Aquatic Plant Management Plan

Long Trade, Round, Little Trade, and Big Trade Lakes

Polk and Burnett Counties, Wisconsin

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Executive Summary

This Aquatic Plant Management Plan for Long Trade, Round, Little Trade, and Big Trade Lakes presents strategies to control an ever expanding population of Eurasian watermilfoil (EWM) (*Myriophyllum spicatum*), and to prevent the introduction of other aquatic invasive species. This plan also includes data on the lakes' watershed and water quality.

Aquatic plant surveys were done by the Wisconsin Department of natural Resources (WDNR), The Polk County Land and Water Resources (LWRD), and the Burnett County Land and Water Conservation Department (LWCD). The aquatic plant surveys show that the lakes have diminished species richness, and seem to be highly impacted by disturbances. Improving the native plant community by decreasing the population of EWM and practicing native plant conservation measures will provide better fish habitat, reduce erosion on shorelines, help prevent further invasion of aquatic invasive species, and stabilize the bottom sediments reducing the internal phosphorous load.

Eurasian watermilfoil was first officially confirmed in Long Trade Lake in 2009 (although is presence has been noted for approximately seven to ten years), Round Lake in 2003, and Little Trade Lake in 2009, and was documented in the channel between Little Trade and Big Trade Lakes in 2010. Its growth does not seem to be limited and is found throughout the littoral zone in Long Trade and Round Lakes, and seems to be rapidly expanding in Little Trade, moving its way into Big Trade Lake.

This plan presents a strategy to reduce the population of Eurasian watermilfoil and prevent its spread into Big Trade Lake.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*), another non-native aquatic invasive species, also has significant populations in each of the lakes. To date, the amount of CLP has not been quantified in the system. Management may have to be adjusted to account for the interaction of these two species and on the effectiveness of the herbicide treatments.

The overall goal of this plan is to decrease the impact of EWM on the lakes' ecosystems and prevent its spread into Big Trade Lake, as well as other surrounding lakes. The goals of this plan are to:

1. Prevent the spread of Eurasian water milfoil.
2. Prevent the spread of Curly-leaf pondweed.
3. Prevent the spread and introduction of other aquatic invasive species.
4. Preserve, protect, and enhance the lakes' native plant communities.
5. Minimize the runoff of pollutants, nutrients, and sediment from the Trade Lake watershed.

The implementation part of this plan describes the actions to be taken to achieve these goals, which includes implementing an early-season EWM herbicide treatment as to minimally impact the native plant community.

Introduction

This aquatic plant management plan presents a strategy to reduce the population of Eurasian water milfoil and to prevent the introduction of additional aquatic invasive species. In doing so, the native aquatic plant community will be protected and in time enhanced, providing fishery and wildlife habitat as well as possibly improving in-lake water quality. The plan includes data on the aquatic macrophyte communities present in the lake, and watershed information and water quality data where available.

Two lake studies were conducted on Long Trade and Round Lakes by the Polk County Land and Water Resources Department (LWRD) in 2007. The reports from those studies suggested that the Lake Association take action towards controlling the population of Eurasian water milfoil. The discovery of EWM in Little Trade Lake by Wisconsin Department of Natural Resources (WDNR) staff prompted the Association to work with the LWRD, the Burnett County Land and Water Conservation Department (LWCD), and the WDNR to apply for a rapid response grant to attack the EWM in Little Trade Lake. As a result, LWRD and LWCD staff completed point intercept surveys of Little Trade and Big Trade Lakes in 2009. WDNR staff had previously conducted surveys on Long Trade and Round Lakes. EWM beds were mapped in Little Trade Lake in 2009, and again in 2010. Long Trade and Round were also mapped in 2010.

The Lake Association has been involved with the development of this Aquatic Plant Management Plan through several meetings and conference calls conducted to gather public input from lake residents and from the Lake Association.

Lake Information

The Trade River system begins in Polk County near of the Villages of Luck and Frederic, flows west into Long Trade Lake, then into Round Lake (Burnett County) and then Little Trade and Big Trade Lakes, eventually returning to Polk County and emptying into the St. Croix River. These lakes are considered drainage lakes because they are fed by the Trade River and other streams, groundwater, precipitation and runoff and are drained by the Trade River. Long Trade Lake is also an impoundment with an 11-foot dam at its outlet.

Physical characteristics of the lakes can be found in Table 1. Long Trade Lake (WBIC 2640500) is a shallow, 152.6-acre lake with a mean depth of 7.5 feet and a maximum depth of 13 feet. Round Lake (WBIC 2640100) is approximately 26 feet deep, with a mean depth of 15.2 feet and covers 204.2 acres. Little Trade (WBIC 2639300) and Big Trade Lakes (WBIC 2638700) cover a combined 460 acres. Little Trade Lake has a maximum depth of 19 feet and a mean depth of approximately 8.2 feet whereas Big Trade Lake has a maximum depth of 39 feet and a mean depth of nearly 14 feet.

Table 1. Lake Characteristics

Lake Characteristic	Long Trade	Round	Little Trade	Big Trade
Lake Area (acres)	152.6	204.2	128.3	331.7
Watershed Area (acres)	32,572	34,954	39,238	41,749
Watershed to Lake Ratio	212:1	170:1	305:1	125:1
Maximum Depth (feet)	13	27	19	39
Mean Depth (feet)	7.5	15.2	8.2	13.8
Volume (acre-feet)	1,141.4	3,104.6	1,051.8	4,577.6
Osgood Index	2.9	5.1	3.5	3.6
Elevation (feet AMSL)	971	928	907	907
Miles of Shoreline	4.34	3.33	3.89	7.37
Lake Type	Drainage (Impoundment)	Drainage	Drainage	Drainage

The Osgood Index is used to describe how likely a lake is to mix due to wind forces and is defined as the mean depth of a lake in meters divided by the square root of the surface area in kilometers. Large, shallow lakes have a lower Osgood Index than smaller, deeper lakes. Lakes with Osgood Index values less than 4 tend to be polymictic, that is, they undergo a number of periods of stratification and mixing during the summer months. Periods of stratification followed by mixing during the summer can release large amounts of phosphorus into the water column which can fuel algal blooms. All of the lakes except Round Lake have an Osgood Index less than 4 (Table 1). Temperature monitoring of Long Trade Lake indicates that it likely remains mixed throughout the summer and monitoring of Round Lake found that the lake does stratify, but does not develop a strong gradient.

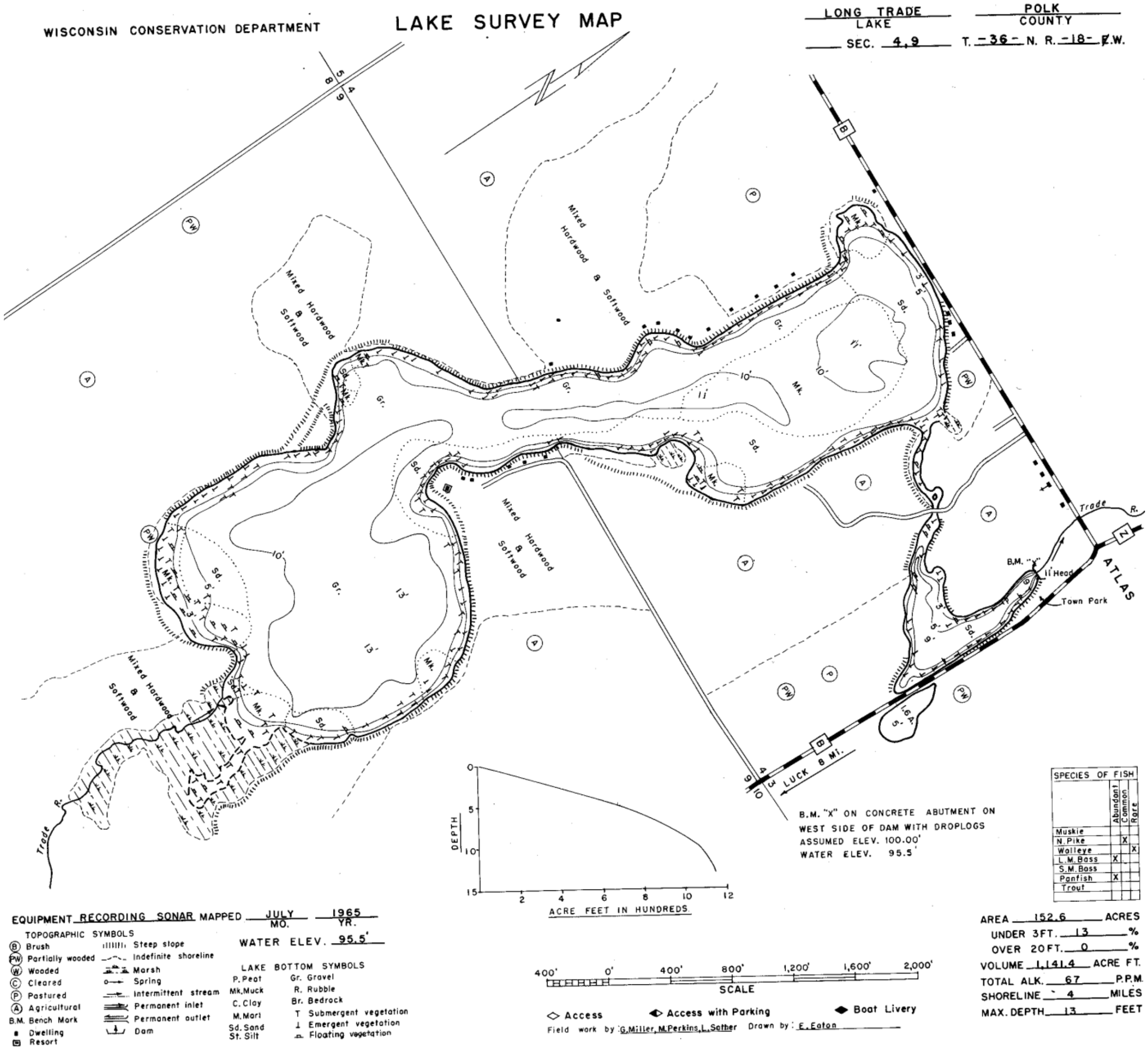


Figure 1. Long Trade Lake Map

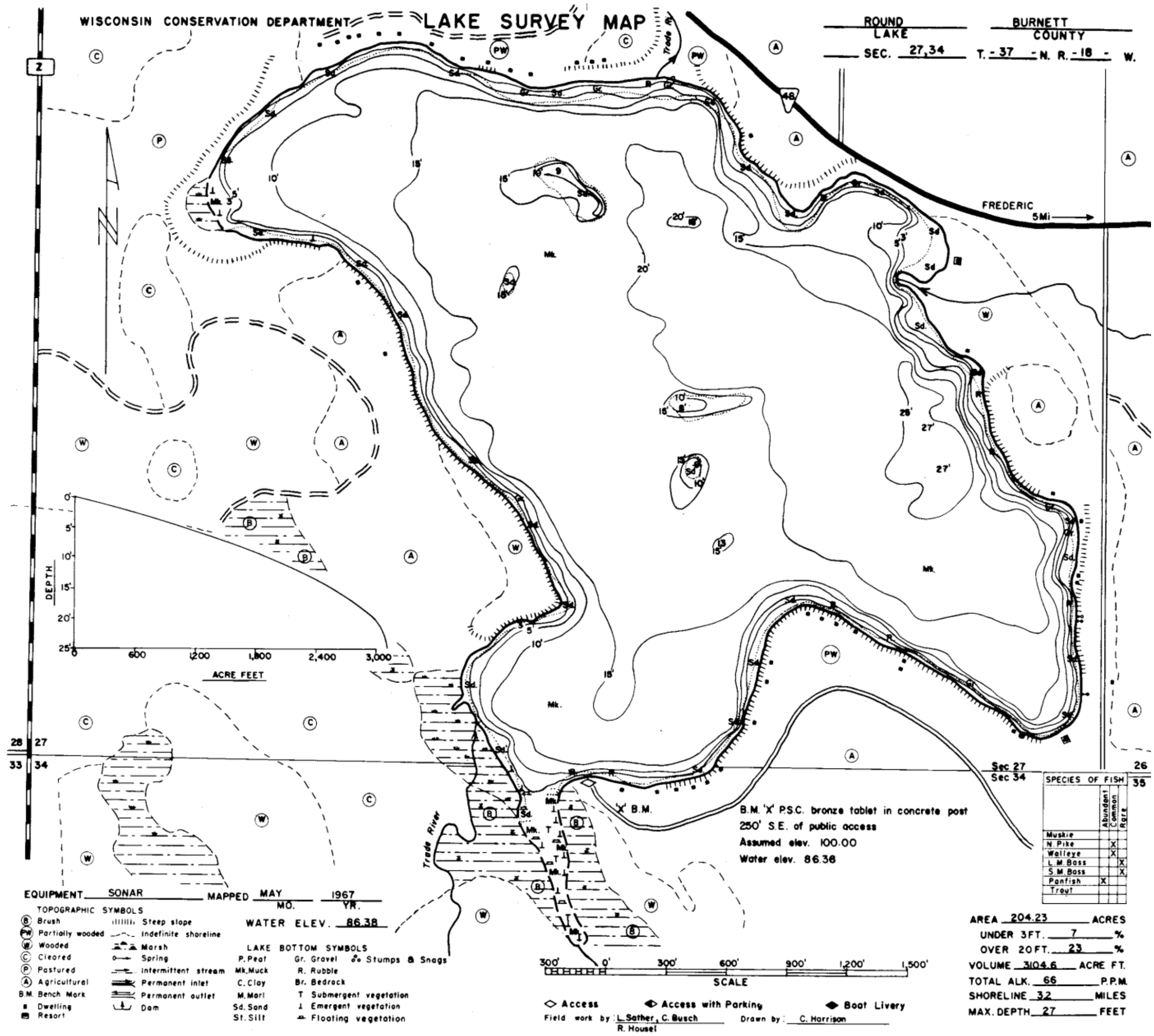


Figure 2. Round Lake Map

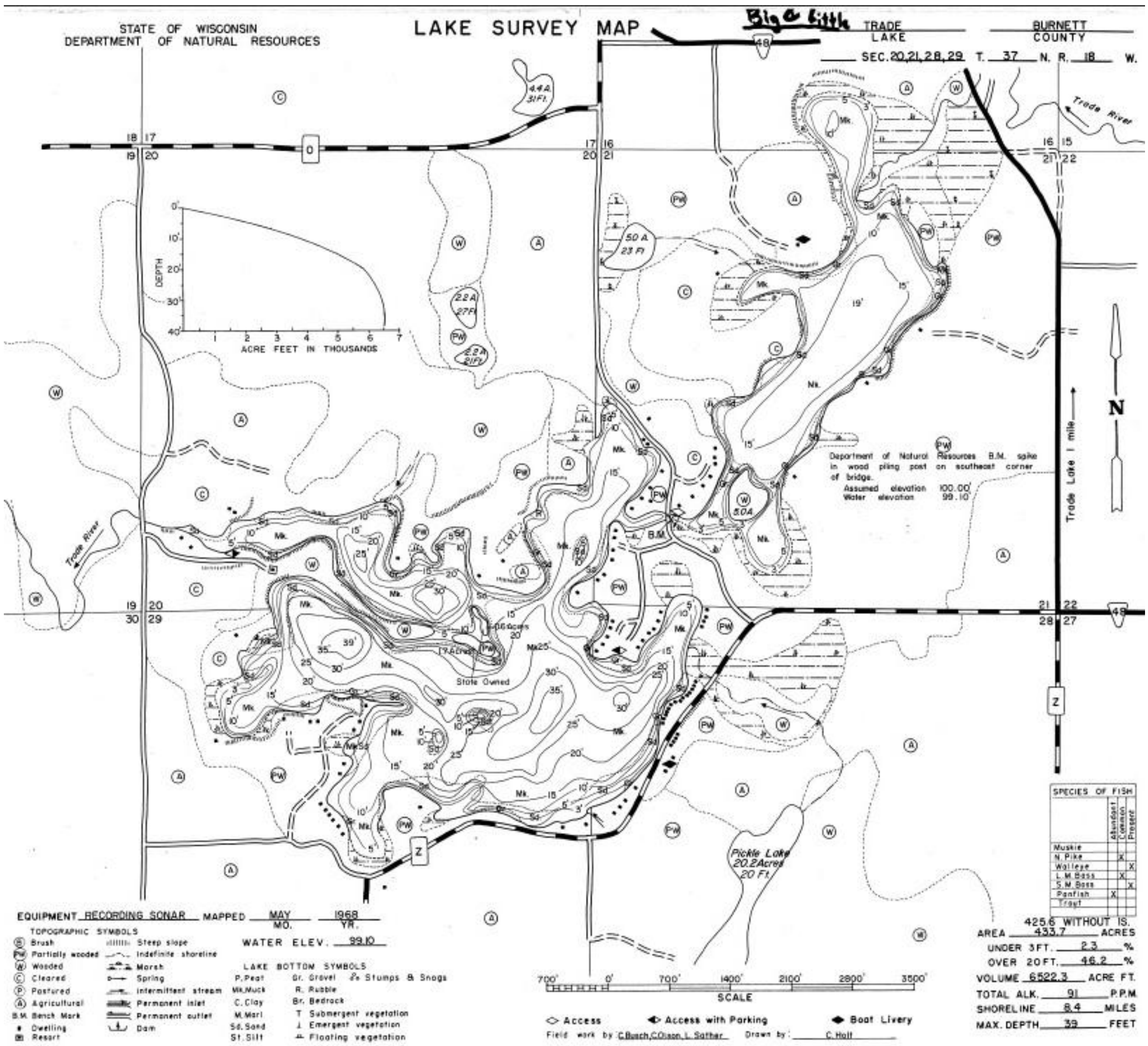


Figure 3. Little and Big Trade Lakes Map

Water Quality

Water quality is frequently reported by the trophic status or nutrient level of the lake. Nutrient rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient poor with little growth of plants and algae.

