Appendix A –

Aquatic Macrophyte Survey
Big Dummy Lake and Little Dummy Lake,
Barron County, Wisconsin,
Ecological Integrity Service,
August 2013

Aquatic Macrophyte Survey

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Barron County, Wisconsin

August, 2013

Survey conducted and prepared by: Ecological Integrity Service
Amery, Wisconsin

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Introduction

This report is a summary of the results from a full lake, point intercept method aquatic macrophyte survey completed in 2013 on Big Dummy Lake and Little Dummy Lake, Barron County Wisconsin. Big Dummy and Little Dummy Lakes are connected by a short channel.

Big Dummy Lake (WBIC: 1835100) is a 114 acre seepage lake that has a maximum depth reported as 54 feet and a mean depth of 12 feet (2013 showed a maximum of 55.6 feet and a mean depth of 9.98 feet.). The sediment composition is mostly muck with some sand present. The trophic status of the lake is mesotrophic with moderate water clarity with the secchi disk mean ranging from 9.5 to 10.5 ft in between 2006 and 2013. Water clarity appears to have slightly improved dating back to 1989, based upon historical data.

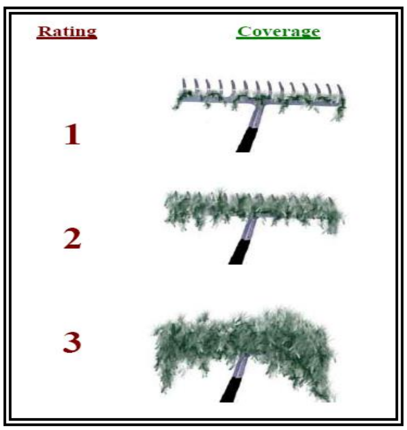
Little Dummy Lake (WBIC: 1861400) is a 43 acre seepage lake that has a maximum depth reported as 44 feet and a mean depth of 13 feet (2013 survey showed a maximum of 43.2 feet and a mean of 12.75 feet). The trophic status of the lake is mesotrophic with moderate water clarity with the secchi disk mean ranging from 9.3 to 11.8 ft between 2006 and 2013.

Field Methods

A point intercept method was employed for the aquatic macrophyte sampling. The Wisconsin Department of Natural Resources (Wisconsin DNR) generated the sampling point grid of 332 sample points for Big Dummy Lake and 122 sample points for Little Dummy Lake. All points were initially sampled for depth only. Once the maximum depth of plants could be established, only sample points at that depth or less were sampled for plants. If no plants were sampled, one sample point beyond that was sampled for plants. In areas such as bays that appear to be under-sampled, a boat survey was conducted to record plants that may have otherwise been missed. This involved going to the area and surveying that area for plants, recording the species viewed and/or sampled. The type of habitat is also recorded. These data are not used in the statistical analysis nor is the density recorded. Only plants sampled at predetermined sampled points were used in the statistical analysis. In addition, any plant within six feet of the boat was recorded as "viewed." A handheld Global Positioning System (GPS) located the sampling points in the field. The Wisconsin DNR guidelines for point location accuracy were followed with an 80 ft resolution window and the location arrow touching the point.

At each sample location, a double-sided fourteen-tine rake was used to rake a 1m tow off the bow of the boat. All plants contained on the rake and those that fell off of rake were identified and rated as to rake fullness. The rake fullness value was used based on the criteria contained in the diagram and table below. Those plants that were within six feet were recorded as "viewed," but no rake fullness rating was given. Any under surveyed areas such as bays and/or areas with unique habitats were monitored. These areas are referred to as a "boat survey."

The rake density criteria used:



Rake fullness rating	Criteria for rake fullness rating
1	Plant present, occupies less than ½ of tine space
2	Plant present, occupies more than ½ tine space
3	Plant present, occupies all or more than tine space
v	Plant not sampled but observed within 6 feet of boat

The depth and predominant bottom type was also recorded for each sample point. Caution must be used in using the sediment type in deeper water as it is difficult to discern between muck and sand with a rope rake. All plants needing verification were bagged and cooled for later examination. Each species was mounted and pressed for a voucher collection and submitted to the Wisconsin DNR for review. On rare occasions a single plant may be needed for verification, not allowing it to be used as a voucher specimen and may be missing from the collection.

An early season, AIS (emphasis on *Potamogeton crispsus*-curly leaf pondweed) is completed to pick up any potential growth before native plants are robust. Curly leaf pondweed grows in the spring, only to senesce in early July before the survey is typically conducted.

Data analysis methods

Data collected was entered into a spreadsheet for analysis. The following statistics were generated from the spreadsheet:

- Frequency of occurrence in sample points with vegetation (littoral zone)
- Relative frequency
- Total points in sample grid
- Total points sampled
- Sample points with vegetation
- Simpson's diversity index
- Maximum plant depth
- Species richness
- Floristic Quality Index

An explanation of each of these data is provided below.

<u>Frequency of occurrence for each species</u>- Frequency is expressed as a percentage by dividing the number of sites the plant is sampled by the number of sites. There can be two values calculated for this. The first is the percentage of all sample points that this plant was sampled at depths less then maximum depth plants were found (littoral zone), regardless if vegetation was present. The second is the percentage of sample points that the plant was sampled at only points containing vegetation. The first value shows how often the plant would be encountered in the defined littoral zone (by depth), while the second value shows if considered where points contain plants. In either case, the greater this value, the more frequent the plant is in the lake. If one wants to compare how frequent in the littoral zone,

we look at the frequency of all points below maximum depth with plants. This frequency value allows the analysis of how common plants are where they could grow based upon depth. If one wants to focus only where plants are actually present, then one would look at frequency at points in which plants were found. Frequency of occurrence is usually reported using sample points where vegetation was present.

Frequency of occurrence example:

Plant A sampled at 35 of 150 littoral points = 35/150 = 0.23 = 23%

Plant A's frequency of occurrence = 23% considering littoral zone depths.

Plant A sampled at 12 of 40 vegetated points = 12/40 = 0.3 = 30%

Relative frequency-This value shows, as a percentage, the frequency of a particular plant relative to other plants. This is not dependent on the number of points sampled. The relative frequency of all plants will add to 100%. This means that if plant A had a relative frequency of 30%, it occurred 30% of the time compared to all plants sampled or makes up 30% of all plants sampled. This value allows us to see which of the plants the dominant species in the lake are. The higher the relative frequency the more common the plant is compared to the other plants and therefore the more frequent in the plant community.

Relative frequency example:

Suppose we were sampling 10 points in a very small lake and got the following results:

	Frequency sampled
Plant A present at 3 sites	3 of 10 sites
Plant B present at 5 sites	5 of 10 sites
Plant C present at 2 sites	2 of 10 sites
Plant D present at 6 sites	6 of 10 sites

So one can see that Plant D is the most frequent sampled at all points with 60% (6/10) of the sites having plant D. However, the relative frequency allows us to see what the frequency is compared the other plants, without taking into account the number of sites. It is calculated by dividing the number of times a plant is sampled by the total of all plants sampled. If we add all frequencies (3+5+2+6), we get a sum of 16. We can calculate the relative frequency by dividing by the individual frequency.

Total points in sample grid- The Wisconsin DNR establishes a sample point grid that covers the entire lake. Each GPS coordinate is given and used to locate the points.

Number of points sampled- This may not be the same as the total points in the sample grid. When doing a survey, we don't sample at depths outside of the littoral zone (the area where plants can grow). Once the maximum depth of plants is established, many of the points deeper than this are eliminated to save time and effort.

Sample sites with vegetation- The number of sites where plants were actually sampled. This gives a good idea of the plant coverage of the lake. If 10% of all sample points had vegetation, it implies about 10% coverage of plants in the whole lake, assuming an adequate number of sample points have been established. We also look at the number of sample sites with vegetation in the littoral zone. If 10% of the littoral zone had sample points with vegetation, then the plant coverage in the littoral zone would be estimated at 10%.

Simpson's diversity index-To measure how diverse the plant community is, Simpson's diversity index is calculated. This value can run from 0 to 1.0. The greater the value, the more diverse the plant community is in a particular lake. In theory, the value is the chance that two species sampled are different. An index of "1" means that the two will always be different (very diverse) and a "0" would indicate that they will never be different (only one species found). The higher the diversity in the native plant community, the healthier the lake ecosystem.

> Simpson's diversity example:
>
> If one sampled a lake and found just one plant, the Simpson's diversity would be "0." This is because if we randomly sampled two plants, there would be a 0% chance of them being different, since there is only one plant.
>
> If every plant sampled were different, then the Simpson's diversity would be "1." This is because if two plants were randomly sampled, there would be a 100% chance they would be different since every plant is different.

Maximum depth of plants-This depth indicates the deepest that plants were sampled. Generally more clear lakes have a greater depth of plants while lower water clarity limits light penetration and reduces the depth at which plants are found.

Species richness-The number of different individual species found in the lake. There is a number for the species richness of plants sampled, and another number that takes into account plants viewed but not actually sampled during the survey.

Floristic Quality Index-The Floristic Quality Index (FQI) is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community in response to development (and human influence) on the lake. It takes into account the species of aquatic plants sampled and their tolerance for changing water quality and habitat quality. The index uses a conservatism value assigned to various plants ranging from 1 to 10. A high conservatism value indicates that a plant is intolerant while a lower value indicates tolerance. Those plants with higher values are more apt to respond adversely to water quality and habitat changes, largely due to human influence (Nichols, 1999). The FQI is calculated using the number of species and the average conservatism value of all species used in the index.

The formula is:

$$\textbf{FQI = Mean C} \cdot \sqrt{\textbf{N}}$$

Where C is the conservatism value and N is the number of species (only species sampled on rake).

Therefore, a higher FQI indicates a healthier aquatic plant community, which is an indication of better plant habitat. This value can then be compared to the median for other lakes in the assigned eco-region. There are four eco-regions used throughout Wisconsin. These are Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. The 2006 and 2008 values from past aquatic plant surveys will also be compared in this analysis.

Summary of Northern Central Hardwood Forests Median Values for Floristic Quality Index:

(Nichols, 1999)

Median species richness = 14

Median conservatism = 5.6

Median Floristic Quality = 20.9

*Floristic Quality has a significant correlation with area of lake (+), alkalinity(-),

conductivity(-), pH(-) and Secchi depth (+). In a positive correlation, as that value rises so will FQI, while with a negative correlation, as a value rises, the FQI will decrease.

Results

Big Dummy Lake

In June, an early season survey searching for *Potamogeton crispus*-curly leaf pondweed, was conducted. All sample points (332) were visited to get a depth at each sample point. Any points less than 20 feet in depth were sampled. In addition, many other areas were monitored with a high definition underwater camera. Other AIS were being monitored as well. **No AIS were located at any point in Big Dummy Lake**

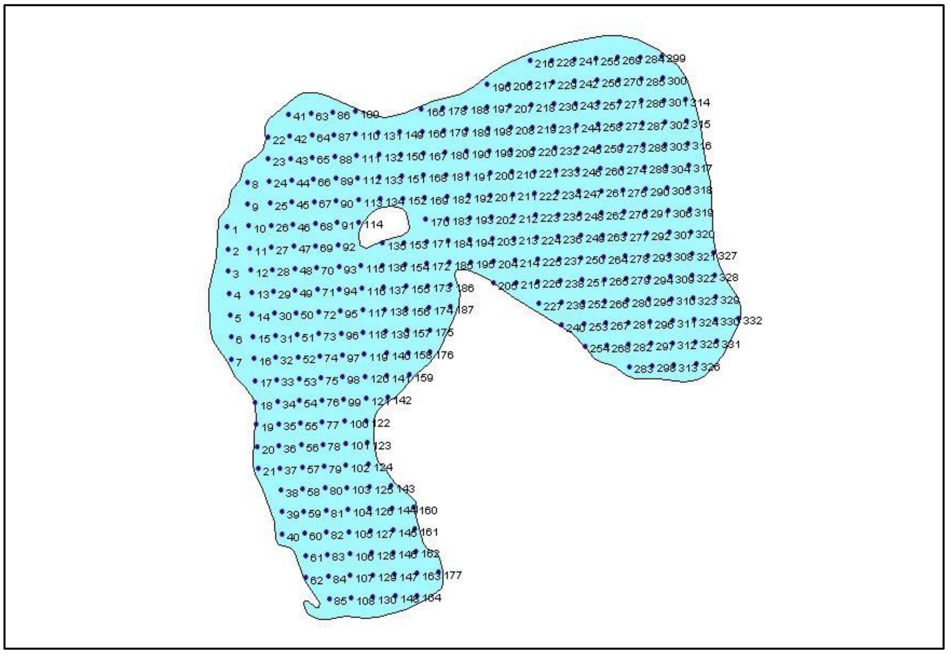


Figure 1: Big Dummy Lake sample points

In early August, the late seasons full lake survey was conducted. All points less than 20 feet were sample. Figure 2 shows where plants were sampled. In the southern portion of the west basin, 17 sample points had floating bog/bottom, so they could not be sampled. They are shown as no plants even though it is likely there were plants there. The maximum depth plants were sampled was 13.7 feet, with a mean depth at 3.22 feet (see figure 3).

Big Dummy Lake has extensive plants coverage at depths plants are capable of growing. At depths less than 13.7 feet, the coverage is 89.7% with plants. In this west basin, where the depth is less than 10 feet in all areas, the coverage is 100% with plants. Many of these areas are extremely dense with plants and can severely impede navigation. Figure 4 shows the rake density rating at each sample point with plants.

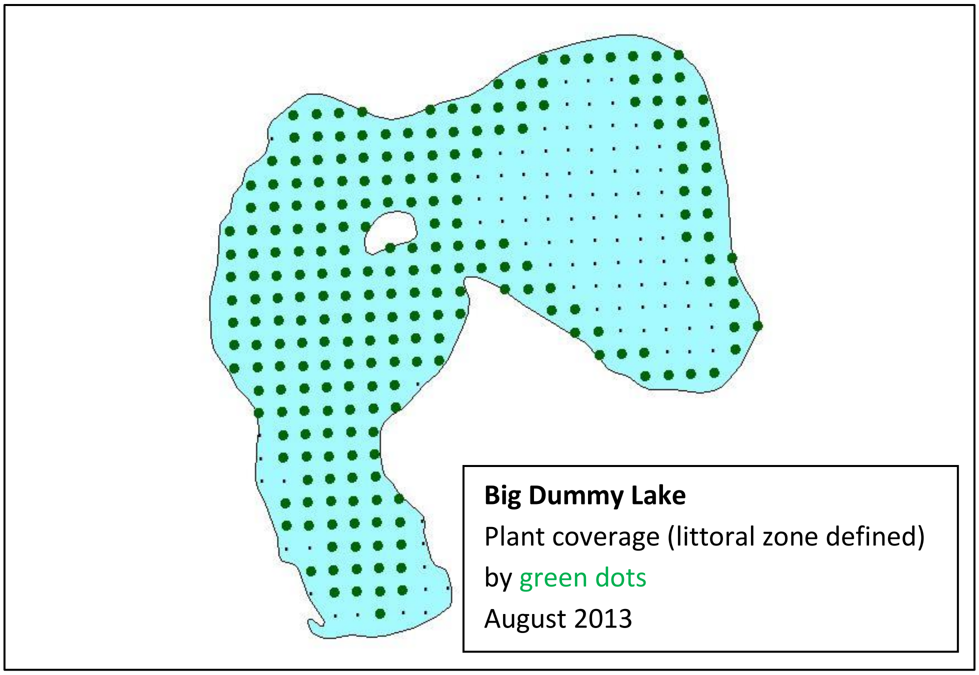


Figure 2: Littoral zone of Big Dummy Lake-points with plants sampled, 2013

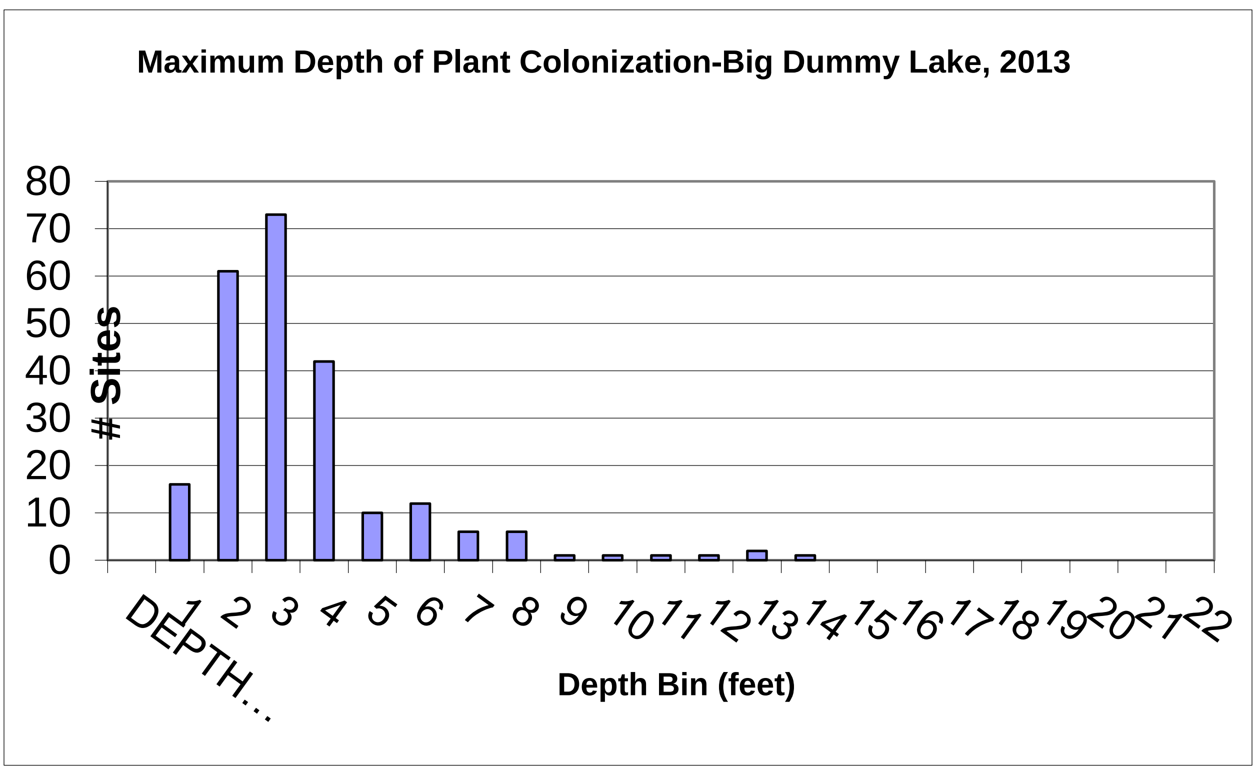


Figure 3: Graph of depth analysis in Big Dummy Lake, 2013.

