Date: 3.9.2017 (Revisions 3.28.2017, 10.19.2017, 12.29.2017, & 1.18.2018)

To: Wisconsin Department of Natural Resources

From: Cisco Chain Riparian Owners Association

Prepared By: Many Waters, LLC
2427 Lake Ottawa Road
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Re: Revision to “Comprehensive Management Plan for Cisco Chain of Lakes” Big, West Bay and Mamie Lakes, Sigurd Olson Environmental Institute-Northland College, 2016.

This document provides revisions to Goal 6: “Maintain Diverse Native Plant Communities” (pg 60) relating to aquatic invasive species management and Appendix E “Aquatic Plant Assessment and Management Plan” relating to “management of existing invasive species.” Furthermore, this document sets an adaptive framework for making aquatic invasive management decisions, and updates existing Eurasian watermilfoil (EWM) conditions for Big Lake.

Goal 6 – Maintain Diverse Native Plant Communities

Specific proposed changes to existing plan: Strike second paragraph from page 60 regarding Big Lake and add information below to current language.

Overview

Diverse in-lake and shoreland habitats provide stable ecosystems capable of absorbing disturbance and resist shifts towards low diversity, less stable ecosystems. Threats to these diverse habitats include shoreland development, new aquatic invasive species introductions, existing invasive species, and their subsequent management. Over the long term, measuring parameters that link stability to long-term health can allow managers to adapt management strategies to preserve or improve upon existing conditions. Specific actions to “monitoring and maintaining the diversity of native aquatic plants” are found in Appendix E. Maintaining healthy diverse aquatic plant communities in the long term should address the importance of nutrient management and habitat protection and restoration. Specific information regarding nutrient management and habitat protection can be found in Appendix C – Shoreline Habitat Assessment and Management Plan, pg 102 and Appendix D – Watershed Assessment and Management Plan, pg 118.

Management of aquatic invasive species shall provide benefits to the use and ecological function of a waterway and its adjacent watershed. It should include the use of control techniques that support the best use of resources, are best fit and adaptive to address the expansion/reduction at that time, follow well accepted best management practices and are most likely to result in long-term control. This approach will recognize that current and potential future introductions of invasive species may need to be monitored and/or managed for depending on the degree of infestation and locations within the water bodies. This approach also recognizes that the level of appropriate actions should be debatable and include discourse on the ecological and social context. It is important to acknowledge that annual variation to native and invasive aquatic plant community occurs, even in the event of no management.

Management of aquatic invasive species (AIS) is supported in:

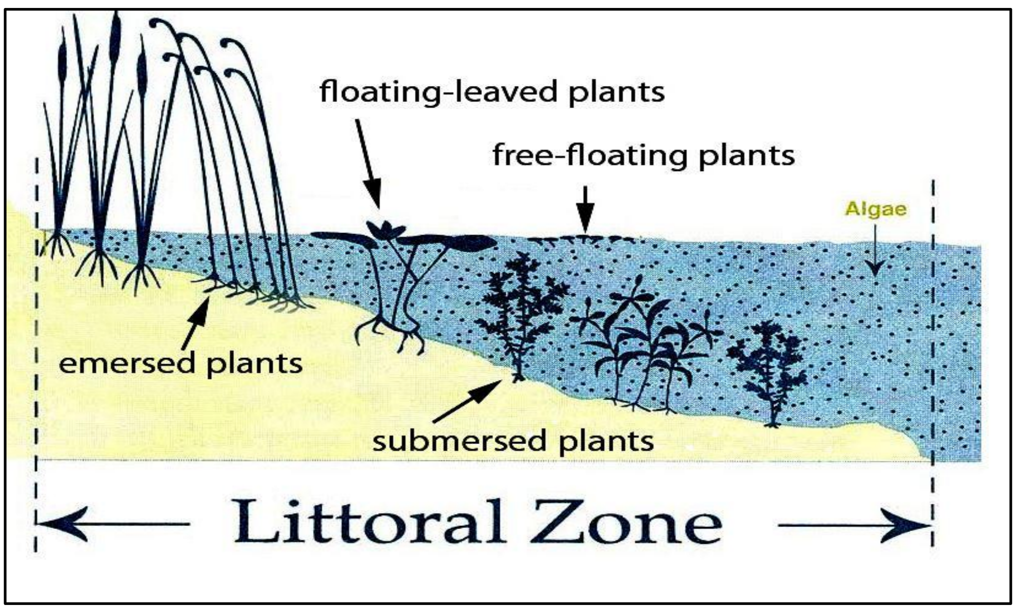
- Michigan Department of Natural Resources: Ontonagon River Assessment Fisheries Division Special Report 46
- Wisconsin Invasive Species Council: Statewide Strategic Plan for Invasive Species 2013-2016
- Vilas County Land and Water Resource Management Plan (2015-2024)
- Michigan Aquatic Invasive Species Management Plan (Objective XIII.D)
- National Invasive Species Management Plan (Objective CM.2)

Specific proposed changes to existing plan: Addition of language under **"Aquatic Plants"** to existing plan providing background to the aquatic plant ecology, management strategies, and techniques.

Aquatic Plants

Aquatic Plant Ecology and Management

Some lake users may consider aquatic plants a nuisance and aesthetically displeasing, however, aquatic plants play a large role in the health of a lake's ecosystem. Aquatic plants provide habitat and food sources for fish, mammals, birds, insects, and amphibians. In addition, aquatic plants replenish lakes with oxygen, stabilize sediment, minimize erosion, and filter water. Aquatic plants are limited to areas of a lake where light can penetrate to the bottom; this area is commonly referred to as the littoral zone and is where most aquatic life lives. Additional factors that affect the distribution, abundance, and types of aquatic plants present in a lake include water levels, water temperature, sediment type, wave action, and nutrients.



Taken from http://plants.ifas.ufl.edu/

Categories of Aquatic Plants

Emergent Plants

Emergent plants, typically associated with the shallowest portion of the littoral zone, tolerate fluctuating water levels and usually root along the edge of the lake. They naturally protect shorelines from erosion by reducing wave action and their roots create a woven barrier that stabilizes sediments. In many cases, these plants are those that are most impacted with shoreline development. Examples of emergent plants include cattails, bulrushes, and irises.