Secchi depth is a measure of the clarity of the water, and helps determine the trophic state of a lake. The Secchi depth of a lake is affected by minerals dissolved in the water column as well as algae and sediment suspended in the water. A deeper Secchi depths means more light penetrates the water column allowing aquatic macrophytes to grow.

The average Secchi depth for the south basin of Long Trade Lake was 2.2 feet and 2.1 feet for the north basin in 2007 (Figure 4). This correlates to very poor water clarity and highly eutrophic conditions. As reflected by the Secchi depth measurements, the amount of suspended particles in the lake increased during the growing season (May – September). This was most likely the growth of algae due to warmer temperatures, increased hours of daylight, and continuous contributions of nutrients through runoff, surface water inputs, or internal recycling from the sediments. While a decrease in water clarity over the summer months is a normal phenomenon, the summer water clarity in Long Trade Lake is such that it can be considered a nuisance and can limit recreational use and diminish the wildlife value. Poor water clarity is typical in Long Trade Lake and summer Secchi depths have consistently averaged about 2 feet since 1986 (Figure 5).

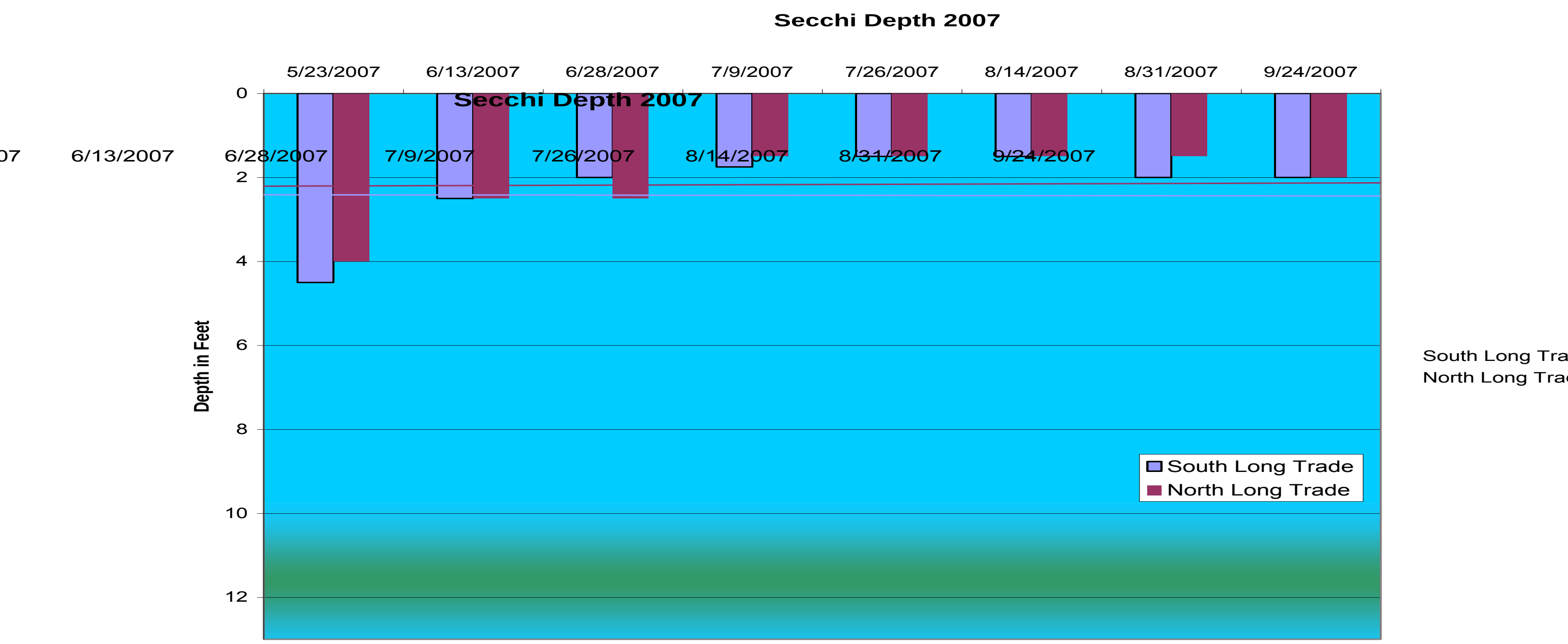


Figure 4. Secchi Depth Measurements in Long Trade Lake during 2007

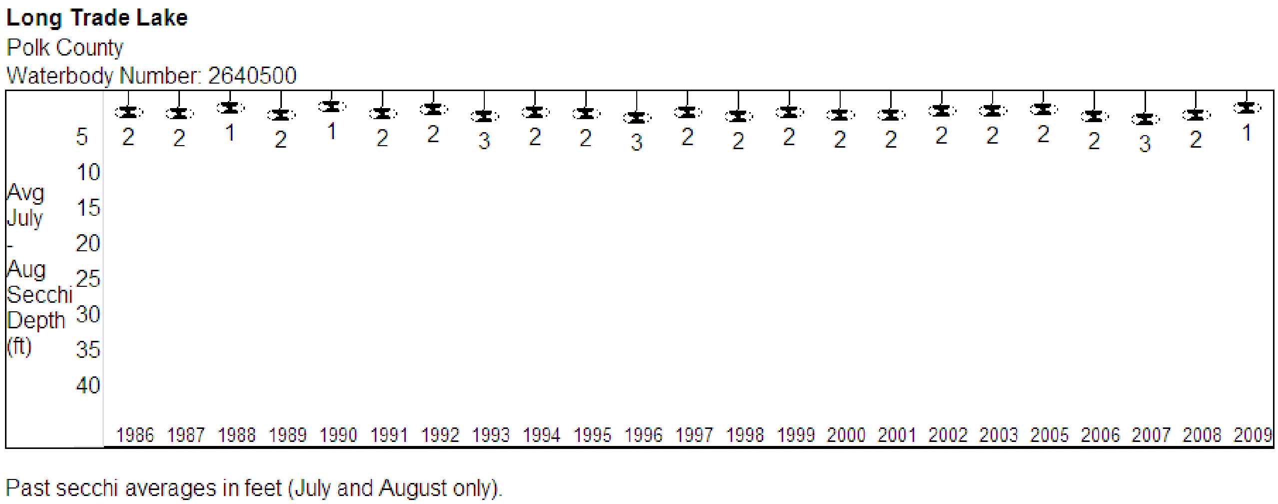


Figure 5. Secchi Depth Trend for Long Trade Lake, 1986-2009

Round Lake did not fare much better in 2007, with an average Secchi depth of 3.8 feet (Figure 6). Low Secchi depth measurements indicative of eutrophic conditions are also typical for Round Lake, which has been monitored since 1986 (Figure 7).

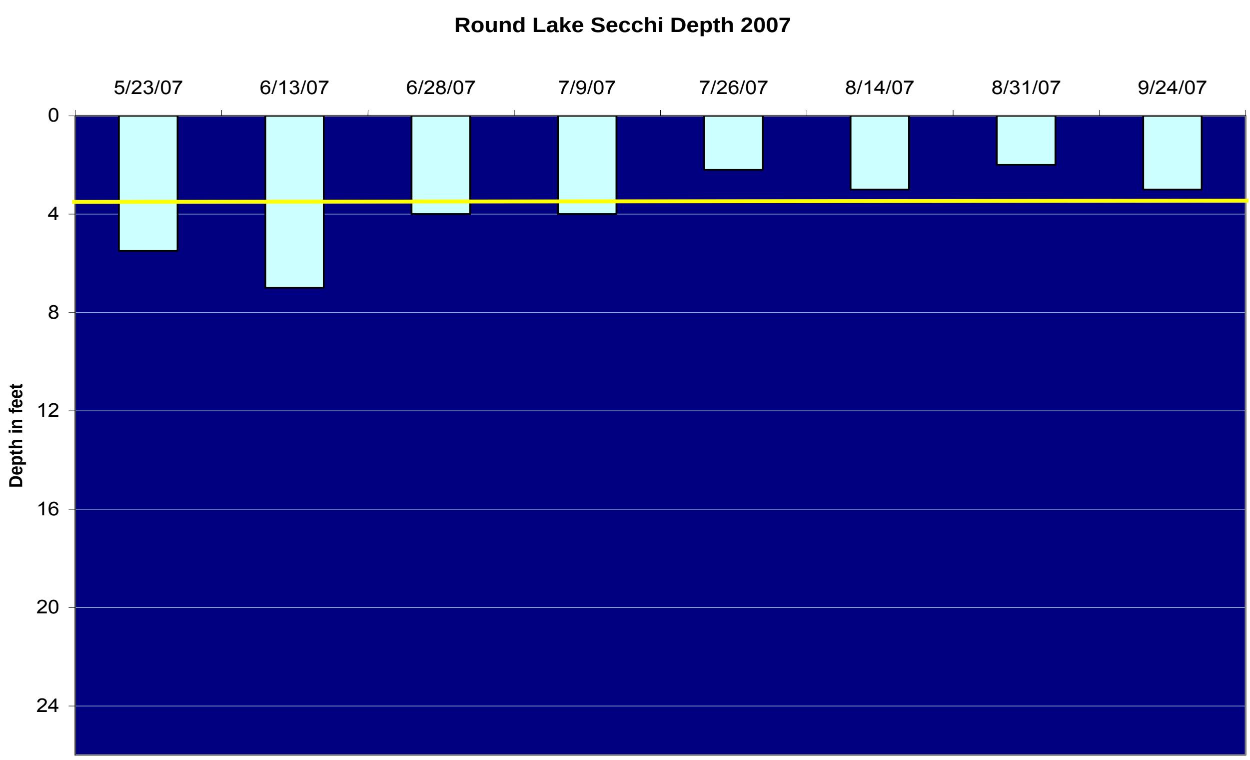


Figure 6. Secchi Depth Measurements in Round Lake during 2007

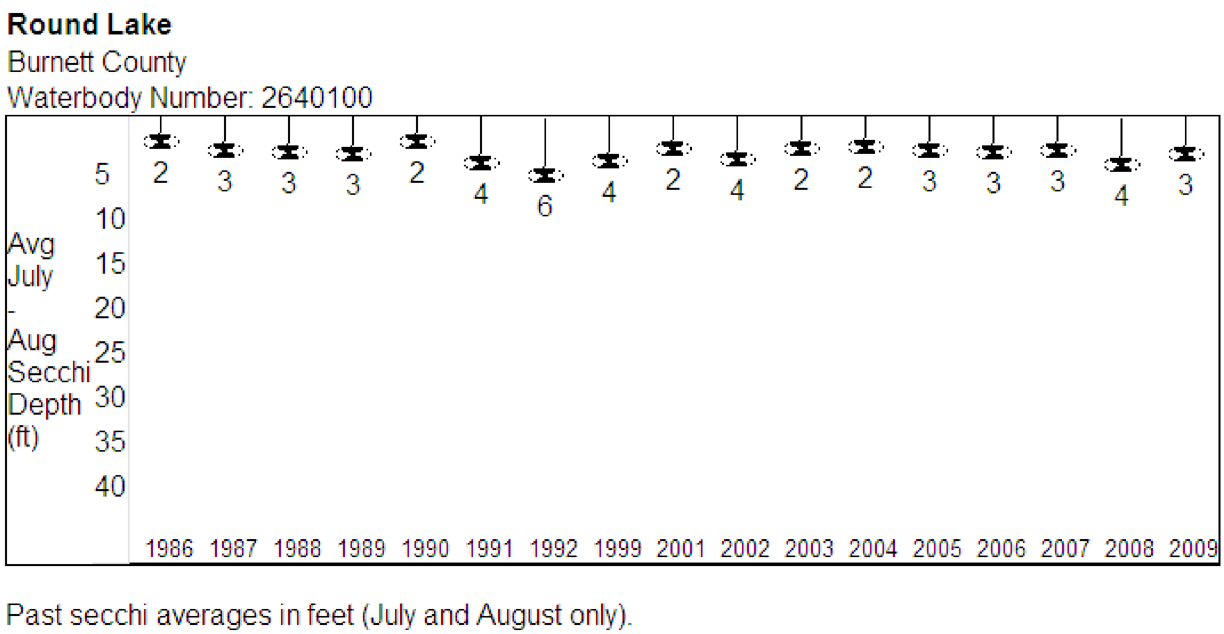


Figure 7. Secchi Depth Trend for Round Lake, 1986-2009

Big Trade Lake has also been monitored since 1986, however monitoring stopped in 2003. The Association should continue monitoring in order to keep a long -term trend of lake clarity. The average Secchi depth for Big Trade Lake over the seventeen years it was monitored was 3.4 feet, putting it in the eutrophic category. Secchi depths were measured in Little Trade Lake from 2000 through 2003 and averaged approximately 3 feet.

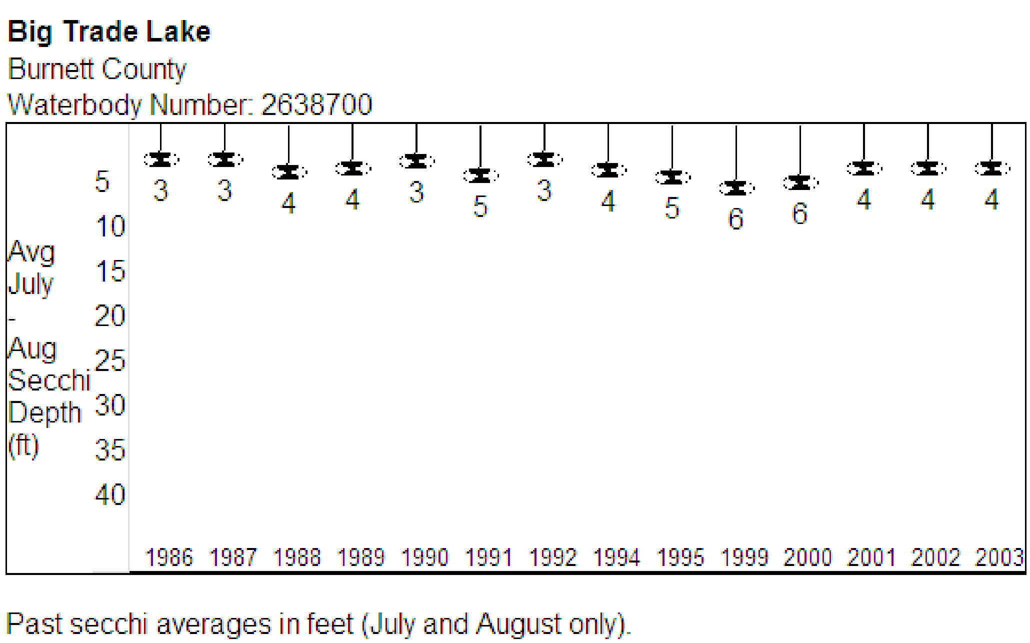


Figure 8. Secchi Depth Trend for Big Trade Lake, 1986-2003

Along with Secchi depth, phosphorous and chlorophyll a are the two parameters generally used to calculate a trophic state index. Using this data collected, lakes can be categorized into three states: oligotrophic, mesotrophic, and eutrophic (Shaw et al., 2000.) The categories are meant to serve as an overall interpretation of a lake's productivity level. Although many factors influence these relationships, the link between Secchi depth, phosphorus, and chlorophyll *a* is the basis of comparison for the Trophic State Index (TSI) (Lillie and Mason, 1983). Three equations for the TSI are used to calculate the trophic state of a lake:

TSI (P) = 14.42 * Ln [TP] + 4.15, where TP is in micrograms per liter (µg/L)
TSI (C) = 30.6 + 9.81 Ln [Chlor-a], where the chlorophyll *a* is in µg/L
TSI (S) = 60-14.41 * Ln [Secchi], where the Secchi depth is in meters (m)

Table 2. Trophic State Index for Long Trade Lake Monitoring Sites, 2007

South Long Trade	Value for Equation	TSI
Total Phosphorus (µg/L)	164	77.7
Chlorophyll *a* (µg/L)	80	73.6
Secchi Depth (m)	0.68	65.5

North Long Trade	Value for Equation	TSI
Total Phosphorus (µg/L)	172	78.4
Chlorophyll *a* (µg/L)	57	70.3
Secchi Depth (m)	0.65	66.2

Although the concentrations and TSI numbers between the north and south basins of Long Trade Lake differ, the range and relative values of the TSI are the same. The trophic state index for total phosphorus is higher than the TSI for chlorophyll *a* which is higher than the TSI for Secchi depth. This indicates that the lake is algae dominated (rather than macrophyte), but the algal biomass is limited by zooplankton grazing or possibly other factors.