Total number of sample sites	332
Total number of sites with vegetation	233*
Total number of sites shallower than maximum depth of plants	252
Frequency of occurrence at sites shallower than maximum depth of plants	92.46
Simpson Diversity Index	0.85
Maximum depth of plants (ft)	13.70
Mean depth plant sampled (ft)	3.22
Average number of all species per site (shallower than max depth)	2.82
Average number of all species per site (veg. sites only)	2.83
Average number of native species per site (shallower than max depth)	2.82
Average number of native species per site (veg. sites only)	2.83
Species Richness	30
Species Richness (including visuals)	34

Table 1: Summary of survey statistics, Big Dummy Lake, 2013.

Big Dummy lake has a moderately diverse plant community. The Simpson's diversity is 0.85 and the species richness is 30 (see table 2 for species list). All plants sampled and viewed are native species to Wisconsin Lakes. Both species richness and Simpson's index values show good diversity. The dominating plants are large purple bladderwort, a submergent aquatic plant, and two floating leaf plants, watershield and white lily. Both large purple bladderwort and watershield have relative frequencies over 20%. This shows that these plants were sampled in many locations. Large purple bladderwort is nearly everywhere plants can grow, with a frequency of occurrence of 97.4%.

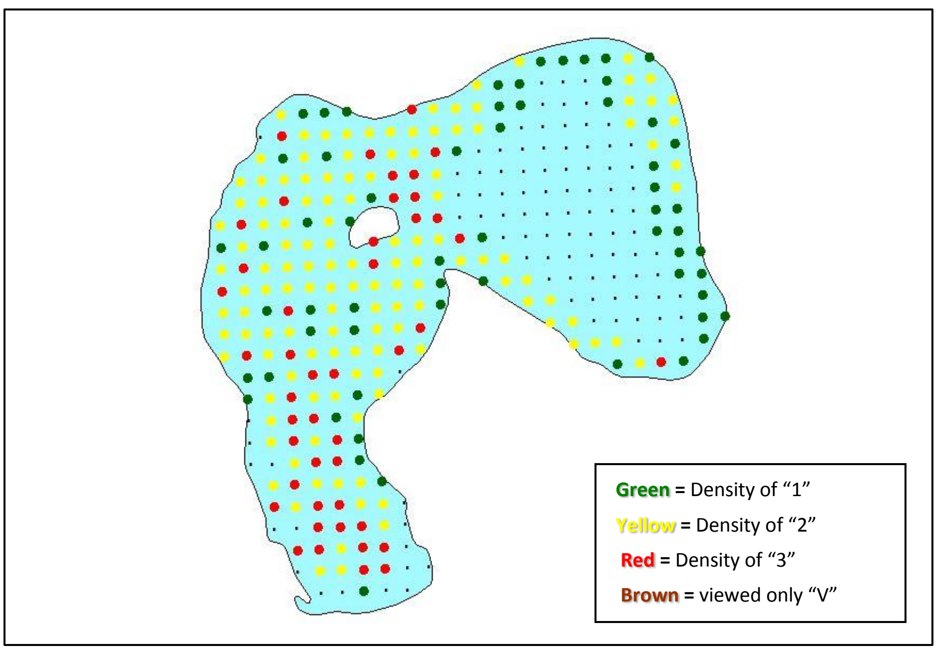


Figure 4: Map of density rating at each sample point-Big Dummy Lake, 2013.

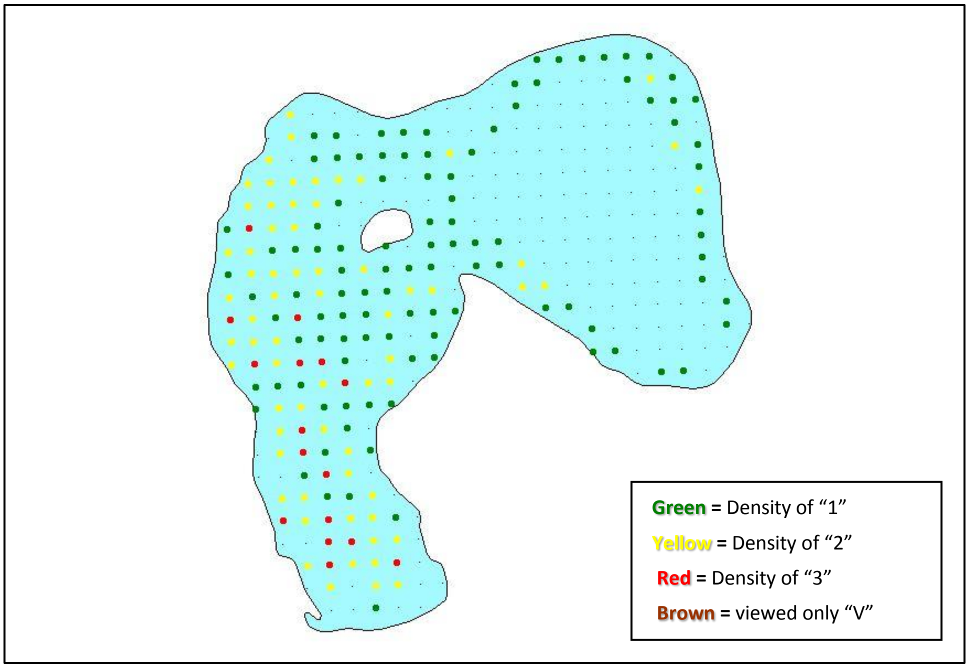


Figure 5: Distribution map of large purple bladderwort-highest relative frequency.

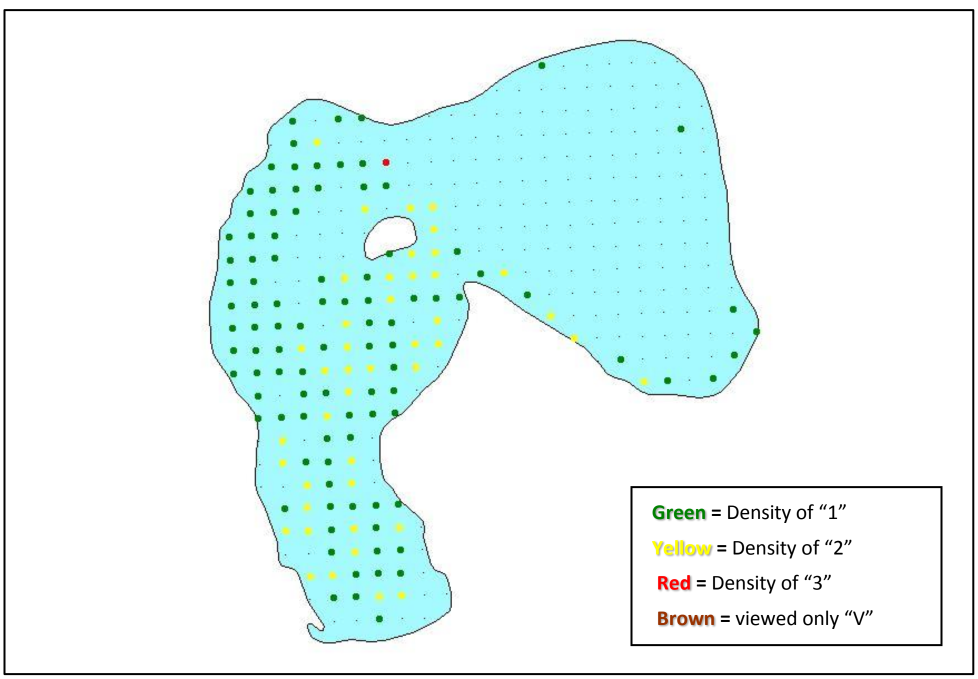


Figure 6: Distribution map of watershield-second highest relative frequency.

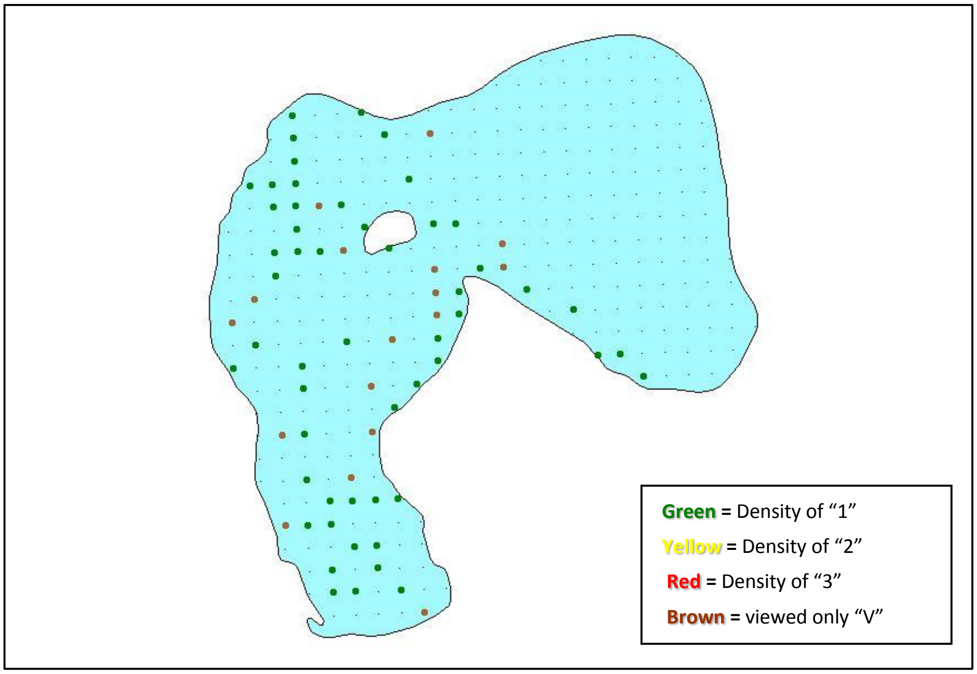


Figure 7: Distribution map of white lily-third highest relative frequency.

Figure 8 is a map showing how many species were found at each sample location. Most of the high diversity sample points were in the west basin. This is also an area dominated by two species at nearly every sample point. However, the diversity is quite high in this basin. A few points in the east basin had high diversity.

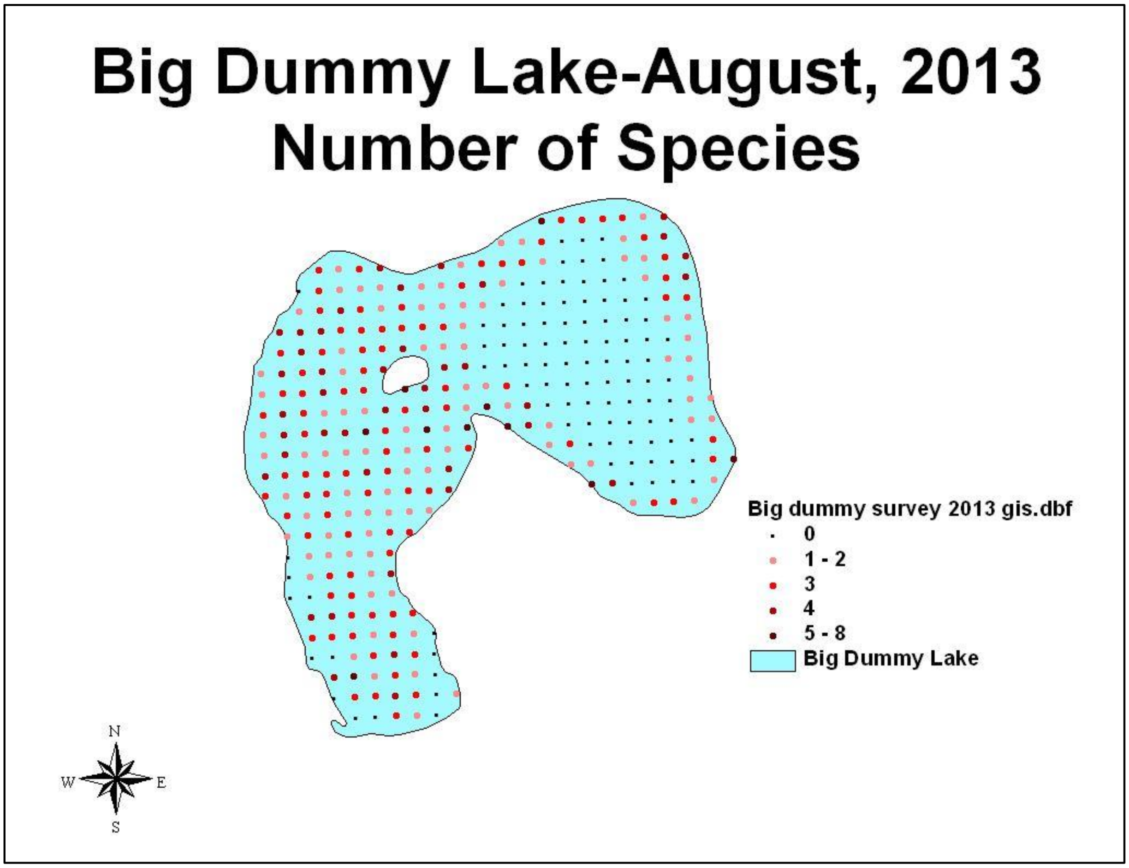


Figure 8: Map showing the number of species per sample point on Big Dummy Lake-2013.

The most profound indicator from the survey data is the number of sensitive plants sampled. There were numerous plants that are adversely affected by habitat changes and some that are quite rare. The State of Wisconsin lists some of these plants as "species of special concern." Although they are not endangered or threatened, their distribution is so limited that the potential from them to reach this status is present. The following "species of special concern" were sampled: Farwell's water milfoil, Vasey's pondweed, snail-seed pondweed, and spiny hornwort.

It is not unusual to find one of these species, but to see this many in a single, small lake is rather unusual and indicates a unique plants community.

Species	Freq. Veg.	Freq Littoral	Relative Freq	# sampled	Mean den	# viewed
Utricularia purpurea, Large purple bladderwort	97.40	80.26	28.38	187	1.52	3
Brasenia schreberi, Watershield	73.96	60.94	21.55	142	1.32	3
Nymphaea odorata, White water lily	27.60	22.75	8.04	53	1.00	17
Potamogeton robbinsii, Fern pondweed	24.48	20.17	7.13	47	1.26	0
Utricularia intermedia, Flat-leaf bladderwort	23.44	19.31	6.83	45	1.00	2
Nuphar variegata, Spatterdock	16.15	13.30	4.70	31	1.00	15
Schoenoplectus subterminalis, Water bulrush	15.10	12.45	4.40	29	1.38	5
Nitella sp., Nitella	10.42	8.58	3.03	20	1.10	1
Sagittaria sp., Arrowhead	7.81	6.44	2.28	15	1.00	2
Potamogeton amplifolius, Large-leaf pondweed	6.77	5.58	1.97	13	1.00	1
Potamogeton vaseyi, Vasey's pondweed	6.25	5.15	1.82	12	1.17	0
Myriophyllum farwellii, Farwell's water-milfoil	4.17	3.43	1.21	8	1.00	6
Pontederia cordata, Pickerelweed	4.17	3.43	1.21	8	1.00	1
Utricularia vulgaris, Common bladderwort	4.17	3.43	1.21	8	1.00	2
Eleocharis acicularis, Needle spikerush	2.60	2.15	0.76	5	1.20	1
Elodea nuttallii, Slender waterweed	2.60	2.15	0.76	5	1.00	0
Potamogeton bicupulatus, Snail-seed pondweed	2.60	2.15	0.76	5	1.20	1
Ceratophyllum echinatum, Spiny hornwort	2.08	1.72	0.61	4	1.25	0
Eleocharis robbinsii, Robbins' spikerush	2.08	1.72	0.61	4	1.25	3
Utricularia gibba, Creeping bladderwort	2.08	1.72	0.61	4	1.00	1
Myriophyllum tenellum, Dwarf water-milfoil	1.56	1.29	0.46	3	1.33	1
Elatine minima, Waterwort	1.04	0.86	0.30	2	1.00	1
Najas gracillima, Northern naiad	1.04	0.86	0.30	2	1.00	0
Dulichium arundinaceum, Three-way sedge	0.52	0.43	0.15	1	1.00	2
Eleocharis palustris, Creeping spikerush	0.52	0.43	0.15	1	1.00	1
Eriocaulon aquaticum, Pipewort	0.52	0.43	0.15	1	1.00	0
Isoetes echinospora, Spiny spored-quillwort	0.52	0.43	0.15	1	1.00	0
Potamogeton pusillus, Small pondweed	0.52	0.43	0.15	1	2.00	0
Schoenoplectus pungens, Three-square bulrush	0.52	0.43	0.15	1	1.00	0
Vallisneria americana, Wild celery	0.52	0.43	0.15	1	1.00	0
Aquatic moss	14.06	11.59	n/a	27	1.07	0
Filamentous algae	3.65	3.00	n/a	7	1.00	0
Carex comosa, Bottle brush sedge	Viewed	only				1
Juncus pelocarpus f. submersus, Brown-fruited rush	Viewed	only				1
Potamogeton epihydrus, Ribbon-leaf pondweed	Viewed	only				1
Sagittaria latifolia, Common arrowhead	Viewed	only				1

Table 2: Species richness list with frequency and sampling data, Big Dummy Lake-2013.

A boat survey was conducted to determine if any plants species may be present in under-sampled areas (due to the sample point generation results. Table 3 lists the species not sampled or viewed but observed from the boat survey. These can vary from survey to survey as there is no basis for effort. As a result, they are not included in the species richness count.

Species observed in boat survey only
Phalaris arundinacea-reed canary grass
Typha latifolia-broad-leaved cattail
Carex sp.-sedge
Potamogeton oakesianus-Oakes' pondweed
Juncus brevicaudatus-narrow panicle rush

Table 3: List of species observed from boat survey conducted on Big Dummy Lake, 2013.

Floristic quality index-Big Dummy Lake

To evaluate any changes that have occurred in a lake, in relationship to the plant community, an index known as the floristic quality index (FBI) is calculated. Any species with a conservatism value assigned and is sampled, is used in the calculation. Table 4 lists the plant species sampled that were used in this calculation.

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Dulichium arundinaceum	Three-way sedge	9
Elatine minima	Waterwort	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis palustris	Creeping spikerush	6
Elodea nuttallii	Slender waterweed	7
Eriocaulon aquaticum	Pipewort	9
Isoetes echinospora	Spiny-spored quillwort	8
Myriophyllum farwellii	Farwell's water-milfoil	8
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas gracillima	Northern naiad	7
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondwwed	9
Potamogeton pusillus	Small pondweed	7
Potamogeton robbinsii	Fern pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Schoenoplectus pungens	Three-square bulrush	5
Schoenoplectus subterminalis	Water bulrush	9
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6

Table 4: Floristic quality species list with conservatism value, Big Dummy Lake-2013.