Near-shore Emergent Vegetation

Floating Leaf Plants

Floating leaf plants gradually replace emergent plants as water depth increases. Floating leaf plants common to the Upper Peninsula of Michigan have circular shaped leaves with a leathery texture to resist tearing from waves and wind, which also makes them ideal to dissipate wave energy reaching the shore. Common floating leaf plants include white water lilies, pond lilies and the American lotus.

Free Floating Plants

Like their name suggests, free-floating plants are not rooted in the lakebed and are easily transported to and from portions of a lake. These plants include duckweed and some bladderworts. The smallest known flowering plant in the world is the free-floating aquatic plant watermeal (*Wolffia*). In addition, duckweed is an important food resource to waterfowl, particularly dabbling ducks.

Submersed Plants

A very diverse group of plants found in both shallow and deeper portions of the littoral zone are submersed aquatic plants. The leaves of these plants are thin and many times highly divided. This trait increases the surface area-to-volume ratio allowing these plants to live in areas of the lake that receive less light. These plants provide spawning structure for many species of fish and provide refuge for juvenile fish and aquatic insects.

Invasive Plants

An invasive species is a non-native species that is introduced into a new habitat and is capable of causing ecological and economic harm. Excessive and dense plant growth of invasive plants may disrupts the balance of an aquatic ecosystem by out-competing native plants, reducing diversity and limiting recreational and navigational use of a water body.

Eurasian watermilfoil

The non-native watermilfoils, Eurasian watermilfoil (EWM) and hybrid watermilfoil (HWM) are highly invasive and aggressive plant species that colonize a variety of habitats including reservoirs, lakes, ponds, low-energy streams and rivers, and brackish waters of estuaries and bays. Rapid growth rates allow this species to form thick mats on the surface of the water. Transport on boating equipment plays the largest role in introducing these species to new water bodies.

The desired goals of aquatic plant management will vary from one person to the next. One individual may prefer less aquatic plants to minimize interference with swimming or boating, where another individual may prefer more aquatic plants to improving fishing. Aquatic plants again, are an important component of a healthy functioning ecosystem; however, they can become problematic interfering with lake access and use, especially when it comes to aquatic invasive plants. These plants are frequently targeted for management. Below is a description of commonly used aquatic plant control methods. Each method has its benefits and drawbacks and not all may be suitable options for the Cisco Chain of Lakes.

Shoreland Protection & Restoration

A natural defense to invasive species is to maintain ecosystem resilience and stability. Minimizing disturbance by protecting native vegetation increases nature's ability to ward off the introduction and subsequent colonization of invasive species. Many times, as lakefront property owners develop their shorelines by removing what is naturally occurring, negative affects to a lake's ecosystem follow. Numerous animals, birds, and amphibians depend on the habitat that natural shorelines provide to live. Removing this sustaining habitat ultimately can reduce the diversity of life that naturally exists in these ecosystems. Removal of shoreline vegetation increases the susceptibility of erosion leading to excessive sediments and nutrients running into a lake. Loose sediments can affect water clarity and nutrients can fuel excessive aquatic plant and algae growth. Examples of shoreline development that can lead to negative ecological impacts include mowing to the water's edge, over fertilization, removing down woody debris from the water, rip-rap, seawalls, and raking rooted native vegetation out of the water. Shoreland protection and restoration can be as simple as not using fertilizers and not mowing to the water's edge or it could include installing plants and other bank stabilization materials.

Before **After**

Before and After: Shoreline Restoration Example from the MI Natural Shoreline Partnership, Middle Lake, Oakland County, MI

Benefits of Shoreland Restoration/Protection	Drawbacks of Shoreland Restoration/Protection
Provides an added barrier to minimize the establishment of invasive species	Low cost restoration sites using seed and small plant material will take several years to mature and see the benefits
Reduces wave action and erosion along shorelines	Will require maintenance until plants become established especially in drought situations
Reduces the re-suspension of sediments	Animal browse may be an issue
Improves/maintains aquatic ecosystem function, resilience and stability	
Once established, shoreland restorations require minimum maintenance	

Physical Control

Physical control encompasses a variety of practices from placement of benthic barriers, manual removal, and water level drawdown.

Benthic barriers are used along the lakebed on a localized level to suppress aquatic plant growth by blocking sunlight. These barriers are typically made from high-grade materials and secured to the lake bottom with the use of scuba divers.

Benefits of Benthic Barriers	Drawbacks of Benthic Barriers
Useful to control small to pioneering infestations	Typically not cost effective for areas greater than one acre
Useful to control areas around docks, boat ramps and swimming areas	Requires seasonal maintenance
There are no restrictions to water use, as with some aquatic herbicides	Non selective, impacts all benthic organisms under the barrier
	Installation and maintenance can be expensive

Manual removal includes removing plants by hand to utilizing rakes or other apparatuses to cut or rake aquatic vegetation. Manual removal with cutters may include dragging a cutting apparatus across the lake bottom. Hand removal alone uses snorkelers or divers. The diver uses his or her hands to physically remove the root of the plant from the lakebed. Suction harvesting is a tool used to assist divers that are hand removing aquatic invasive plants from a water body. Instead of a diver coming to the surface to dispose of invasive plants that he or she has hand removed, plants are hand fed into a hose and the entire plant is vacuumed from the diver's hands to the surface. Once the plants reach the surface, a series of bins or bags located on a boat collects the material. These bins/bags allow water to filter out, leaving the entire plant captured. Plants are then disposed of offsite in an upland location. This process improves diver efficiency allowing him or her to remain underwater for longer periods and minimizes potential for plants to fragment.

Benefits of Manual Removal	Drawbacks of Manual Removal
Hand removal is selective	Labor intensive
Used as a follow up strategy after herbicide treatments	Not practical for larger areas
Can be effective when populations are at small scales	Rakes and cutters are not selective
There are no restrictions to water use, as with some aquatic herbicides	Plants can fragment when hand removed
	Sediment composition affects visibility and may decrease effectiveness

Water level drawdowns are intended to expose the targeted species to desiccation. This technique, primarily used in the northern climates, uses desiccation during the freezing cycle to kill the plant.