Water chemistry data has been collected on Long Trade Lake since 2005 by volunteers. Seasonal total phosphorus has ranged from 102 to 187 µg/L, and chlorophyll *a* has ranged from 60 to 94 µg/L (Figure 9). The trophic state of Long Trade Lake from 1986 through 2009, as determined by Secchi depth and water chemistry is shown, in Figure 10 and a description of the general conditions is in Figure 11.

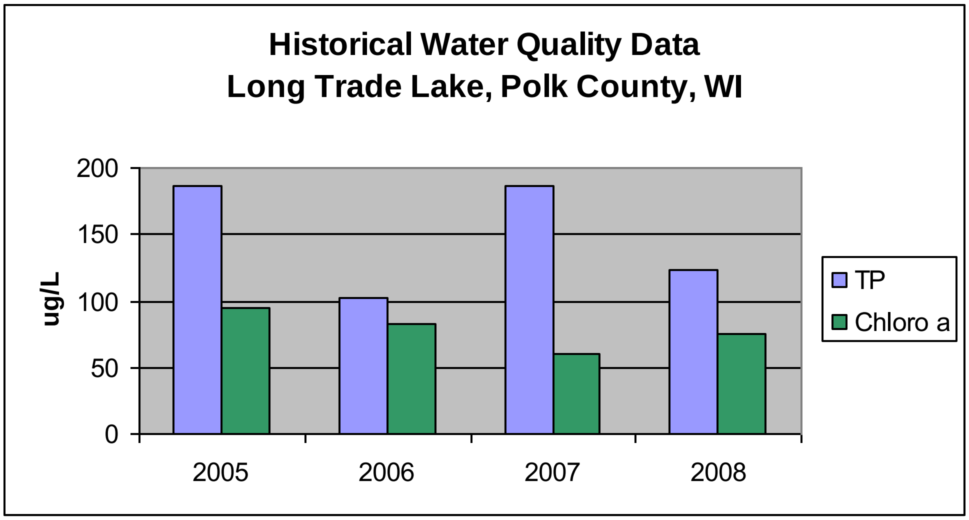
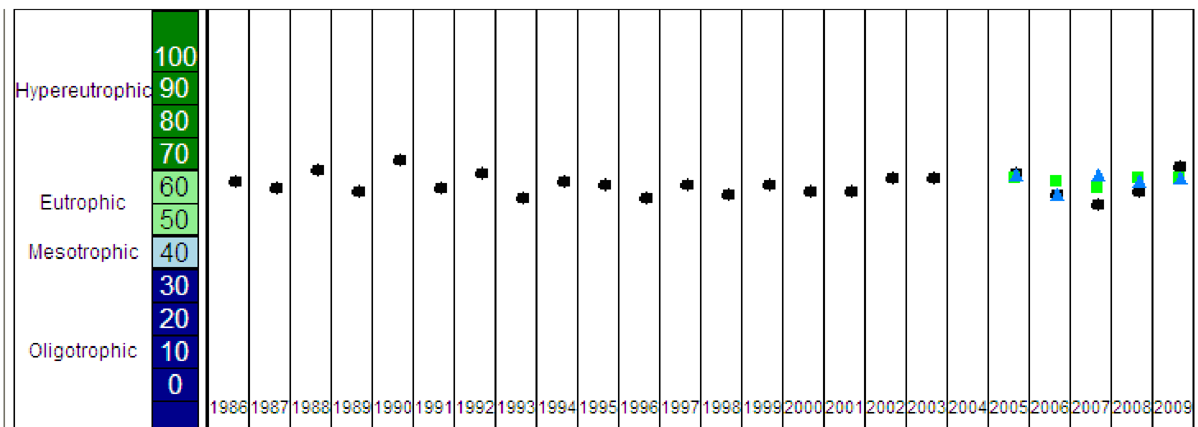


Figure 9. Historic Total Phosphorus (TP) and Chorophyll *a* (Chloro a) in Long Trade Lake



Monitoring Station: Long Trade Lake - Deep Hole-South Basin, Polk County
Past Summer (July-August) Trophic State Index (TSI) averages.

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

Figure 10. Long-term Trophic State Index of Long Trade Lake

TSI	General Description
<30	Oligotrophic; clear water, high dissolved oxygen throughout the year throughout the lake
30-40	Oligotrophic; clear water, possible periods of oxygen depletion in the lower depths of the lake
40-50	Mesotrophic; moderately clear water, increasing change of anoxia near the bottom of the lake in summer, fully acceptable for all recreation/aesthetic uses
50-60	Mildly eutrophic; decreased water clarity, anoxic near the bottom, may have macrophyte problem; warm-water fisheries only.
60-70	Eutrophic; blue-green algae dominance, scums possible, prolific aquatic plant growth. Full body recreation may be decreased
70-80	Hypereutrophic; heavy algal blooms possible throughout the summer, dense algae and macrophytes
>80	Algal scums, summer fish kills, few aquatic plants due to algal shading, rough fish dominate.

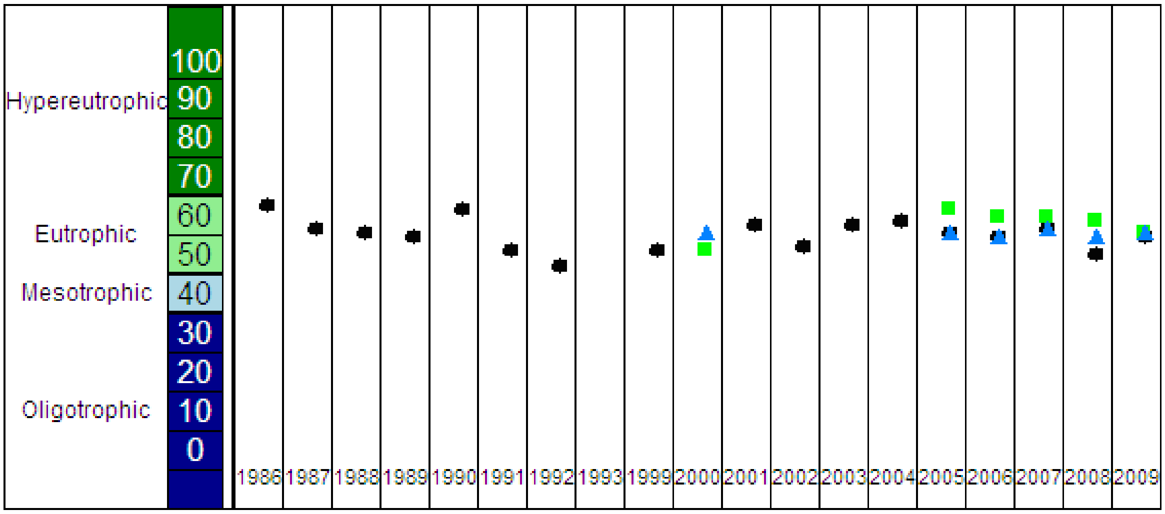
Long Trade TSI Ratings

Figure 11. Description of Long Trade Lake Trophic State Index

Round Lake had an average total phosphorus concentration of 54 µg/L in 2007, indicating eutrophic conditions (Table 3). While this concentration of phosphorus is less than that of Long Trade Lake, there is still enough phosphorus to cause nuisance algal blooms throughout the summer. The trophic state of Round Lake from 1986 through 2009 is shown, in Figure 12.

Table 3. Trophic State Index for Round Lake, 2007

Round Lake	Value for Equation	TSI
Total Phosphorus (µg/L)	54	61.7
Chlorophyll *a* (µg/L)	38	41.4
Secchi Depth (m)	1.17	57.7



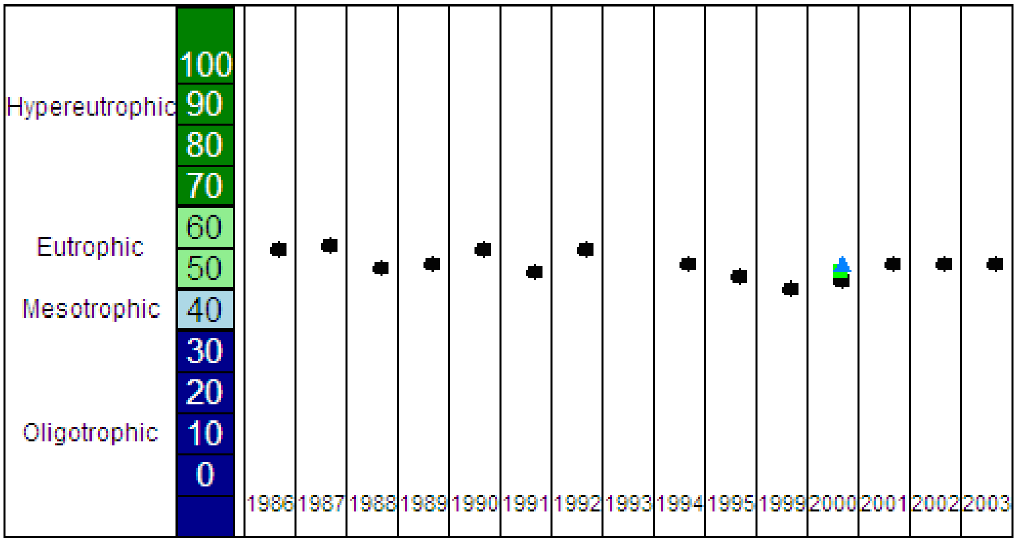
Monitoring Station: Round Lake - Deep Hole, Burnett County

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

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

Figure 12. Long-term Trophic State Index of Round Lake

Although Secchi measurements were taken consistently since 1986 in Big Trade Lake, total phosphorus and chlorophyll *a* concentrations were measured only once near the deep hole in late August 2000 () and once near the center of the lake in late August 2001. In 2000, the total phosphorous measured 36 µg/L and the chlorophyll *a* was 15 µg/L and in 2001 the total phosphorus was 60 µg/L and the chlorophyll *a* was 19 µg/L. As with the other lakes in the Trade River system, the long term Secchi monitoring shows the lake has been eutrophic for some time.



Monitoring Station: Big Trade Lake - Deep Hole, Burnett County
Past Summer (July-August) Trophic State Index (TSI) averages.

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

Figure 13. Long-term Trophic State Index of Big Trade Lake

The high productivity, or eutrophic state, of the lakes can be attributed to both natural characteristics of the lakes and to human impacts. The lakes are relatively shallow and are therefore susceptible to mixing events occurring during the summer after stratification has occurred. When phosphorus is distributed throughout the water column during such mixing events, algae are present to readily use the phosphorus.

The large watersheds of the lakes also contribute to the eutrophic state. Generally, water quality decreases with an increasing ratio of watershed area to lake area. A lake with ratio greater than 20:1 is likely to be naturally eutrophic. This is because as the watershed area increases, there are additional sources of runoff and nutrients to the lake. Also, the soils in this part of Wisconsin, in particular the Trade River Formation, contain elevated levels of plant-available phosphorus which can be delivered to the lakes by either sediment runoff or as dissolved phosphorus in the groundwater.

This naturally-occurring greater nutrient loading rate is compounded by human land use practices such as development and agriculture which puts a greater strain on the system to assimilate nutrients. Leaking or failing septic systems, pollution, and lawn and agricultural fertilizers and runoff are a few of the many probable impacts to water quality in the Trade River system.

Watersheds

A watershed is an area of land from which water drains to a common surface water feature, such as a stream, lake, or wetland. Long Trade, Round, Little Trade and Big Trade Lakes are all part of the Trade River watershed. The Trade River system begins in Polk County near of the Villages of Luck and Frederic, flows west into Long Trade Lake, then into Round Lake (Burnett County) and the rest of the Trade River lakes, eventually returning to Polk County and emptying into the St. Croix River. The results of a water quality study completed in 2007 for the Round and Long Trade Lakes watersheds are summarized below.

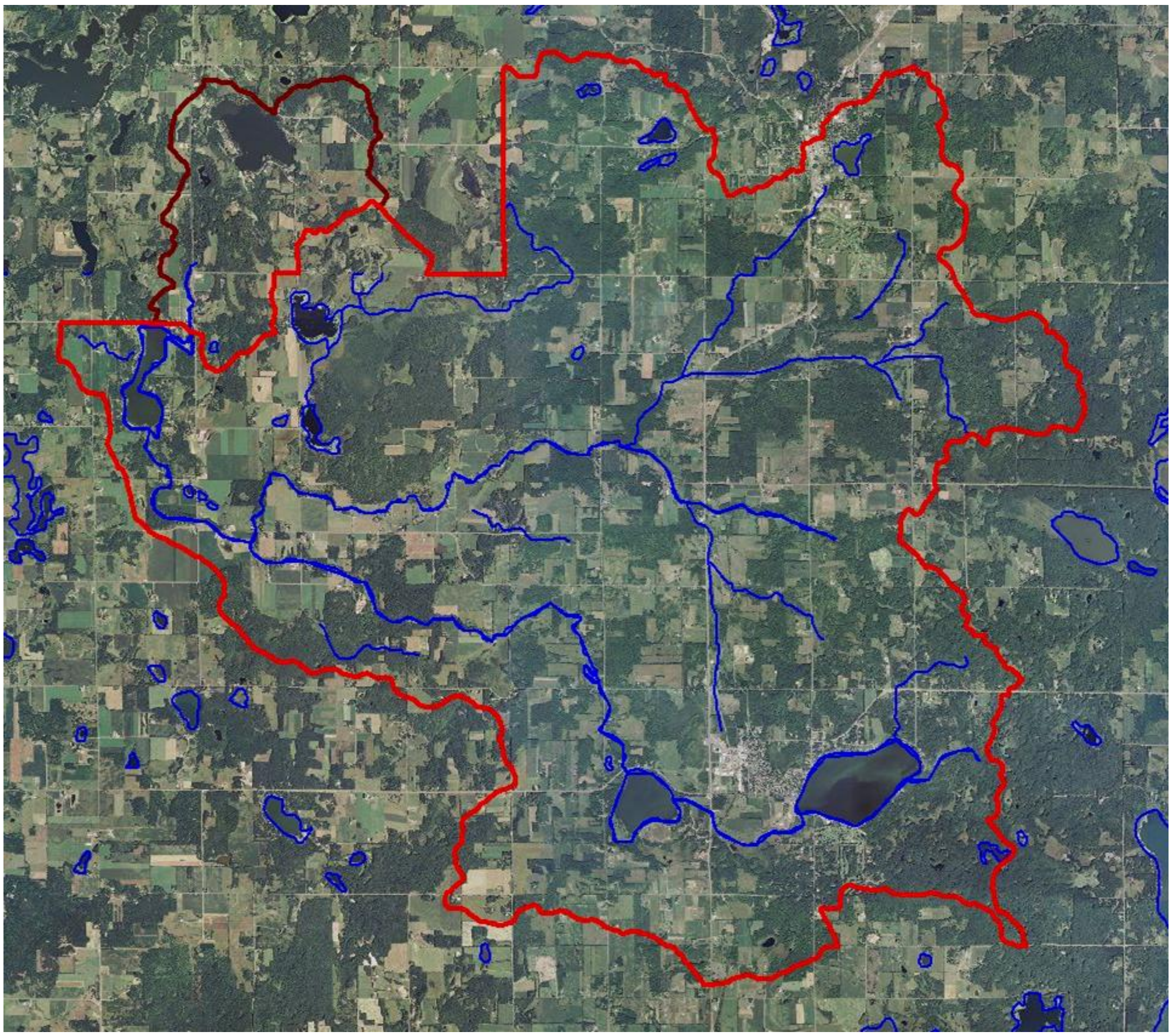


Figure 14. Long Trade Lake and Round Lake Watersheds

The watershed of Long Trade Lake encompasses 32,572 acres (Figure 14). The land use in the watershed is 44% agriculture, 42% forest, 11% wetland, 2% high density (HD) urban, 0.5% rural residential, and 0.5% lake surface (Figure 15). The agricultural land use can be broken further into pasture land or grassland (36% of total watershed), row crops (8% of total watershed), and mixed agriculture (including farmsteads, 0.25% of total watershed).