Big Dummy FQI Info.	Big Dummy Lake 2013	Median for Ecoregion[1]
Number of species in FQI	28	14
Mean conservatism	7.71	5.6
FQI value	40.82	20.9

Table 5: Floristic quality index values, Big Dummy Lake-2013.

The FBI in Big Dummy Lake is very high. This is due to the sensitive nature of the plants. There is a fairly large number of plants used in the Big Dummy Lake FBI. However, the mean conservatism for the plants used is very high at 7.7. The Big Dummy Lake FBI is twice the FBI median for other studied lakes in the eco-region.

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

Little Dummy Lake Results

In June, an early season survey searching for *Potamogeton crispus*-curly leaf pondweed, was conducted. All sample points (122) were visited to get a depth at each sample point. Any points less than 20 feet in depth were sampled. In addition, many other areas were monitored with a high definition underwater camera. Other AIS were being monitored as well. **No AIS were located at any point in Little Dummy Lake**

In early August, the late seasons full lake survey was conducted. All points less than 20 feet were sample. Figure 10 shows where plants were sampled. In the southern portion of the west basin, sample points had floating bog/bottom, so they could not be sampled. They are shown as no plants even though it is likely there were plants there. The maximum depth plants were sampled was 10.0 feet, with a mean depth of plants at 3.35 feet (see figure 11). The plants are most common in the 2-5 foot depths.

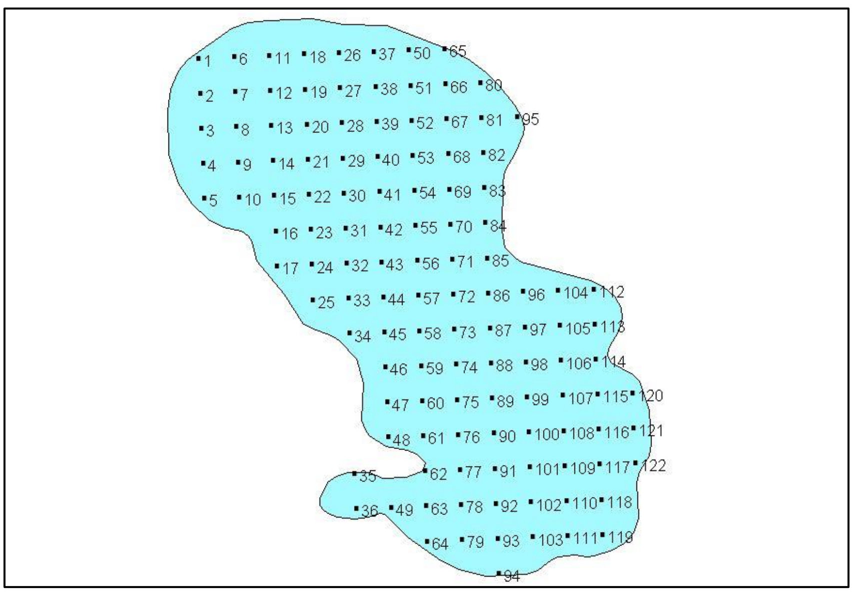


Figure 9: Sample point grid on Little Dummy Lake.

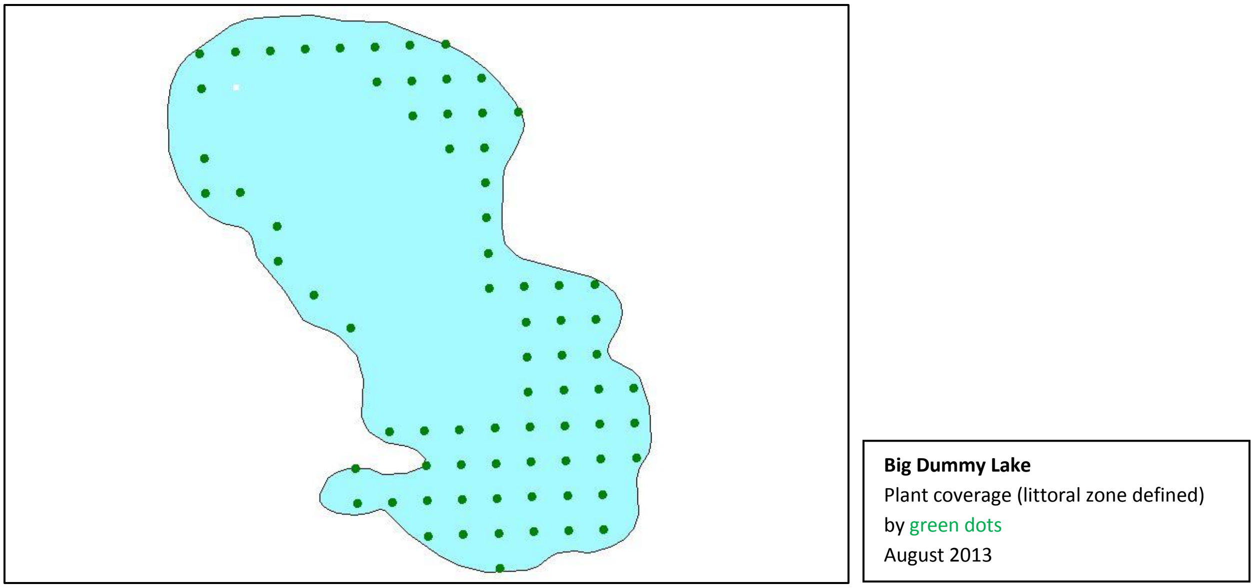


Figure 10: Sample points with plants, defining the littoral zone, Little Dummy Lake-2013.

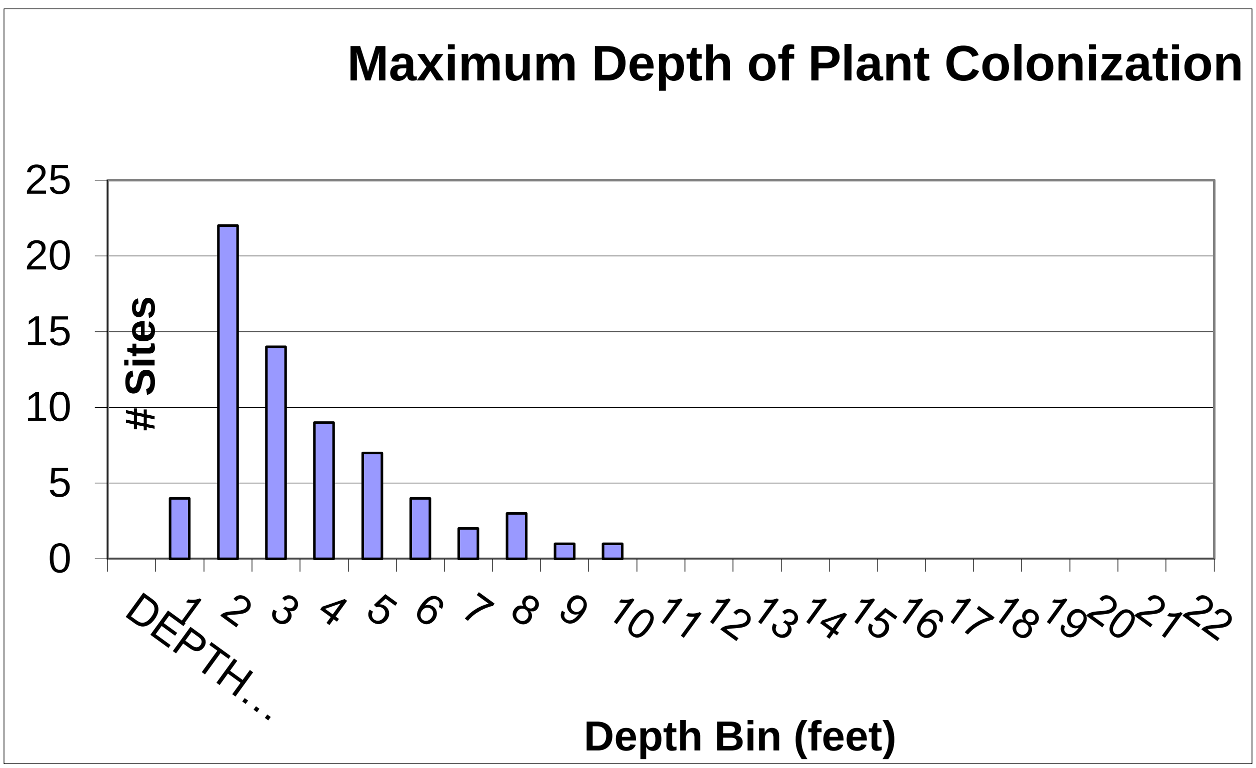


Figure 11: Depth analysis graph for Little Dummy Lake, 2013. This shows the depths with the number of sites sampled.

Total number of sample sites	122
Total number of sites with vegetation	68
Total number of sites shallower than maximum depth of plants	71
Frequency of occurrence at sites shallower than maximum depth of plants	95.77
Simpson Diversity Index	0.83
Maximum depth of plants (ft)	10.00
Mean depth plants sampled (ft)	3.35
Average number of all species per site (shallower than max depth)	2.46
Average number of all species per site (veg. sites only)	2.61
Average number of native species per site (shallower than max depth)	2.46
Average number of native species per site (veg. sites only)	2.61
Species Richness	20
Species Richness (including visuals)	21

Table 6: Summary of survey statistics, Little Dummy Lake-2013.

The coverage of aquatic plants in Little Dummy Lake at depths below 10 ft. (maximum depth plants were sampled) is high. Of the sample points 10 feet and less, 95.77% had plants present. The density of plant growth was high in some areas, mostly south basin and east. Numerous sample points had a rake density of 3. There were areas that could impeded navigation.

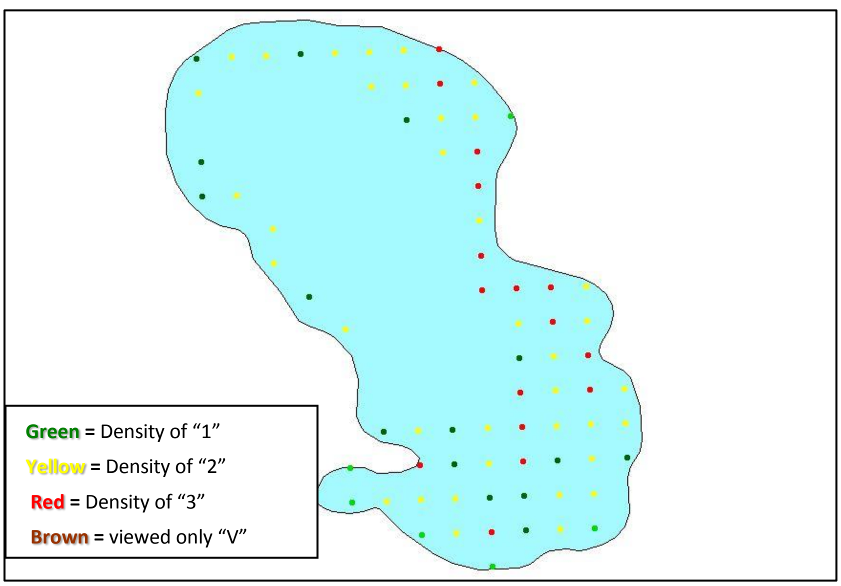


Figure 12: Density rating at each sample point, Little Dummy Lake, 2013.

Species	Freq. veg	Freq. littoral	Rel. Freq	# sampled	Mean density	# viewed
Utricularia purpurea, Large purple bladderwort	83.82	80.28	32.77	58	1.47	0
Brasenia schreberi, Watershield	55.88	53.52	21.47	38	1.37	1
Nymphaea odorata, White water lily	23.53	22.54	9.04	16	1.00	3
Schoenoplectus subterminalis, Water bulrush	16.18	15.49	6.21	11	1.18	0
Eleocharis robbinsii, Robbins' spikerush	14.71	14.08	5.65	10	1.20	3
Nuphar variegata, Spatterdock	8.82	8.45	3.39	6	1.00	3
Utricularia intermedia, Flat-leaf bladderwort	8.82	8.45	3.39	6	1.00	0
Myriophyllum farwellii, Farwell's water-milfoil	5.88	5.63	2.82	5	1.20	4
Pontederia cordata, Pickerelweed	5.88	5.63	2.26	4	1.00	3
Potamogeton robbinsii, Fern pondweed	5.88	5.63	2.26	4	1.00	0
Utricularia gibba, Creeping bladderwort	5.88	5.63	2.26	4	1.00	0
Utricularia vulgaris, Common bladderwort	5.88	5.63	2.26	4	1.00	0
Ceratophyllum echinatum, Spiny hornwort	2.94	2.82	1.13	2	1.00	0
Eriocaulon aquaticum, Pipewort	2.94	2.82	1.13	2	1.00	0
Potamogeton oakesianus, Oakes' pondweed	2.94	2.82	1.13	2	1.00	0
Nitella sp., Nitella	1.47	1.41	0.56	1	1.00	0
Potamogeton amplifolius, Large-leaf pondweed	1.47	1.41	0.56	1	1.00	2
Potamogeton bicupulatus, Snail-seed pondweed	1.47	1.41	0.56	1	1.00	0
Potamogeton epihydrus, Ribbon-leaf pondweed	1.47	1.41	0.56	1	1.00	0
Sagittaria sp., Arrowhead	1.47	1.41	0.56	1	1.00	1
Aquatic moss	2.94	2.82	n/a	2	1.00	0
Filamentous algae	1.47	1.41	n/a	1	1.00	0
Typha latifolia, Broad-leaved cattail	viewed	only				1

Table 7: Species richness list with frequency and sampling data, Little Dummy Lake-2013.

A boat survey was conducted to determine if any plants species may be present in under-sampled areas (due to the sample point generation results. Table 8 lists the species not sampled or viewed but observed from the boat survey. These can vary from survey to survey as there is no basis for effort. As a result, they are not included in the species richness count.

Species observed in boat survey only
Sparganium eurycarpum-common bur-reed
Eleocharis erythropoda-bald spikerush
Juncus brevicaudatus-narrow panicle rush
Sagittaria gramineus-grass-leaved arrowhead
Sagittaria latifolia-common arrowhead
Schoenoplectus acutus-hardstem bulrush
Isoetes echinospora-spiny spored quillwort
Phalaris arundinacea-reed canary grass

Table 8: Species list of plants observed from boat survey, Little Dummy Lake-2013.

Little Dummy Lake has less diversity in terms of species richness than Big Dummy Lake, with 20 species. All of the plants sampled and viewed are native aquatic plants in Wisconsin lakes. The area where plants have habitat to grow is less and can account for this. The Simpson's diversity index is somewhat lower at 0.83, which again is moderately high. The most dominant species were large purple bladderwort, watershield, and white lily respectively. The relative frequency of large purple bladderwort was 32.77% which is very high and indicates the lake is dominated by this plant.

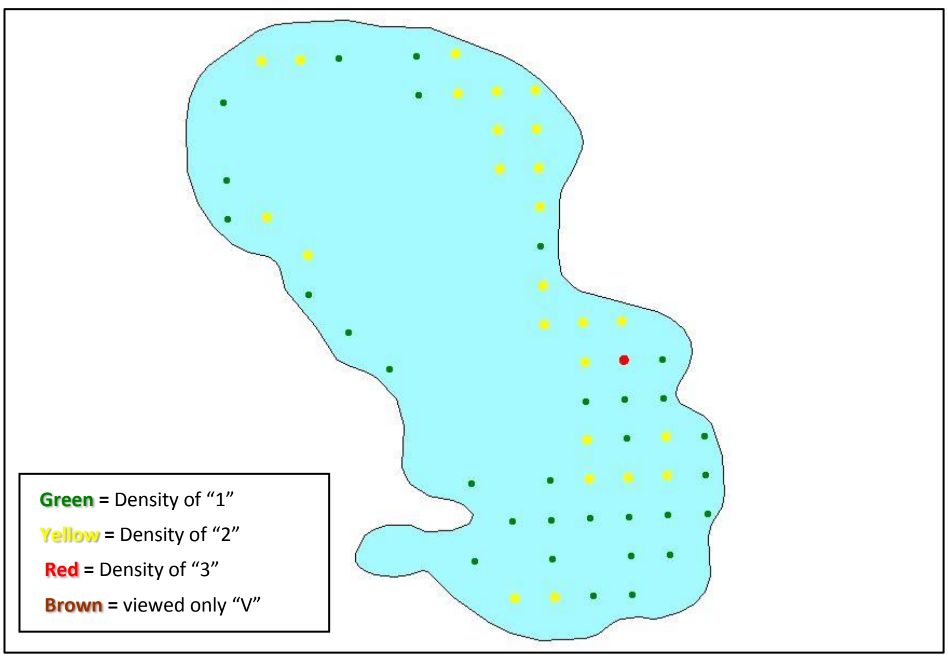


Figure 13: Distribution map of large purple bladderwort, most frequent aquatic plant sampled, Little Dummy Lake-August, 2013.

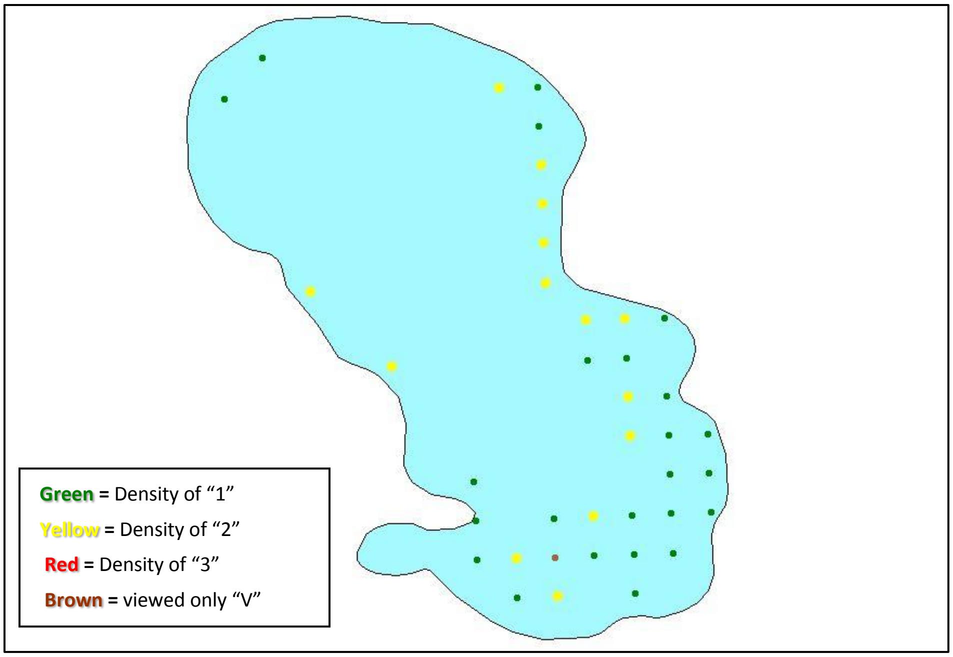


Figure 14: Distribution map of watershield, second most frequent plant, Little Dummy Lake-August 2013.