Benefits of Drawdowns	Drawbacks of Drawdowns
Consolidates loose sediment	Some emergent invasive species are known to spread during drawdowns, including common reed (*Phragmites australis*) and reed canary grass (*Phalaris arundianceae*)
Cost effective when a water level control structure (outlet) exists	Is expensive if water has to be pumped or siphoned
Submergent species that primarily reproduce through roots and vegetative means may be controlled well for several years	May have negative impacts to adjacent wetlands and wells
Low water levels may provide protection to docks and offers an opportunity to complete dock or other shoreland structure repair work	Is not selective
	Can have adverse impacts to fish and other aquatic life

Mechanical Control

Mechanical control uses machine-powered pieces of equipment to either cut or chop aquatic plant material. The size and cutting depths vary depending on the type of equipment used. There are several types of mechanical harvesting boats, adapted to fit different types of aquatic plants from floating leaf plants along the surface to submergent plants in deeper water. Groups that utilize mechanical harvesters typically either purchase the harvester and staff the boat themselves, or will contract with a harvesting company.

Example of one type of mechanical harvester. Taken from: www.alphaboats.com

Benefits of Mechanical Harvesting	Drawbacks of Mechanical Harvesting
Aquatic habitats are maintained because plants are typically not harvested to the lake bottom	Non-selective
There are no restrictions to water use, as with some aquatic herbicides	Small fish and other aquatic organisms may be accidentally harvested
Efforts are site selective, there is no risk of offsite impacts	Generally an expensive approach given the size of the operation, accessibility and transport of material to disposal site
New technologies in harvesting are improving the ability to capture fragments	Re-growth of harvested areas occur and may require several cuts
	Fragmentation may lead to the spread of the invasive plant

Biological Control

Biological control is the use of insects, pathogens or other animals to suppress the growth of another organism. Primarily insects are used in controlling aquatic plants. The *Galerucella* leaf beetle has been proven successful at reducing purple loosestrife. Larvae feed on the purple loosestrife plant, defoliating the plant and killing it. The weevil *Eurychiopsis lecontei,* native to North America, is used to control Eurasian watermilfoil. Stocking programs typically require a large volume of weevils and will need to be stocked annually for several years, before seeing results.

Benefits of Biological Control	Drawbacks of Biological Control
Galerucella beetles are relatively easy to raise and stock with the use of volunteers	*Eurychiopsis* stocking costs are high because of the amount of weevils that need to be continuously stocked over several years
Galerucella beetles have proven to be very successful in controlling purple loosestrife	*Eurychiopsis* stocking programs have been received with mixed results
Eurychiopsis weevils are naturally occurring in the Upper Peninsula of Michigan	
Low risk of inadvertent environmental consequences	

Chemical Control

The chemical control of aquatic plants is widely practiced throughout the United States. All herbicides used in the aquatic environment are approved by the EPA and must be registered in the State of use. Of the 300 plus herbicides registered in the US, only a hand full are registered for use in aquatic environments. Herbicides are referred to by their trade name and their common name. A trade name is the name that the manufacturer will call their product, whereas the common name will be what the chemical is. For example, Sculpin and Navigate are two trade names for the herbicide 2, 4-D.

States will have their own specific registration requirements, and a certain chemical or chemical formulation that is legal in one state, may not be legal in the next. For example, the State of Michigan does not allow the use of liquid 2, 4-D, but allows the use of granular of 2, 4-D, whereas the State of Wisconsin allows the use of both liquid and granular 2, 4-D. The use of herbicides can potentially be hazardous and only trained licensed professional applicators should apply aquatic herbicides.

Aquatic herbicides are generally grouped into two categories, contact herbicides, and systemic herbicides. Contact herbicides are fast acting herbicides that kill the plant tissue that the herbicide comes in contact with. Systemic herbicides are taken up by the plant and spread throughout the entire plant.

Below is a description of a few commonly used herbicides to control aquatic vegetation in Michigan and Wisconsin. Please consult with a licensed professional applicator that is familiar with statutory regulations on the use of these herbicides.

<u>Diquat</u>

Diquat is a fast acting contact herbicide that disrupts plant cells and inhibits a plants ability to photosynthesize. Diquat is generally considered a broad-spectrum herbicide; however, different aquatic plants are susceptible to diquat over a range of concentrations, so some level of selectivity can be maintained. Diquat is generally used for small sites, when immediate results are desired and when dilution may influence the concentration and exposure time. Only partial treatments of bays or ponds should occur to avoid issues with oxygen depletion caused by decomposing vegetation. Effectiveness of diquat is decreased when water is turbid or muddy because suspended sediments will inactivate the herbicide faster.

Endothall

Endothall is a broad-spectrum (varying opinions) herbicide that inhibits plant respiration and protein synthesis. Endothall is highly degradable and becomes less active when water temperatures are warm. Treating in the early spring when water temperatures are cool can minimize degradation. Endothall has been typically used to treat small or spot locations; however, recent use has included large-scale early spring treatments and using endothall in combination with other herbicides to control hybrid watermilfoil.

2, 4-D

2, 4-D is a systemic herbicide that is used to control broadleaf plants including non-native watermilfoils. This herbicide is a synthetic auxin that mimics a naturally occurring growth hormone in the plant and induces uncontrolled growth in the plant. There are two types of 2, 4-D used in aquatic applications including dimethyl amine salt and butoxythly ester and toxicity will vary between the two (WDNR, 2012). Ester formulations are considered more toxic to fish and some invertebrates at application rates, whereas the amine may be less toxic. 2, 4-D has not been shown to bioaccumulate in significant levels in fish (WDNR, 2012). The University of Wisconsin and the Wisconsin DNR are currently studying endocrine disruption in fish. According to the Navigate specimen label water pH at 8 or higher may reduce weed control.

Triclopyr

Triclopyr is considered a selective systemic herbicide and is commonly used to control broadleaf plants including Eurasian watermilfoil. Like 2, 4-D, triclopyr simulates a naturally occurring growth hormone in the plant affecting all portions of the plant including the roots. In Michigan, triclopyr does not carry the same near shore regulations for use as 2, 4-D does.