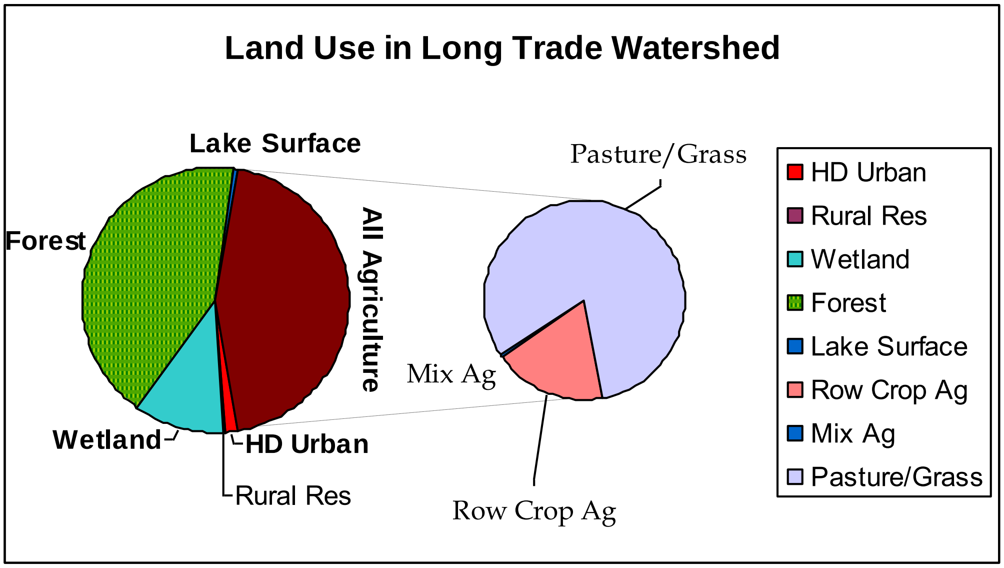


Figure 15. Land Use in the Long Trade Lake Watershed

The round lake watershed includes the Long Trade Lake watershed and 2,382 additional acres downstream of Long Trade Lake (Figure 16). The land use in this additional area is comprised of 39% agriculture, 53% forest, 5% wetland, 2% rural residential, and 9% lake surface. The agricultural land use can be broken further into pasture land or grassland (30% of total watershed) and row crops (8% of total watershed).

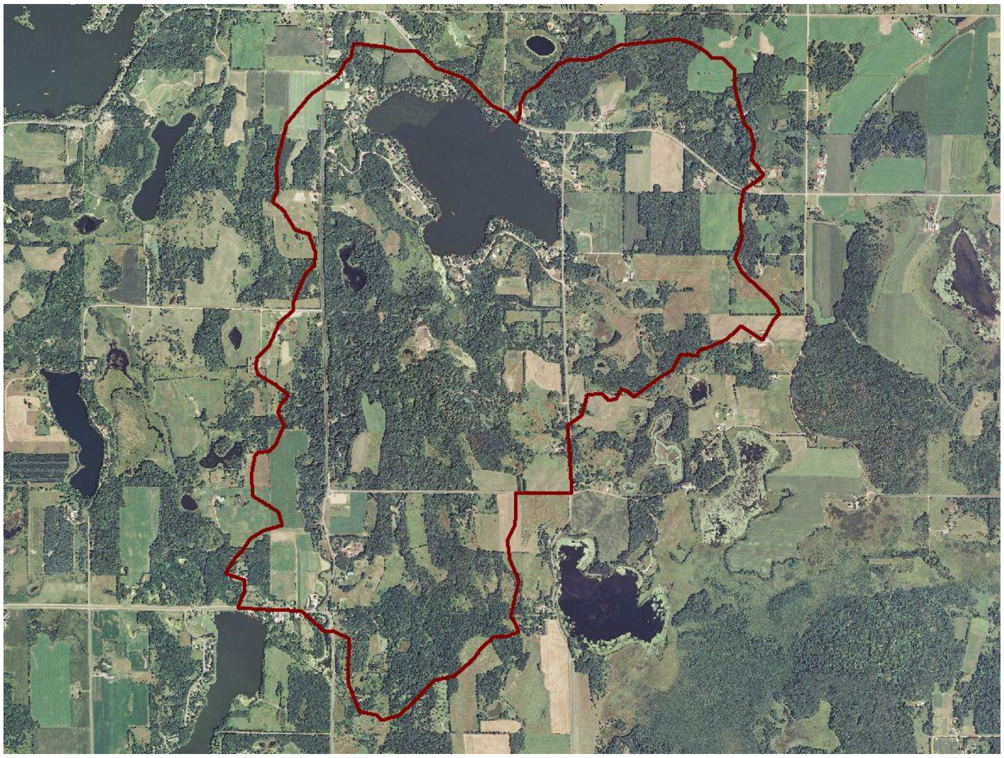


Figure 16. Portion of the Round Lake Watershed Downstream of Long Trade Lake

Ground-truthing has not been completed for the Big Trade or Little Trade Lake watersheds (Figure 17). Also, the land use within the Big Trade Lake and Little Trade Lake watersheds has not been delineated or modeled with current data. Although these lakes in relatively close proximity to Long Trade and Round Lakes, the watershed factors influencing water quality (for example, land use practices, topography, and soils) may vary greatly. As such, the Association should apply for a lake planning grant in order to assess the water quality and watershed condition of the Big Trade Lake and Little Trade Lake.

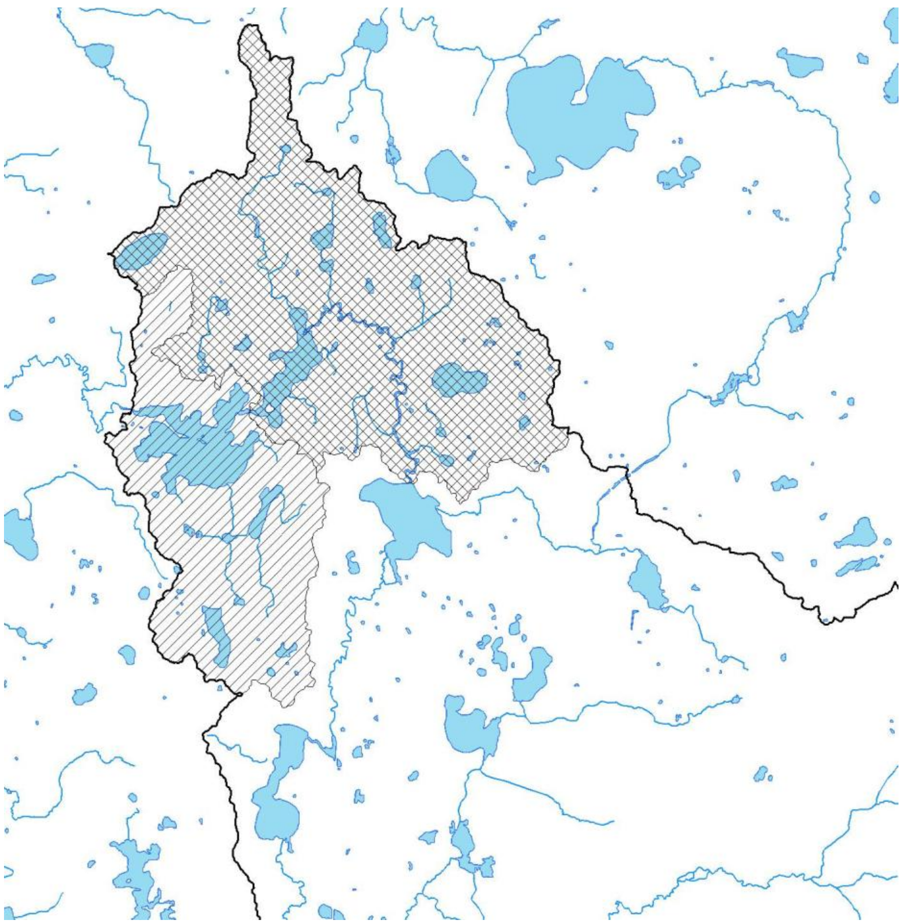


Figure 17. Portions of the Big Trade Lake and Little Trade Lake Watersheds

Phosphorous Loading from Watersheds

Phosphorous is the nutrient that limits algae growth in most Midwestern lakes, affecting water clarity and plant growth. The 2007 study found that 63 % of the phosphorous load to Long Trade Lake comes from non-point sources (Figure 18). Non-point sources include dissolved phosphorous carried by runoff and phosphorus bound to soil particles that are eroded from areas with inadequate vegetation. Only 0.6% of the load is from the atmosphere and, based on default loading coefficients, septic systems provided less than 0.1% of the phosphorus load.

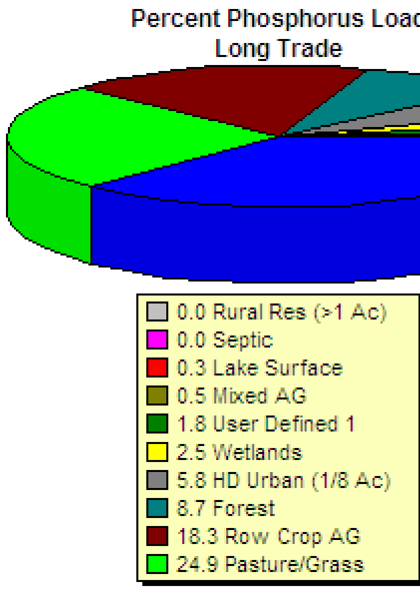


Figure 18. Phosphorus Sources in the Long Trade Lake Watershed

Round Lake has a different situation. 97% of the phosphorous loading is from "point sources"; either the Trade River leaving Long Trade Lake, or to a much lesser degree septic systems around the lake (Figure 19). Approximately 2.5% of the load comes from nonpoint sources directly draining to the lake. However, when the Trade River is taken out of the equation, nonpoint source phosphorous becomes over 89% of the load.

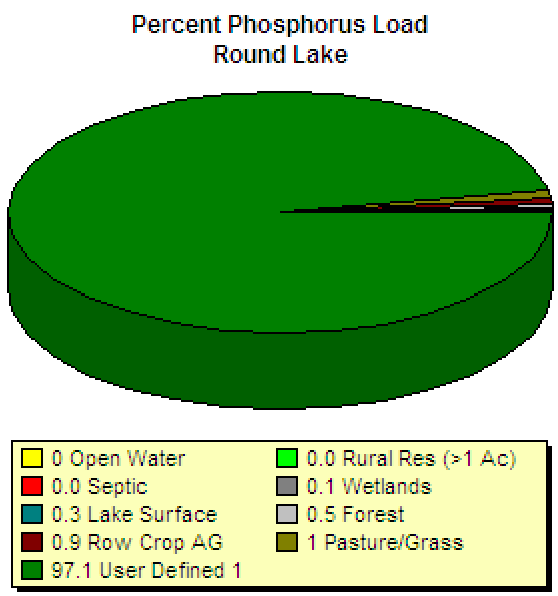


Figure 19. Phosphorus Sources in the Round Lake Watershed

When a watershed incorporates Best Management Practices (BMPs) and is maintained in a state of natural vegetation wherever possible, there is less impact of pollutants on any given lake. Agricultural and residential land-uses contribute a much higher phosphorous load than natural ecosystems, as soil erosion is greatly reduced when there is adequate vegetation cover. Soil erosion is reduces with a good ground cover (be it vegetation of a forest duff layer). Also, native vegetation, forest ground cover, and duff layers slow runoff and allow water to infiltrate into the ground where nutrients are utilized by plants, fungi and bacteria. Anything that reduces runoff will reduce nutrient inputs to a lake. A reduction of the nutrient load will in turn improve water quality and water clarity and thus help enhance the native aquatic plant community.

Shoreland areas are important source areas for nutrients to a lake. As described above, shorelands in a natural state will generally provide less runoff and phosphorus loading to lakes. Reducing soil erosion directly adjacent to the lake will improve the native aquatic plant community which is sensitive to sedimentation and disturbances. Erosion directly affects plants by removing nutrient rich soils, by covering plants in fine sediments and hindering photosynthesis, and via disturbances to the rhizosphere, which is the soil zone surrounding the roots in which complex relations exist between the plant, microorganisms and the soil. Fallen trees also help by protecting sensitive and shallow rooted species from boat wakes and wave action.

Aquatic Ecosystems

Native macrophyte communities provide an abundance of different habitat for many organisms, help to maintain water quality, sustain a healthy fishery, and protect the shoreline and riparian habitat that is utilized by organisms such as frog and nesting waterfowl.

Aquatic plants have many important functions and values to a lake ecosystem. They absorb nutrients from the sediment and the water column, which if not utilized by aquatic macrophytes would be utilized by algae and bacterioplankton. Some macrophytes, especially emergent species, can also remediate other pollutants. The roots of all aquatic macrophytes help deter sediment from re-suspending and emergent and rooted floating-leaf plants do an especially good job of mitigating the impact of wave on adjacent shorelines.

The different habitats that a native aquatic macrophyte community provides food and shelter for both large and small fish, invertebrates living both on the plants and in the sediment directly underneath provide a major food source for many panfish. Zooplankton often congregate in plant stands in shallow lakes, which is a major food source for many young of year fish (panfish will also graze on copepods). For large fish such as Northern Pike (*Esox lucius*), which are sit and wait predators, aquatic vegetation provides camouflage. Some fish, such as bluegill, can simply feed on the plants themselves.

Aquatic vegetation also offers food, shelter, and nesting material for waterfowl. Birds eat the invertebrates on the plants (a female blue-wing teal's diet while nesting may consist of 99% invertebrates), or the plants themselves, especially the seeds and tubers.

Native aquatic plant communities also offer protection from the invasion of aquatic invasive species. Much like lawn and agricultural weeds that germinate in newly disturbed soil, the two invasive species in these lakes (Eurasian Water Milfoil and Curly-leaf pondweed) are opportunistic. This means that as the native community is disturbed or removed (this could be from boat props, hand pulling, etc.) there is a more likely invasion of EWM or CLP in the disturbed area. Allowing native plants to persist may reduce the chance of invasion by invasive species. There may be localized problems with dense native vegetation for recreation, but that pales in comparison the devastation of a lake by invasive species, which often require very expensive annual control programs using herbicides in the lake.

Sensitive Areas

The WDNR has completed Sensitive Area surveys to designate areas within aquatic plant communities that provide important game fish, forage fish, macroinvertebrate, and wildlife habitat as well as important shoreline stabilization functional values. The WDNR is transitioning to designations of *critical habitat areas* that include both *sensitive areas* and *public rights features*. The c*ritical habitat area* designation will provide a holistic approach to ecosystem assessment and protection of those areas within a lake that are most important for preserving the very character and qualities of the lake. These sites are those sensitive and fragile areas that support wildlife and fish habitat, provide the mechanisms that protect the water quality in the lake, harbor quality plant communities, and preserve the places of serenity and aesthetic beauty for the enjoyment of lake residents and visitors.

Critical habitat areas include *sensitive areas* that offer critical or unique fish and wildlife habitat (including seasonal or lifestage requirements) or offer water quality or erosion control benefits to the area (Administrative code 107.05(3)(1)(1)). The Wisconsin Department of Natural Resources is given the authority for the identification and protection of sensitive areas of the lakes. *Public rights features* are areas that fulfill the right of the public for navigation, quality and quantity of water, fishing, swimming, or natural scenic beauty. Protecting these *critical habitat areas* requires the protection of shoreline and in-lake habitat. The *critical habitat area* designation will provide a framework for management decisions that impact the ecosystem of the lake.

The WDNR completed a Sensitive Areas survey for Big Trade and Little Trade Lakes in the summer of 2000. The Sensitive Area survey identified 9 areas that merit special protection of the aquatic habitat (Figure 20 and Figure 21). The aquatic vegetation and make morphology in these areas provide important spawning and nursery habitat for numerous fish species. The report notes CLP as a member of the aquatic plant community and recommends chemical or mechanical treatment methods be approached with caution in the Sensitive Areas. The full WDNR report can be found in Appendix A. The data and recommendations from these reports are always considered in plan implementation.

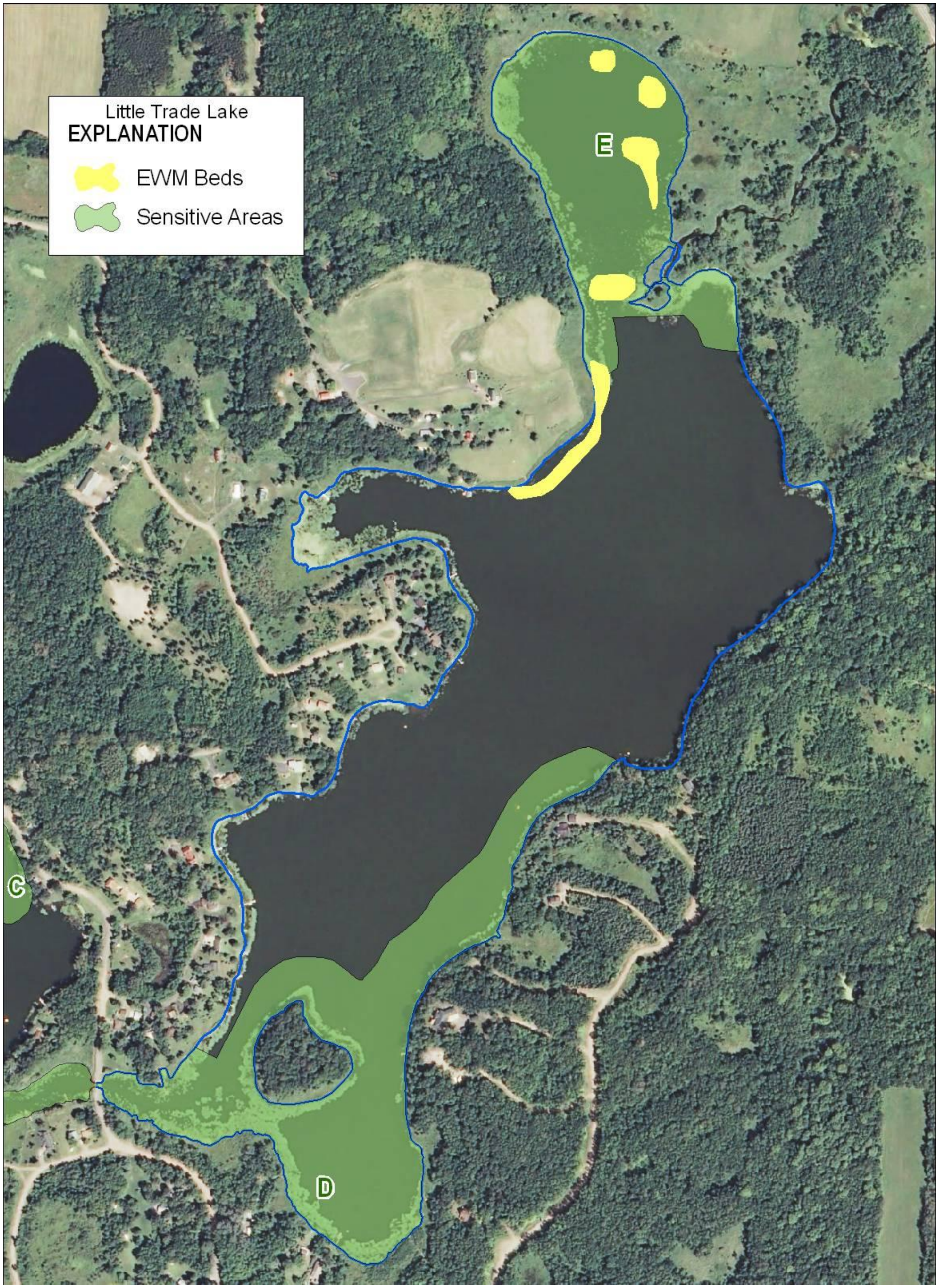


Figure 20. Little Trade Lake Sensitive Areas

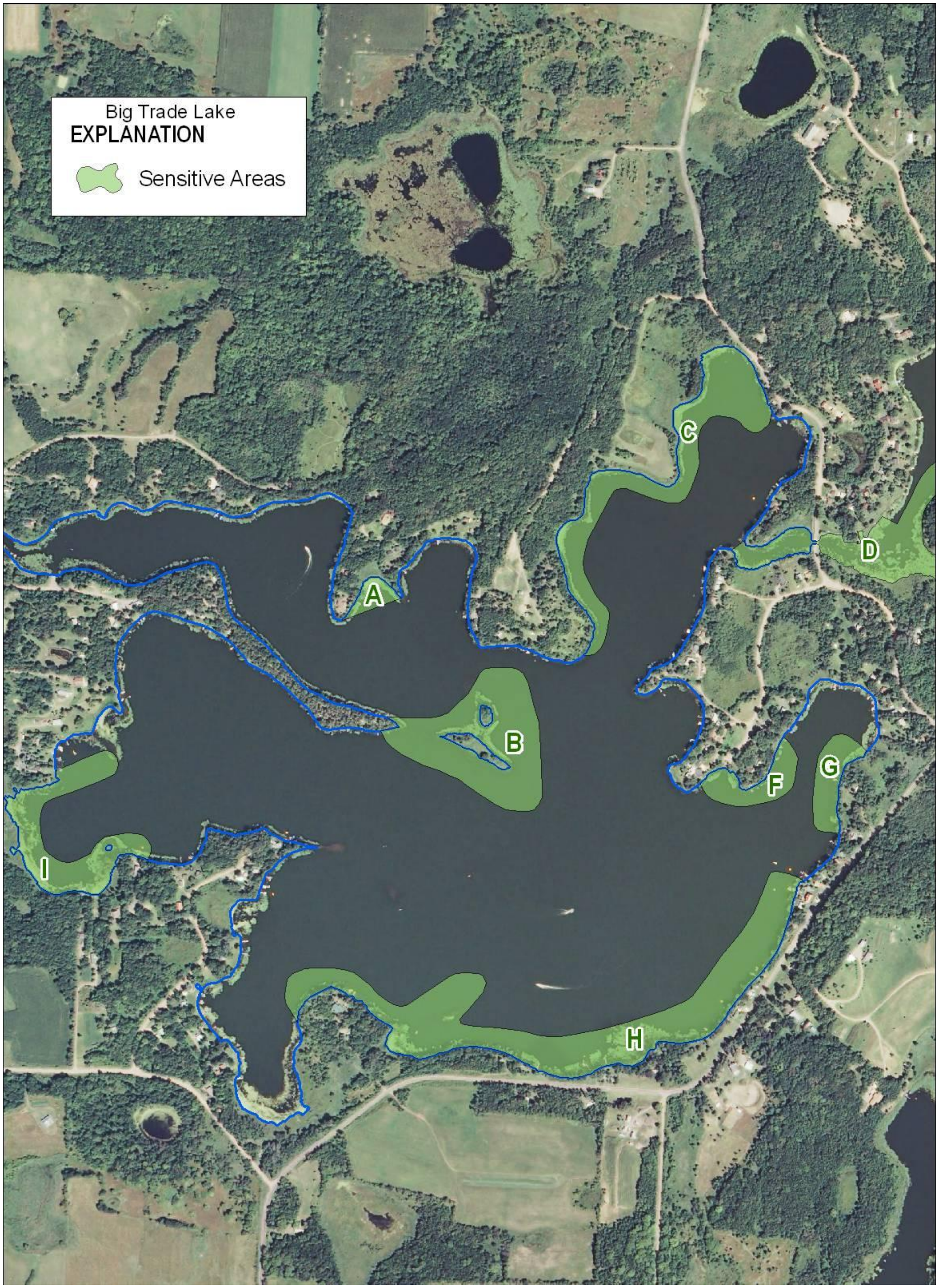


Figure 21. Big Trade Lake Sensitive Areas

Rare and Endangered Species and Habitat

Long Trade Lake is located in the Town of Laketown (T.36N. – R.18W.) in Polk County. Round Lake, Little Trade Lake, and Big Trade Lake are located in the Town of Trade Lake (T.37N. – R.18W.) in Burnett County. The Wisconsin Natural Heritage Inventory lists the following species as having been identified in these areas:

Table 4. Rare and Endangered Species

Genus Species Name	Common Name	State Status
Cygnus buccinator	Trumpeter Swan	END
Fundulus diaphanus	Banded Killfish	SC/N
Haliaeetus leucocephalus	Bald Eagle	SC/P
Opuntia fragilis	Brittle Prickley-pear	THR

THR = Threatened; END = endangered; SC/N = Special Concern (no laws regulating use, possessions, or harvesting); and SC/P = Special Concern (fully protected)

Fisheries

Fish species found in the Trade Lakes system are listed in Table 5. This species list is from the Wisconsin Lakes booklet published by the WDNR (2005) which provides basic information on the relative abundance of game fish. The only known fishery population estimate was completed in 2001 by the WDNR on adult musky. At that time, there were an estimated 77 adult musky in Big Trade Lake and 33 in Little Trade Lake. The Lake Association should work with WDNR fisheries biologists and Tribal officials to assess the fishery and population dynamics. The population of carp, which are known to inhabit the lake, should also be evaluated to assess their impact on the water quality, the native aquatic plant community, and the spread of aquatic invasive species.

Table 5. Fishery Resources in the Trade Lakes System

Fish species	Long Trade	Round	Trade Lakes
Muskie			Present
Northern Pike	Common	Common	Common
Walleye		Common	Present
Large Mouth Bass	Common	Common	Abundant
Small Mouth Bass		Present	
Pan Fish	Common	Common	Common

Wild Rice (*Zizania palustris*)

According to the Great Lakes Indian Fish and Wildlife Commission (GLIFWC), Long Trade, Round, Little Trade and Big Trade Lakes are not wild rice waters. Additionally, wild rice was not found during the aquatic plant surveys of the lakes or during the Sensitive Areas survey. Although wild rice is not present in these lakes, it warrants attention due to its ecologic and cultural significance and its abundance in nearby lakes and streams (for example, the Grettum Flowage, Rice Lake, Spirit Lake, and the Clam Lakes). Any activity included in a comprehensive lake or aquatic plant management plan that could potentially impact the growth of wild rice in any body of water that has in the past, currently has, or potentially could have wild rice in the future requires consultation with the Tribal Nations. This consultation is completed by the Department of Natural Resources during their review of lake management documents. When present in a lake, wild rice is afforded numerous protections due to its ecological and cultural significance and management is therefore focused on harvest goals and protection rather than removal.

Wild rice is an annual aquatic grass that produces seed that is a nutritious source of food for wildlife and people (Figure 22). As a native food crop, it has a tremendous amount of cultural significance to the Wisconsin and Minnesota Native American Nations. Wild rice pulls large amounts of nutrients from the sediment in a single year and the stalks provide a place for filamentous algae and other small macrophytes to attach and grow. These small macrophytes pull phosphorous in its dissolved state directly from the water. Wild rice can benefit water quality, provide habitat for wildlife, and help minimize substrate re-suspension and shoreland erosion.

In Wisconsin, wild rice has historically ranged throughout the state. Declines in historic wild rice beds have occurred statewide due to many factors, including dams, pollution, large boat wakes, and invasive plant species. Renewed interest in the wild rice community has led to large-scale restoration efforts to reintroduce wild rice in Wisconsin's landscape. There is the potential for planting wild rice at shoreline restoration and rehabilitation sites in the Trade Lakes system. Extensive information is available on wild rice from GLIFWC and the WDNR.

Figure 22. Wild Rice on Clam Lake in Burnett County. Photo by John Haack

Aquatic Plant Communities

Whole-lake aquatic plant surveys were completed by WDNR staff on Long Trade Lake (July 12, 2006) and on Round Lake (July 17-18, 2007), by Polk County LWRD and Burnett County LWCD staff on Big Trade Lake (August 18 and 20, 2007) and by LWRD staff on Little Trade Lake (September 3 and 30, 2009). Detailed methods and results of the surveys can be found in Appendix B. The surveys, which were completed following a WDNR protocol for a point intercept survey, provide the basis for aquatic plant management discussion in this APM Plan. Summary statistics from each survey are presented in Table **6**.

Table 6. **Aquatic Plant Survey Summary Statistics**

Statistic	Long Trade (2006)	Round (2007)	Little Trade (2009)	Big Trade (2009)
Total number of sample sites	376	1000	336	652
Total number of sites sampled	130	303	329	632
Total number of sites with vegetation	67	105	115	147
Total number of sites shallower than maximum depth of plants	129	223	158	285
Frequency of occurrence at sites shallower than maximum depth of plants	51.9	47.1	72.8	51.6
Simpson Diversity Index	0.9	0.9	0.8	0.9
Maximum depth of plants (ft)	7.5	13.0	8.0	11.0
Number of sites sampled using rake on Rope	0	0	0	10
Number of sites sampled using rake on Pole	129	272	174	201
Average number of all species per site (shallower than max depth)	1.81	1.26	1.73	
Average number of all species per site (veg. sites only)	3.48	2.67	2.37	3.10
Average number of native species per site (shallower than max depth)	1.26	1.03	1.48	1.33
Average number of native species per site (veg. sites only)	3.18	2.30	2.11	2.98
Species Richness	12	22	12	21
Species Richness (including visuals)	14	24	12	22

Aquatic plants were found to be growing to maximum depths ranging from 7.5 feet in Long Trade Lake to 13 feet in Round Lake (Table **6**). The maximum depth of plant growth was used to identify the littoral zone, defined as the area where rooted and floating aquatic plants (also called macrophytes) can grow because sufficient sunlight reaches the sediments and lake bottom. The diverse habitat in the littoral zone provides food and habitat for a large number of vertebrates and invertebrates. For example, the littoral zone is key area for fish spawning and cover, typically supports the largest and most diverse populations of invertebrates, and is used by birds and waterfowl for nesting and feeding. Shallow lakes depend on littoral communities to provide sediment stabilization and to offer zooplankton refuge (zooplankton are tiny critters that eat algae).

The littoral zones of Long Trade, Round, Little Trade, and Big Trade Lakes are shown in Figure 23, Figure 24, Figure 25, and Figure 26, respectively. The number of sites with vegetation gives a good indication of the plant coverage of the lake. In Long Trade Lake, 67 of the 376 sites had aquatic plants, so approximately 18% (67/376) of the lake, or roughly 27 acres, has aquatic plants. Using this method, the approximate aquatic plant coverage of Round Lake is 21 acres (11% of the lake), for Little Trade 44 acres (34%) and for Big Trade 75 acres (23%). Using the total number of sites shallower than the maximum depth of plants similarly can provide an estimate of littoral zone area. The absence of plants at such sites indicates some factor (for example, substrate, localized low water clarity, or foraging fish such as carp) is limiting plant growth.

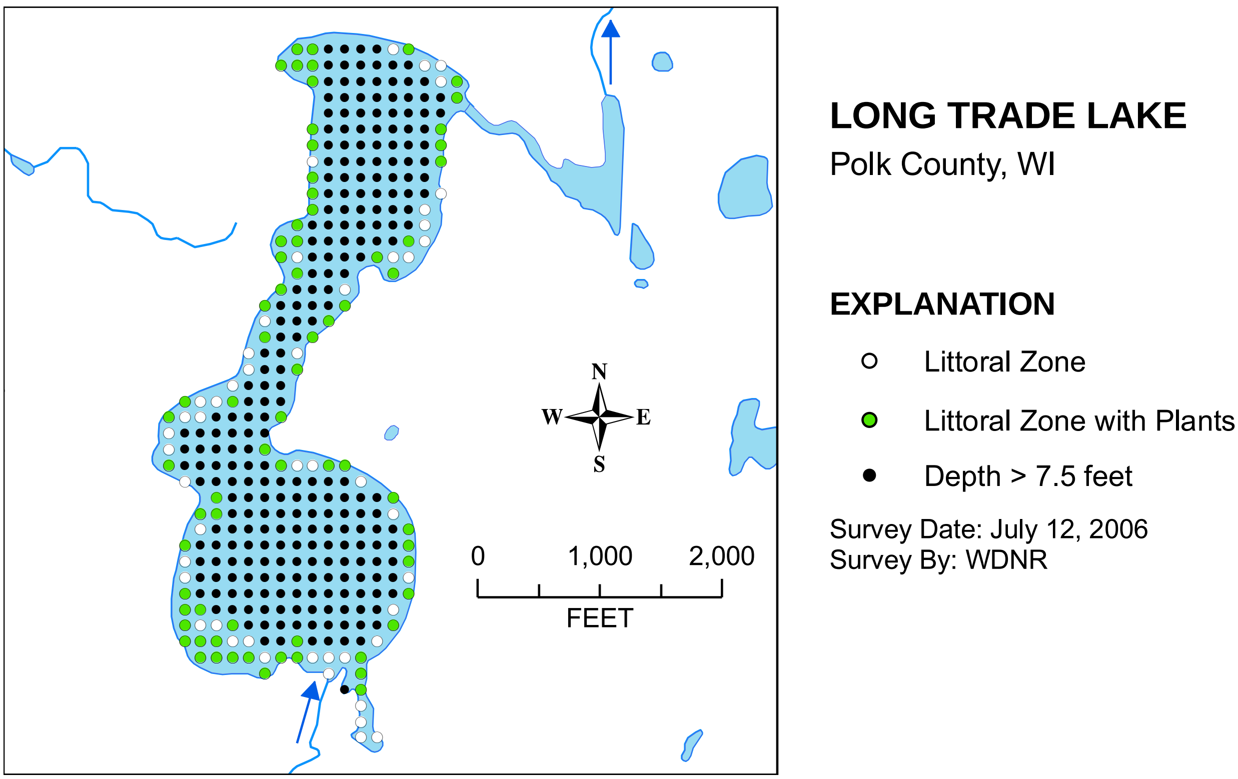


Figure 23. Littoral Zone in Long Trade Lake, 2006

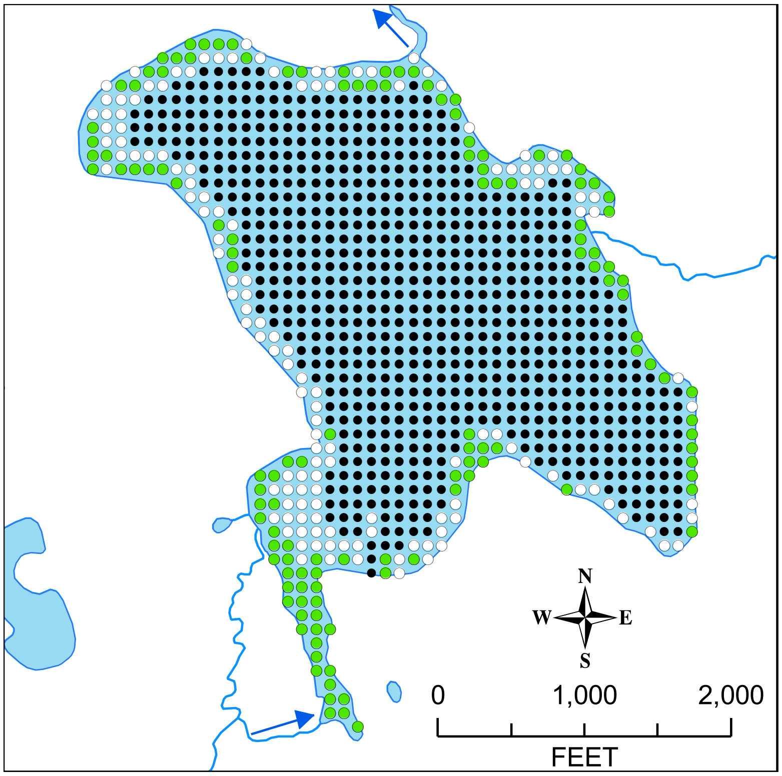


Figure 24. Littoral Zone in Round Lake, 2007

ROUND LAKE

Burnett County, WI

EXPLANATION

○ Littoral Zone

● Littoral Zone with Plants

● Depth > 13 feet

Survey Date: July 17-18, 2007
Survey By: WDNR

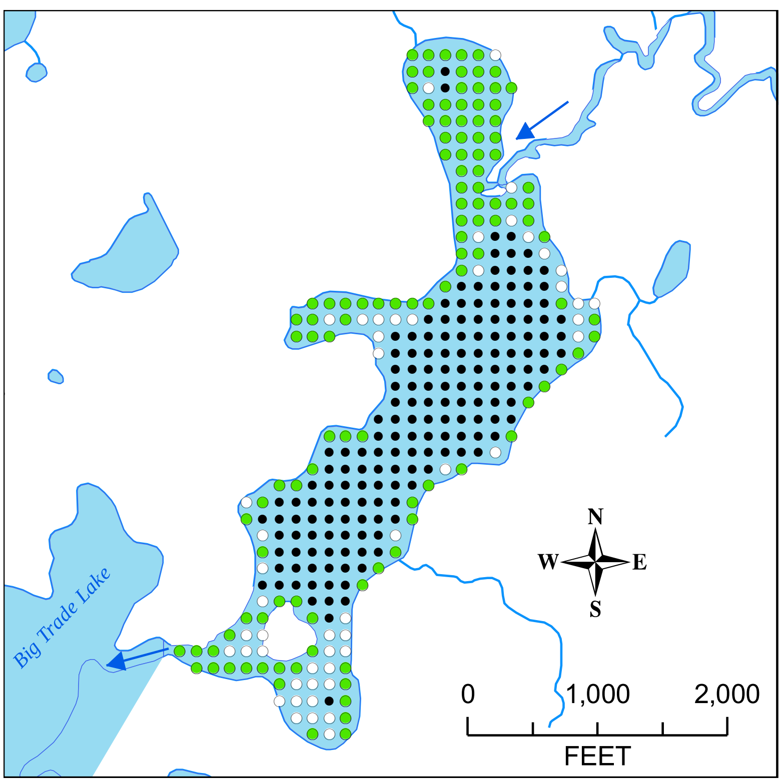


Figure 25. Littoral Zone in Little Trade Lake, 2009

LITTLE TRADE LAKE

Burnett County, WI

EXPLANATION

○ Littoral Zone

● Littoral Zone with Plants

● Depth > 8 feet

Survey Date: September 3 and 30, 2009
Survey By: Polk Co LWRD

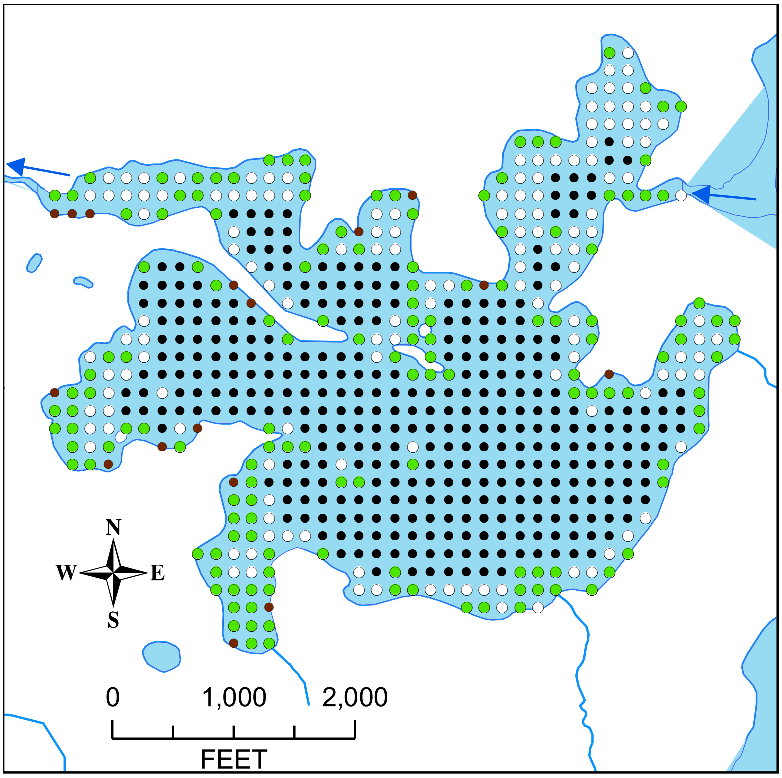


Figure 26. Littoral Zone in Big Trade Lake, 2009

The littoral zone substrate varied throughout the lakes. Muck and sand were the dominant lakebed materials in the Long Trade Lake littoral zone. The substrate in the Round Lake littoral zone is comprised primarily of muck and some rock; however a 1,500-foot portion of the littoral zone along the northern shore (near the outlet) was largely comprised of rock. The substrate in both the Little Trade and Big Trade Lake littoral zone was largely muck.

A Floristic Quality Assessment was performed using the data from each of the aquatic plant surveys. This assessment replaces a subjective measure of quality, such as "high" or "low" with more quantitative measures that allow for comparison of the floristic quality among many sites and for tracking changes over time. A Floristic Quality Assessment is based on calculating an average coefficient of conservatism (mean C) and a floristic quality index (FQI) for a lake. Higher mean C and FQI numbers indicate higher floristic quality and biological integrity and a lower level of disturbance impacts. Non-native plants were not part of the pre-settlement flora, so no coefficient is assigned to them and they are not considered in the calculation of mean C or FQI.

The coefficient of conservatism (C) is the basis of the FQI calculation. Each native species is assigned a value from zero to 10, which represents the probability that a plant species is likely to occur in a lake relatively unaltered from what is believed to be a pre-settlement condition. A C value of zero indicates the probability is almost zero, while a C of 10 indicates the plant is almost certain to be found only in an un-degraded natural community. The mean C value in the Trade Lakes system ranged from 4.8 to 5.1 (Table 7), which is below the North Central Hardwood Forests median mean C of 5.6.

The FQI is calculated by multiplying the mean C by the square root of the total number of native species inventoried, thereby combining the conservatism of the species present with a measure of the species richness. The FQI is commonly used to express the quality of a natural area; a higher FQI indicates a healthier aquatic plant community. Nichols (1999) reported a range of FQI values from 3.0 to 44.6 in Wisconsin Lakes. The FQI of the lakes in the Trade Lakes system ranged from 15.5 to 22.3 (Table 7), with all but Big Trade Lake being lower than both the statewide median of 22.2 and the North Central Hardwood Forests Ecoregion median of 20.9 (Nichols, 1999).

Table 7. Floristic Quality Assessment Variables

Floristic Quality Variable	Long Trade (2006)	Round (2007)	Little Trade (2009)	Big Trade (2009)
Number species assigned C value	11	17	10	19
Mean C	4.8	5.0	4.9	5.1
Floristic Quality Index	16.0	20.6	15.5	22.3

C = coefficient of conservatism

The lower mean C and FQI values indicate lower floristic quality and biological integrity and a higher level of disturbance in the Trade Lakes system compared to other lakes in northwest Wisconsin. Improving the health and quality of the native plant community through protection and education is one goal of this APM Plan.

The plant species with the highest frequency of occurrence varied among the lakes. Filamentous algae and coontail (*Ceratophyllum demersum*) were the two most common aquatic plants found in Round, Little Trade, and Big Trade Lakes whereas filamentous algae and small duckweed were the most common in Long Trade Lake. In fact, algae and free floating aquatic plants made up the top four most common aquatic plants in Long Trade Lake. Further detail on plant occurrences can be found in Appendix B.

Aquatic Invasive Species in the Trade Lakes System

Two species of non-native aquatic invasive plants have been identified in the lakes. These are Eurasian water milfoil (*Myriophyllum spicatum*), or EWM, and curly-leaf pondweed (*Potamogeton crispus*), or CLP. WDNR records indicate that the EWM in Long Trade Lake is Hybrid watermilfoil (*Myriophyllum spicatum x M. sibiricum*), an invasive cross between the native northern watermilfoil and EWM. Further testing would be needed to confirm whether or not it is a hybrid; management will remain the same. To date, the CLP has not been quantified but has been found in each lake. Purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), two other non-native plant species classified as aquatic invasive species, are also present within the Trade Lakes watershed.

In 2010 the Polk County Land and Water Resources Department mapped EWM beds in the entire Trade Lakes system. The LWRD found that the Little Trade Lake EWM beds had expanded from 3 acres in 2009 to 5.32 acres in 2010 (Figure 27). The bed mapping identified 15.54 acres of EWM in Round Lake, covering much of the littoral zone (Figure 28). The most expansive EWM beds found in 2010 were in Long Trade Lake, which covered 25.33 acres (Figure 29). The beds were covering much of the littoral zone and many were canopied out, likely shading beneficial native macrophytes (Figure 30).

Figure 27. 2010 Eurasian Watermilfoil Bed Distribution in Little Trade Lake

Figure 28. 2010 Eurasian Watermilfoil Bed Distribution in Round Lake

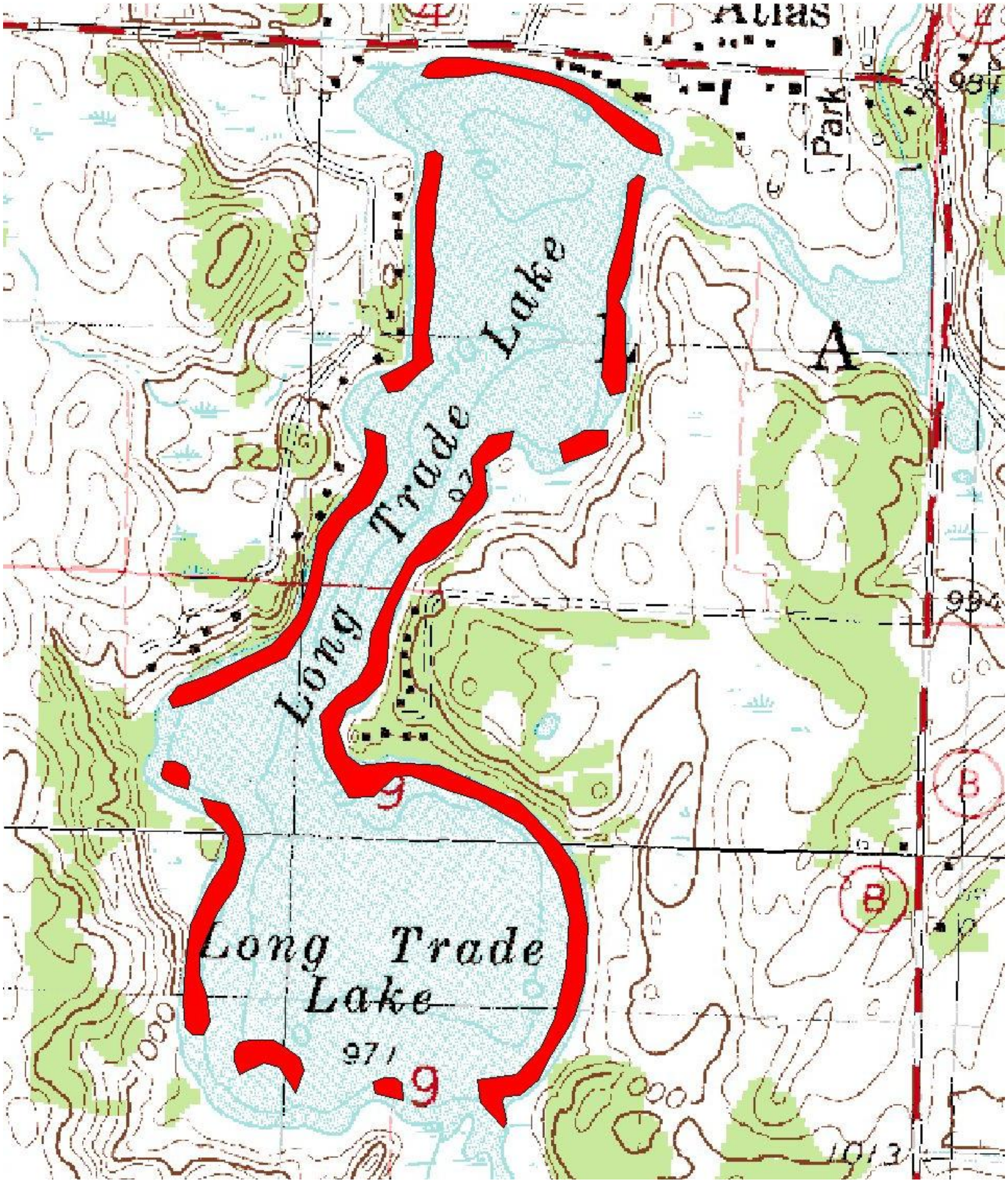


Figure 29. 2010 Eurasian Watermilfoil Bed Distribution in Long Trade Lake

Figure 30. Dense, Canopied Eurasian Watermilfoil Bed in Long Trade Lake in 2010

Eurasian Water Milfoil (*Myriophyllum spicatum)*

The following Eurasian water milfoil information is taken from the Wisconsin DNR website.

Identification

Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface.
The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is difficult to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

Characteristics

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is generally restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lakebeds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

Reproduction and dispersal

Unlike many other plants, Eurasian water milfoil 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. Milfoils is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring.

Ecological impacts

Eurasian water milfoil's ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil 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.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct water intakes for industrial and power generation. 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 Eurasian water milfoil may also lead to deteriorating water quality and algae blooms in infested lakes.

Control methods

Preventing a Eurasian water milfoil invasion requires various efforts. The first component is public awareness of the necessity to remove aquatic plant fragments at boat landings. Inspection programs should provide physical inspections as well as a direct educational message. The public awareness and inspection programs supported by Wisconsin DNR and UW Extension are called Clean Boats, Clean Waters programs in Wisconsin. Native plant beds must be protected from disturbance caused by boaters and careless plant control methods. A watershed management program should decrease nutrients reaching the lake thereby reducing the likelihood that Eurasian milfoil colonies will establish and spread.

Monitoring is also important so that introduced plants can be controlled immediately. The lake association and lakeshore owners should check for new colonies and control them before they spread. The plants can be hand pulled or raked. It is imperative that all fragments be removed from the water and the shore. If Eurasian water milfoil is present, additional control methods should be considered including mechanical control, chemical control, and biological control. As always, prevention is the best approach to invasive species management.

A good strategy for a systematic monitoring program is to target areas where the native Northern water milfoil (*Myriophyllum sibiricum)* is found. From a management perspective, the location of northern water milfoil can be important, because EWM and Northern water milfoil grow in similar conditions. This plant is often confused with Eurasian water milfoil, which looks relatively similar. Unlike Eurasian water milfoil (EWM), northern water milfoil is native and a desirable plant to have in the lake. It has very fine leaves that provide habitat for small planktonic organisms, which make up an important part of the food chain.

Status

There are several other lakes in Polk and Burnett Counties as well as nearby Washburn and Barron Counties with Eurasian water milfoil.

Table 8. Eurasian Watermilfoil Infestations in the Surrounding Area

Waterbody	County	Year Identified
Horseshoe Lake	Polk	
Pike Lake	Polk	2010
Long Trade	Polk	
Round	Burnett	2003
Big (Little) Trade	Burnett	2009
Ham Lake	Burnett	2003
Minong Flowage	Washburn	2002
Nancy Lake	Washburn	1991
Totogatic River	Washburn	2003
Shallow Lake	Washburn/Burnett/Barron	2003
Beaver Dam	Barron	1991

Curly-Leaf Pondweed (*Potamogeton crispus*)

The following curly-leaf pondweed information is taken from the Wisconsin DNR website.

Description

Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves 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

Distribution and Habitat

Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine

Life History and Effects of Invasion

Curly-leaf pondweed 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 curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It 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 outcompete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed 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. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation.

Control Methods

Turions and plant fragments can be carried on boats, trailers, motors and fishing gear from one water body to another, thus proper prevention techniques are essential to curb the spread of this aquatic invasive. An effective prevention and remediation program also addresses the overall health of a waterbody: Maintaining a healthy ecosystem with diverse native aquatic plants and animals as well as minimizing nutrient and ollutant inputs will deter invasions. Once introduced, curly-leaf pondweed spreads rapidly. Long-term management requires the reduction or elimination of turions to interrupt the lifecycle.

WDNR permits are required for chemical treatments, mechanical treatments, some manual treatments, biological control, bottom screening, and buoy/barrier placement. Manual/Mechanical Control: To have the maximum benefit, manual/mechanical control efforts should be undertaken in the spring or early summer. Mechanical control includes raking, hand-cutting or harvesting vegetation. Raking and hand cutting remove plants at the sediment surface, and there is some evidence that early season cutting of pondweed can prevent turion production. Harvesting generally removes the top 5 feet of the plant. Curly-leaf pondweed can spread from plant fragments, so it is important to clean all vegetation off boats and equipment before leaving water access.

Chemical control: There are a small number of aquatic herbicides that can be used to control curly-leaf pondweed. In Minnesota, good to excellent control was obtained using formulations of diquat (Reward) and endothall (Aquathall K). These chemicals can be used in small areas and will usually knock down curly-leaf pondweed within 2 weeks. The best time for treatment is in spring or early summer when natives are still dormant and temperatures are low enough for endothall be effective. In early experiments with fluridone (Sonar), production of turions was completely inhibited following early season treatments. Fluridone usually has to be applied to an entire lake and requires 30 days to knock down curly-leaf pondweed.

Habitat manipulation: Habitat manipulation such as drawdowns and dredging can also be used to manage curly-leaf pondweed. Fall drawdown can kill the plants by exposing them to freezing temperatures and dessication. Dredging can be used as a control by increasing the water depth. In deep water, the plants do not receive enough light to survive. This method can be detrimental to desired plants, as all macrophytes would be prevented from growing for many years. This high level of disturbance may also create favorable conditions for the invasion of other invasive species.

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems (Figure 31). The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars. 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.

Figure 31. Purple Loosestrife Flower Head and Stems

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. Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2010: http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)

Purple loosestrife is widely dispersed throughout the Trade River system (Figure 32). Purple loosestrife essentially lines the banks of the Trade River in many places through the Long Trade, Round, Trade Lakes' area. It is well-established in the wetlands adjacent to the lakes and the river and can be found in many places along the shoreline as single plants, small patches, or in large beds. It is relatively easy to distinguish in late July and August by its very distinctive flowering head (Figure 31).

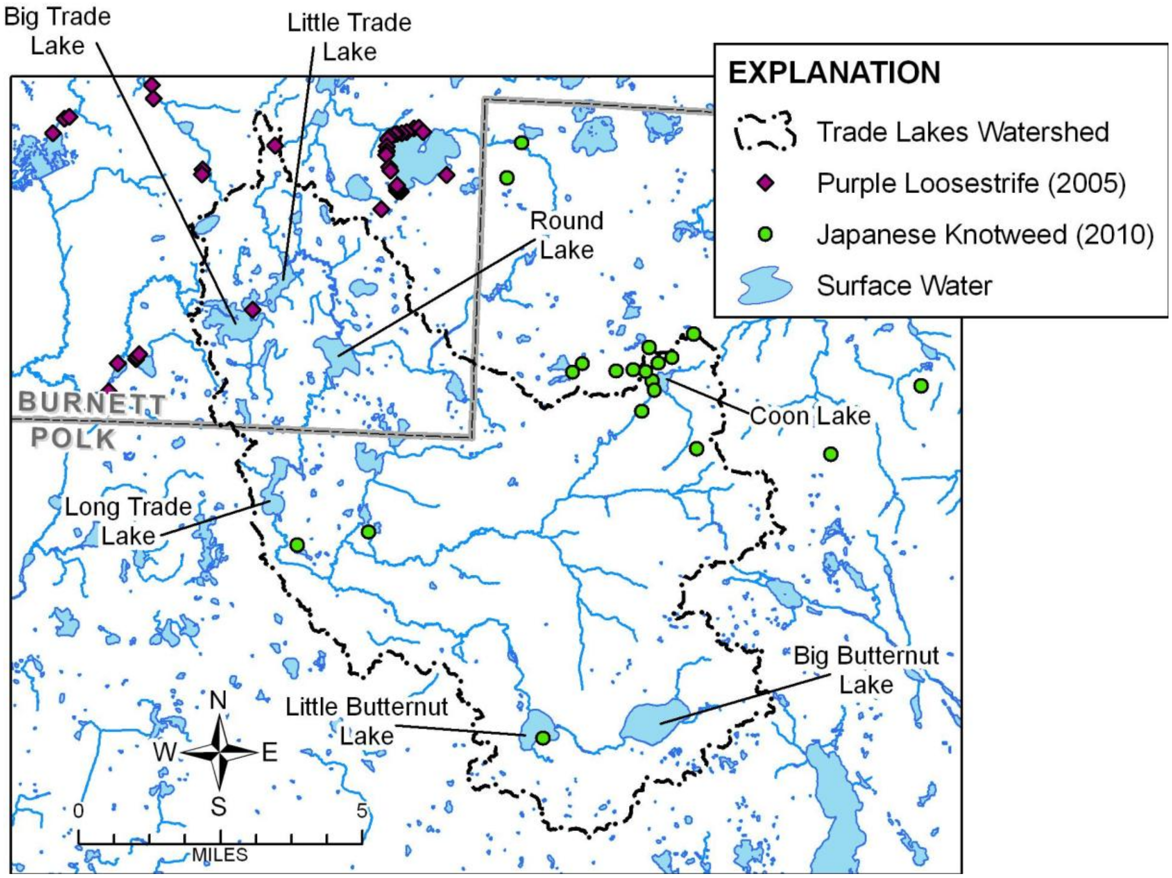


Figure 32. Purple Loosestrife and Japanese Knotweed Locations Mapped in the Trade Lakes Area

<u>Control Methods</u>

Purple loosestrife can be effectively controlled by physically removing new or isolated individual plants and small beds of plants. Pulling and digging are both effective but can leave root parts in the ground the will often grow new plants. Small-scale herbicide use is also effective. A foliar application or dabbing of cut stems with Glyphosate can be effective, but a permit is required for its use over, in, or near water. There is a very effective and well tested biological control in the form of a beetle that can be easily reared and distributed by interested parties (). The Polk County LWRD, the Burnett County LWCD, and several volunteers on the Trade Lakes have released biological controls on the river system and on Big and Little Trade Lake in the past. There is a known established population of beetles along the Trade River downstream of the Trade Lakes, and it is assumed that there are beetles in areas of where purple loosestrife is found on the Trade Lakes, but it is not know the extent of the existing population.

Purple loosestrife control work should continue in the Trade Lakes area, with volunteers or some other designated authority raising and releasing beetles into larger infestations (Figure 33). Small beds or isolated plants should be monitored for and pulled or dug if found. Herbicide application could be used if those applying the herbicide are formally trained and recognized as treatment specialists. A survey of the existing beds should be completed to track future expansion and to track the presence or absence of reproducing beetles populations.

Figure 33. Galerucella Beetle Rearing Station and Galerucella Beetle

Japanese Knotweed (*Polygonum cuspidatum*)

Knotweeds are robust, bamboo-like perennials introduced from Asia that are spreading throughout the Great Lakes states. The main species is Japanese Knotweed. Knotweed grows in dense stands 6-12-ft tall. Its stems are hollow, green to reddish in color and bamboo-like. Its leaves are bright green, broad, egg or heart shaped, with a pointed tip. Small white flowers in branched spray appear July through August. Dormant in winter, the dead reddish brown stems often remain standing. It emerges from root crowns in April and reaches full height in June. The heaviest concentrations of knotweed are usually along rivers and roads, but are also found in parks, backyards, along lake shore, in forests and on farms. Japanese knotweed spreads primarily by extensive networks of underground rhizomes, which can reach 6 feet deep, 60 feet long, and become strong enough to damage pavement and penetrate building foundations. Controlling Japanese knotweed is difficult and requires persistence and diligence. It can be dug, cut, covered, chemically sprayed, or have herbicide injected into individual stems.

At this time, Japanese knotweed has not been found in or around Long Trade, Round, Little Trade or Big Trade Lake, but is known to be scattered throughout the Trade Lakes area (Figure 32).

Figure 34. Japanese Knotweed along a Northern Wisconsin Lakeshore

Aquatic Plant Management

This section reviews the potential management methods available to reach plan goals, reports existing management activities, and presents aquatic plant management goals and strategies for the Trade Lakes System.

Discussion of Management Methods

Techniques to control the growth and distribution of aquatic plants are discussed in Appendix D. Permitting requirements and herbicide use to manage invasive species are discussed below. The application, location, timing, and combination of techniques must be considered carefully.

Permitting Requirements

The WDNR regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107 – Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin.

The requirements for manual and mechanical plant removal are described in NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations (Appendix E). A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants, (with the exception of wild rice) from his/her shoreline up to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, curly leaf pondweed, and purple loosestrife along his or her shoreline without a permit. Manual removal means the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power.

WDNR Northern Region Aquatic Plant Management Strategy

All APM Plans and the associated management permits (chemical or harvesting) are reviewed by the WDNR. It has become increasingly important for new and existing APM Plans to at a minimum include yearly monitoring and assessment to document impacts on water quality, fish and wildlife, native plants, and control results for the targeted species. It is equally important for new APM Plans to evaluate the potential for restoring the natural plant community within a lake. If needed, shifting the plant community toward more native species through a reduction of targeted aquatic invasive species can prevent plant management from becoming endless, routine maintenance.

The WDNR has a Northern Region Aquatic Plant Management Strategy (Appendix C) that went into effect in 2007. All aquatic plant management plans developed for northern Wisconsin lakes are evaluated according to the following goals:

- Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds;
- Prevent openings for invasive species to become established in the absence of the native species;

- Concentrate on a whole-lake approach for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist;
- Prohibit removal of wild rice. WDNR-Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. The WDNR discourages applications for removal of this ecologically and culturally important native plant.
- To be consistent with WDNR Water Division Goals (work reduction-disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

Native plant management under this plan will follow the policy recommended in the Northern Region Aquatic Plant Management Strategy (Appendix C). Under this APM Plan, riparian access lanes (lanes from the shore that are normally used by an individual shoreland property owner) will be maintained via boat traffic and manual removal methods. Other management strategies will only be considered if severe nuisance or impaired navigation conditions are documented and if non-native aquatic invasive species are present. The Association will assist to determine if navigation is impaired or nuisance conditions exist (following the guidelines on page 6 of Appendix C), but will defer a permit decision to the WDNR.

<u>Herbicide Use to Manage Eurasian Water Milfoil</u>

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: 2,4-D, diquat, endothall, fluridone, and Triclopyr. All of these herbicides with the exception of diquat have granular and liquid formulations. It is possible to target invasive species by using the appropriate herbicide and timing. The herbicide 2,4-D is most commonly used to treat EWM in Wisconsin. This herbicide kills dicots including native aquatic species such as northern water milfoil, coontail, water lilies, spatterdock, and watershield. Early season (April to May) treatment of Eurasian water milfoil is recommended to limit the impact on native aquatic plant populations because EWM tends to grow before native aquatic plants.

Granular herbicide formulations are more expensive than liquid formulations (per active ingredient). However, granular formulations release active ingredient over a longer period of time. Granular formulations, therefore, may be more suited to situations where herbicide exposure time will likely be limited such as in small bands or blocks. In large, shallow lakes with widespread EWM, a whole lake treatment with a low rate of liquid herbicide may be most cost effective because exposure time is greater. Factors that affect exposure time are size and configuration of treatment area, water flow, and wind.

Application rates for liquid and granular formulations are not interchangeable. A rate of 1 to 1.5 mg/L 2,4-D applied as a liquid is a middle rate that will require a contact time of 36 to 48 hours. Application rates recommended for Navigate (granular 2,4-D) are 100 pounds per acre for depths of 0 to 5 feet, 150 pounds per acre for 5 to 10 feet, and 200 pounds per acre for greater than 10 foot depths.

Physical methods to control Eurasian Water Milfoil
This includes bottom plant barriers and water drawdown. These methods are used only in special circumstances. Because they involve placing structure on the bed of a lake and(or) affect lake water level, a Chapter 30 or 31 permit will most likely be needed. Barriers would likely not be permitted. Drawdown activities have been used in Wisconsin to control Eurasian water milfoil.

The effectiveness of milfoil control by drawdown is determined by several factors including the amount of the waterbody bottom exposed, duration of exposure, presence of springs, and the weather at the time of drawdown. The success or failure of drawdowns in controlling milfoil can be highly variable from lake to lake and from year to year within the same waterbody It is recommended lake level drawdown for macrophyte control in situations where prolonged (one month or more) dewatering of lake sediments is possible under rigorous conditions of cold or heat; a key factor being desiccation. Conditions suitable for macrophyte control may not occur with heavy snowfall or during milder winters.

Current and Past Plant Management Activities

Eurasian Water Milfoil Management
EWM was officially confirmed in Long Trade Lake in 2009, Round Lake in 2003, and Little Trade Lake in 2009. Hybrid watermilfoil (HWM), a cross between Eurasian watermilfoil and the native northern watermilfoil, was identified in Long Trade Lake in 1995. Hybrid watermilfoil is an invasive plant species that is managed the same as EWM. Since 2009, the Long Trade, Round, and Trade Lakes Association actively sought to control the EWM population beginning with seeking an AIS Rapid Response Grant for treatment in Little Trade lake in the early 2009. EWM was treated in 2009 and 2010 in Little Trade Lake.

Figure 35. 2010 Eurasian Watermilfoil Treatment Areas in Little Trade Lake

<u>Curly-Leaf Pondweed Management</u>

There has been no targeted CLP treatment in the Trade Lakes system to date.