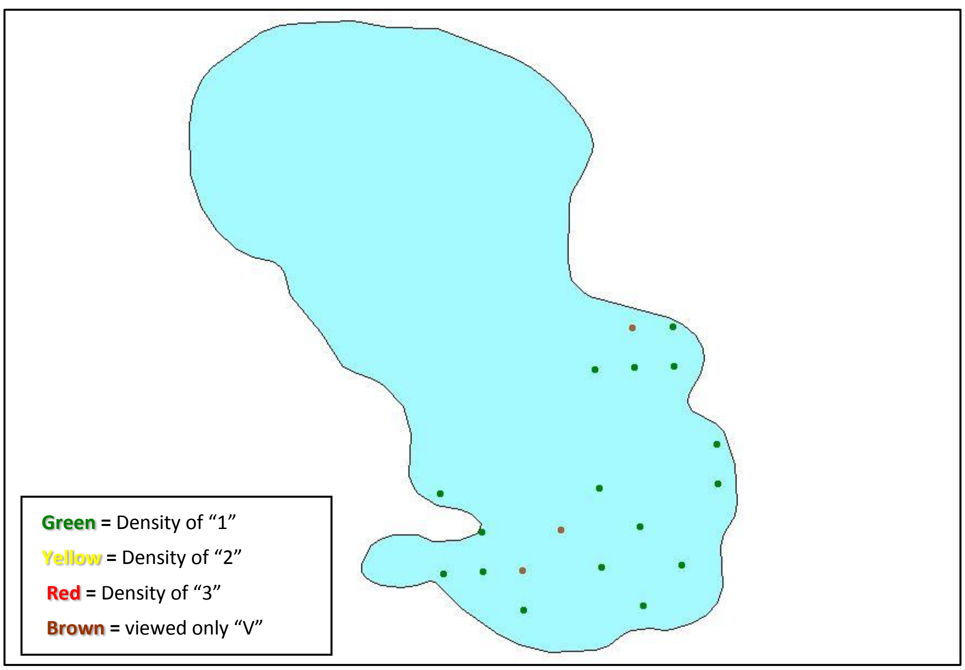


Figure 15: Distribution map of white lily, third most frequent plant sampled, Little Dummy Lake-August 2013.

The south basin of Little Dummy Lake contains the most diversity. Figure 16 shows the number of species per sample point.

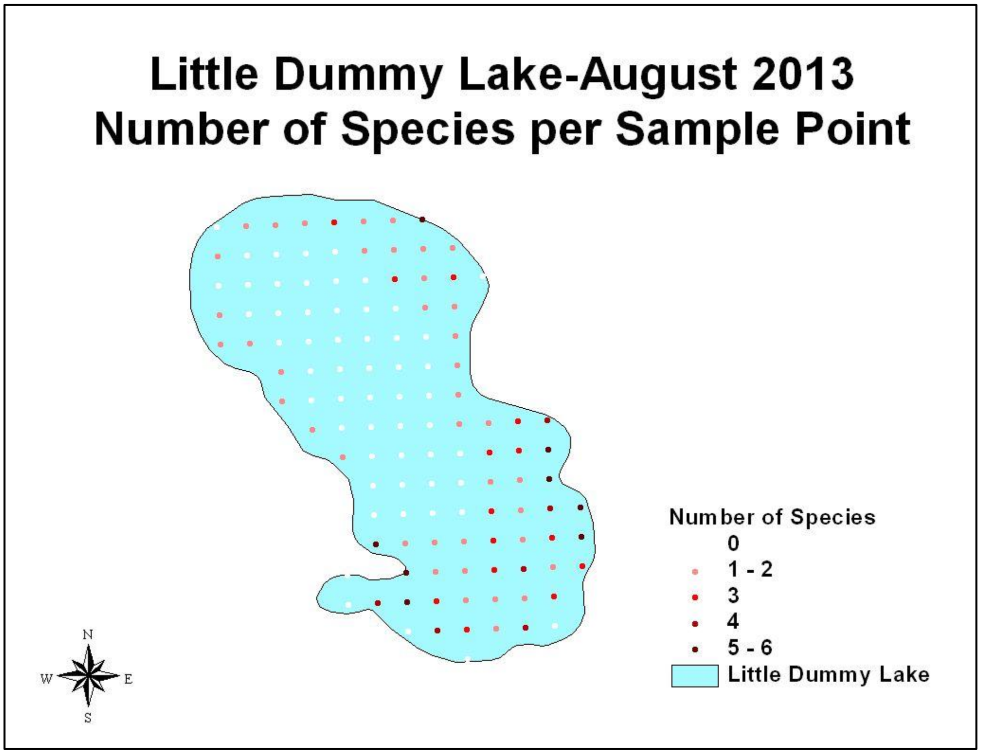


Figure 16: Number of species sampled at each sample point, Little Dummy Lake-2013.

Floristic quality index-Little Dummy Lake

The floristic quality index for Little Dummy Lake was also very high. Big Dummy Lake had a higher FQI, but that is due to a higher number of species used in the calculation. Little Dummy Lake had a very high average conservatism at 8.06. The overall FQI was 34.18, which is significantly higher than the median for the eco-region. This indicates that there are many sensitive plants remaining in Little Dummy Lake, with little changes in the plant community due to human activities.

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Eriocaulon aquaticum	Pipewort	9
Myriophyllum farwellii	Farwell's water-milfoil	8
Nitella	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondwwed	9
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton oakesianus	Oakes' pondweed	10
Potamogeton robbinsii	Fern pondweed	8
Schoenoplectus subterminalis	Water bulrush	9
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7

Table 9: Floristic quality index species list with conservatism values, Little Dummy Lake-2013.

	Little Dummy Lake 2013	**Ecoregion**
Number of species	18	14
mean Conservatism	8.06	5.6
FQI value	34.18	20.9

Table 10: Floristic quality index values, Little Dummy Lake-2013.

Comparison to previous macrophyte survey

A full lake point intercept macrophyte survey was conducted on Big Dummy Lake in 2006. In comparing those data to the survey data of 2013, there are some minor differences. One is that it appears a slightly higher percentage of littoral zone with plants in 2006 compared to 2013. This could be due to lesser water clarity, eliminating plants in deeper water. The 2006 survey showed plants growing at a maximum of 15.5 feet, which is greater than the 13.7 feet observed in 2013. However, the annual secchi disk data does not support this speculation. The difference could be simply sampling variation.

The species richness is slightly higher in 2013, but does not indicate a major change in the diversity of the plants community. A few differences in species sampled and/or viewed are present. Coontail was not sampled in 2013, but was present in only one point in 2006. This is of no concern as coontail if a very adaptable and hardy plant. There was no Farwell's water-milfoil sampled or viewed in 2006 but there was in 2013. The milfoil identified in 2006 was listed as whorled water-milfoil. Farwell's and whorled water milfoils are very difficult to tell apart when no fruiting bodies are present. The whorled water milfoil may have actually been Farwell's. The Farwell identification was verified[2].

The Simpson's diversity index was actually lower in 2013, indicating less diversity per sample point. It appears that the dominance of large purple bladderwort and watershield has increased from 2006. The west basin has both of these plants sampled at nearly every point.

Big Dummy Lake	2006	2013
% of littoral zone with plants	93.8	92.46
Simpson's diversity index	0.89	0.85
Number of species sampled	26	30
Maximum depth of plants	15.5	13.7
Three most dominant species (rel. freq.)	Large purple bladderwort (19.7) Watershield (17.7) Common bladderwort (10.9)	Large purple bladderwort (28.38) Watershield (21.55) White lily (8.04)
FBI	35.52	40.82

Table 11: Comparison of stats between 2006 and 2013 surveys.

[2] Dr. Susan Knight. UW Trout Lake Station. Boulder Junction, WI

Species	2006*	2013*	p	Significant change	Change
Utricularia purpurea, Large purple bladderwort	127	187	0.00000	***	+
Brasenia schreberi, Watershield	114	142	0.0025	**	+
Nymphaea odorata, White water lily	35	53	0.02	*	+
Potamogeton robbinsii, Fern pondweed	47	47	0.84	n.s.	+
Utricularia intermedia, Flat-leaf bladderwort	19	45	0.0002	***	+
Nuphar variegata, Spatterdock	22	31	0.14	n.s.	+
Schoenoplectus subterminalis, Water bulrush	67	29	0.00004	***	-
Nitella sp., Nitella	4	20	0.0006	***	+
Sagittaria sp., Arrowhead	2	15	0.001	***	+
Potamogeton amplifolius, Large-leaf pondweed	23	13	0.11	n.s.	-
Potamogeton vaseyi, Vasey's pondweed	11	12	0.76	n.s.	+
Myriophyllum farwellii, Farwell's water-milfoil	0	8	0.004	**	+
Pontederia cordata, Pickerelweed	1	8	0.015	*	+
Utricularia vulgaris, Common bladderwort	70	8	0.00000	***	-
Eleocharis acicularis, Needle spikerush	2	5	0.23	n.s.	+
Elodea nuttallii, Slender waterweed	0	5	0.022	*	+
Potamogeton bicupulatus, Snail-seed pondweed	0	5	0.022	*	+
Ceratophyllum echinatum, Spiny hornwort	5	4	0.78	n.s.	-
Eleocharis robbinsii, Robbins' spikerush	0	4	0.041	*	+
Utricularia gibba, Creeping bladderwort	31	4	0.00000	***	-
Myriophyllum tenellum, Dwarf water-milfoil	4	3	0.74	n.s.	-
Elatine minima, Waterwort	0	2	0.15	n.s.	+
Najas gracillima, Northern naiad	0	2	0.15	n.s.	+
Dulichium arundinaceum, Three-way sedge	1	1	0.98	n.s.	+
Eleocharis palustris, Creeping spikerush	0	1	0.31	n.s.	+
Eriocaulon aquaticum, Pipewort	0	1	0.31	n.s.	+
Isoetes echinospora, Spiny spored-quillwort	0	1	0.31	n.s.	+
Potamogeton pusillus, Small pondweed	1	1	0.98	n.s.	+
Schoenoplectus pungens, Three-square bulrush	0	1	0.31	n.s.	+
Vallisneria americana, Wild celery	1	1	0.98	n.s.	+
Myriophyllum verticillatum , whorled water milfoil	2	0	0.16	n.s.	-
Ceratophyllum demersum, coontail	1	0	0.32	n.s.	-
Najas flexilis, bushy pondweed	1	0	0.32	n.s.	-
Heteranthera dubia, water stargrass	2	0	0.16	n.s.	-

***Note: Does not include viewed only or boat survey species.**

Table 12: Chi-square analysis data comparing 2006 and 2013 survey frequencies, Big Dummy Lake.

A chi-square analysis was conducted to compare the frequency of the various native plants sampled in 2006 to those sampled in 2013. If the p value is less than 0.05, the change is considered significant and more than just random chance. If the change is significant, the cause of the change is not known, just that a change has occurred. The causes could include water depth change, water temperature differences at various times of the growing season, water clarity, nutrient availability, or sediment/substrate composition. Sampling differences could also cause a change in frequency. For those plants with low frequency of occurrence, just a small change in location of sample could determine if a plant were sampled or not.

Big Dummy Lake shows a statistically significant reduction in the frequency of three species. These species include: water bulrush (*Schoenoplectus subterminalis*), common bladderwort (*Utricularia vulgaris*), and creeping bladderwort (*Utricularia gibba*). There was statistically significant increase in 11 species. This shows that the plant community has maybe changed since the 2006, showing the dynamic nature of lakes. Since there was more increase in frequency of species than decreases, it is unlikely the changes are due to human activities.

In 2008, a full lake point intercept macrophyte survey was completed on Little Dummy Lake. Comparing this survey to the 2013 survey reveals some differences. The major difference is the percentage of the littoral zone with plants growing. It was nearly 10% less in 2008. However, this is largely due to the fact that the maximum depth of plants is twice the depth as in 2013 (20 ft in 2008 vs 10 ft in 2013). Since the littoral zone is defined in 2008 at any point less than 20 ft, many points are added to this calculation. The lower percentage with plants indicates that most of these added points did not have plants present.

The reason for a greater depth of plants typically would be higher water clarity. However the annual secchi disk data does not support this increase, especially enough of an increase to cause this change. A possible reason is that in 2008 a dislodged plant was picked up upon rake retrieval in a 20 foot depth. This would also explain why most depth 10-20 feet did not have plants. It is also possible that a small sample of plants was living at that depth and got sampled.

All other data are only slightly different and show no big changes in the plant community between 2008 and 2013. There were no plants sampled in 2008 that were not observed in 2013. In 2013, there were three plants viewed that were not viewed in 2008, but were observed in the boat survey. These differences are negligible.

Little Dummy Lake	2008	2013
% of littoral zone with plants	85.1	95.77
Simpson's diversity index	0.84	0.83
Number of species sampled	17	20
Maximum depth of plants	20.0	10.0
Three most dominant species (rel. freq.)	Large purple bladderwort (32.64) Watershield (16.58) White lily (10.36)	Large purple bladderwort (32.77) Watershield (21.47) White lily (9.04)
FBI	29.18	34.18

Table 13: Comparison of survey stats from 2008 and 2013 surveys, Little Dummy Lake.

Species	**2008***	**2013***	**P value**	**Significant change**	**(proportional to # sampling points)**
Utricularia purpurea, Large purple bladderwort	63	58	0.17080	**n.s.**	**+**
Brasenia schreberi, Watershield	32	38	0.03512	*	**+**
Nymphaea odorata, White water lily	20	16	0.94613	**n.s.**	**-**
Schoenoplectus subterminalis, Water bulrush	15	11	0.76811	**n.s.**	**-**
Eleocharis robbinsii, Robbins' spikerush	11	10	0.79072	**n.s.**	**+**
Nuphar variegata, Spatterdock	12	6	0.29309	**n.s.**	**-**
Utricularia intermedia, Flat-leaf bladderwort	2	6	0.07936	**n.s.**	**+**
Myriophyllum farwellii, Farwell's water-milfoil	2	5	0.14949	**n.s.**	**+**
Pontederia cordata, Pickerelweed	6	4	0.74574	**n.s.**	**-**
Potamogeton robbinsii, Fern pondweed	5	4	0.97561	**n.s.**	**-**
Utricularia gibba, Creeping bladderwort	4	4	0.76763	**n.s.**	**+**
Utricularia vulgaris, Common bladderwort	6	4	0.74574	**n.s.**	**-**
Ceratophyllum echinatum, Spiny hornwort	0	2	0.11515	**n.s.**	**+**
Eriocaulon aquaticum, Pipewort	0	2	0.11515	**n.s.**	**+**
Potamogeton oakesianus, Oakes' pondweed	0	2	0.11515	**n.s.**	**+**
Nitella sp., Nitella	0	1	0.26679	**n.s.**	**+**
Potamogeton amplifolius, Large-leaf pondweed	6	1	0.09539	**n.s.**	**-**
Potamogeton bicupulatus, Snail-seed pondweed	1	1	0.88481	**n.s.**	**+**
Potamogeton epihydrus, Ribbon-leaf pondweed	0	1	0.26679	**n.s.**	**+**
Sagittaria sp., Arrowhead rosette	0	1	0.26679	**n.s.**	**+**
Sagittaria latifolia, common arrowhead	1	0	0.36480	**n.s.**	**-**
Dulichium arundinaceum ,three-way sedge	1	0	0.36480	**n.s.**	**-**

***Does not include viewed only or boat survey species.**

Table 14: Chi-square analysis data comparing 2008 and 2013 frequencies, Little Dummy Lake.

The chi-square analysis showed only statistically significant in frequency between 2008 and 2013. The change was an increase in watershield (*Brasenia shreberi*). There are no other changes to address in Little Dummy Lake.

Discussion

Big Dummy Lake has a thriving, robust aquatic plant community. There were no AIS sampled or observed. The lake contains many very sensitive plants, four of which are listed as species of special concern in Wisconsin. As a result, it is imperative to manage the lake in accordance with maintaining this unique community.

Little Dummy Lake also has many sensitive plants within its shore. The diversity is not as high as Big Dummy, but it has less littoral zone by area and doesn't allow as much habitat for plants. As with Big Dummy Lake, management should consider these sensitive plants.

One major issue with both lakes, but more with Big Dummy Lake is accumulation of sediment, thick plant growth in that sediment, and the periodic floating of lake bottom in these areas. This results in restricting navigation and recreational use of the lakes. The west basin in Big Dummy Lake is very dense with plants, mainly large purple bladderwort, watershield and white lily. In addition, the lake depth is minimal in many areas with lake bottom floating at the surface. It was observed in 2013 during the survey that many areas of the west basin were nearly non-navigable (17 sample points couldn't be reached as a result). Figures 18 and 19 are photo documentation of these observations.

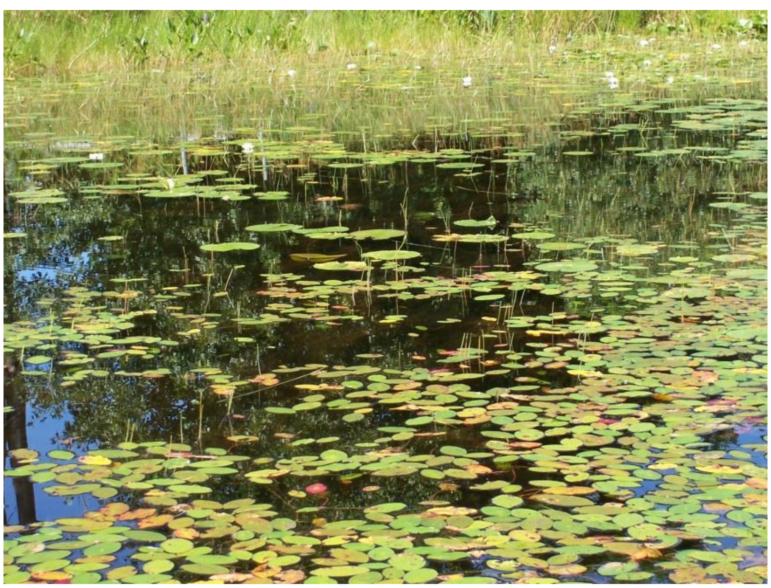


Figure 17: Photo documentation of watershield density. Numerous high density submergent plants are also present below the surface, Big Dummy Lake-2013.

Figure 18: Photo documentation of floating lake bottom/bog in west basin of Big Dummy Lake, 2013.

Figure 19: Photo documentation fo floating lake bottom/bog on south end of Little Dummy Lake, 2013.

There are similar issues in Little Dummy Lake. On the south end and east, there are some areas where the lake bottom floats. It issue isn't as severe as Big Dummy, but is present. According to residents, the lake was low during the 2013 plant survey, which could exacerbate the issue. However, it was also stated that this has been an issue in the past, and according to some residents is getting worse.

The west basin in Big Dummy Lake did appear to have navigation channels. This may be due to boat traffic or a possible management practice. Regardless, these navigation channels were helpful in reaching into this portion of the lake by boat.

Recommendations

The plant community in Big Dummy Lake and Little Dummy Lake is very unique and special as there are numerous sensitive plants. It is important that the aquatic plant management take this into consideration. This is not to say that management can't occur. If the desire to navigate into certain areas of both lakes is present from stakeholders, management will be necessary to reduce large purple bladderwort and watershield (as well as some other natives) to produce navigation corridors. This could be done carefully to avoid any detrimental effects on the sensitive plants. It does appear that the lake has plants growing where they can, so the density may be at or near a maximum.

Big Dummy and Little Dummy Lakes appear to contain no aquatic invasive species (AIS) (or at least have not been encountered in a survey). It is imperative to take safe guards to reduce the chance of any introduction of AIS. This should include monitoring the boat landings, depending on the frequency of their use. The best way to deal with AIS is to not have them get into the lake in the first place. If an invasive species does get introduced into a lake, the earlier it can be detected as a pioneer community, the better. This way the plant can be removed before it spreads to other areas. One way to do this is to organize volunteer monitors to monitor all littoral zone areas of the lakes on a routine basis.

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Appendix B – Point Intercept Sample Coordinates

Appendix C1 – Importance of Aquatic Plants to Lake Ecosystem

AQUATIC PLANT TYPES AND HABITAT

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

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

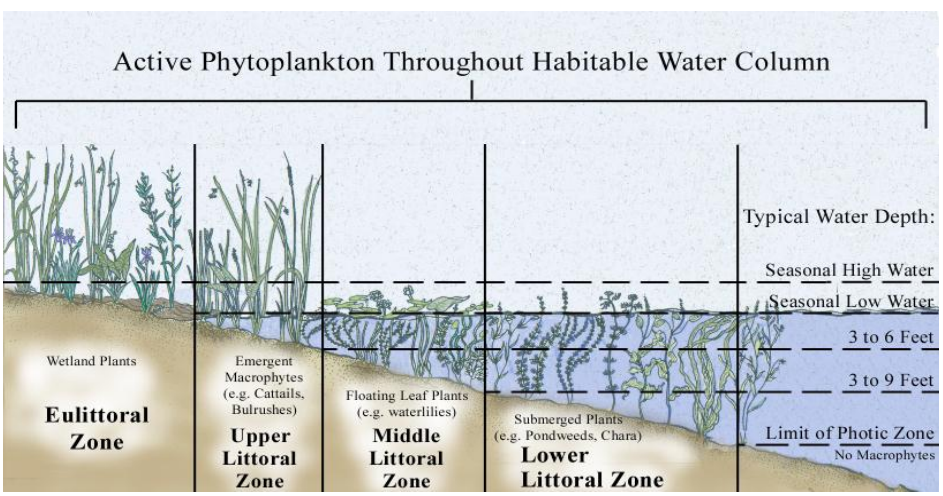
Eulittoral Zone: Includes the area between the highest and lowest seasonal water levels, and often contains many wetland plants.

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

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

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

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



Aquatic Plant Communities Schematic

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

AQUATIC PLANTS AND WATER QUALITY

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

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

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

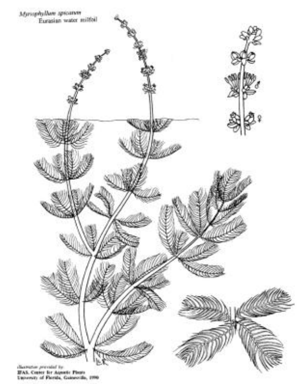
Aquatic plants also play a key role in the ecology of a lake system. Aquatic plants provide food and shelter for fish, wildlife and invertebrates. Plants also improve water quality by protecting shorelines and the lake bottom, improving water quality, adding to the aesthetic quality of the lake and impacting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

Appendix C2 – Aquatic Invasive Species

INVASIVE AQUATIC PLANTS

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

Eurasian Watermilfoil *(Myriophyllum spicatum)*



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

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

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

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

Curly-leaf pondweed *(Potamogeton crispus)*

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

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

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

Purple Loosestrife (Lythrum salicaria)

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

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

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

OTHER AQUATIC INVASIVE SPECIES

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

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

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

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

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

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

Early Detection and Response Procedures

April 2008 Draft #3

Purpose: Provide procedural guidance for Aquatic Invasive Species (AIS) Control grants awarded under NR 198.30 Early Detection and Response Projects**.** These projects are intended to control pioneer populations of aquatic invasive species before they become established.
"Pioneer population" means a small population of aquatic invasive species in the early stages of colonization, or re-colonization, in a particular water body or portion thereof. For rooted aquatic plants, a pioneer population is a localized bed that has been present less than 5 years and is less than 5 acres in size or less than 5% of lake area which ever is greater.
"Sponsor" means a grant-eligible organization or local unit of government.

Sponsor

1. Contacts the department after finding suspected AIS in a waterbody.
2. Collects an entire intact adult specimen and submits it to the department within 3 days or otherwise facilitates department verification.
3. Works with department staff to develop a response plan.
4. Applies for permits if required.
5. Conducts or contracts for control of the aquatic invasive species through means authorized by the department in the response plan.
6. Completes grant application requirements for the project and submits it to the department.
7. Pays all costs of the control as defined in response plan, reports to the department the results of the completed project and request s reimbursement for the state's share of the project.

Region Staff

1. Advises the sponsor on how to collect and voucher specimen and makes arrangements for its delivery or conducts onsite visit.
2. Verifies the species is an invasive.
3. Visits site and determines that it is a pioneer population and that an early response is appropriate.
4. Consults with sponsor and appropriate expertise within and outside the department and writes or facilitates development of response plan. Determines appropriate control method including pre- and post-control monitoring, follow-up control and reporting requirements.
5. Determines sponsor eligibility for AIS Early Detection and Response grant.

6. Authorizes project verbally and sends confirmation email to the Bureau of Community Financial Assistance and copies regional Environmental Grant Specialist.
7. Follows up in writing prescribing the control response, specifying the conditions and procedures under which the project may take place, issues any required permits and includes grant application and guidance.
8. Provides on-site supervision/observation of control treatments and provides technical assistance as needed throughout the project.
9. Reviews report and authorizes grant reimbursement.

Response for Early Detection of Eurasian Water milfoil

Field Protocol

A. PRETREATMENT

1. Visual concurrence by trained DNR staff that it is Eurasian Water milfoil (EWM). If there is doubt, proceed quickly with Herbarium or DNA verification but authorize project to proceed regardless. Collect voucher specimens and send to the U.W. Stevens Point Herbarium and notify SWIMS data manager in Central Office or enter information into SWIMS for statewide listing of existing populations.

2. Use GPS and rake throws to precisely define the location of the colony or plants following the established infestation sampling protocol.

3. Consider need and ability to quarantine the area - mark beds with buoys - to help prevent spread from boating activity in consultation with area Conservation Warden and Water Management Specialist.

4. Visually survey entire lake littoral zone from a boat. Throw rakes at random points. If possible, deploy underwater survey, either SCUBA or video. This effort is best targeted after surface survey.

5. Contact Bureau of Integrated Science Services and request point/intercept grids for entire lake. Deploy DNR survey crew, or sponsor retains qualified consultant, to survey and map aquatic plants during summer peak growing season (mid June to mid Sept).

6. Sign boat landings, recruit/establish CBCW boat landing inspection program, inform and educate lake residents to recognize EWM and recruit volunteers or retain qualified consultant for ongoing monitoring.

B. TREATMENT

1. Determine if herbicide is the appropriate tool. Scattered plants may be better dealt with through hand pulling. Hand pulling in conjunction with herbicide treatments has proven the most effective way to manage and possibly eliminate pioneer infestations over time. Hand pulling can be done throughout the season and should be integrated into all post-herbicide treatment monitoring efforts. Bottom barriers may be an effective, though

untried, method for control of small isolated beds. A chapter 30 permit is required for bottom barriers.

2. If early season and plant is still actively growing, use pretreatment mapping (A2) to apply for NR 107 permit and conduct treatment using a systemic herbicide such as 2,4-D.

3. If mid to late season and plants are topped out (flowering) and reached mid-season dormancy, map bed following pretreatment protocol (A2) and prepare for spring or, fall and spring, treatment with a systemic herbicide. The decision to delay treatment needs to consider location - isolated vs. near boating traffic - the ability to quarantine and other factors that may enhance or help inhibit spreading.

   3.1 Hand pulling plants with SCUBA or snorkel divers collecting all plant fragments and disposing them inland on the shore is highly recommended at this stage.

   3.2 A contact herbicide can be used to kill apical tips /condemn fragments. This will eliminate/reduce plant biomass. Follow up treatment with systemic herbicide or hand pulling will be required to eliminate regrowth. Careful consideration of formulation and dose is needed to limit impacts to non-target native plants.

   3.3 The effectiveness of herbicide treatments on compact, small beds may be enhanced by deploying a barrier or curtain to help “hold” the chemical on plants. Most appropriate in flowing or large open water especially adjacent to deep water drop offs. (This is not an established procedure at this time - EXPERIMENTAL.)

C. POST TREATMENT

1. Following initial treatment, repeat all steps above as necessary until at least one season year after plant is no longer detected.

2. Maintain monitoring/surveillance, education and CBCW efforts indefinitely.

3. Obtain plant survey results and develop an aquatic plant management plan.

Appendix D – Descriptions of Aquatic Plants

Appendix D

Description of Plants

Big Dummy and Little Dummy Lakes 2014

Watershield (Braensia schreberi)

- Floating-leaf
- Native, common in northern WI
- Found in soft-water lakes with organic sediment in very shallow to water 2 m deep
- Consumed by waterfowl; provides habitat for fish and invertebrates

Bottlebrush sedge (Carex comosa)

- Emergent
- Native, widely spread
- Found in very shallow water on banks of lakes, streams
- Nutlets eaten by waterfowl, shoreline stabilizer

Spiny hornwort (Ceratophyllum echinatum) *

- Submersed
- Native, species special concern
- Found in shallow to deep water

Three-way sedge (Dulichium arundinaceum)

- Emergent
- Native, common
- Found in shallow water in a variety of sediment, tolerant of turbidity
- Grazed by waterfowl and muskrats, shoreline stablization

Waterwort (Elatine minima)

- Submersed
- Native, scattered in northern WI
- Exposed mudflats, sandy, low disturbance sites
- Grazed by waterfowl, habitat for zooplankton and fingerling fish

Creeping spikerush (Eleocharis palustris)

- Emergent
- Native; common in WI
- Found along lakeshores in up to 2 meters of water
- Anchors shoreline sediment, nutlets consumed by waterfowl, grazed by mammals

Robbins' spikerush (Eleocharis robbinsii)

- Emergent
- Native, scattered in northern WI, species of special concern*
- Found in moist shorelines to 1m deep, soft-water low pH
- Grazed by waterfowl and muskrats, habitat for inverts and small fish

Slender waterweed (Elodea nuttallii)

- Submersed
- Native and common in WI
- Found in soft substrate, soft-moderate water
- Provide shelter and grazing opportunities for fish, food for muskrats and waterfowl.

Pipewort (Eriocaulon aquaticum)

- Submersed
- Native, common in soft-water lakes
- Found on sandy shorelines in shallow water
- Habiat for young fish, amphibians, inverts; grazed by waterfowl

Quillwort (Isoetes sp)

- Submersed
- Native; occasional in soft-water lakes in northern and central WI
- Prefer soft water lakes in soft to sandy sediment
- Provide habitat in low nutrient water; sometimes consumed by waterfowl

Brown-fruited rush (Juncus pelocarpus)

- Emergent
- Native, common in soft-water, northern lakes
- Found in boggy or sandy soil of shorlines and shallow water
- Habitat for fish spawning and inverts; habitat for waterfowl, grazed by muskrats and moose

Farwells watermilfoil (Myriophyllum farwellii)

- Submersed
- Native , scattered, species of special concern
- Found in fine sediments in soft-water lakes; shallow to 2m deep
- Consumed by waterfowl; provide invertebrate habitat; provides shade, shelter and forage for fish

Dwarf watermilfoil (Myriophyllum tenellum)

- Submersed
- Native, primarily in northern WI
- Found in sandy sites, to 4 m deep
- Provides spawning habitat for panfish, shelter for inverts, stabilizes shoreline

Northern naiad (Najas gracillima)

- Submersed
- Native
- Found in soft-water, clear lakes; sensitive to pollution; shallow to deep

Nitella (Nitella sp)

- Submersed
- Native; common throughout WI
- Found in soft sediments in deeper zones sometimes 10 meters or more deep
- Grazed by waterfowl, provides forage for fish

Spatterdock (Nuphar variegata)

- Floating leaf
- Native and widely distributed in WI
- Found in sun or shade, prefers soft sediment in water 2 meters or less
- Anchors shallow water community; provides food for waterfowl, deer, muskrat, beaver; provides shade and shelter for fish

White water lily (Nymphaea odorata)

- Floating leaf
- Native and widely distributed in WI
- Found in quiet water, variety of sediments in water 2 meters or less
- Provides food for waterfowl, deer, muskrat, beaver; provides shade and shelter for fish

Pickerelweed (Pontederia cordata)

- Emergent
- Native; common in northern WI
- Found in ankle-deep to 2 meters deep in a variety of sediment
- Flower provides habitat for insects; seed consumed by waterfowl; provides shade/shelter for fish

Large-leaf pondweed (Potamogeton amplifolius)

- Submersed
- Native, throughout WI
- Found in one to several meters deep water , soft sediment; sensitive to increased turbidity and suffers when top-cut by motors
- Offers shade and foraging for fish, valuable waterfowl food

Snail-seed pondweed (Potamogeton bicupulatus)

- Submersed
- Native, common locally
- Found in soft-water lakes, shallow water

Ribbon-leaf pondweed (Potamogeton epihydrus)

- Submersed
- Native; common in northern WI
- Found in low alkalinity water in a variety of sediments from knee deep to 2 meters
- Locally important waterfowl food, grazed by mammals, offers forage for fish

Small pondweed (Potamogeton pusillus)

- Submersed
- Native; common throughout WI
- Tolerates turbid conditions and is found shallow to 2-3 meters deep
- Locally important food for waterfowl and may be grazed by mammals, provides food and cover for fish

Robbins (fern) pondweed (Potamogeton robbinsii)

- Submersed
- Native; primarily in northern WI
- Thrives in deeper water
- Provides habitat for invertebrates, cover for fish (northern pike)

Vasey's pondweed (Potamogeton vaseyi)

- Submersed

- **Special Concern** species
- Found in soft water lakes

Common arrowhead (Sagittaria latifolia)

- Emergent
- Native; common in WI
- Found in shallow water from ankle-deep to 1 meter in a variety of sediments
- High value plant for wildlife; high-energy tubers for migrating waterfowl; grazed by mammals; provides shade/shelter for fish

Water bulrush (Schoenoplectus subterminalis)
Three-square bulrush (Schoenoplectus pungens)

- Emergent
- Native; scattered in WI
- Deep to shallow marshes and along lake shores
- Food source for waterfowl, grazed by muskrats

Creeping bladderwort (Utricularia gibba)

- Submersed
- Native and uncommon in WI
- Free-floating, moist shorelines to several meters deep, quiet waters
- Provide fish habitat

Flat-leaf bladderwort (Utricularia intermedia)

- Submersed
- Native and common in WI
- Free-floating, creeping along shorelines; bogs, fens, mucky shallows

Large purple bladderwort (Utricularia purpurea)

- Submersed
- Native , scattered in WI, species of special concern
- Free-floating, quiet waters of soft-sediment; shallow to several meters deep
- Provides habitat for inverts and foraging for fish

Common bladderwort (Utricularia vulgaris)

- Submersed
- Native and common in WI
- Free-floating, occur in various depths; most successful in still water
- Provide fish habitat

Wild celery (Vallisneria Americana)

- Submersed
- Native, throughout WI
- Found in firm substrate in water from ankle to several meters deep; turbidity tolerant and survives wide range of water chemistries
- Premiere source of food for waterfowl, all portions of plant are consumed; grazed by muskrats, good fish habitat that provide shade, shelter and food

Aquatic moss

- Submersed
- Native, common
- Found in clumps at bottom; shallow to deep in soft-moderate water

Filamentous algae

- Submersed
- Forms on bottom and floats to top in mats
- Stringy, like wet wool

Appendix E – Summary of Aquatic Plant Management Alternatives

Management Options for Aquatic Plants

Option	Permit Needed?	How it Works	PROS	CONS
No treatment	N	Do not treat plants	Protects native species that can prevent spread of invasive or exotic species, enhance water quality, and provide habitat for aquatic fauna	May allow small population of invasive plants to become larger, more difficult to control later
			No financial cost	
			No system disturbance	
			No harmful effects of chemicals	
			Permit not required	
Mechanical Control	Required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a. Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing EWM or CLP	Roots, runners, and even fragments of some species (including EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

b.	Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore	Immediate results	Not selective in species removed
			Harvest invasives only if invasive is already present throughout the lake	EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting	Fragments of vegetation can re-root
				Usually minimal impact to the lake	Can remove some small fish and reptiles from lake
				Harvested lanes through dense weed beds can increase growth and survival of some fish	Initial cost of harvester expensive
				Can remove some nutrients from lake	
Biological Control		Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year	Effectiveness will vary as control agent's population fluctates
				Lowers density of problem plant to allow growth of natives	Provides moderate control - complete control unlikely
					Control response may be slow
					Must have enough control agent to be effective
a.	Weevils on EWM*	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem	Need to stock large numbers, even if some already present
				Selective control of target species	Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines
				Longer-term control with limited management	Bluegill populations decrease densities through predation
b.	Pathogens	Y	Fungal/bacterial/viral pathogen introduced to target species to induce mortalitiy	May be species specific	Largely experimental; effectiveness and longevity unknown
				May provide long-term control	Possible side effects not understood
				Few dangers to humans or animals	

c.	Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long-term, maintenance-free control Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth	Initial transplanting slow and labor-intensive Spikerushes native to WI, and have not effectively limited EWM growth Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d.	Restoration of native plants	N; strongly recommend plan and consultation with DNR	Diverse native plant community established to repel invasive species	Native plants provide food and habitat for aquatic fauna Diverse native community more repellant to invasive species Supplements removal techniques	Initial transplanting slow and labor-intensive Nuisance invasive plants may outcompete plantings Largely experimental; few well-documented cases

Physical Control	Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Drawdown	Y, May require Environmental Assessment	Lake water lowered; plants killed when sediment dries, compacts or freezes	Can be effective, especially when done in winter, provided drying and freezing occur. Sediment compaction is possible over winter	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
		Must have a water level control device or siphon	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced
		Season or duration of drawdown can change effects	Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality	May impact attached wetlands and shallow wells near shore
			Success for EWM, variable success for CLP*	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning
			Restores natural water fluctuation important for all aquatic ecosystems	Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians
				Controversial
b. Dredging	Y	Plants are removed along with sediment	Increases water depth	Expensive
		Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
		For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
		Extensive planning required		Sediment testing is expensive and may be necessary
				Removes benthic organisms
				Dredged materials must be disposed of
				Severe impact on lake ecosystem

c.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks.	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Affects to microscopic organisms unknown
d.	Mechanical circulation (Solarbees)	Y	Water is circulated and oxygenated	Reduces blue-green algae	Method is experimental; no published studies have been done
			Oxygenation of water decreases ammonium-nitrogen, which is a preferred nutrient source of EWM, theoretically limiting EWM growth (has not been demonstrated scientifically)	May reduce levels of ammonium-nitrogen in the water and at the sediment interface, which could reduce EWM growth	Although EWM prefers ammonium-nitrogen to nitrate, it will uptake nitrate efficiently, so EWM growth may not be affected
				Oxygenated water may reduce phosphorus release from sediments if mixing is complete	Units are aesthetically unpleasing
				Reduces chance of fish kills by aerating water	Units could be a navigational hazard
e.	Non-point source nutrient control	N	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use)	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Expensive
				Native plants may be able to compete invasive species better in low-nutrient conditions	Requires landowner cooperation and regulation
					Improved water clarity may increase plant growth

Chemical Control	Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae Results usually within 10 days of treatment, but repeat treatments usually needed	Some flexibility for different situations Some can be selective if applied correctly Can be used for restoration activities	Possible toxicity to aquatic animals or humans, especially applicators May kill desirable plant species, e.g. native water-milfoil or native pondweeds Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape Controversial
a. 2,4-D (Weedar, Navigate)	Y	Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue Applied as liquid or granules during early growth phase	Moderately to highly effective, especially on EWM Monocots, such as pondweeds (e.g. CLP) and many other native species not affected. Can be used in synergy with endotholl for early season CLP and EWM treatments Widely used aquatic herbicide	May cause oxygen depletion after plants die and decompose Cannot be used in combination with copper herbicides (used for algae) Toxic to fish
b. Endothall (Aquathol)	Y	Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis Applied as liquid or granules	Especially effective on CLP and also effective on EWM May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring Can be selective depending on concentration and seasonal timing Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds Limited off-site drift	Kills many native pondweeds Not as effective in dense plant beds Not to be used in water supplies Toxic to aquatic fauna (to varying degrees) 3-day post-treatment restriction on fish consumption

c.	Diquat (Reward)	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning Applied as liquid, can be combined with copper treatment	Mostly used for water-milfoil and duckweed Rapid action Limited direct toxicity on fish and other animals	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads Toxic to aquatic invertebrates Needs to be reapplied several years in a row Ineffective in muddy or cold water (<50°F)
d.	Fluridone (Sonar or Avast)	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis; some reduction in non-target effects can be achieved by lowering dosage Must be applied during early growth stage Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Effective on EWM for 1 to 4 years with aggressive follow-up treatments Applied at very low concentration Slow decomposition of plants may limit decreases in dissolved oxygen Low toxicity to aquatic animals	Affects many non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations. These plants are important to combat invasive species Requires long contact time: 60-90 days Demonstrated herbicide resistance in hydrilla subjected to repeat treatments, EWM has the potential to develop resistance Unknown effect of repeat whole-lake treatments on lake ecology
e.	Glyphosate (Rodeo)	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function Usually used for purple loosestrife stems or cattails Applied as liquid spray or painted on loosetrife stems	Effective on floating and emergent plants such as purple loosestrife Selective if carefully applied to individual plants Non-toxic to most aquatic animals at recommended dosages	Effective control for 1-5 years Ineffective in muddy water Cannot be used near potable water intakes RoundUp is often illegally substituted for Rodeo Associated surfactants of RoundUp believed to be toxic to reptiles and amphibians No control of submerged plants

f.	Triclopyr (Renovate)	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher doses (e.g. coontail)
			Applied as liquid spray or liquid	More effective on dicots, such as purple loosestrife; may be more effective than glyphosate	May be toxic to sensitive invertebrates at higher concentrations
				Results in 3-5 weeks	Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)
				Low toxicity to aquatic animals	Sensitive to UV light; sunlight can break herbicide down prematurely
				No recreational use restrictions following treatment	Relatively new management option for aquatic plants (since 2003)
g.	Copper compounds (Cutrine Plus)	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
			Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment	Short-term results
				Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Precipitates rapidly in alkaline waters
					Small-scale control only, because algae are easily windblown
					Toxic to invertebrates, trout and other fish, depending on the hardness of the water
					Long-term effects of repeat treatments to benthic organisms unknown
					Clear water may increase plant growth

h.	Lime slurry	Y	Applications of lime temporarily raise water pH, which limits the availablity of inorganic carbon to plants, preventing growth	Appears to be particularly effective against EWM and CLP	Relatively new technique, so effective dosage levels and exposure requirements are not yet known
				Prevents release of sediment phosphorus, which reduces algal growth	Short-term increase in turbidity due to suspended lime particles
				Increases growth of native plants beneficial as fish habitat	High pH detrimental to aquatic invertebrates
					May restrict growth of some native plants
i.	Alum (aluminum sulfate)	Y	Removes phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems	Must not eat fish for 30 days from treatment area
			Dosage must consider pH, hardness and water volume	Improves water clarity	Minimal effect on aquatic plants, or increased light penetration may increase aquatic plants
					Toxic to aquatic animals, including fish at some concentrations

***EWM - Eurasian water-milfoil**
***CLP - Curly-leaf pondweed**
[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.
[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.
[3]Broad-spectrum herbicide - Affects both monocots and dicots.
[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

	Option	How it Works	PROS	CONS
Biological Control				
a.	Carp	Plants eaten by stocked carp	Effective at removing aquatic plants	Illegal to transport or stock carp in Wisconsin
			Involves species already present in Madison lakes	Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels, and reduction of light penetration
				Widespread plant removal deteriorates habitat for other fish and aquatic organisms
				Complete alteration of fish assemblage possible
				Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants
b.	Crayfish	Plants eaten by stocked crayfish	Reduces macrophyte biomass	Illegal to transport or stock crayfish in Wisconsin
				Control not selective and may decimate plant community
				Not successful in productive, soft-bottom lakes with many fish predators
				Complete alteration of fish assemblage possible
Mechanical Control				
a.	Cutting (no removal)	Plants are "mowed" with underwater cutter	Creates open water areas rapidly	Root system remains for regrowth
			Works in water up to 25 ft	Fragments of vegetation can re-root and spread infestation throughout the lake
				Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners
				Not selective in species removed
				Small-scale control only
b.	Rototilling	Sediment is tilled to uproot plant roots and stems	Decreases stem density, can affect entire plant	Creates turbidity
		Works in deep water (17 ft)	Small-scale control	Not selective in species removed
			May provide long-term control	Fragments of vegetation can re-root
				Complete elimination of fish habitat
				Releases nutrients
				Increased likelihood of invasive species recolonization

c.	Hydroraking	Mechanical rake removes plants from lake Works in deep water (14 ft)	Creates open water areas rapidly	Fragments of vegetation can re-root May impact lake fauna Creates turbidity Plants regrow quickly Requires plant disposal
Physical Control				
a.	Fabrics/ Bottom Barriers	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem May inhibit spawning by some fish Need maintenance or will become covered in sediment and ineffective Gas accumulation under blankets can cause them to dislodge from the bottom Affects benthic invertebrates Anaerobic environment forms that can release excessive nutrients from sediment

Aquatic Plant Management

Aquatic plants are a critical component in an aquatic ecosystem. Any management of an ecosystem can have negative or even detrimental effects on the whole ecosystem. Therefore, the practice of managing aquatic plants should not be taken lightly. The concept of Aquatic Plant Management (APM) is highly variable since different aquatic resource users want different things. Ideal management to one individual may mean providing prime fish habitat, for another it may be to remove surface vegetation for boating. The practice of APM is also highly variable. There are numerous APM strategies designed to achieve different plant management goals. Some are effective on a small scale, but ineffective in larger situations. Others can only be used for specific plants or during certain times of the growing season. Of course, the types of plants that are to be managed will also help determine which APM alternatives are feasible. The following paragraphs discuss the APM methods used today. The discussion is largely adopted from *Managing Lakes and Rivers, North American Lake Management Society, 2001*, supplemented with other applicable current resources and references. The methods summarized here are largely for management of rooted aquatic plants, not algae. While some methods may also have effects on nuisance algae blooms, the focus is submergent rooted aquatic macrophytes. This information is provided to allow the user to gain a basic understanding of the APM method, it is not designed to an all-inclusive APM decision-making matrix. APM alternatives can be divided into the following categories: Physical Controls, Chemical Controls, and Biological Controls.

Physical Controls

Physical APM controls include various methods to prevent growth or remove part or all of the aquatic plant. Both manual and mechanical techniques are employed. Physical APM methods include:

- Hand pulling
- Hand cutting
- Bottom barriers
- Light limitation (dyes, covers)
- Mechanical harvesting
- Hydroraking/rototilling
- Suction Dredging
- Dredging
- Drawdown

Each of these methods are described below. The costs, benefits, and drawbacks of each APM strategy are provided.

Hand Pulling: This method involves digging out the entire unwanted plant including stems and roots with a hand tool such as a spade. This method is highly selective and suitable for shallow areas for removing invasive species that have not become well established. This technique is obviously not for use on large dense beds of nuisance aquatic plants. It is best used in areas less than 3 feet, but can be used in deeper areas with divers using scuba and snorkeling equipment. It can also be used in combination with the suction dredge method. In Wisconsin, hand pulling may be completed outside a designated sensitive area without a permit but is limited to 30 feet of shoreline frontage. Removal of exotic species is not limited to 30 feet.

Advantages: This technique results in immediate clearing of the water column of nuisance plants. When a selective technique is desired in a shallow, small area, hand pulling is a good choice. It is also useful in sensitive areas where disruption must be minimized.

Disadvantages: This method is labor intensive. Disturbing the substrate may affect fish habitat, increase turbidity, and may promote phosphorus re-suspension and subsequent algae blooms.

Costs: The costs are highly variable. There is practically no cost using volunteers or lakeshore landowners to remove unwanted plants, however, using divers to remove plants can get relatively expensive. Hand pulling labor can range from $400 to $800 per acre.

Hand Cutting: This is another manual method where the plants are cut below the water surface. Generally the roots are not removed. Tools such as rakes, scythes or other specialized tools are pulled through the plant beds by boat or several people. This method is not as selective as hand pulling. This method is well suited for small areas near docks and piers. Plant material must be removed from the water. In Wisconsin, hand cutting may be completed outside a designated sensitive area without a permit but is limited to 30 feet of shoreline frontage. Removal of exotic species is not limited to 30 feet.

Advantages: This technique results in immediate clearing of the water column of nuisance plants. Costs are minimal.

Disadvantages: This is also a fairly time consuming and labor intensive option. Since the technique does not remove the entire plant (leaves root system and part of plant), it may not result in long-term reductions in growth. This technique is not species specific and results in all aquatic plants being removed from the water column.

Costs: The costs range from minimal for volunteers using hand equipment up to over $1,000 for a hand-held mechanized cutting implement. Hand cutting labor can range from $400 to $800 per acre.

Bottom Barriers: A barrier material is applied over the lake bottom to prevent rooted aquatics from growing. Natural barriers such as clay, silt, and gravel can be used although eventually plants may root in these areas again. Artificial materials can also be used for bottom barriers and anchored to the substrate. Barrier materials include burlap, nylon, rubber, polyethylene, polypropylene, and fiberglass. Barriers include both solid and porous forms. A permit is required to place any fill or barrier structure on the substrate of a waterbody. This method is well suited for areas near docks, piers, and beaches. Periodic maintenance may be required to remove accumulated silt or rooting fragments from the barrier.

Advantages: This technique does not result in production of plant fragments. Properly installed, it can provide immediate and multiple year relief.

Disadvantages: This is a non-selective option, all plants beneath the barrier will be affected. Some materials are costly and installation is labor intensive. Other disadvantages include limited material durability, gas accumulation beneath the cover, or possible re-growth of plants from above or below the cover. Fish and invertebrate habitat is disrupted with this technique. Anchored barriers can be difficult to remove.

Costs: A 20 foot x 60 foot panel cost $265, while a 30 foot x 50 foot panel cost $375 (this does not include installation costs). Costs for materials vary from $0.15 per square foot ($ft^2$) to over $0.35/ ft^2. The costs for installation range from $0.25 to $0.50/ ft^2. Barriers can cost $20,000 to $50,000 per acre.

Light Limitation: Limiting the available light in the water column can prevent photosynthesis and plant growth. Dark colored dyes and surface covers have been used to accomplish light limitation. Dyes are effective in shallow water bodies where their concentration can be kept at a desired concentration and loss through dilution is less. This method is well suited for small, shallow water bodies with no outlets such as private ponds.

Surface covers can be a useful tool in small areas such as docks and beaches. While they can interfere with aquatic recreation, they can be timed to produce results and not affect summer recreation uses.

Advantages: Dyes are non-toxic to humans and aquatic organisms. No special equipment is required for application. Light limitation with dyes or covers method may be selective to shade tolerant species. In addition to submerged macrophyte control, it can also control the algae growth.

Disadvantages: The application of water column dyes is limited to shallow water bodies with no outlets. Repeated dye treatments may be necessary. The dyes may not control peripheral or shallow-water rooted plants. This technique must be initiated before aquatic plants start to grow. Covers inhibit gas exchange with the atmosphere.

Costs: Costs for a commercial dye and application range from $100 to $500 per acre.

Mechanical Harvesting: Mechanical harvesters are essentially cutters mounted on barges that cut aquatic plants at a desired depth. Maximum cutting depths range from 5 to 8 feet with a cutting width of 6.5 to 12 feet. Cut plant materials require collection and removal from the water. Conventional harvesters combine cutting, collecting, storing, and transporting cut vegetation into one piece of equipment. Transport barges and shoreline conveyors are also available to remove the cut vegetation. The cut plants must be removed from the water body. The equipment needs are dictated by severity of the aquatic plant problem. Contract harvesting services are available in lieu of purchasing used or new equipment. Trained staff will be necessary to operate a mechanical harvester. To achieve maximum removal of plant material, harvesting is usually completed during the summer months while submergent vegetation is growing to the surface. The duration of control is variable and re-growth of aquatic plants is common. Factors such as timing of harvest, water depth, depth of cut, and timing can influence the effectiveness of a harvesting operation. Harvesting is suited for large open areas with dense stands of exotic or nuisance plant species. Permits are now required in Wisconsin to use a mechanical harvester.

Advantages: Harvesting provides immediate visible results. Harvesting allows plant removal on a larger scale than other options. Harvesting provides flexible area control. In other words, the harvester can be moved to where it is needed and used to target problem areas. This technique has the added benefit of removing the plant material from the water body and therefore also eliminates a possible source of nutrients often released during fall decay of aquatic plants. While removal of nutrients through plant harvesting has not been quantified, it can be important in aquatic ecosystem with low nutrient inputs.

Disadvantages: Drawbacks of harvesting include: limited depth of operation, not selective within the application area, and expensive equipment costs.

Harvesting also creates plant fragments, which can be a concern since certain plants have the ability to reproduce from a plant fragment (e.g. Eurasian watermilfoil). Plant fragments may re-root and spread a problem plant to other areas. Harvesting can have negative effects on non-target plants, young of year fish, and invertebrates. The harvesting will require trained operators and maintenance of equipment. Also, a disposal site or landspreading program will be needed for harvested plants.

<u>Costs:</u> Costs for a harvesting operation are highly variable dependant on program scale. New harvesters range from $40,000 for small machines to over $100,000 for large, deluxe models. Costs vary considerably, depending on the model, size, and options chosen. Specially designed units are available, but may cost more. The equipment can last 10 to 15 years. A grant for ½ the equipment cost can be obtained from the Wisconsin Waterways Commission and a loan can be obtained for the remaining capital investment. Operation costs include insurance, fuel, spare parts, and payroll. Historical harvesting values have been reported at $200 up to $1,500 per acre. A survey of recent Wisconsin harvesting operations reported costs to be between $100/acre and $200/acre.

A used harvester can be purchased for $10,000 to $20,000. Maintenance costs are typically higher.

Contract harvesting costs approximately $125/per hour plus mobilization to the water body. Contractors can typically harvest ¼ to ½ acre per hour for an estimated cost of $250 to $500/per acre.

<u>Hydroraking/rototilling:</u> Hydroraking is the use of a boat or barge mounted machine with a rake that is lowered to the bottom and dragged. The tines of the rake rip out roots of aquatic plants. Rototilling, or rotovation, also rips out root masses but uses a mechanical rotating head with tines instead of a rake. Harvesting may need to be completed in conjunction with these methods to gather floating plant fragments. This application would best be used where nuisance populations are well established and prevention of stem fragments is not critical. A permit would be required for this type of aquatic plant management and would only be issued in limited cases of extreme infestations of nuisance vegetation. In Wisconsin, this method is not looked upon favorably or at all by the WDNR.

<u>Advantages:</u> These methods have the potential for significant reductions in aquatic plant growth. These methods can remove the plant stems and roots, resulting in thorough plant disruption. Hydroraking/rototilling can be completed in “off season” months avoiding interference with summer recreation activities.

<u>Disadvantages:</u> Hydroraking/rototilling are not selective and may destroy substrate habitat important to fish and invertebrates. Suspension of sediments will increase turbidity and release nutrients trapped in bottom sediments into the water column potentially causing algal blooms. These methods can cause floating plant and root fragments, which may re-root and spread the problem. Hydroraking/rototilling are expensive and not likely to be permitted by regulatory agencies.

Costs: Bottom tillage costs vary according to equipment, treatment scale, and plant density. For soft vegetation costs can range from $2,000 to $4,000 per acre. For dense, rooted masses, costs can be up to $10,000 per acre. Contract bottom tillage reportedly ranges from $1,200 to $1,700 per acre (Washington Department of Ecology, 1994).

Suction Dredging: Suction dredging uses a small boat or barge with portable dredges and suction heads. Scuba divers operate the suction dredge and can target removal of whole plants, seeds, and roots. This method may be applied in conjunction with hand cutting where divers dislodge the plants. The plant/sediment slurry is hydraulically pumped to the barge through hoses carried by the diver. Its effectiveness is dependent on sediment composition, density of aquatic plants, and underwater visibility. Suction dredging may be best suited for localized infestations of low plant density where fragmentation must be controlled. A permit will be required for this activity.

Advantages: Diver suction dredging is species –selective. Disruption of sediments can be minimized. These methods can remove the plant stems and roots, resulting in thorough plant disruption and potential longer term control. Fragmentation of plants is minimized. This activity can be completed near and around obstacles such as piers or marinas where a harvester could not operate.

Disadvantages: Diver suction dredging is labor intensive and costly. Upland disposal of dredged slurry can require additional equipment and costs. Increased turbidity in the area of treatment can be a problem. Release of nutrients and other pollutants can also be a problem.

Costs: Suction dredging costs can be variable depending on equipment and transport requirements for slurry. Costs range from $5,000 per acre to $10,000 per acre.

Dredging

Sediment removal through dredging can work as a plant control technique by limiting light through increased water depth or removing soft sediments that are a preferred habitat to nuisance rooted plants. Soft sediment removal is accomplished with drag lines, bucket dredges, long reach backhoes, or other specialized dredging equipment. Dredging has had mixed results in controlling aquatic plant, however it can be highly effective in appropriate situations. Dredging is most often applied in a major restructuring of a severely degraded system. Generally, dredging is an activity associated with other restoration efforts. Comprehensive pre-planning will be necessary for these techniques and a dredging permit would be required.

Advantages: Dredging can remove nutrient reserves which result in nuisance rooted aquatic plant growth. Dredging, when completed, can also actually improve substrate and habitat for more desirable species of aquatic plants, fish, and invertebrates. It allows the complete renovation of an aquatic ecosytem. This method has the potential for significant reductions in aquatic plant growth. These methods can be completed in "off season" months avoiding interference with summer recreation activities.

Disadvantages: Dredging can temporarily destroy important fish and invertebrate habitat. Suspension of sediments usually increases turbidity significantly and can possibly releases nutrients causing algae blooms. Dredging is extremely expensive and requires significant planning. Dredged materials may contain toxic materials (metals, PCBs). Dredged material transportation and disposal of toxic materials are additional management considerations and are potentially expensive. It could be difficult and costly to secure regulatory permits and approvals.

Costs: Dredging costs depend upon the scale of the project and many other factors. It is generally an extremely expensive option.

Drawdown: Water level drawdown exposes the plants and root systems to prolonged freezing and drying to kill the plants. It can be completed any time of the year, however is generally more effective in winter, exposing the lake bed to freezing temperatures. If there is a water level control structure capable of drawdown, it can be an in-expensive way to control some aquatic plants. Aquatic plants vary in their susceptibility to drawdown, therefore, accurate identification of problem species is important. Drawdown is often used for other purposes of improving waterfowl habitat or fishery management, but sometimes has the added benefit of nuisance rooted aquatic plant control. This method can be used in conjunction with a dredging project to excavate nutrient-rich sediments. This method is best suited for use on reservoirs or shallow man-made lakes. A drawdown would require regulatory permits and approvals.

Advantages: A drawdown can result in compaction of certain types of sediments and can be used to facilitate other lake management activities such as dam repair, bottom barrier, or dredging projects. Drawdown can significantly impact populations of aquatic plants that propagate vegetatively. It is inexpensive.

Disadvantages: This method is limited to situations with a water level control structure. Pumps can be used to de-water further if groundwater seepage is not significant. This technique may also result in the removal of beneficial plant species. Drawdowns can decrease bottom dwelling invertebrates and overwintering reptiles and amphibians. Drawdowns can affect adjacent wetlands, alter downstream flows, and potentially impair well production. Drawdowns and any water level manipulation are often highly controversial since shoreline landowners access and public recreation are limited during the drawdown. Fish populations are vulnerable during a drawdown due to over-harvesting by fisherman in decreased water volumes.

Costs: If a suitable outlet structure is available then costs should be minimal. If dewatering pumps would be required or additional management projects such as dredging are completed, additional costs would be incurred. Other costs would include recreational losses and perhaps loss in tourism revenue.

Chemical Controls

Using chemical herbicides to kill nuisance aquatic plants is the oldest APM method. However, past pesticides uses being linked to environmental or human health problems have led to public wariness of chemicals in the environment. Current pesticide registration procedures are more stringent than in the past. While no chemical pesticide can be considered 100 percent safe, federal pesticide regulations are based on the premise that if a chemical is used according to its label instructions it will not cause adverse environmental or human health effects.

Chemical herbicides for aquatic plants can be divided into two categories, systemic and contact herbicides. Systemic herbicides are absorbed by the plant, translocated throughout the plant, and are capable of killing the entire plant, including the roots and shoots. Contact herbicides kill the plant surface in which in comes in contact, leaving roots capable of re-growth. Aquatic herbicides exist under various trade names, causing some confusion. Aquatic herbicides include the following:

- Endothall Based Herbicide
- Diquat Based Herbicide
- Fluridone Based Herbicide
- 2-4 D Based Herbicide
- Glyophosate Based Herbicide
- Triclopyr Based Herbicide
- Phosphorus Precipitation

Each of these methods are described below. The costs, benefits, and drawbacks of each chemical APM alternative are provided.

Endothall Based Herbicide: Endothall is a contact herbicide, attacking a wide range of plants at the point of contact. The chemical is not readily transferred to other plant tissue, therefore regrowth can be expected and repeated treatments may be needed. It is sold in liquid and granular forms under the trade names of Aquathol® or Hydrothol®. Hydrothol is also an algaecide. Most endothall products break down easily and do not remain in the aquatic environment. Endothall products can result in plant reductions for a few weeks to several months. Multi-season effectiveness is not typical. A permit is required for use of this herbicide.

Advantages: Endothall products work quickly and exhibit moderate to highly effective control of floating and submersed species. This herbicide has limited toxicity to fish at recommended doses.

Disadvantages: The entire plant is not killed when using endothall. Endothall is non-selective in the treatment area. High concentrations can kill fish easily. Water use restrictions (time delays) are necessary for recreation, irrigation, and fish consumption after application.

Costs: Costs vary with treatment area and dosage. Average costs for chemical application range between $400 and $700 per acre.

Diquat Based Herbicide: Diquat is a fast-acting contact herbicide effective on a broad spectrum of aquatic plants. It is sold under the trade name Reward®. Diluted forms of this product are also sold as private label products. Since Diquat binds to sediments readily, its effectiveness is reduced by turbid water. Multi-season effectiveness is not typical. A permit is required for use of this herbicide.

Advantages: Diquat works quickly and exhibit moderate to highly effective control of floating and submersed species. This herbicide has limited toxicity to fish at recommended doses.

Disadvantages: The entire plant is not killed when using diquat. Diquat is non-selective in the treatment area. Diquat can be inactivated by suspended sediments. Diquat is sometimes toxic to zooplankton at the recommended dose. Limited water used restrictions (water supply, agriculture, and contact recreation) are required after application.

Costs: Costs vary with treatment area and dosage. A general cost estimate for treatment is between $200 and $500 per acre.

Fluoridone Based Herbicide: Fluoridone is a slow-acting systemic herbicide, which is effectively absorbed and translocated by both plant roots and stems. Sonar® and Avast!® is the trade name and it is sold in liquid or granular form. Fluoridone requires a longer contact time and demonstrates delayed toxicity to target plants. Eurasian watermilfoil is more sensitive to fluoridone than other aquatic plants. This allows a semi-selective approach when low enough doses are used. Since the roots are also killed, multi-season effectiveness can be achieved. It is best applied during the early growth phase of the plants. A permit and extensive planning is required for use of this herbicide.

Advantages: Fluoridone is capable of killing roots, therefore producing a longer lasting effect than other herbicides. A variety of emergent and submersed aquatics are susceptible to this herbicide. Fluoridine can be used selectively, based on concentration. A gradual killing of target plants limits severe oxygen depletion from dead plant material. It has demonstrated low toxicity to aquatic fauna such as fish and invertebrates. 3 to 5 year control has been demonstrated. Extensive testing has shown that, when used according to label instructions, it does not pose negative health affects.

Disadvantages: Fluoridine is a very slow-acting herbicide sometimes taking up to several months for visible effects. It requires a long contact time. Fluoridine is extremely soluble and mixable, therefore, not effective in flowing water situations or for treating a select area in a large open lake. Impacts on non-target plants are possible at higher doses. Time delays are necessary on use of the water (water supply, irrigation, and contact recreation) after application.

Costs: Costs vary with treatment area and dosage. Treatment costs range from $500 to $2,000 per acre.

2,4-D Based Herbicide: 2,4-D based herbicides are sold in liquid or granular forms under various trade names. Common granular forms are sold under the trade names Navigate® and Aqua Kleen®. Common liquid forms include DMA 4® and Weedar 64®. 2,4-D is a systemic herbicide that affects broad leaf plants. It has been demonstrated effective against Eurasian watermilfoil, but it may not work on many aquatic plants. Since the roots are also killed, multi-season effectiveness may be achieved. It is best applied during the early growth phase of the plants. Visible results are evident within 10 to 14 days. A permit is required for use of this herbicide.

Advantages: 2,4-D is capable of killing roots, therefore producing a longer lasting effect than some other herbicides. It is fairly fast and somewhat selective, based on application timing and concentration. 2,4-D containing products are moderately to highly effective on a few emergent, floating, or submersed plants.

Disadvantages: 2,4-D can have variable toxicity effects to aquatic fauna, depending on formulation and water chemistry. 2,4-D lasts only a short time in water, but can be detected in sediments for months after application. Time delays are necessary on use of the water (agriculture and contact recreation) after application. The label does not permit use of this product in water used for drinking, irrigation, or livestock watering.

Costs: Costs vary with treatment area and dosage. Treatment costs range from $300 to $800 per acre.

Glyophosate Based Herbicide: Glyophosate has been categorized as both a contact and a systemic herbicide. It is applied as a liquid spray and is sold under the trade name Rodeo® or Pondmaster®. It is a non-selective, broad based herbicide effective against emergent or floating leaved plants, but not submergents. It's effectiveness can be reduced by rain. A permit is required for use of this herbicide.

Advantages: Glyophoshate is moderately to highly effective against emergent and floating-leaf plants resulting in rapid plant destruction. Since it is applied by spraying plants above the surface, the applicator can apply it selectively to target plants. Glyophosate dissipates quickly from natural waters, has a low toxicity to aquatic fauna, and carries no restrictions or time delays for swimming, fishing, or irrigation.

Disadvantages: Glyophoshate is non-selective in the treatment area. Wind can dissipate the product during the application reducing it's effectiveness and cause damage to non-target organisms. Therefore, spray application should only be completed when wind drift is not a problem. This compound is highly corrosive, therefore storage precautions are necessary.

Costs: Costs average $500 to $1,000 per acre depending on the scale of treatment.

Triclopyr Based Herbicide: Triclopyr is a systemic herbicide. It is registered for experimental aquatic use in selected areas only. It is applied as a liquid spray or injected into the subsurface as a liquid. Triclopyr is sold under the trade name Renovate® or Restorate®. Triclopyr has shown to be an effective control to many floating and submersed plants. It has been demonstrated to be highly effective against Eurasian watermilfoil, having little effect on valued native plants such as pondweeds. Triclopyr is most effective when applied during the active growth period of younger plants.

Advantages: This herbicide is fast acting. Triclopyr can be used selectively since it appears more effective against dicot plant species, including several difficult nuisance plants. Testing has demonstrated low toxicity to aquatic fauna.

Disadvantages: At higher doses, there are possible impacts to non-target species. Some forms of this herbicide are experimental for aquatic use and restrictions on use of the treated water are not yet certain.

Biological Controls

There has been recent interest in using biological technologies to control aquatic plants. This concept stems from a desire to use a "natural" control and reduce expenses related to equipment and/or chemicals. While use of biological controls is in its infancy, potentially useful technologies have been identified and show promise for integration with physical and chemical APM strategies. Several biological controls that are in use or are under experimentation include the following:

- Herbivorous Fish
- Herbivorous Insects
- Plant Pathogens
- Native Plants

Each of these methods are described below. The costs, benefits, and drawbacks of each biologic APM method are provided.

Herbivorous Fish: A herbivorous fish such as the non-native grass carp can consume large quantities of aquatic plants. These fish have high growth rates and a wide range of plant food preferences. Stocking rates and effectiveness will depend on many factors including climate, water temperature, type and extent of aquatic plants, and other site-specific issues. Sterile (triploid) fish have been developed resulting in no reproduction of the grass carp and population control. This technology has demonstrated mixed results and is most appropriately used for lake-wide, low intensity control of submersed plants. Some states do not allow stocking of herbivorous fish. In Wisconsin, stocking of grass carp is prohibited.

Advantages: This technology can provide multiple years of aquatic plant control from a single stocking. Compared to other long-term aquatic plant control techniques such as bottom tillage or bottom barriers, costs may be relatively low.

Disadvantages: Sterile grass carp exhibit distinct food preferences, limiting their applicability. Grass carp may feed selectively on the preferred plants, while less preferred plants, including milfoil, may increase. The effects of using grass carp may not be immediate. Overstocking may result in an impact on non-target plants or eradication of beneficial plants, altering lake habitat. Using grass carp may result in algae blooms and increased turbidity. If precautions are not taken (i.e. inlet and outlet control structures to prevent fish migration) the fish may migrate and have adverse effects on non-target vegetation.

Costs: Costs can range from \$50/acre to over \$2,000/acre, at stocking rates of 5 fish/acre to 200 fish/acre.

Herbivorous Insects: Non-native and native insect species have been used to control rooted plants. Using herbivorous insects is intended to selectively control target species. These aquatic larvae of moths, beetles, and thrips use specific host aquatic plants. Several non-native species have been imported under USDA approval and used in integrated pest management programs, a combination of biological, chemical, and mechanical controls.

These non-native insects are being used in southern states to control nuisance plant species and appear climate-limited, their northern range being Georgia and North Carolina. While successes have been demonstrated, non-native species have not established themselves for solving biological problems, sometimes creating as many problems as they solve. Therefore, government agencies prefer alternative controls.

Native insects such as the larvae of midgeflies, caddisflies, beetles, and moths may be successful APM controls in northern states. Recently however, the native aquatic weevil *Euhrychiopsis lecontei* has received the most attention. This weevil has been associated with native northern water milfoil. The weevil can switch plant hosts and feed on Eurasian watermilfoil, destroying it's growth points. While the milfoil weevil is gaining popularity, it is still experimental.

Advantages: Herbivorous insects are expected to have no negative effects on non-target species. The insects have shown promise for long term control when used as part of integrated aquatic plant management programs. The milfoil weevils do not use non-milfoil plants as hosts.

Disadvantages: Natural predator prey cycles indicate that incomplete control is likely. An oscillating cycle of control and re-growth is more likely. Fish predation may complicate controls. Large numbers of milfoil weevils may be required for a dense stand and can be expensive. The weevil leaves the water during the winter, may not return to the water in the spring, and are subject to bird predation in their terrestrial habitat. Application is manual and extremely time consuming. Introducing any species, especially non-native ones, into an aquatic ecosystem may have undesirable effects. Therefore, it is extremely important to understand the life cycles of the insects and the host plants.

Costs: Reported costs of herbivorous insects rang from $300/acre to $3,000/acre.

Specifically, the native milfoil weevils cost approximately $1.00 per weevil. It is generally considered appropriate to use 5 to 7 weevils per stem. Dense stands of milfoil may contain 1 to 2 million stems per acre. Therefore, costs of this new technology are currently prohibitive.

Plant Pathogens: Using a plant pathogen to control nuisance aquatic plants has been studied for many years, however, plant pathogens still remain largely experimental. Fungi are the most common pathogens, while bacteria and viruses have also been used. There is potential for highly specific plant applications.

Advantages: Plant pathogens may be highly species specific. They may provide substantial control of a nuisance species.

Disadvantages: Pathogens are experimental. The effectiveness and longevity of control is not well understood. Possible side effects are also unknown.

Costs: These techniques are experimental therefore a supply of specific products and costs are not established.

Native Plants: This method involves removing the nuisance plant species through chemical or physical means and re-introducing seeds, cuttings, or whole plants of desirable species. Success has been variable. When using seeds, they need to be planted early enough to encourage the full growth and subsequent seed production of those plants. Transplanting mature plants may be a better way to establish seed producing populations of desirable aquatics. Recognizing that a healthy, native, desirable plant community may be resistant to infestations of nuisance species, planting native plants should be encouraged as an APM alternative. Non-native plants can not be translocated.

Advantages: This alternative can restore native plant communities. It can be used to supplement other methods and potentially prevent future needs for costly repeat APM treatments.

Disadvantages: While this appears to be a desirable practice, it is experimental at this time and there are not many well documented successes. Nuisance species may eventually again invade the areas of native plantings. Careful planning is required to ensure that the introduced species do not themselves become nuisances. Hand planting aquatic plants is labor intensive.

Costs: Costs can be highly variable depending on the selected native species, numbers of plants ordered, and the nearest dealer location.

Aquatic Plant Prevention

The phrase "an ounce of prevention is worth a pound of cure" certainly holds true for APM. Prevention is the best way to avoid nuisance aquatic plant growth. Prevention of the spread of invasive aquatic plants must also be achieved. Inspecting boats, trailers, and live wells for live aquatic plant material is the best way to prevent nuisance aquatic plants from entering a new aquatic ecosystem. Protecting the desirable native plant communities is also important in maintaining a healthy aquatic ecosystem and preventing the spread of nuisance aquatics once they are present.

Prolific growth of nuisance aquatic plants can be prevented by limiting nutrient (i.e. phosphorus) inputs to the water body. Aeration or phosphorus precipitation can achieve controls of in-lake cycling of phosphorus, however, if there are additional outside sources of nutrients, these methods will be largely ineffective in controlling algae blooms or intense aquatic macrophyte infestations. Watershed management activities to control nutrient laden storm water runoff are critical to controlling excessive nutrient loading to the water bodies. Nutrient loading can be prevented/minimized by the following:

- Shoreline buffers
- Using non-phosphorus fertilizers on lawns
- Settling basins for storm water effluents

Appendix F – NR 107 and NR 109 Wisconsin Administrative Code

Chapter NR 107

AQUATIC PLANT MANAGEMENT

Note: Chapter NR 107 as it existed on February 28, 1989 was repealed and a new Chapter NR 107 was created effective March 1, 1989.

NR 107.01 Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance–causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade and consumer protection. Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.02 Applicability. Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department. Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.03 Definitions. (1) "Applicator" means the person physically applying the chemicals to the treatment site.

(2) "Chemical fact sheet" means a summary of information on a specific chemical written by the department including general aquatic community and human safety considerations applicable to Wisconsin sites.

(3) "Department" means the department of natural resources.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.04 Application for permit. (1) Permit applications shall be made on forms provided by the department and shall be submitted to the district director for the district in which the project is located. Any amendment or revision to an application shall be treated by the department as a new application, except as provided in s. NR 107.04 (3) (g).

Note: The DNR district headquarters are located at:

1. Southern — 3911 Fish Hatchery Road, Fitchburg 53711
2. Southeast — 2300 N. Dr. Martin Luther King Jr. Dr., Box 12436, Milwaukee 53212
3. Lake Michigan — 1125 N. Military Ave., Box 10448, Green Bay 54307
4. North Central — 107 Sutliff Ave., Box 818, Rhinelander 54501
5. Western — 1300 W. Clairemont Ave., Call Box 4001, Eau Claire 54702
6. Northwest — Hwy 70 West, Box 309, Spooner 54801

(2) The application shall be accompanied by:

(a) A nonrefundable permit application fee of $20, and, for proposed treatments larger than 0.25 acres, an additional refundable acreage fee of $25.00 per acre, rounded up to the nearest whole acre, applied to a maximum of 50.0 acres.

1. The acreage fee shall be refunded in whole if the entire permit is denied or if no treatment occurs on any part of the permitted treatment area. Refunds will not be prorated for partial treatments.

2. If the permit is issued with the proposed treatment area partially denied, a refund of acreage fees shall be given for the area denied.

(b) A legal description of the body of water proposed for treatment including township, range and section number;

(c) One copy of a detailed map or sketch of the body of water with the proposed treatment area dimensions clearly shown and with pertinent information necessary to locate those properties, by name of owner, riparian to the treatment area, which may include street address, local telephone number, block, lot and fire number where available. If a local address is not available, the home address and phone number of the property owner may be included;

(d) A description of the uses being impaired by plants or aquatic organisms and reason for treatment;

(e) A description of the plant community or other aquatic organisms causing the use impairment;

(f) The product names of chemicals proposed for use and the method of application;

(g) The name of the person or commercial applicator, and applicator certification number, when required by s. NR 107.08 (5), of the person conducting the treatment;

(h) A comparison of alternative control methods and their feasibility for use on the proposed treatment site.

(3) In addition to the information required under sub. (2), when the proposed treatment is a large–scale treatment exceeding 10.0 acres in size or 10% of the area of the water body that is 10 feet or less in depth, the application shall be accompanied by:

(a) A map showing the size and boundaries of the water body and its watershed.

(b) A map and list identifying known or suspected land use practices contributing to plant–related water quality problems in the watershed.

(c) A summary of conditions contributing to undesirable plant growth on the water body.

(d) A general description of the fish and wildlife uses occurring within the proposed treatment site.

(e) A summary of recreational uses of the proposed treatment site.

(f) Evidence that a public notice of the proposed application has been made, and that a public informational meeting, if required, has been conducted.

1. Notice shall be given in 2 inch x 4 inch advertising format in the newspaper which has the largest circulation in the area affected by the application.

2. The notice shall state the size of the proposed treatment, the approximate treatment dates, and that the public may request within 5 days of the notice that the applicant hold a public informational meeting on the proposed application.

a. The applicant will conduct a public informational meeting in a location near the water body when a combination of 5 or more individuals, organizations, special units of government, or local units of government request the meeting in writing to the applicant

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with a copy to the department within 5 days after the notice is made. The person or entity requesting the meeting shall state a specific agenda of topics including problems and alternatives to be discussed.

b. The meeting shall be given a minimum of one week advance notice, both in writing to the requestors, and advertised in the format of subd. 1.

(g) The provisions of pars. (a) to (e) shall be repeated once every 5 years and shall include new information. Annual modifications of the proposed treatment within the 5–year period which do not expand the treatment area more than 10% and cover a similar location and target organisms may be accepted as an amendment to the original application. The acreage fee submitted under sub. (2) (a) shall be adjusted in accordance with any proposed amendments.

(4) The applicant shall certify to the department that a copy of the application has been provided to any affected property owners' association, inland lake district, and, in the case of chemical applications for rooted aquatic plants, to any riparian property owners adjacent to and within the treatment area.

(5) A notice of the proposed treatment shall be provided by the department to any person or organization indicating annually in writing a desire to receive such notification.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.05 Issuance of permit. (1) The department shall issue or deny issuance of the requested permit between 10 and 15 working days after receipt of an acceptable application, unless:

(a) An environmental impact report or statement is required under s. 1.11, Stats. Notification to the applicant shall be in writing within 10 working days of receipt of the application and no action may be taken until the report or statement has been completed; or

(b) A public hearing has been granted under s. 227.42, Stats.

(2) If a request for a public hearing is received after the permit is issued but prior to the actual treatment allowed by the permit, the department is not required to, but may, suspend the permit because of the request for public hearing.

(3) The department may deny issuance of the requested permit if:

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

(b) The proposed chemical does not have a current department aquatic chemical fact sheet;

(c) The department determines the proposed treatment will not provide nuisance relief, or will place unreasonable restrictions on existing water uses;

(d) The department determines the proposed treatment will result in a hazard to humans, animals or other nontarget organisms;

(e) The department determines the proposed treatment will result in a significant adverse effect on the body of water;

(f) The proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;

(g) The proposed chemical applications, other than those conducted by the department pursuant to ss. 29.421 and 29.424, Stats., will significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction;

(h) The proposed chemical application is in a location known to have endangered or threatened species as specified pursuant to s. 29.604, Stats., and as determined by the department;

(i) The proposed chemical application is in locations identified by the department as sensitive areas, except when the applicant demonstrates to the satisfaction of the department that treatments can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

1. Sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water.

2. The department shall notify any affected property owners' association, inland lake district, and riparian property owner of locations identified as sensitive areas.

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water.

(5) The department may approve the application in whole or in part consistent with the provisions of subs. (3) (a) through (i) and (4). Denials shall be in writing stating reasons for the denial.

(6) Permits may be issued for one treatment season only.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (3) (g) and (h) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.06 Chemical fact sheets. (1) The department shall develop a chemical fact sheet for each of the chemicals in present use for aquatic nuisance control in Wisconsin.

(1m) Chemical fact sheets for chemicals not previously used in Wisconsin shall be developed within 180 days after the department has received notice of intended use of the chemical.

(2) The applicant or permit holder shall provide copies of the applicable chemical fact sheets to any affected property owners' association and inland lake district.

(3) The department shall make chemical fact sheets available upon request.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.07 Supervision. (1) The permit holder shall notify the district office 4 working days in advance of each anticipated treatment with the date, time, location, and proposed size of treatment. At the discretion of the department, the advance notification requirement may be waived.

(2) Supervision by a department representative may be required for any aquatic nuisance control project involving chemicals. Supervision may include inspection of the proposed treatment area, chemicals, and application equipment before, during or after treatment. The inspection may result in the determination that treatment is unnecessary or unwarranted in all or part of the proposed area, or that the equipment will not control the proper dosage.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.08 Conditions of the permit. (1) The department may stop or limit the application of chemicals to a body of water if at any time it determines that chemical treatment will be ineffective, or will result in unreasonable restrictions on current water uses, or will produce unnecessary adverse side effects on nontarget organisms. Upon request, the department shall state the reason for such action in writing to the applicant.

(2) Chemical treatments shall be performed in accordance with label directions, existing pesticide use laws, and permit conditions.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks except where approval is given by the department for projects of public benefit.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long–term or permanent changes to a plant community in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in spe-

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cific aquatic ecosystems, including *Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Potamogeton pectinatus, Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania aquatica, Zannichellia palustris* and *Brasenia schreberi.*

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide"; or

(d) Liquid chemicals are to be used.

(6) Power equipment used to apply liquid chemicals shall include the following:

(a) Containers used to mix and hold chemicals shall be constructed of watertight materials and be of sufficient size and strength to safely contain the chemical. Measuring containers and scales for the purpose of measuring solids and liquids shall be provided by the applicator;

(b) Suction hose used to deliver the chemical to the pump venturi assembly shall be fitted with an on–off ball–type valve. The system shall also be designed to prevent clogging from chemicals and aquatic vegetation;

(c) Suction hose used to deliver surface water to the pump shall be fitted with a check valve to prevent back siphoning into the surface water should the pump stop;

(d) Suction hose used to deliver a premixed solution shall be fitted with an on–off ball–type valve to regulate the discharge rate;

(e) Pressure hose used to discharge chemicals to the surface water shall be provided with an on–off ball–type valve. This valve will be fitted at the base of the hose nozzle or as part of the nozzle assembly;

(f) All pressure and suction hoses and mechanical fittings shall be watertight;

(g) Equipment shall be calibrated by the applicator. Evidence of calibration shall be provided at the request of the department supervisor.

(h) Other equipment designs may be acceptable if capable of equivalent performance.

(7) The permit holder shall be responsible for posting those areas of use in accordance with water use restrictions stated on the chemical label, but in all cases for a minimum of one day, and with the following conditions:

(a) Posting signs shall be brilliant yellow and conspicuous to the nonriparian public intending to use the treated water from both the water and shore, and shall state applicable label water use restrictions of the chemical being used, the name of the chemical and date of treatment. For tank mixes, the label requirements of the most restrictive chemical will be posted;

(b) Minimum sign dimensions used for posting shall be 11 inches by 11 inches or consistent with s. ATCP 29.15. The department will provide up to 6 signs to meet posting requirements. Additional signs may be purchased from the department;

(c) Signs shall be posted at the beginning of each treatment by the permit holder or representing agent. Posting prior to treatment may be required as a permit condition when the department determines that such posting is in the best interest of the public;

(d) Posting signs shall be placed along contiguous treated shoreline and at strategic locations to adequately inform the public. Posting of untreated shoreline located adjacent to treated shoreline and noncontiguous shoreline shall be at the discretion of the department;

(e) Posting signs shall be made of durable material to remain up and legible for the time period stated on the pesticide label for water use restrictions, after which the permit holder or representing agent is responsible for sign removal.

(8) After conducting a treatment, the permit holder shall complete and submit within 30 days an aquatic nuisance control report on a form supplied by the department. Required information will include the quantity and type of chemical, and the specific size and location of each treatment area. In the event of any unusual circumstances associated with a treatment, or at the request of the department, the report shall be provided immediately. If treatment did not occur, the form shall be submitted with appropriate comment by October 1.

(9) Failure to comply with the conditions of the permit may result in cancellation of the permit and loss of permit privileges for the subsequent treatment season. A notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder accompanied by a statement of appeal rights.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89**;** correction in (7) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477.

NR 107.09 Special limitation. Due to the significant risk of environmental damage from copper accumulation in sediments, swimmer's itch treatments performed with copper sulfate products at a rate greater than 10 pounds of copper sulfate per acre are prohibited.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.10 Field evaluation use permits. When a chemical product is considered for aquatic nuisance control and does not have a federal label for such use, the applicant shall apply to the administrator of the United States environmental protection agency for an experimental use permit under section 5 of the federal insecticide, fungicide and rodenticide act as amended (7 USC 136 et seq.). Upon receiving a permit, the permit holder shall obtain a field evaluation use permit from the department and be subject to the requirements of this chapter. Department field evaluation use permits shall be issued for the purpose of evaluating product effectiveness and safety under field conditions and will require in addition to the conditions of the permit specified in s. NR 107.08 (1) through (9), the following:

(1) Treatment shall be limited to an area specified by the department.

(2) The permit holder shall submit to the department a summary of treatment results at the end of the treatment season. The summary shall include:

(a) Total chemical used and distribution pattern, including chemical trade name, formulation, percent active ingredient, and dosage rate in the treated water in parts per million of active ingredient;

(b) Description of treatment areas including the character and the extent of the nuisance present;

(c) Effectiveness of the application and when applicable, a summary comparison of the results obtained from past experiments using the same chemical formulation;

(d) Other pertinent information required by the department; and

(e) Conclusions and recommendations for future use.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.11 Exemptions. (1) Under any of the following conditions, the permit application fee in s. NR 107.04 (2) (a) will be limited to the basic application fee:

(a) The treatment is made for the control of bacteria on swimming beaches with chlorine or chlorinated lime;

(b) The treatment is intended to control algae or other aquatic nuisances that interfere with the use of the water for potable purposes;

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(c) The treatment is necessary for the protection of public health, such as the control of disease carrying organisms in sanitary sewers, storm sewers, or marshes, and the treatment is sponsored by a governmental agency.

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(a) A private pond is a body of water located entirely on the land of an applicant, with no surface water discharge or a discharge that can be controlled to prevent chemical loss, and without access by the public.

(b) The permit application fee will be limited to the non–refundable $20 application fee.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights–of–way where the department determines that fish and wildlife resources are insignificant; or

(f) Waste treatment facilities which have received s. 281.41, Stats., plan approval or are utilized to meet effluent limitations set forth in permits issued under s. 283.31, Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (4) (d) and (f) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

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Chapter NR 109

AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL and MECHANICAL CONTROL REGULATIONS

NR 109.01 Purpose. The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.715, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter. Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non–native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.02 Applicability. A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non–native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.03 Definitions. In this chapter:

(1) "Aquatic community" means lake or river biological resources.

(2) "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

(3) "Body of water" means any lake, river or wetland that is a water of this state.

(4) "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

(5) "Department" means the Wisconsin department of natural resources.

(6) "Manual removal" means the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power.

(7) "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

(8) "Permit" means aquatic plant management permit.

(9) "Plan" means aquatic plant management plan.

(10) "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.04 Application requirements and fees. **(1)** Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

Note: Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

(2) The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. $30 for a proposed project to manage aquatic plants on less than one acre.

2. $30 per acre to a maximum of $300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one–half the original application fee, but not less than $30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a description of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

(h) A description of other introduction or control methods considered and the justification for the method selected.

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(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

(3) (a) The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long–term sustainability of beneficial water use activities.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

(4) The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.05 Permit issuance. (1) The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

(2) The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

(3) The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long–term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Stuckenia pectinata (Potamogeton pectinatus), Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania spp., Zannichellia palustris and Brasenia schreberi.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

(4) The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

(5) (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3–year term.

(b) The department may issue an aquatic plant management permit for a one–year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department–approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3–year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5–year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

(6) The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03**; reprinted to restore dropped language from rule order, Register October 2003 No. 574.**

NR 109.06 Waivers. The department waives the permit requirements under this chapter for any of the following:

(1) Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

Note: A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non–navigable waters of the state is not required to obtain a permit for the activities.

(2) A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the

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shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30–foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on–shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

(4) Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re–growth of purple loosestrife or other nonnative vegetation.

(5) Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

(6) Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

Note: Scientific collectors permit requirements are still applicable.

(7) Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.07 Invasive and nonnative aquatic plants. (1) The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

(2) The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

(3) Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.08 Prohibitions. (1) No person may distribute an invasive aquatic plant, under s. NR 109.07.

(2) No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

(3) No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

(4) (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re–launched on the same body of water without having visited different waters, provided the re–launching will not introduce or encourage the spread of existing aquatic species within that body of water.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.09 Plan specifications and approval. (1) Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

(2) The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

(3) The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.10 Other permits. Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.11 Enforcement. (1) Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

(2) Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

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Appendix G – Resource for Additional Information

Appendix G

Additional Resources

Websites

Wisconsin Department of Natural Resources

Lakes

http://dnr.wi.gov/topic/lakes/

Grants

http://dnr.wi.gov/lakes/grants/Lakes

Aquatic Invasive Species

http://dnr.wi.gov/lakes/invasives/AquaticInvasive.aspx

Water Quality

http://dnr.wi.gov/lakes/waterquality/

UW-Extension Lakes

http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/default.aspx

Wisconsin Lakes

http://wisconsinlakes.org/

Barron County Soil and Water Conservation

http://www.barroncountywi.gov/index.asp?Type=B_BASIC&SEC={89D075CD-5873-4056-8599-65155CFB943F}

Aquatic Invasive Species - County or Tribal Coordinator

Tyler Gruetzmacher

715-537-6315

tyler.gruetzmacher@co.barron.wi.us

WDNR Contacts

Aquatic Invasive Species - Report A New Finding

Alex Smith
715-635-4124
Alex.Smith@Wisconsin.gov

Aquatic Invasive Species Grants - Applying and Technical Assistance

Alex Smith
715-635-4124
Alex.Smith@Wisconsin.gov

Aquatic Invasive Species Grants - Financial Administration

Jane Malischke
715-635-4062

jane.malischke@wisconsin.gov

Aquatic Plant Management

Alex Smith
715-635-4124
Alex.Smith@Wisconsin.gov

Mark Sundeen
715-635-4074
mark.sundeen@wisconsin.gov

Lake Coordinators - DNR

Alex Smith
715-635-4124
Alex.Smith@Wisconsin.gov

Appendix H – Aquatic Plant Management Strategy

AQUATIC PLANT MANAGEMENT STRATEGY

Northern Region WDNR
Summer, 2007
(working draft)

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. 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.
4. 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. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our 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.

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

State Statute 23.24 (2)(c) states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.

7. The requirements for plans that the department may require under sub. (3) (b). "

State Statute 23.24(3)(b) states:
"The department may require that an application for an aquatic plant management permit contain a plan for the department's approval as to how the aquatic plants will be introduced, removed, or controlled."

Wisconsin Administrative Code NR 109.04(3)(a) states:
"The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities."

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
   a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
   b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

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* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

Documentation of *impairment of navigation* by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

Documentation of the *nuisance* must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DEFINITIONS

Manual removal:	Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.
Native aquatic plants:	Aquatic plants that are indigenous to the waters of this state.
Invasive aquatic plants:	Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Sensitive area:	Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).
Rapid Response protocol:	This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.