Fluridone

Fluridone can be considered both a broad spectrum and a selective systemic herbicide depending on the target concentration used. Fluridone requires long exposure times, minimum of 45 days and is most applicable to whole lake treatments or in situations where dilution can be controlled.

Flumioxazin

A broad spectrum contact herbicide that works by interfering with the plant's production of chlorophyll. Flumioxazin is not recommended to be used in very hard-water lakes (pH over 8.5) (WDNR, 2012). It is available in granular form and used to control submerged and emergent floating leaf plants and filamentous algae.

Imazapyr

A systemic herbicide that works by preventing the plant from producing ALS (acetolactate synthase) enzyme. Plants will stop growing shortly after treatment and develop reddish tints on the tips of the plant. The mode of action (how the herbicide affects/kills the plant) with imazapyr may lead to more resistant plants than other herbicide's mode of action (WDNR, 2012).

Benefits of Herbicides	Drawbacks of Herbicides
Are effective tools in large scale management	Stakeholder approval on this option varies
Selectivity to control Eurasian watermilfoil can be achieved when certain herbicides are applied at the appropriate concentration	Many herbicides will have water use restrictions
Are cost effective	Many herbicides are not selective
Requires little to no volunteer efforts	There are irrigation restrictions with certain herbicide products
	Hybrid watermilfoils can pose management challenges
	Large-scale herbicides applied during warm summer months may impact water quality including dissolved oxygen due to plant decomposition
	Herbicides may degrade quicker if applied during the warmer summer months
	Dissipation or dispersal of herbicides can occur to offsite areas of the lake
	Non-target impacts to native species can occur. Some native plants are more susceptible to herbicides than others
	Variable results in control can occur with small-scale applications
	Subsequent applications may be necessary to achieve desired control

Management Considerations-Herbicide Use

Herbicide effectiveness is the results of two primary factors. One being the concentration of the herbicide applied and two, the length of time the target plant is exposed to the herbicide. For herbicides to be effective, plants need to be exposed to a lethal concentration of the herbicide over a certain period of time. Generally, contact herbicides will require shorter exposure times than systemic herbicides. Factors that will affect concentration-exposure times include water depth, flow, and treatment size and plant density. These factors alone or in combination may reduce the concentration and exposure time below the level of adequate control. Keep in mind that target concentrations will vary depending on the treatment scenario. Small scale or spot treatments, where exposure time may be limited may use a higher rate of product. Whereas large scale or whole lake applications, may use a lower rate because the entire water body is being treated and dissipation of the herbicide off site is not an issue.

The larger the scale the greater potential for lake wide affects versus smaller scales treatments where localized small treatment sites do not result in significant lake wide impacts. Lake wide affects can occur when multiple small scale or spot treatments dissipate lake wide. Dissipation is the horizontal and vertical movement of the herbicide in the water column and is affected by the treatment area relative to the lake area, wind, and water flow and water depth. Mixed lakes, the herbicide may mix throughout the entire lake, where as a lake that stratifies might only see mixing of the herbicide in the upper portion of the water column.

Recent research supports some hybrids being less sensitive to the herbicide 2, 4-D and tolerant to fluridone (LaRue et al, 2012, Parks et al, 2016). Furthermore, not all hybrids may respond equally, meaning certain hybrid clones may have various responses to treatment (LaRue et al, 2012). Rotating the mode of action of the herbicide may reduce the potential of resistance issues. Laboratory analysis of milfoil samples from Big Lake, confirmed pure strain Eurasian watermilfoil, and no hybrids (GVSU, 2013). This does not mean hybrids do not exist on Big Lake; just those samples analyzed are not hybrid watermilfoil.

Repetitive herbicide treatments over time that result in non-lethal killing of the target plant species may result in that target species to develop resistance or a reduced sensitivity to herbicides. This is particularly valid when the mechanism of action and limited methods used for treatments is used (EPA-DRAFT, 2016). Furthermore, these repetitive annual treatments may shift aquatic plant communities from diverse stable communities to low diversity more disturbance tolerant systems, including increased risks of the development of hybrid watermilfoils. The judicial use of herbicides should include consideration to how many repetitive annual treatments take place and minimizing repetitive consecutive modes of action of the herbicides chosen. Practices that decrease risk of resistance include minimizing frequent uses of herbicides with similar mechanism of action and use of non-chemical control practices, such as hand harvesting.

Permitting

The State of Michigan requires permits for the chemical treatment of aquatic plants. Permits are submitted and issued through the Michigan Department of Environmental Quality, Water Resource Division – Aquatic Nuisance Control Program. For more information on permit requirements, please contact the MDEQ – Water Resources Division – Aquatic Nuisance Control.

Hand removal with the use of auxiliary power, such as diver assisted suction harvesting, does require a joint MDEQ/USACE permit from the State of Michigan. Waters under USACE jurisdiction may have additional permitting requirements. Depending on the waterbody, diver assisted suction harvesting may have seasonal restrictions. Please contact the local MDEQ permitting agent for details on permit requirements.

When treating with herbicides or hand removal using auxiliary power in Michigan, the presence of State listed threatened and endangered species may require additional permitting from the MDNR Wildlife Division. Please contact the MDNR Wildlife Division for information on permitting.

Aquatic plant management and nuisance control activities requires a permit issued by the Wisconsin Department of Natural Resources (WDNR). Depending on the criteria and the type of activity (chemical vs. DASH) different permits will apply. Please contact the local aquatic plant management coordinator on details before any management activities take place.

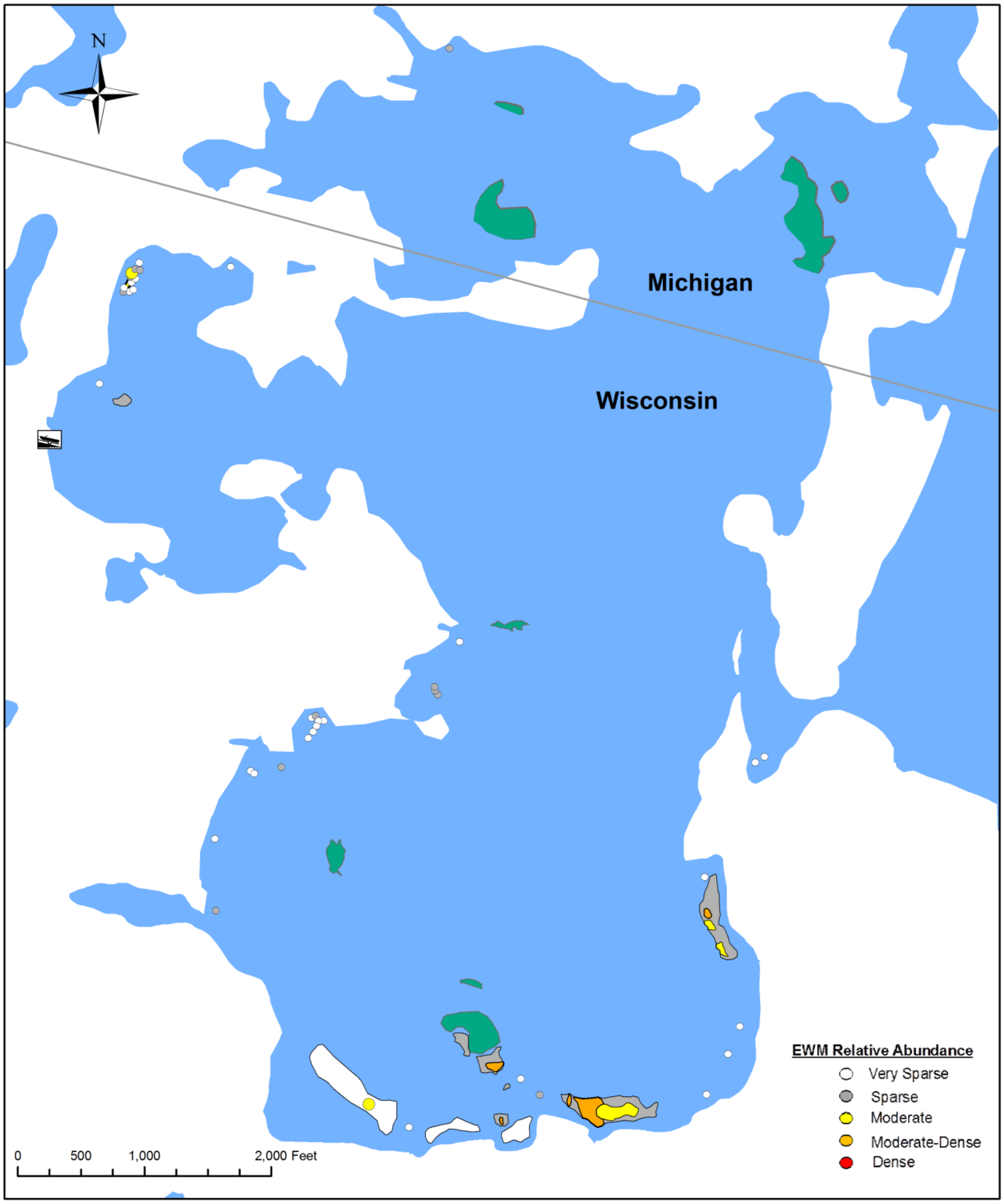
Updated Condition of Eurasian Watermilfoil on Big Lake

Specific proposed changes to existing plan: Update existing map of EWM on Big Lake (figure 15.7, pg 144). Provide additional information under "New Data Collection" regarding invasive species survey results for Big Lake (pg 43).

Surveys completed in 2015 and 2016 using lake wide meander survey targeting EWM, found EWM in various densities and locations outside of initial findings documented in the Lake Management Plan. Monitoring surveys using a meander approach are primarily completed using visual observations, but also include the use of rake tosses and underwater cameras. Monitoring efforts are qualitative in nature, meaning that information collected describes the condition of EWM rather than using measured or quantitatively calculated values. For example, Table 1 describes the observed abundance estimate of EWM found during each survey. A GPS records observations. Smaller sites are geo-referenced with a GPS point and extent is determined by using a visually estimated circumference converted to acres. On average, these sites are less than a 0.10 of an acre in size. Larger sites, typically greater than a 0.10 of an acre in size are circumnavigated and extent in acres is calculated and represented by a polygon.

Very Low	Typically consists of less than 10 plants visually observed, unless otherwise noted. Extent varies and is estimated visually for smaller locations and noted. Larger locations are delineated using GPS to calculate area.
Low	Typically consisted of 10-20 plants visually observed, unless otherwise noted. Extent varies and is estimated visually for smaller locations and noted. Larger locations are delineated using GPS to calculate area.
Moderate	Typically consists primarily of EWM with some native vegetation visually observed to be intermixed. Extent varies and is estimated visually for smaller locations and noted. Larger locations are delineated using GPS to calculate area.
Moderate-Dense	Typically consists of dominant EWM with little observed native vegetation intermixed. Extent varies and is estimated visually for smaller locations and noted. Larger locations are delineated using GPS to calculate area.
Dense	Dominant EWM, with little to no native vegetation observed. Dense locations may or may not have surface matting depending on the time of year. Extent varies and is estimated visually for smaller locations and noted. Larger locations are delineated using GPS to calculate area.

Figure 15.7a Invasive species distribution in Big Lake, 2016.



Lake: Big Lake - Vilas County, WI
Map Date & Creator: 2/12/2017, Many Waters, LLC
Source: WDNR Hydro, ESRI Base Maps,
MiGDL Lake_polygons_200403
File: PI_Big_2016_v1

EWM Colony Mapping	
EWM Abundance Estimate	**Acreage**
Very Sparse	5.0
Sparse	2.9
Moderate	1.1
Moderate-Dense	0.9
Dense	0.0
TOTAL	**9.9**

EWM Survey
Big Lake
Cisco Chain of Lakes
2016

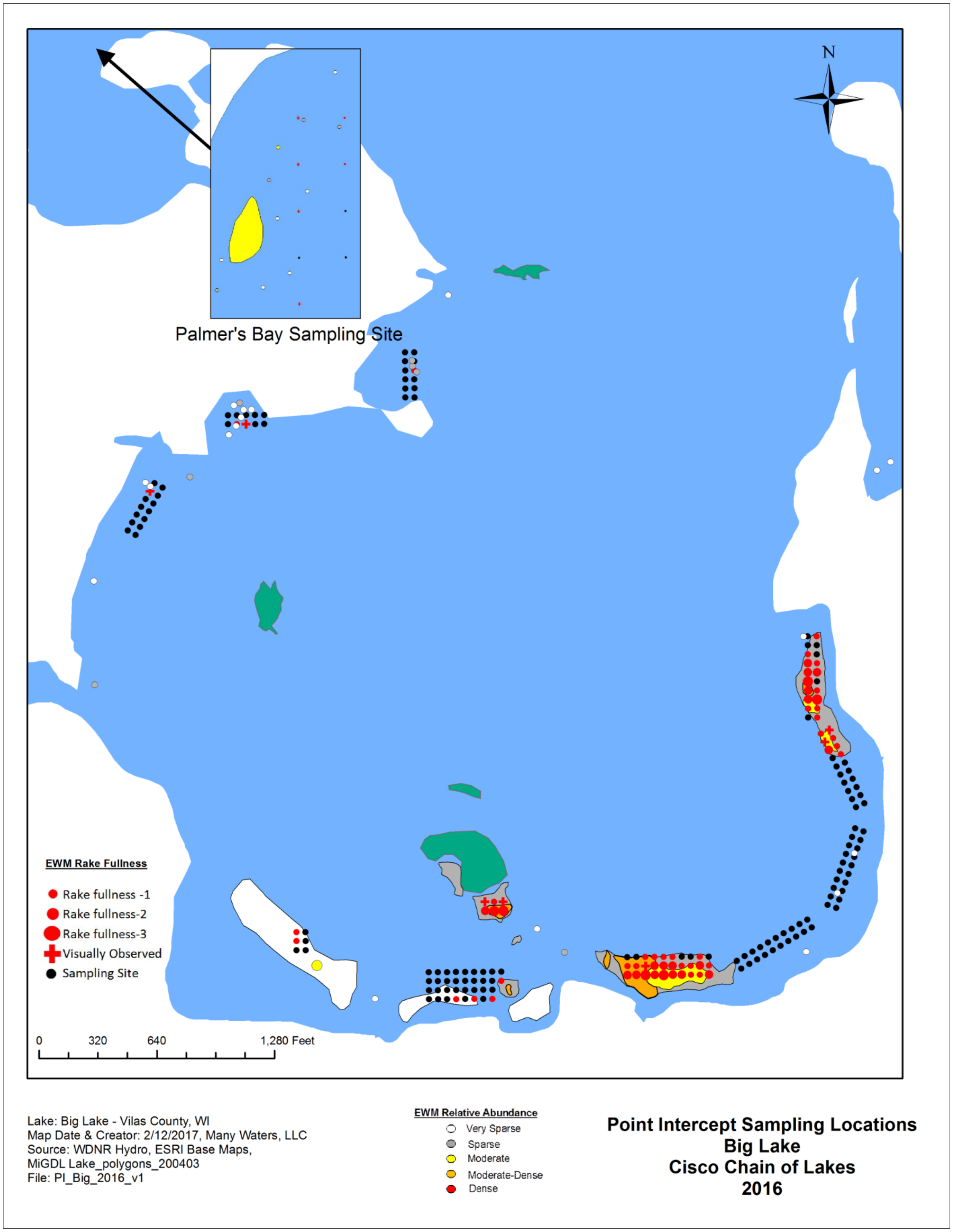
A sub sample point intercept survey conducted in 2015 and 2016 quantified both the invasive and native plant communities located within selected areas of EWM extent (WDNR). The survey in 2015, typically would be timed for earlier in the growing season, however, given the extended growing season conditions seen in 2015, native plant species maintained integrity allowing for identification. In 2015, species comprising 10% or greater percent occurrence include: Northern watermilfoil, (41.29%), Eurasian watermilfoil (33.83%), clasping-leaf pondweed (21.89%), fern pondweed (20.40%) and white-water crowfoot (14.43%). In 2016, species comprising 10% or greater percent occurrence include: Eurasian watermilfoil (28.36%), Northern watermilfoil (24.88%), clasping-leaf pondweed (12.94%), and coontail (10.45%).

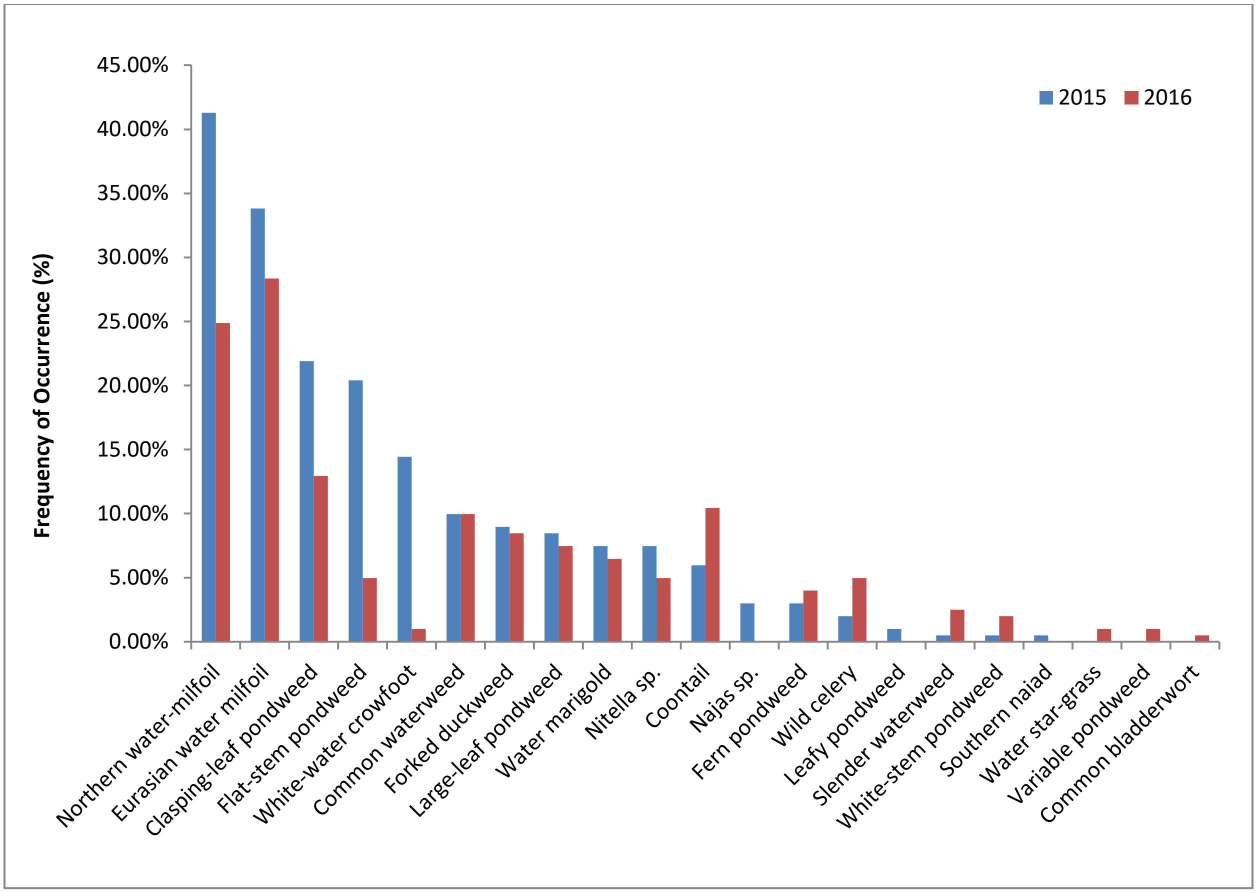
Summary Comparisons of Sub Point Intercept Results- Big Lake, 2015 & 2016.

Lake	Big Lake
County	Vilas County
WBIC	2963800
Survey Date	10.8.2015 & 9.26.2016
Survey Type	Sub PI - Aquatic Plant Evaluation

SUMMARY STATS:	2015	2016
Total number of sites visited	201	201
Total number of sites with vegetation	169	152
Total number of sites shallower than maximum depth of plants	201	201
Frequency of occurrence at sites shallower than maximum depth of plants	84.08	75.62
Simpson Diversity Index	0.88	0.89
Maximum depth of plants (ft)**	9	10.5
Number of sites sampled using rake on Rope (R)	0	0
Number of sites sampled using rake on Pole (P)	201	201
Average number of all species per site (shallower than max depth)	1.91	1.36
Average number of all species per site (veg. sites only)	2.27	1.80
Average number of native species per site (shallower than max depth)	1.57	1.08
Average number of native species per site (veg. sites only)	1.99	1.68
Species Richness	18	19
Species Richness (including visuals)	18	19
Mean C	6.38	6.35
FQI	25.5	26.19

Figure 15.7b: Frequency of occurrence (%) of detected aquatic plant species 2015 & 2016 – Big Lake, Vilas County WI.





Frequency of Occurrence (%)
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
2015
2016
Northern water-milfoil
Eurasian water milfoil
Clasping-leaf pondweed
Flat-stem pondweed
White-water crowfoot
Common waterweed
Forked duckweed
Large-leaf pondweed
Water marigold
Nitella sp.
Coontail
Najas sp.
Fern pondweed
Wild celery
Leafy pondweed
Slender waterweed
White-stem pondweed
Southern naiad
Water star-grass
Variable pondweed
Common bladderwort

14. Appendix E – Aquatic Plant Assessment and Management Plan

Specific proposed changes to existing plan: Strike 4th paragraph regarding Big Lake under "Management of Existing Invasive Species" (pg 130). Add language regarding goals and objectives and "Options for Eurasian watermilfoil Management."

The overall intent or goal of aquatic plant management planning shall conserve ecological condition of the Cisco Chain of Lakes, thereby allowing ecosystems to remain stable and resilient through time.

Aquatic invasive species management goals: (Note: Management and monitoring considerations for these goals are described in detail within the original text of the Lake Management Plan and are not given additional detail in this section.)

- Conserve native species.
- Minimize risk for spread of invasive species within the Chain and to surrounding lakes.
- Continue public education on natural resource issues.
- Maintain aesthetic recreational opportunities.

Specific objectives will vary based on annual condition, guidance/input from lake-user groups and agency personal. However, objectives need to balance social perspective, conservation, and ecosystem stability/resilience in approach including weighing priorities with potential risk over the long term.

Guiding objectives include:

- Management that aims at reducing the abundance and distribution of the target species.
- Provide recreational nuisance relief caused invasive species.
- Improve early detection and response to new aquatic invasive species.
- Continue to monitor and collect baseline data to detect ecological systems change.
- Improve upon and generate site-specific adaptive frameworks to manage for and control aquatic invasive species.
- Provide accountability for management actions – management evaluation.
- Reduce risk to non-target species.

Options for Eurasian watermilfoil Management

Outlined below are several options to consider when developing short and long-term management strategies and objectives. These options are for EWM, however can be adapted for curly leaf pondweed or other aquatic invasive species. Management options are designed to stand alone or be blended depending on the needs at the time. Using these options, objectives and strategies can be developed base on annual conditions and lake-user input. For example, an annual strategy may include maintaining waterbody access on site-specific regions that are impairing recreational use and access. This strategy, defined under Option 2 – to maintain waterbody access, links program goals to maintain recreational opportunities and guiding objectives that provide nuisance relief from the invasive species. Smaller pioneering populations of EWM may be managed under rational defined under Option 3 – maintenance control of EWM. The intent here would be to keep to population of EWM at particular sites at low levels, minimizing spread and the potential for expansion. This rational is supported in the guiding objectives to reduce abundance and distribution and potentially an early detection and response.

This framework needs to be adaptive; however, strategies should be supported in the overall goals and objectives and a rationale on management choice be outlined. Using a balance of social perspective, conservation, and ecosystem stability/resilience annual management should provide information on the population lake-wide and have site-specific strategies based on the options outlined below.

Regardless of the options adopted, management will follow well-accepted best management practices including monitoring and an evaluation/demonstration component. Quantitative metrics are favored, however there are challenges posed with small-scale management, including sampling size (replicates), controls (which are used to verify effects), nonuniform treatments (varying treatment and monitoring dates) and pseudoreplication (sample units not being independent but rather subsamples of the same unit). The degree of importance of statistically verified information regarding management will vary however, it is important to mention these limitation and thus reliance many times on more qualitative monitoring. Specific monitoring recommendations by the WDNR regarding large-scale treatment scenarios in Wisconsin will be followed and may be adapted to smaller scale management based on site specific ability to address sampling size using a point intercept method.

Generally, monitoring and management evaluations will use qualitative metrics, which collects information that describes the condition of target species colonies rather than using measured or quantitatively calculated values. For example, information collected during monitoring or pre/post evaluation efforts may use a scale from very sparse to dense to describe the condition or abundance and distribution of EWM found.

An integrative framework is suggested regardless of the management options chosen. This framework uses a combination of management techniques (described above) to manage the invasive species to an acceptable level. (Eradication is not a feasible option and should not be the end goal of any management approach.) Management of EWM using an integrated approach should look at judicious use of herbicides. Herbicide use will be consistent with applicable WDNR and MDEQ regulations and policy depending on the location within the waterbody. Management decisions should include discussions on system interconnectivity and jurisdictionally differences between Michigan and Wisconsin. Site by site determination using hand removal will consider visibility that affects efficiency and effectiveness and boat traffic that would pose safety concerns for divers.

Historically the CCROA has taken a proactive approach to EWM management across the Cisco Chain of Lakes. Whether their proactive approach to management including citizen monitoring and prevention efforts minimized the likelihood of new introductions and relatively slow spread of current populations is fully unknown. When weighing management options, social intolerance for EWM including but not limited to levels that affect recreational use of the water body need to balance ecological concerns and any pre-conceived management triggers, that would shift management approaches from one option to another. Specific shifts should not be concrete, but rather flexible and adaptive to the current situation and the information known at the time.

Management decisions should be based on the collected data, most recent science and dialog regarding values and presented options. In the case of the CCROA, using the AIS Task Force, general membership input, and CCROA board meetings as avenues to share information and develop short-term/annual strategies is sought. This will allow an opportunities to discuss social values (which every group will be different), the data collected for that specific year and options to decide how to move forward. Meeting minutes and summaries will be provided in reporting to reflect decision making rationale.

Option (1) Management approach - Monitor and evaluate EWM population over time with no active management.

> At first, this option may appear that not pursing any active management is a do nothing approach, which is definitely not the case. No management is an active decision. Several questions to ask when considering this approach include:
>
> (1) What is the current size or status of the infestation?
> (2) Is it impairing recreational use of the water body?

(3) Looking historically at this species, is it established wide spread in the lake and at nuisance levels?
(4) Are current populations at levels that can potential be sourcing other lakes?
(5) Is the plant providing some sort of ecological services? (E.g. food source or habitat)
(6) Will there be more harm to the environment than good if the species is left unmanaged.
(7) Will there be more harm to the environment than good if the species is managed for?

This approach continues to monitor the abundance and distribution of EWM as fiscal resources and budgets allow however, annual monitoring is preferred. There would be no costs associated with management; however, annual monitoring will come with costs. If volunteers are going to be doing the monitoring, they will need to be trained on plant identification and sampling techniques. A monitoring and evaluate approach may be favored if residents are educated on reasoning. This approach does not exclude the decision to pursue management in the future; there would always be that option to do so.

Evaluation metrics favored include both qualitative lake wide monitoring for EWM (or the target invasive) and quantitative point intercept sampling of the native and invasive population. Seasonal lake wide monitoring will provide information on the abundance and distribution of the invasive population at that time. This information will be used to determine whether the monitor and evaluate option will continue or there should be further discussion on potential management. In the case of potential management, this monitoring will provide information on appropriate action. Continuation of sub-PI sampling across sites sampled in 2015 & 2016 will provide annual population trends to both the invasive and native aquatic plant community and also tie into long term monitoring of potential ecological impacts whether it may be related to management or no-management of the invasive species.

Option (2) Management approach - maintain recreational use and waterbody access.

This management approach includes base line qualitative monitoring detailed under Option 1 however, would shift from no management to some level of management at sites where recreational use and access are impaired.

"Larger scale" (loose definition) beds targeted for management will include (if feasible) sub-point intercept grids to quantitatively evaluate treatment effectiveness. At a minimum, success criteria is a reduction in the average rake fullness of the invasive species across all sampling points. A qualitative success criterion seeks a reduction in estimated abundance and/or distribution, which may not be mutually exclusive. Meaning, a treatment may be successful if a reduction in abundance and/or distribution is achieved.

A shift from a recreational/navigational improvement strategy to a monitoring and evaluating or population control strategy would be based on meeting the set success criteria set above. No EWM (or another AIS) detected would result in a monitoring and evaluation strategy being implemented the following year. Non-nuisance level EWM abundance and/or distribution would results in either Option 1 or 3 being implemented. In the event that the set success criteria is not met, discussions with the Association and appropriate DNR/DEQ agencies would guide future management actions.

Option (3) Management option – population control of EWM.

Management under this option seeks to maintain the population of the invasive species as some reduced level (size and/or abundance). This option does differ from the recreational improvement strategy. This previous strategy addresses specific areas on the lake that are causing recreational impairment and addressing those areas at the time the impairment is occurring. Whereas this population control strategy continues some level of management to maintain a reduction in the species.

This approach may either be site-specific or more broadly lake-wide. Site specific eradication/non-detection may occur however, this is not a feasible nor realistic lake-wide long term management goal.

Evaluation metrics would be similar as those proposed under the recreational improvement strategy and include base line qualitative monitoring detailed under the first strategy above. Also, if the aim of using this approach is to maintain a desired lower level of EWM through active management, a comparison of lake wide abundance and distribution from year to year is important to review. This information will include maps depicting EWM (or a different invasive) locations and qualitative estimations of abundance and distribution typically represented visually in the form of a bar or pie chart.

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