Plan Goals and Strategies

This section of the plan lists goals for aquatic plant management for the Trade Lakes system. It also presents a detailed strategy of actions to reach Aquatic Plant Management Plan goals. Educational strategies that outline audience, messages, and methods are included under each goal. A three-year Aquatic Invasive Species Control Grant should be pursued in 2011 to begin implementation of this APM Plan.

Overall Purpose

Preserve the Trade Lakes ecosystem for future generations.

Aquatic Plant Management Plan Goals

Goal 1) Prevent the spread of Eurasian water milfoil.

Goal 2) Prevent the spread of Curly-leaf pondweed.

Goal 3) Prevent the spread and introduction of other aquatic invasive species.

Goal 4) Preserve, protect, and enhance the lakes' native plant communities.

Goal 5) Minimize the runoff of pollutants, nutrients, and sediment from the Trade Lake watershed.

Goal 1) Prevent the spread of Eurasian water milfoil (EWM).

<u>Objective</u>: Total growth of EWM in The Trade Lake system is reduced by 75% over time.

<u>Objective</u>: EWM does not spread and establish in Big Trade Lake

<u>Objective</u>: EWM from the Trade Lake system does not spread to other lakes.

<u>Objective</u>: Lakeshore owners and visitors understand appropriate actions to take to control EWM growth in the Trade Lake system

<u>Action</u>: Map EWM beds to establish treatment areas.
(Note beds and treatment areas for 2010 are mapped in Figure 27, Figure 28, Figure 29, and Figure 35)

<u>Action</u>: Use DNR pre- and post-monitoring protocol to monitor effectiveness of treatment efforts and re-emergence of native plant species.

Action: Place bright colored milfoil buoys around significant areas of EWM infestation in Little Trade Lake.
Action: Train shoreland property owners to recognize EWM and encourage manual removal.

Action: Treat EWM beds according to plan standards discussed below.

Action: Consider new treatment methods based upon experience from other Wisconsin and Minnesota lakes.

Action: Regularly monitor shallow areas of the Little and Big Trade Lakes for EWM. (Note: board members should initially take on this responsibility. Consultants may be hired to complete this survey periodically.)

Action: Carry out a standard of no-tolerance if EWM is found in shallow areas of the lakes.

Action: Participate in and support The Burnett and Polk County Land Conservations Committees and the county-wide lake associations in either county.

Action: Inform the Trade Lake system residents and visitors about EWM programs.

Audience
Lake owners
Lake renters
Visitors

Message
AIS identification: pictures and information
Contact a Lake board member if you find suspected EWM.
Describe EWM control program and effectiveness
Bright colored buoys indicate areas of EWM infestation. Avoid these areas when using watercraft on Little Trade Lake.

Methods
Distribute new shoreline homeowner packets
Post boat landing signs
Produce and mail AIS educational materials to residents.
Present information at lake association meetings

EWM Treatment Standards and Methods for the Trade Lakes system

Standards for treatment

<u>High Density Growth in Deep and Big Lake Basins</u>

- Herbicide treatment will occur in EWM beds of 80 percent and greater density.

<u>Scattered Growth in un-infested shallow lake areas and Big Trade Lake</u>

- No tolerance standard for EWM growth
- Diver pulling and/or hand pulling will be used to remove all scattered plants.
- Herbicide treatment may be used if beds of EWM become greater than 200 square feet with a density of at least 25%.

Treatment Methods

<u>Herbicide treatment</u>

- Treat Eurasian water milfoil beds early in the season when new EWM growth is from 1 -3 inches (late May to early June).
- Use granular 2,4-D at a rate of 100 pounds per acre (lbs/ac) at depths < 5 feet, 150-175 lbs/ac at depths from 5-10 feet, and 200 lbs/ac at depths >10 feet, or as modified by best available information.
- Treat EWM early in the day when the winds are calm.
- Consider expanding treatment areas beyond the boundaries of the mapped bed of high density growth an additional 10 to 20 ft. beginning in 2011 if plan objectives are not being met and funds are available.
- Use these expanded treatment areas for no-tolerance zones of Big Trade Lake.

<u>Manual removal</u>

- Train shoreland property owners to distinguish EWM from native plant species and encourage manual removal of EWM and preservation of native species.
- All plant fragments (to the greatest extent practical) must be removed from the lake and disposed of in an upland area, such as a garden or compost pile.

<u>Drawdown for Long Trade Lake</u>

- Assess dewatering potential of sediments for EWM control
- Assess the impact on Long Trade Lake's fishery
- Assess impacts to Trade River System

<u>Divers</u>

- Seek volunteer divers or hire divers to hand pull EWM
- All EWM plant fragments will be removed from the lake and disposed on an upland area (to the greatest extent practical).

Schedule and roles for herbicide treatments

February/March preceding treatment
Contract with herbicide applicator

Apply for aquatic plant management permit from DNR. Permit will be based upon potential acreage mapped in late summer of preceding year using standards for treatment of EWM areas listed previously.

Spring preceding treatment (First three weeks of May)
Residents to notify Board EWM lead of potential EWM locations via email or telephone. Board member or designee checks for presence of EWM in suspected locations and records boundaries of EWM beds using GPS equipment. This mapping will focus in and near areas where EWM has been found previously.

Prior to treatment (late May)
Consultant will map treatment areas and provide specific treatment area and location to contractor, lake association, and DNR permit staff.

Early season treatment (late May to early June)
Contractor to apply herbicide according to permit conditions when new EWM growth is from 1-3 inches. Use granular 2,4-D at a rate of 100 lbs./acre at depths < 5 feet, 150-175 lbs./acre at depths from 5-10 feet, and 200 lbs./acre at depths >10 feet – or as modified by best available information.

Board member or designee will supervise contractor, notifying contractor and DNR when new EWM growth reaches one inch and overseeing permit conditions such as location and timing of treatment, and wind conditions that preclude treatment.

Measure effectiveness of treatment according to DNR monitoring protocol (Four weeks following treatment or late June to early July)
Sample EWM beds noting species rake fullness for EWM and native species at each sample point. Compare results to treatment standard and prepare potential treatment area for next season. Assess whether total acres meet treatment threshold. There will be no treatment if the total acreage is less than two.

Late Summer/Early Fall
Identify additional potential EWM treatment locations using a map of previous EWM locations–note where EWM is present/suspected with GPS equipment.

Goal 2) Prevent the spread of curly-leaf pondweed (CLP).

Objective: Identify the extent of CLP infestation within the lake system.

Objective: Develop a CLP management strategy to coincide with EWM management.

Action: Train volunteers and seek expert volunteers to identify and survey for curly-leaf pondweed within the system through bed mapping and turion density surveys.

Action: Coordinate contracted early season bed mapping survey for curly-leaf pondweed in May.

Action: Conduct June surveys for curly-leaf pondweed in the years that whole lake point-intercept surveys are completed.

Action: Train shoreland property owners to recognize CLP and encourage manual removal.

Action: Follow Department of Natural Resources recommended treatment methods for the management of curly-leaf pondweed.

Action: Implement an education strategy to prevent CLP spread as outlined below.

Audience
Lake monitors
Lake residents
Transient boaters

Messages
CLP is present in the Trade Lakes system.
Trained volunteers can help identify CLP.
Call lake monitors (and other trained volunteers) for help with CLP identification.
Collect and bag suspected plant before you call for help.
Call a LTRTA Board member for help.

Methods
Lake monitor training
Standard methods: newsletters, brochures, posters, boat landing signs, annual meetings

Goal 3) Prevent the spread and introduction of other aquatic invasive species.

Other aquatic invasive species may include aquatic plants such as flowering rush or animals like zebra mussels, among many others.

Objective: Monitor and control purple loosestrife and Japanese knotweed already present in the Trade Lakes system

Objective: Residents, renters, and visitors understand the impacts of AIS and the actions they can take to prevent their introduction.

Objective: AIS introductions are prevented

Objective: If introduced, aquatic invasive species are discovered early

Action: Continue purple loosestrife control work with volunteers or some other designated authority raising and releasing beetles into larger infestations

Action: Carry out Clean Boats, Clean Waters program at boat landings using volunteer and/or paid monitors.

Action: Conduct surveys for other invasive species as information and methods become available.

Action: Consider and potentially implement new methods for AIS prevention, such as remote camera monitoring, as they become available.

Action: Carry out a comprehensive AIS prevention education program as outlined below.

Audience
Lake residents
Renters
Visitors
Town of Laketown (Polk) & Trade Lake (Burnett)

Messages
Report status of existing and potential Aquatic Invasive Species
The State of Wisconsin, Polk County, and Burnett County all have "do not transport ordinances"

Methods
Monitor training, raising Galerucella beetles, active communication with AIS coordinators and Polk LWRD and Burnett LWCD.
Standard methods: newsletters, brochures, posters, boat landing signs, annual meetings

Goal 4) Preserve, protect, and enhance the lakes' native plant communities.

Objective: Prevent disturbance of native plants from watercraft

Objective: Limit disturbance of native plants from homeowner removal

Objective: Educate people regarding functions and values of native plants

Action: Implement recommendations from the WDNR Sensitive Areas report and Northern Region Management Strategy.

Action: Consider establishing no-wake zones to prevent the disturbance of native plants and to prevent the spread of EWM and CLP.

Action: Implement an education strategy aimed at preserving native plants in the Trade Lake system.

Audience
Lake residents
Renters
Visitors
Town of Laketown (Polk) & Trade Lake (Burnett)

Messages
Shallow bays are important for wildlife diversity.
Healthy populations of native plants help to prevent introduction and spread of invasive species.
Diverse native plants provide diverse habitat for wildlife.
Invasive plants reduce plant and animal diversity.
Abundant plants keep the water clear, especially in shallow areas of the lake.
Native plant removal is discouraged because disturbance provides areas for invasive species to grow.
If you believe you have EWM, please call a board member to confirm identification.
Request/suggest that boaters and personal watercraft operators travel at no wake in certain areas to prevent plant removal and introduction of EWM and other invasive aquatic plants.
Manage waterfront properties with minimal plant removal.
If you need to remove plants in front of your property, rake to a maximum opening of no more than thirty feet. Less is better.

Methods
Standard methods: newsletters, brochures, posters, boat landing signs, annual meetings

Goal 5) Minimize the runoff of pollutants, nutrients, and sediment from the Trade River watershed.

Objective: Lake residents restore and preserve shoreline buffers of native vegetation.

Objective: Implement recommendations from the Long Trade and Round Lakes management plan prepared by Polk County LWRD.

Objective: Develop a nutrient budget and watershed management plan for Big and Little Trade Lakes

Action: Implement a shoreland property owners education program.

Audience
Waterfront property owners

Messages
Shoreline buffers protect water quality and provide fish and wildlife habitat.
Describe ways to restore shoreline buffers (natural recovery, stop mowing, plant natives).
Describe the County shoreline buffer requirements and how to report violations of these requirements.
Highlight good examples of shoreline buffers on private waterfront property.

Methods
Standard methods: newsletters, brochures, posters, boat landing signs, annual meetings

Measurement
Ask who has changed buffer zones or other shoreline practices as a result of educational efforts.

Action: Work with Burnett and Polk County Land and Water Resources Departments to utilize cost sharing of Best Management practices

Action: Apply for Wisconsin DNR Lake Planning Grant(s) to develop a nutrient budget and watershed management plan for Big & Little Trade Lakes.

Adaptive Management Approach

The EWM treatment areas, standards, and methods will be reviewed each year to see if they are effective and cost efficient. Changes may be made to the treatment approach based upon project results, the experience of other lake groups, and/or recommendations from the WDNR, the Polk County LWRD, or the Burnett County LWCD. Significant changes will be documented as brief addendums to the aquatic plant management plan to be reviewed by the Long Trade, Round, and Trade Lakes Association Board, the APM Committee, and the WDNR.

Implementation Plan

Action Items	Time Line	2012	2013	2014	Responsible Parties
Prevent Spread of EWM					
Map EWM treatment areas	Late summer	Infested lakes	Infested lakes	Infested lakes	Association, LWRD, Consultant
Pre and post treatment protocols	May and summer	Infested lakes	Infested lakes	Infested lakes	LWRD, Consultant, Association
Place bright colored milfoil buoys	Early Summer	Infested lakes	Infested lakes	Infested lakes	Association
Treat EWM beds according to APM	May	Infested lakes	Infested lakes	Infested lakes	Association, Treatment Contractor
Monitor un-infested shallow areas and Big Trade Lake	Spring/Summer	All lakes	All lakes	All lakes	Association, Contractor
Hand pull or diver pull areas where EWM is discovered	Summer	All lakes	All lakes	All lakes	Association, Residents
Participate in County Government and county-wide lake association meetings	On-going	All lakes	All lakes	All lakes	Association
Apply for APM permits	December	All lakes	All lakes	All lakes	Association, Consultant
Work with treatment applicator	May	All lakes	All lakes	All lakes	Association, Treatment Contractor

Implementation Plan (continued)

Action Items	Time Line	2012	2013	2014	Responsible Parties
Prevent Spread of CLP					
Train volunteers to identify and survey CLP	Spring	All lakes	All lakes		LWRD, DNR, Association, Consultant
Early season PI/ bed survey	Late May	All lakes	All lakes	All lakes	Consultant, Association
Volunteer CLP surveys	June	All lakes	All lakes	All lakes	Association
CLP Treatment	May	Infested Lakes	Infested Lakes	Infested Lakes	Association, Treatment Contractor, Consultant
Prevent introduction of other AIS					
Carry out Clean Boats Clean Waters	Ongoing	All lakes	All lakes	All lakes	Association
Conduct other AIS surveys (as available)	Ongoing	All lakes	All lakes	All lakes	Association
Preserve Native Plant Communities					
Implement Critical Habitat Area Study	Ongoing	Round	Long Trade	Little Trade, Big Trade	DNR
Consider no-wake zone	Ongoing	All lakes			Association, LWRD, DNR

Implementation Plan (continued)

Action Items	Time Line	2012	2013	2014	Responsible Parties
Minimize runoff pollutants					
Develop runoff survey for homeowners	Winter	All lakes			Association, LWRD, UWEX
Conduct survey	Spring		All lakes		Association
Utilize cost sharing for BMPs	Ongoing	All lakes	All lakes	All lakes	Association
Apply for Lake Planning Grants	February, August	As Needed	As Needed	As Needed	Association, Consultant, LWRD
Educational Activities					
Produce AIS materials	Ongoing	All lakes	All lakes	All lakes	Association, DNR, UWEX
Update signs at boat landings	Ongoing	All lakes	As Needed	As Needed	Association
Newsletters & AIS mailings	Ongoing	All lakes	All lakes	All lakes	Association & others
Runoff education	Ongoing	All lakes	All lakes	All lakes	Association, DNR
Education at Assoc. meetings	Ongoing	All lakes	All lakes	All lakes	Association, LWRD, etc.
Critical habitat education	Ongoing	All lakes	All lakes	All lakes	LWRD, DNR
Association board shoreline program	Ongoing	All lakes	All lakes	All lakes	Association, LWRD

Implementation Plan (continued)

Action Items	Time Line	2012	2013	2014	Responsible Parties
Administration					
Ensure funding is available to implement plan	Ongoing	All Lakes	All Lakes	All Lakes	Association
Apply for grant funding	Planning: Feb., Aug. Protection: May	As Needed	As Needed	As Needed	Association, Consultant, LWRD
Grant Reporting	Annual and as required	As Needed	As Needed	As Needed	Association, Consultant, LWRD
Update point intercept survey and APM plan	As Needed	Long Trade (PI)		Little Trade (PI) Big Trade (PI)	Association, LWRD, Consultant, DNR

Monitoring and Assessment

Aquatic Plant Surveys

Aquatic plant (macrophyte) surveys are the primary means to track achievement toward plan goals.

Action: Conduct whole lake aquatic plant surveys approximately every five years to track plant species composition and distribution.
The whole lake surveys will be conducted in accordance with the guidelines established by the Wisconsin DNR. Any new species sampled will be saved, pressed, and mounted for voucher specimens.

Aquatic Invasive Species Grants

Department of Natural Resources Aquatic Invasive Species Grants are available to assist in funding the action items in the implementation plan. Currently, grants provide up to 75 percent funding. Applications are accepted twice each year with postmark deadlines of February 1 and August 1. With completion and approval of the aquatic plant management plan funds will be available not only for education and planning, but also for control of aquatic invasive species.

Appendix A

Big Trade and Little Trade Lakes Sensitive Area Survey Report and Management Guidelines

Appendix B

Aquatic Plant Survey Methods and Results

Appendix C

WDNR Northern Region Aquatic Plant Management Strategy

Appendix D

Aquatic Plant Management Options

Appendix E

NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations