
5	20	2	8	20	4	*
6	72	4	5	30	22	*
7	131	11	9	30	52	*
8	113	22	20	30	34	*

* Currently at or below goal

When chemical treatment is used sub-sampling must be completed to evaluate the effectiveness of the treatment. When the areas (polygons) that will be treated are determined a refined plant community analysis must be performed. The sampling must be done before treatment is performed. If treatment is planned early in the spring the sampling should be completed the prior summer. For small scale projects (less than 10 acres) five polygons must be surveyed. Large scale projects require 10 polygons. Within each of the five (or ten) areas, sample ten points 20 meters apart. Identify the points by GPS coordinates. The DNR protocol for post treatment sampling is included in Appendix B.

The costs for the monitoring should be included in the budget and any grants that are applied for. If funding allows, a consultant should conduct the formal sub-sampling according to DNR protocol. If funding does not allow the hiring of a consultant, Sawyer County AIS Coordinator should be contacted to work with the Association to complete the sub-sampling.

Contract with divers to pull plants from treated areas

Great control has been seen in areas that have been treated with 2,4-D. However there are areas where several EWM plants have been found in the treated areas. To prevent these individual plants or small colonies from spreading hand pulling by divers is recommended.

Contact has been made with Al Windsor of Windsor Diving in Hayward. He is willing to meet with the Association to assess the feasibility of diving and prepare a cost estimate to have divers pull individual plants in the treated areas. The Association would assist the divers to reduce costs by the following tasks.

- Provide a boat and several people to assist the divers.
- Provide collection bins for the plants and dispose of plants.
- Mark the locations of plants to be pulled.
- Transport divers around lake.

Treatment by hand pulling should be assessed each year through the aquatic plant survey. Any areas that have small colonies of EWM with light density should be considered. This includes

areas that have not been treated with 2,4-D and areas that have been treated and have a few individual EWM plants that have emerged. The documented musky spawning sites should be considered for hand-pulling treatment.

Conduct a survey for weevils

Contact Sawyer County Invasive Species Coordinator to conduct a survey of weevil populations on the lakes. These naturally occurring insects can be very effective at controlling EWM under certain conditions. Determining if the weevils naturally occur in this lake would be useful information to determine if they may be successful at controlling EWM in these lakes.

Apply for AIS Grant to control established populations

A multi-year grant to treat EWM areas is recommended. The grant can be written to request the amount of money that would be needed to cover the expenses of treatment using 2,4-D and divers, pre and post-treatment surveying, report preparation and education efforts. The tasks should be spread over several years to meet the Associations budget.

Annual Visual Survey

Monitoring of the lake for invasives is vital to preventing new infestations and limiting the spread of EWM. Monitoring of the vegetation should be done on a regular basis. Each spring the lakes should be inspected with a visual survey, paying special attention to the area near the boat landing. EWM grows quickly and will likely be evident before the native vegetation can readily be seen. Point-intercept surveys should be redone and management plans should be updated approximately every five years. This will provide information that can be statistically analyzed to track trends in the vegetation.

Train several individuals in the Citizen Lake Monitoring Network to detect other invasives. Special attention should be given to surveys for purple loosestrife. This invasive has been documented upstream of the lakes. Monitor the wetland areas along the lake shore annually and remove any young plants that are found. The plants are easily identified when they are flowering but need to be removed before the seeds drop to prevent further spread. Dispose of plants and seeds by land filling, drying or burning. The following websites provide further information: http://dnr.wi.gov/invasives/fact/loosecontrol.htm.

Begin CBCW Program

All boat landings should be involved in the Clean Boats Clean Waters program. This will aid in the education of boaters to prevent new invasives species from entering the lake and prevent the spread of EWM to other waters. The program works by inspecting boats for vegetation and other invaders before they are launched and by educating the boaters on the spread of the invasives. This program has been proven to be very effective. It is best to have a group at the landing during the busiest times, such as on weekends and holidays. This is also the most difficult time to find volunteers to conduct the inspections. As many people as possible should be trained in the inspection process to ensure adequate staffing during these busy times.

Post signs at all boat landings

Educational material should be posted and available at the boat landings. A kiosk with

brochures on aquatic invasives is a great way to distribute material. Signs should be posted warning users of the invasives present in the lake to prevent the spread to other area lakes.

Lake Fair

A great way to educate people and get them involved in protecting the lake it through a lake fair. This can be presented by an individual association or members from several area lakes can join to conduct a large fair. Members of the Associations as well as the general public should be invited to participate. Representatives from DNR, County zoning, County land conservation, NRCS (Natural Resource Conservation Service), Sawyer County Lakes Forum and UW-Extension would likely be happy to participate and provide information on all topics of lake protection from shoreland protection/restoration to invasive species.

Protect Water Quality, Natural Shoreline and Native Plant Populations

The lakes currently have good water quality, substantial natural shorelines and native plant populations. Steps should be taken to maintain and protect these valuable features. Information on all of these steps can be obtained at the DNR website or through County AIS Coordinator. The following should be considered.

- Water quality on the lakes can be protected through education of the lake users and lakeshore owners. Reduce runoff, sediment and nutrient loading by reducing impervious areas and maintaining buffers along the lake shore. Reduce/eliminate fertilizer applications on lawns.

- Protect existing undeveloped, natural shorelines. Restore native vegetation to shorelines and maintain a natural buffer of at least 35 feet from the shoreline.

- The lakes have a healthy native plant population where the EWM is not present. In areas that have been treated with 2,4-D the EWM has been removed and the native plants dominate. Removing the EWM through treatments is the recommended way to protect/expand the native plant population. In discussions with DNR there is no restriction on treatments areas based on rare/endangered plant populations.

Protect Musky/Fish Spawning Habitat

Figure 8 indicates the areas of musky spawning habitat. If these areas require treatment care should be taken in choosing the treatment method. The areas with documented spawning activity should be treated by hand pulling small stands. The larger EWM stands that can not be hand pulled should be treated with low doses of 2,4-D outside of the spawning season (mid-April to late-May).

Implementing this Plan

Following are the steps recommended to implement this plan.

Step 1: Formally adopt this Aquatic Plant Management Plan.

Step 2: Discuss grant process with DNR/County AIS Coordinator/Consultant. AIS Control Grant deadline is February 1 and August 1 of each year.

Step 3: Determine zones that require treatment. Conduct annual aquatic plant survey to determine areas of EWM in each zone. Determine type of treatment required for zones.

Step 4: Prepare grant application for treating zones. See Appendix B for detailed information on AIS Control grants and treatment specific requirements.

Step 5: If grant is awarded continue as planned. If grant is not awarded determine which areas may be treated with available funds.

Step 6: Repeat Steps 2 through 5 on an annual or as needed basis.

Step 7: Form committee to discuss and plan lake fair, CBCW program and sign posting.

The following table lists the tasks that should be completed and the approximate time.

Month	Task
January	- Prepare final February grant
February	- Grants Due
March	- Committee meetings to plan activities for the year
April	- Conduct Association meeting to plan activities for the year
May	- Contact DNR/Sawyer County AIS Coordinator to discuss August grants - Conduct plant surveys to determine treatment areas - Conduct pre-treatment sub-sampling for areas to be treated in June - Conduct post-treatment sub-sampling for areas treated in October
June	- Begin preparation of August grant - Treat EWM areas
July	- Finalize August grant
August	- Grants Due
September	- Conduct post treatment sub-sampling on areas treated in June - Conduct plant survey to determine areas to be treated following year
October	- Conduct fall treatments on EWM areas
November	- Contact DNR/Sawyer County AIS Coordinator to discuss February grants
December	- Begin preparation of February grant

Monitoring and Evaluation

Monitoring and evaluation of the plan is critical to successful management of the lake. The treatments need to be evaluated to determine if they are accomplishing the goals of the plan. If the goals are not being met with the recommended treatment (2,4-D and hand-pulling) the goals may be revised or other treatment actions may be considered.

To evaluate the effects of treatments on the lake and the plant community the following steps should be taken (UW-Extension website). Additional information is included in Appendix B.:

Water Quality

- Collect pH, dissolved oxygen (DO) on day of treatment and several dates post treatment.
- Measure standard water quality parameters (DO, temperature, and pH) in the lake during pre and post treatment period.
- In areas where the depth of the treated area is less than 10 feet and the area treated is greater than 10 acres collect weekly DO profiles for four weeks following treatment.

Plant Community

- Assess effectiveness of treatment after treatment has taken effect and prior to end of growing season using DNR protocol for pre and post-treatment sub-sampling. Protocol included in Appendix B.
- Resample polygons surveyed prior to treatment using same GPS points and reporting form.
- Calculate the cost per area of treatment.
- Evaluate the effectiveness of the treatments and the cost for the treatment. If treatment is not meeting the goals or is not cost effective meet with stakeholders/consultant/treatment firm/AIS coordinator to look at alternatives.

Public Input

A presentation was given by Tiffiney Kleczewski, Water Resources Engineer, Ayres Associates to the Callahan – Mud Lakes Protective Association on September 19, 2009. The aquatic plant management plan was discussed. A summary of each section of the plan was presented and open to discussion. General comments were received.

References:

1. Nichols, Stanley A. (1999). Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. *Journal of Lake and Reservoir Management, 15(2),* 133-141.

2. Department of Natural Resources website, Glossary of Lake and Water Terms. Retrieved February 19, 2009 from http://www.dnr.state.wi.us/org/water/fhp/lakes/laketerm.htm.

3. UW-Extension website, Aquatic Plant Management in Wisconsin publication. http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp