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Upper Nemahbin Lake Management Plan 2024

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Upper Nemahbin Lake is a 277 acre drainage lake located in town of Delafield, Waukesha County, Wisconsin. The lake connects to Lower Nemahbin Lake via the Bark River. There is access to the lake at the boat landing on the Bark River between Upper and Lower Nemahbin. On behalf of the Upper Nemhbin Lake Management District, Aquatic Biologists, Inc. conducted a full point intercept survey to assess the aquatic plant community in August 2024.

Aquatic Plant Survey

A whole lake point intercept survey was conducted August 21st, 2024 to evaluate the aquatic plant community and determine if there was any distribution of starry stonewort in Upper Nemahbin Lake. Distribution and density of non-native and native aquatic plants were surveyed to determine the best management practices. Rake samples were taken at predetermined GPS locations specified by the Wisconsin Department of Natural Resources. Species and density of aquatic plants were recorded. Rake fullness is recorded on a scale of 1 to 3, with 3 being the densest. If a plant species is not identified on the rake but observed at the GPS location, it is recorded as visually observed.

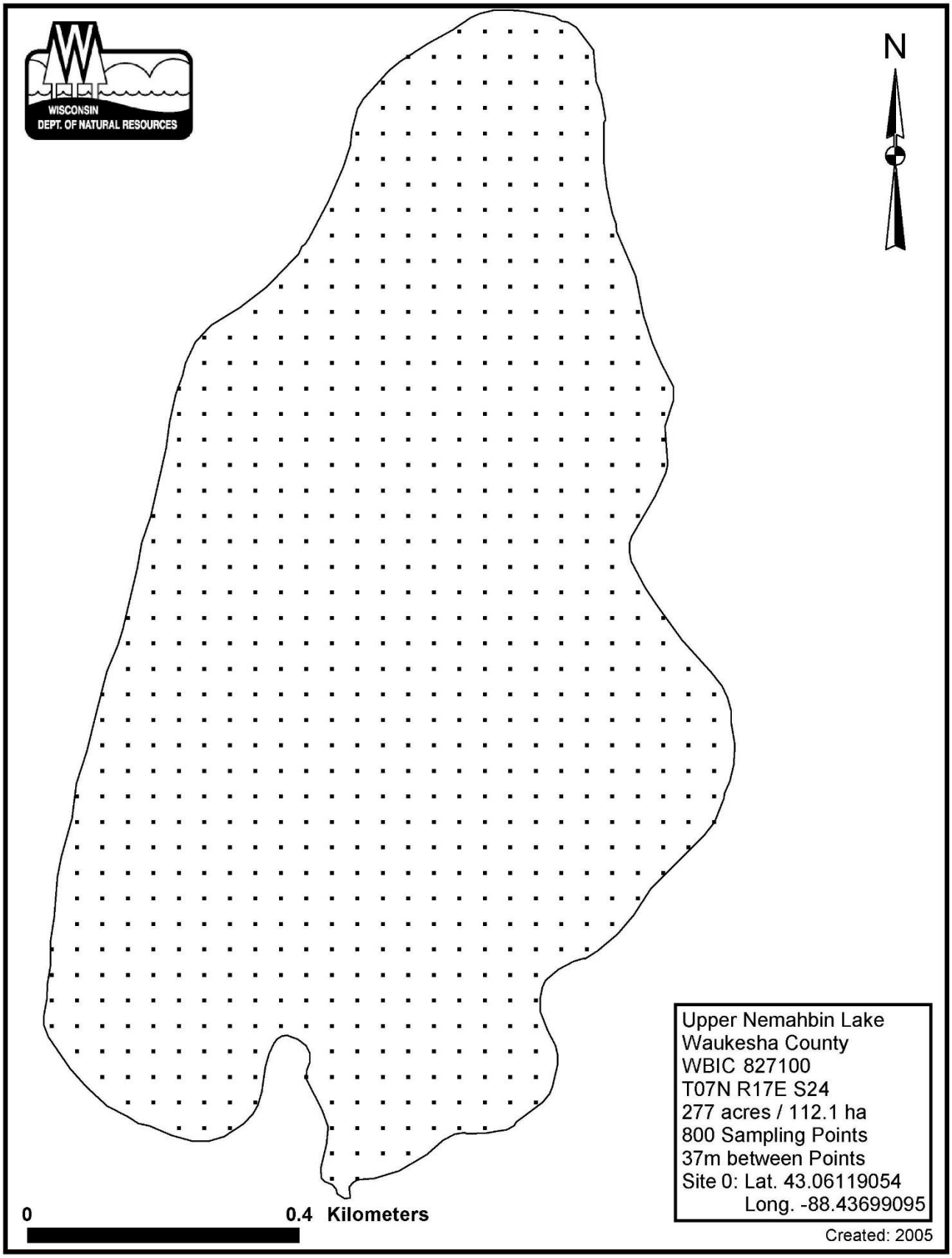


Figure 1: Point intercept survey points of Upper Nemahbin Lake provided by the Wisconsin Deparment of Natural Resources

The Southeastern Wisconsin Regional Planning Commission(SEWRPC) conducted a plant survey of Upper Nemahbin Lake in 2008. Distribution of the plant species from this survey can be seen in the map provided.

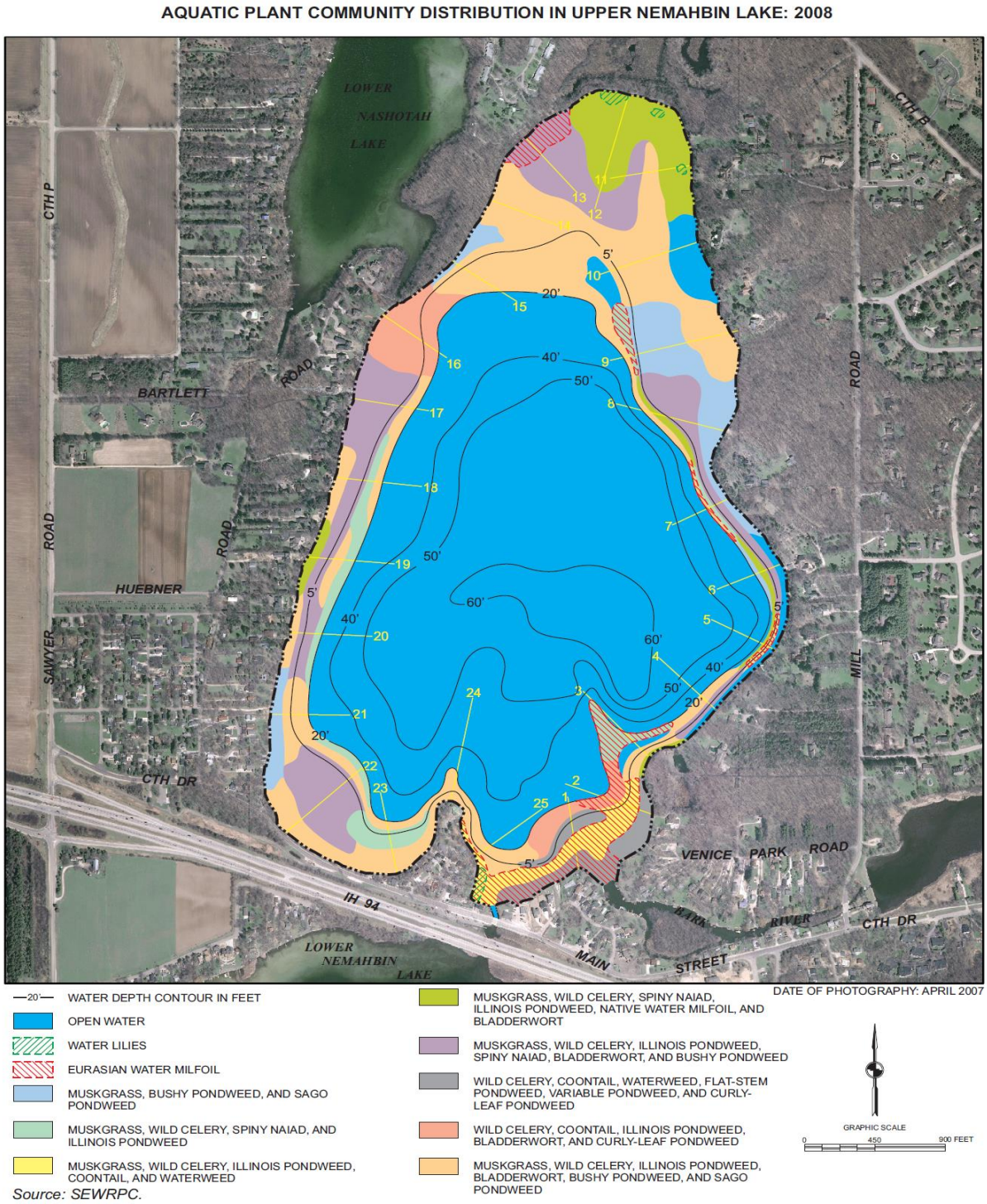


Figure 2: Aquatic plant distribution in Upper Nemahbin Lake in 2008

Non-Native Aquatic Plant Species

Eurasian water milfoil (EWM), curly leaf pondweed (CLP), and spiny naiad are non-native plants species that were identified in the lake during the 2024 survey. Starry stonewort was observed in the lake prior to the fall survey but was not seen at any of the P.I. sample points in 2024.

Eurasian Water Milfoil

Eurasian water milfoil was located at four survey points in the south portion of the lake. One rake sample was identified on the south west bay. Three other rake samples were identified in the southeast bay of the lake. All rake samples were a density of one. Distribution of EWM was reduced from twenty locations of EWM in the 2019 P.I. survey versus four locations of EWM in 2024. EWM locations can be seen in the map below.

Curly Leaf Pondweed

There were five survey points of curly leaf pondweed. One point is in the northwest corner of the lake and four survey locations are in the southeast bay. The survey was conducted in August of 2024. Curly leaf pondweed is a species that grows early in the season. CLP can start growing when ice is still on the lakes. Management of this species is typically done when water temperatures are between 55-60 degrees Fahrenheit at the beginning of the season. Once the water temperatures increase, a turion will form. This turion is a seed like structure. These turions can be present in the sediment for several years before sprouting. Majority of curly leaf pondweed plants will die or subside by late June. The survey in August does not accurately give a proper representation of the curly leaf pondweed population. A survey done in the spring when CLP is actively growing will give the best representation of the population.

Figure 3: Eurasian water milfoil distribution in Upper Nemahbin Lake August 2024.

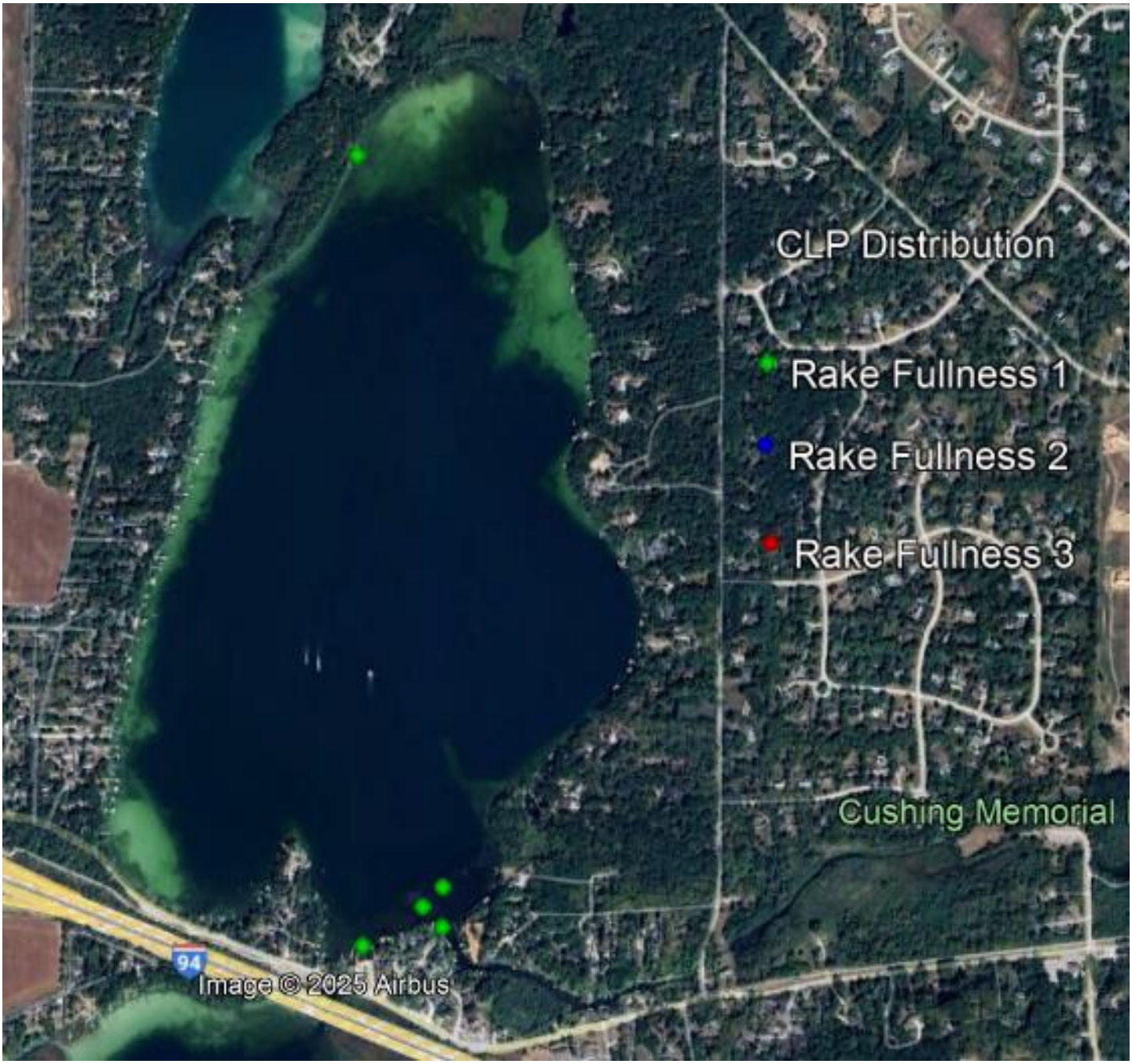


Figure 4: Curly leaf pondweed distribution in Upper Nemahbin Lake August 2024.

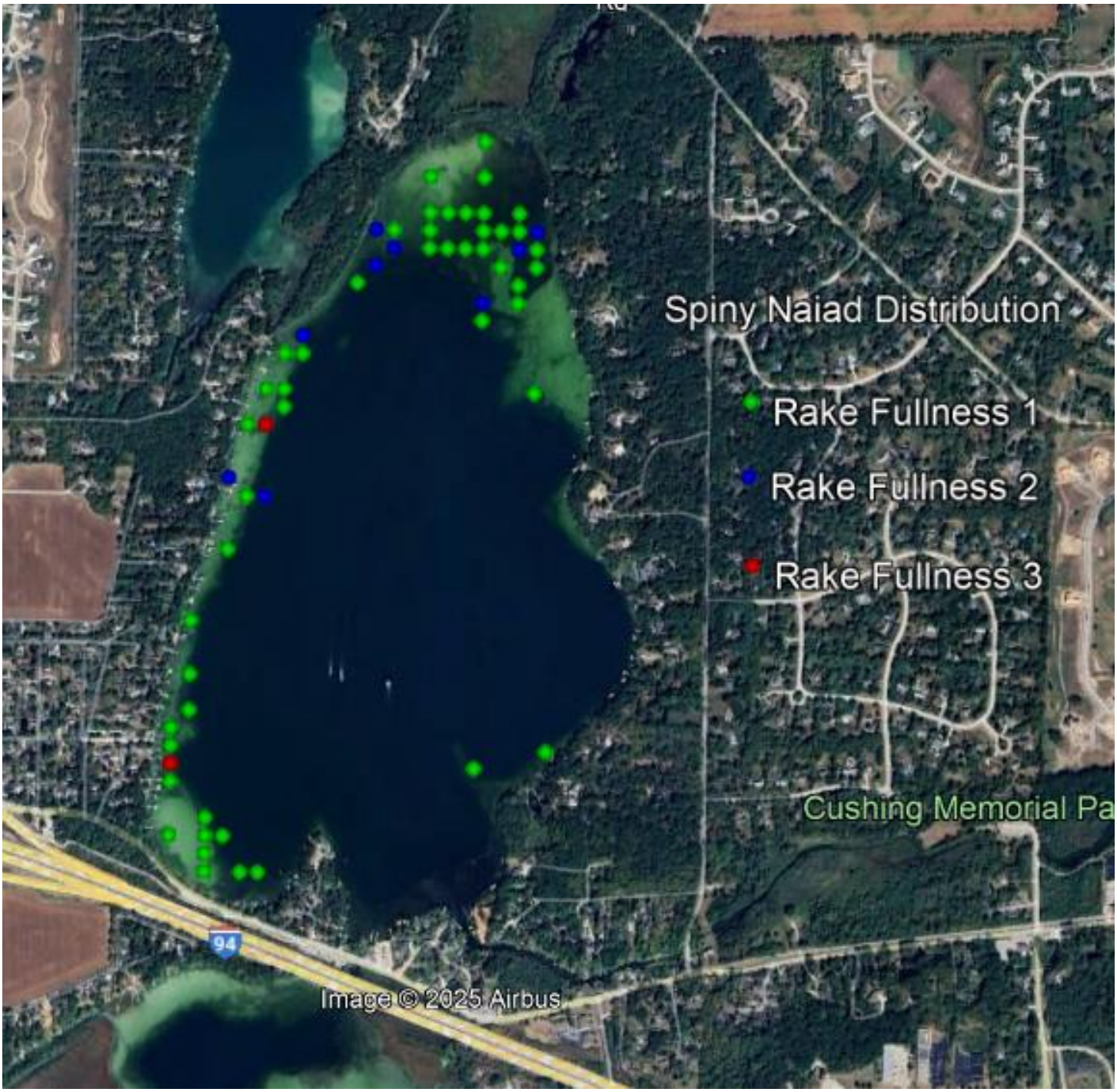


Figure 5: Spiny naiad dsitribution in Upper Nemahbin Lake August 2024.

Floristic Quality Index

The Floristic Quality Index (**FQI**) is a metric that describes the overall condition of aquatic plants in the lake. Higher FQI indicate a more pristine condition. Each plant species has a tolerance for human disturbance. The higher the value the more sensitive plants are present. FQI's are rated on a scale of 0-19 Low quality, 20-35 High Quality, 35-50 Very High Quality, > 50 Extremely rare and important. Upper Nemahbin Lake had a FQI in 2024 of 21.11 compared to a FQI of 18.07 in 2019. FQI did increase 3 points and changed the FQI from low quality in 2019 into the high quality category in 2024.

Many lakes in the region have a FQI of high quality but Upper Nemahbin Lake is slightly lower in comparison. Nagawicka Lake had a FQI of 25.92 in 2016, Okauchee and Upper Oconomowoc Lakes had a FQI of 24.7. Lower Namahbin Lake had a FQI of 20.7 in 2022 that was slightly lower than Upper Nemahbin Lake.

Aquatic Plant Species

Fourteen native plant species were identified during the survey in 2024 vs thirteen species in 2019. Species and number of sites can be seen in the table below. EWM, CLP, and Spiny Naiad are three non-native species identified in the survey.

The most common native plant species found in 2024 were; muskgrass, wild celery, sago pondweed, clasping leaf pondweed and small pondweed. Distribution of these species along with rake fullness are shown in the maps provided.

Native Plant Distribution 2008 vs 2019

There were fourteen different native species found in 2024 vs thirteen in 2019 and fifteen in 2008.

Plant Species Found (Common Name)	Plant Species Found (Scientific Name)	#Sites	Frequency of Occurrence at sites shallower than maximum depth of plants	Avg. Rake Fullness
Eurasian water milfoil	Myriophyllum spicatum	4	1.4	1
Curly-leaf pondweed	Potamogeton crispus	5	1.75	1
Coontail	Ceratophyllum demersum	9	3.15	1.5
Muskgrasses	Chara	161	56.29	1.72
Common Waterweed	Elodea canadensis	11	3.85	1.55
Slender naiad	Najas flexilis	15	4.55	1.08
Spiny naiad	Najas marina	60	20.98	1.22
Illinois pondweed	Potamogeton illinoensis	15	5.24	1.07
Small pondweed	Potamogeton pusillus	18	6.29	1.06
Flatstem pondweed	Potamogeton zosteriformis	4	1.4	1.5
Sago pondweed	Stuckenia pectinata	35	12.24	1.31
Common bladderwort	Utricularia vulgaris	15	5.24	1
Wild celery	Vallisneria americana	106	37.66	1.16
Yellow Water Lilly	Nuphar advena	1	0.35	1
Leafy Pondweed	Potamogeton foliosus	8	2.8	1
Variable Pondweed	Potamogeton gramineus	11	3.85	1
Clasping Leaf Pondweed	Potamogeton richardsonii	20	6.99	1

Table 1: Aquatic plant species and number of sites found at in Upper Nemahbin P.I. Survey August, 2024

Presence/Absence 2008 vs 2019 vs 2024				
Plant Species Found (Common Name)	Plant Species Found (Scientific Name)	Present in 2008	Present in 2019	Present in 2024
Eurasian water milfoil	Myriophyllum spicatum	X	X	X
Curly-leaf pondweed	Potamogeton crispus	X	X	X
Coontail	Ceratophyllum demersum	X	X	X
Muskgrasses	Chara	X	X	X
Common Waterweed	Elodea canadensis	X	X	X
Northern water-milfoil	Myriophyllum sibiricum	X		X
Slender naiad	Najas flexilis		X	X
Southern naiad	Najas guadalupensis	X	X	
Spiny naiad	Najas marina	X	X	X
White water lilly	Nymphaea odorata	X	V	
Variable pondweed	Potamogeton gramineus	X		X
Illinois pondweed	Potamogeton illinoensis	X	X	X
White-stem pondweed	Potamogeton praelongus	X	X	X
Small pondweed	Potamogeton pusillus		X	X
Clasping leaf pondweed	Potamogeton richardsonii	X		X
Flatstem pondweed	Potamogeton zosteriformis	X	X	X
Sago pondweed	Stuckenia pectinata	X	X	X
Common bladderwort	Utricularia vulgaris	X	X	X
Wild celery	Vallisneria americana	X	X	X

Table 2: Presence and absence of aquatic vegetation comparison of 2008, 2019, and 2024.

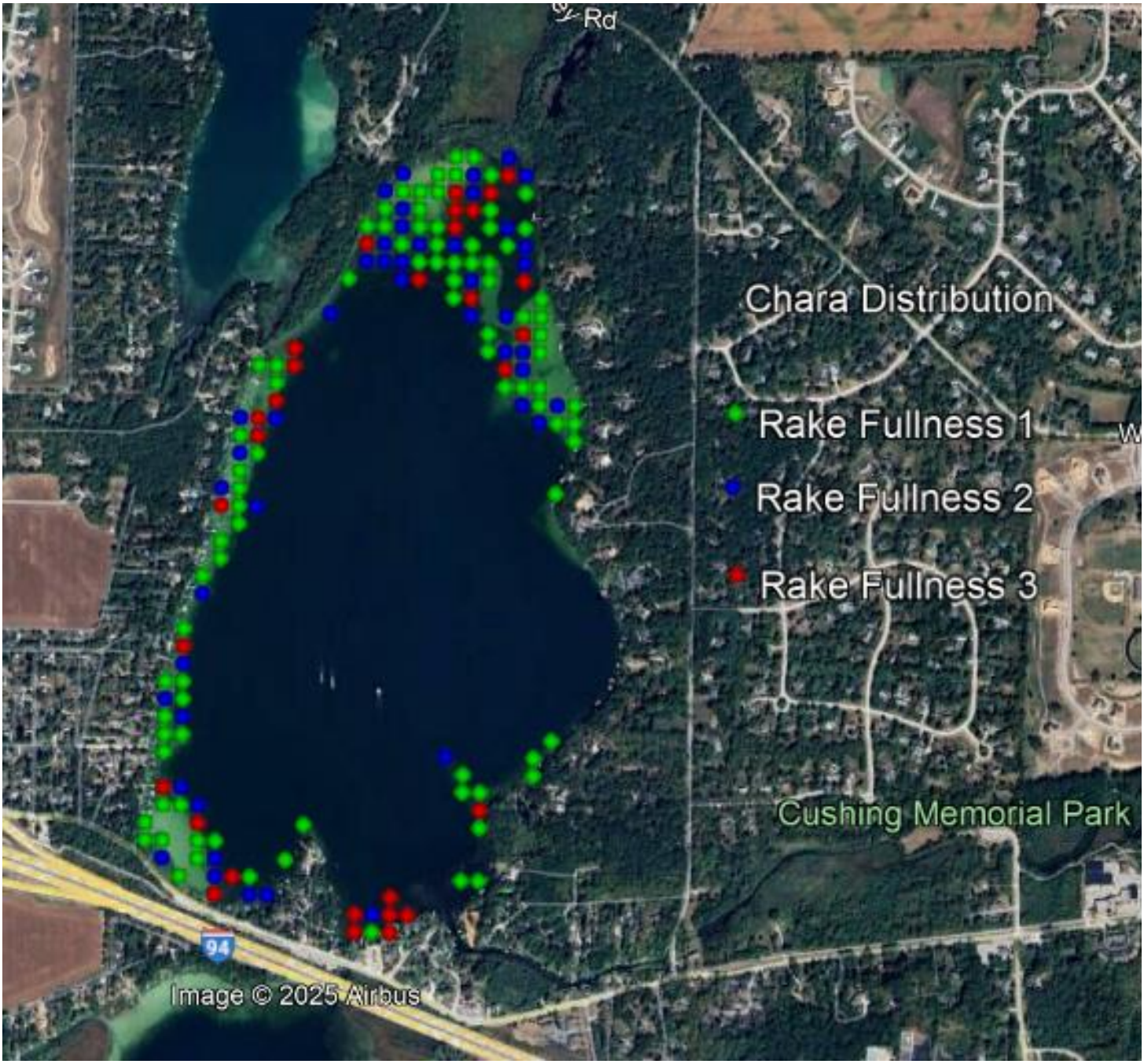


Figure 6: Muskgrass (chara) distribution on Upper Nemahbin Lake August 2024

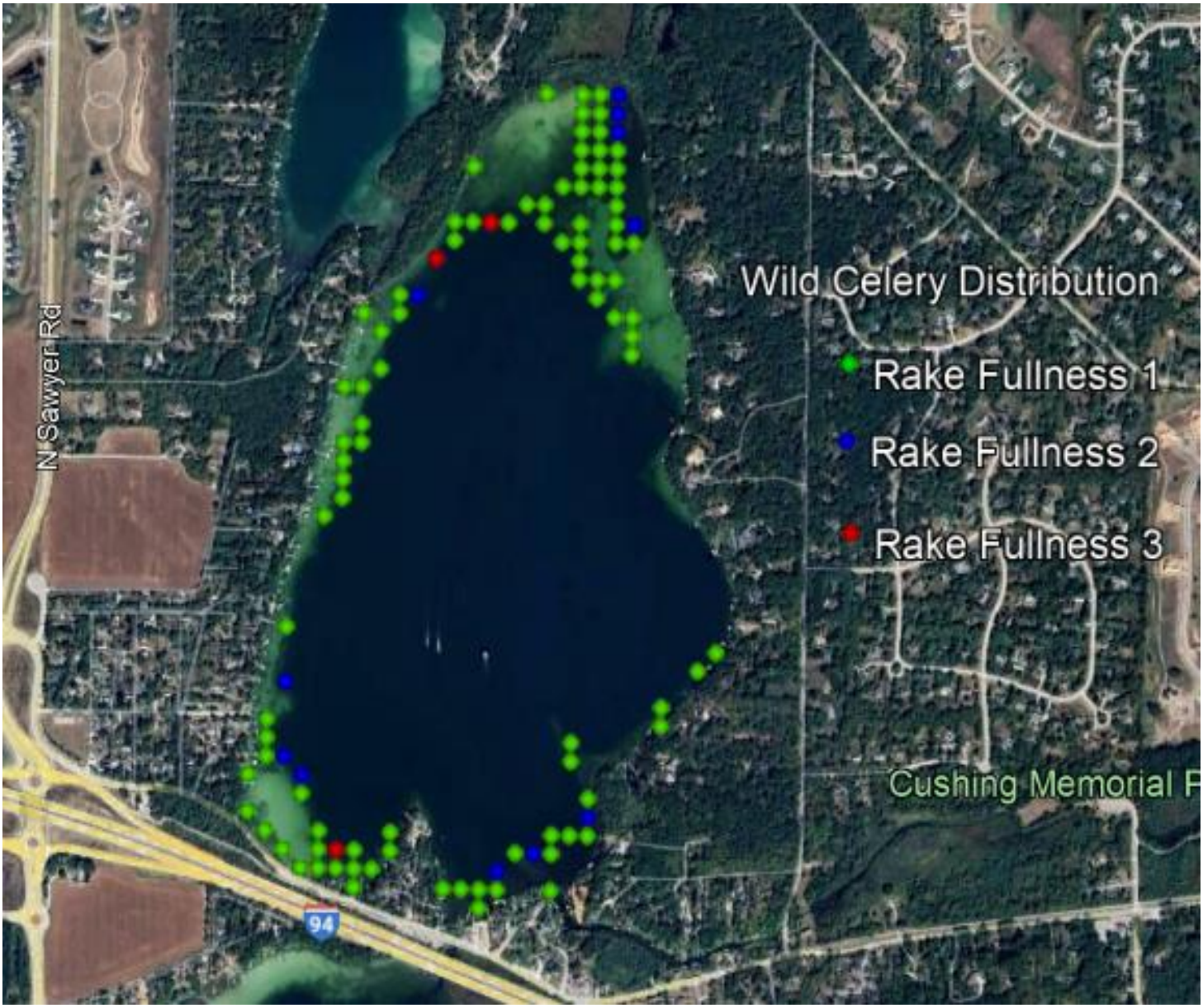


Figure 7: Wild Celery distribution in Upper Nemahbin Lake August 2024.

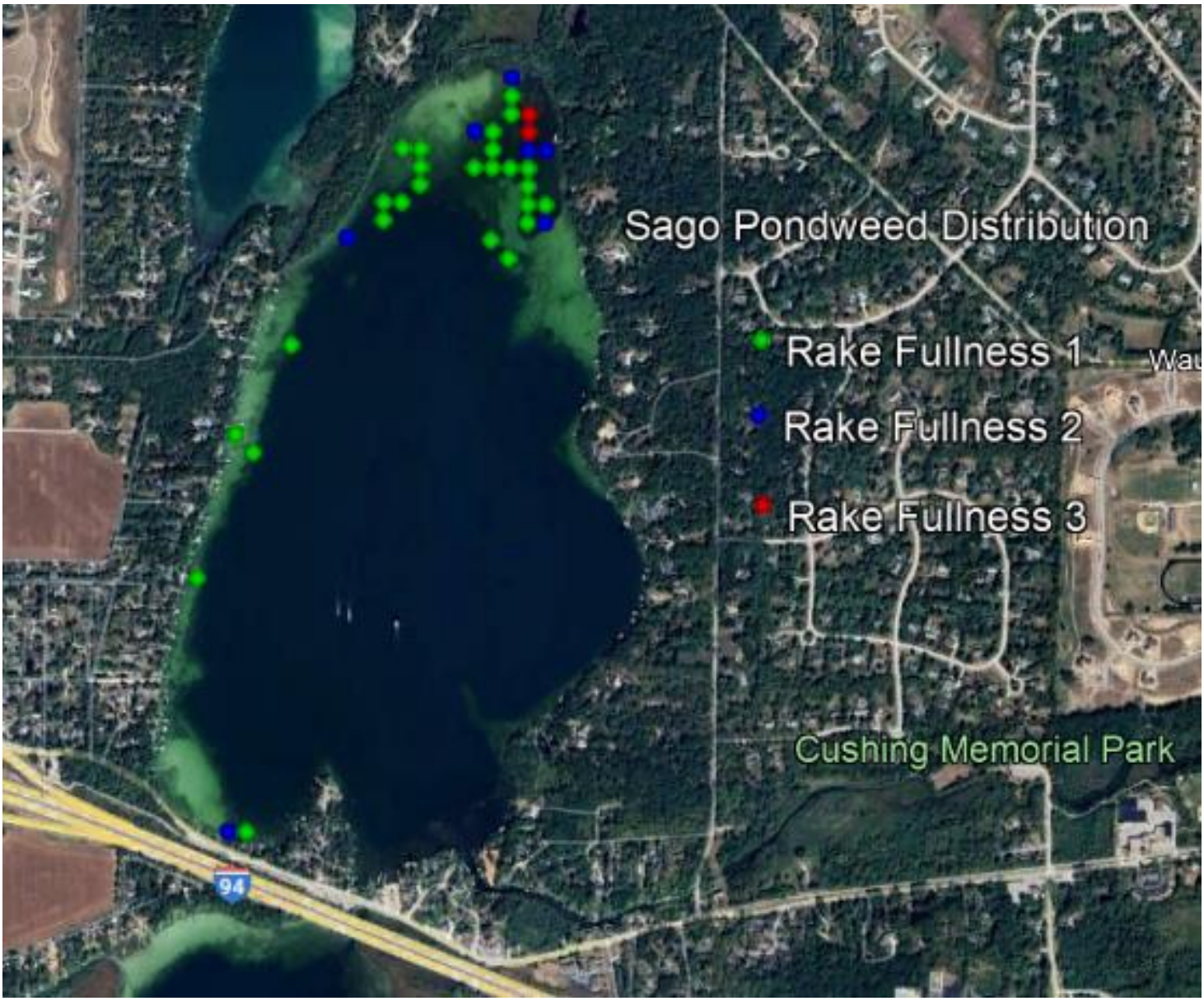


Figure 8: Sago pondweed dsitribution in Upper Nemahbin Lake August 2024.

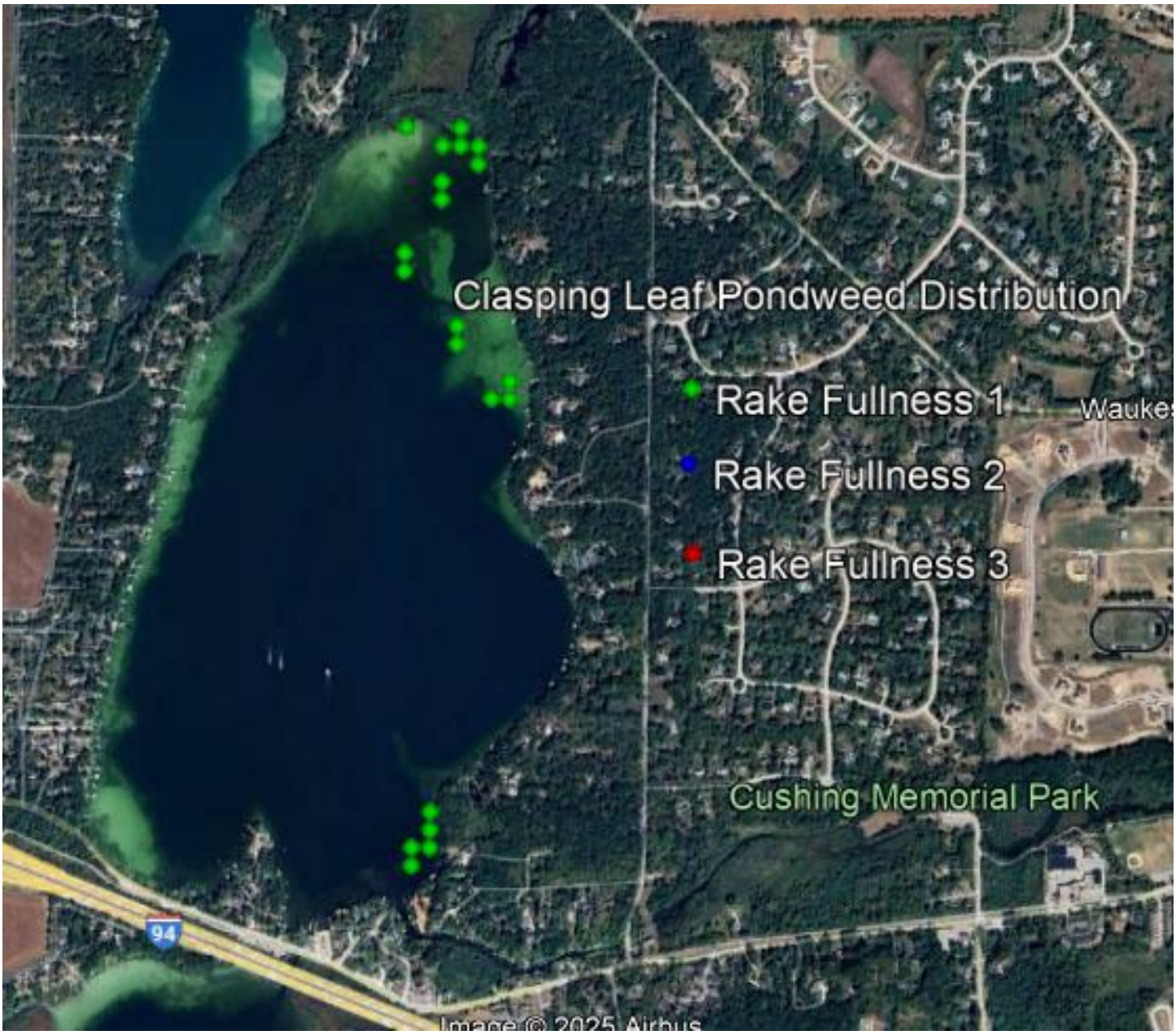


Figure 9: Clasping leaf pondweed distribution in Upper Nemahbin Lake August 2024.

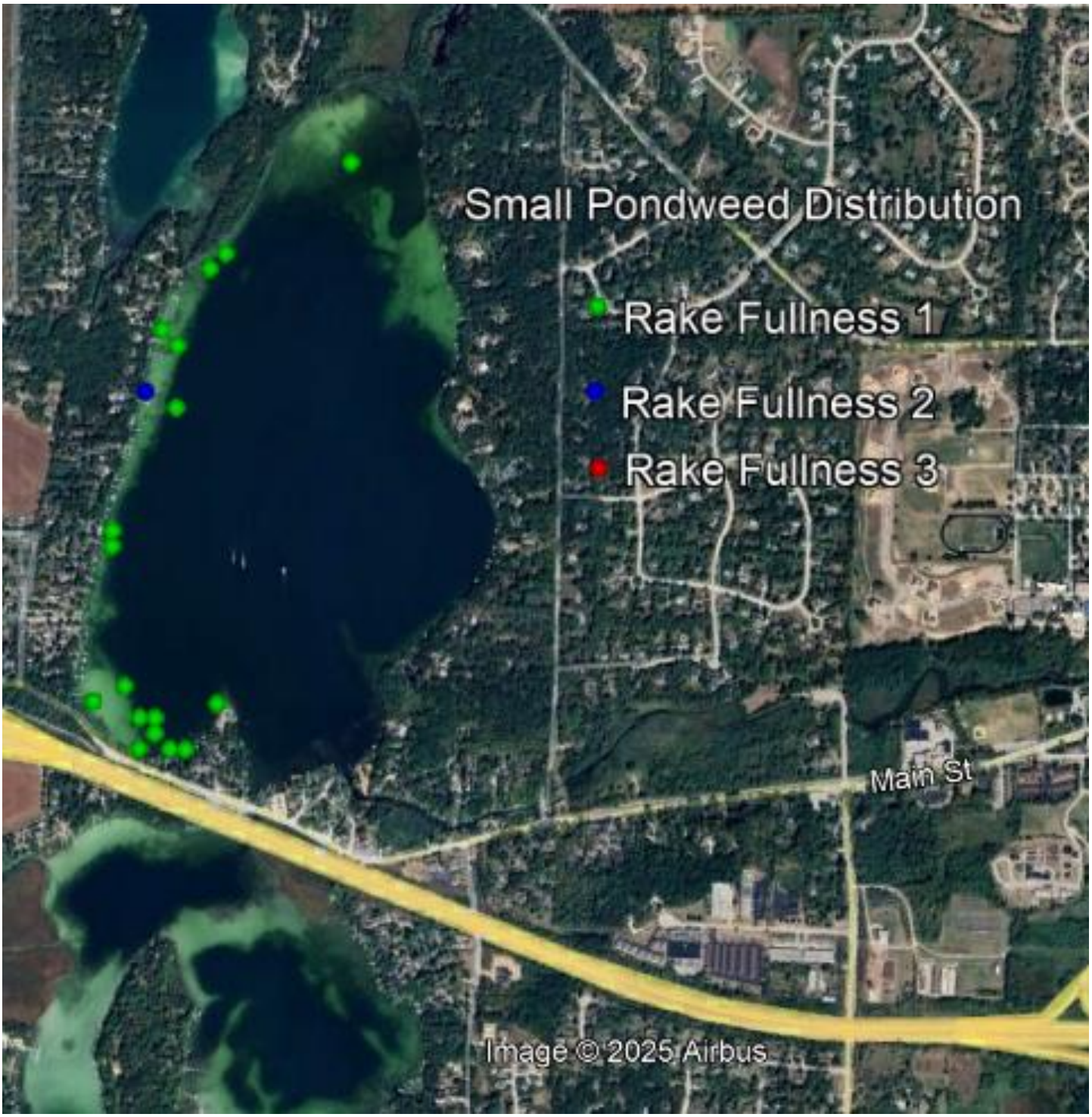


Figure 10: Small pondweed distribution in Upper Nemahbin Lake August 2024.

Aquatic Plant Control Methods

There are three methods of aquatic plant control, including manual removal, mechanical removal, and herbicide control.

Manual Removal

Manually removal of vegetation is a selective method of controlling aquatic plant growth. Hand raking and hand pulling are two commonly used methods of manual removal. Specific areas can be targeted by hand pulling and raking. Physically removing the plants removes nutrients, seeds, and fragments that otherwise could be deposited back in the lake. This aquatic plant management technique helps incrementally maintain water depth, improves water quality, and can help decrease the spread of nuisance/exotic plants. Hand raking and hand pulling are allowed by WDNR and are methods that can be used by riparian owners in a small target area nearshore and around docks and piers. Raking is inexpensive, can be done by most riparian owners, and remove pioneer populations in shallow waters. Raking is limited to shallow water that are close to shore and or easy to access within the riparian area. You can be more selective when hand pulling vegetation compared to raking. The entire plant including roots should be pulled and removed. Hand pulling is a method thst is effective and efficient in very small areas.

Mechanical Removal

Mechanical harvesting and suction harvesting are two mechanical methods of vegetation removal allowed by the DNR in Wisconsin. Both are regulated by WDNR and require a permit.

Mechanical Harvesting

Aquatic plants can be mechanically removed using specialized equipment called harvesters. Mechanical harvesting is a common practice used in Wisconsin. Harvesters can cut up to about a five foot depth using adjustable height cutters. Once the harvester cuts the plants, it puts them on a conveyor or basket on the harvester. Harvesting removes biomass, nutrients, and seeds from reentering the lake. Mechanical harvesting is most effective in large-scale open-water projects. Small harvesters are also produced and can be used around piers and docks in shallow nearshore areas.

Some advantages of mechanical harvesting are that the harvester should leave enough living plant material in place therefore providing habitat for aquatic wildlife while also stabilizing the lake-bottom sediment. Harvesting should not kill aquatic plants, it simply trims plants back. Aside from residual plant mass remaining because of imperfect treatment strategy execution, none of the other aquatic plant management methods purposely leave living plant material in place after treatment. The use of a harvester will allow more light to penetrate in previously dense vegetated areas therefore able to stimulate regrowth of native plants that were once suppressed.

Some disadvantages of mechanical harvesting are that harvesting process can fragment plants. Fragmented plants can move throughout the lake and potentially reestablish EWM and curly-leaf pondweed. Harvesting may stir up bottom sediments in shallow areas, potentially increasing turbidity. Due to this, most WDNR-issued permits do not allow deep-cut harvesting in water less than three feet deep. It is important to note that boating activity can fragment aquatic plants and also contribute to accumulations of cut plant fragments in the lake or along the shoreline. Some harvesting contractors will pick up fragmented plants along the shoreline from recreational use.

Diver assisted Suction Harvesting

Diver assisted suction harvesting is another method of mechanical harvesting. Suction harvesting removes sediment, aquatic plants, plant roots, and anything else from the lake bottom. This method also requires a dredging permit in addition to the aquatic plant management permit.

Divers can target specific aquatic plants and roots from the lakebed and then insert the entire plant into a suction hose that transports the plant to the surface for collection and disposal. DASH is labor-intensive and done by professional divers making it a costly method of removal.

Some advantages of DASH include lower potential for plant fragments compared to mechanical harvesting, raking, and hand-pulling. Increased selectivity and lower potential for disturbing aquatic and fish habitat

All plant material harvested with the use of a harvester or DASH will need to properly be disposed. Upper Nemahbin Lake Management District may consider partnering with neighboring lakes to coordinate a disposal site to be used. Pewaukee Lake, North Lake, and Nagawicka Lake are area lakes that currently or recently used harvesting as a management tool and may be able to assist in a disposal site.

Harvesters can be rather large and access to the lake will be needed. A typical harvester would not be able to get underneath the bridge at the public boat landing. If harvesting is to be considered, access to the lake should be secured by UNLMD on the southern half of the lake near the main target areas for potential harvesting.

Herbicide Treatment

Herbicide treatments are used to chemically control aquatic vegetation using EPA registered and approved products. Some herbicides are broad spectrum, treating all species present in an area, and other herbicides are selective for certain species based on concentrations used.

The Wisconsin DNR allows for spring treatment (through June) for non-native species with herbicides selecting for a target species. Other criteria such as size of proposed area and density will determine if herbicides are warranted. In the summer, the DNR would only allow herbicide treatment for navigation impediments typically using broad spectrum contact herbicides to treat all species natives and non-native within the treatment area.

Herbicide treatments for non-native species such as EWM and CLP should be done early in the spring when plants and growing but before native vegetation starts to rapidly grow. Herbicide treatments offer large scale management and in areas that are too large for DASH/hand pulling, and in instances that using a harvester are not preferred.

EWM Managagement

Two locations of EWM were treated in July of 2020. These locations were recommended to be treated based on the 2019 P.I. survey. The two areas totaled 4.28 acres and were treated with ProcellaCOR EC based on SePro's recommendations and suggested rates.

Treatment Areas For Milfoil in Upper Nemahbin Lake – 2020					
	Surface Acres	Avg. Depth	Acre Feet	ProcellaCOR EC - PDUs per acre foot	Total PDUs
Treatment Area 1	3.56	6	21.36	3	64.08
Treatment Area 3	0.72	10.9	7.848	5	39.24

Table 3: Treatment areas in Upper Nemahbin Lake using ProcellaCOR in 2020

Figure 11: Map of treatment areas of EWM in 2020

A meandering survey for EWM was conducted in fall of 2022. Some EWM was detected in the east treatment area from 2020 and no EWM in the west treatment area. Individual plants were also observed on the north end of the lake. EWM was at low density and herbicide treatment was not recommended based on the survey results.

Starry Stonewort

Starry stonewort (*Nitellopsis obtusa)* is a submerged macroalga. It is related to muskgrass (chara). Starry stonewort can out compete native species and form monotypic plant communities. Populations of starry stonewort can become very dense. The dense mats can directly impact the habitat used by native fish for spawning and reduce light availability and substrate used by other beneficial native aquatic plants. Starry stonewort will easily establish in areas where there is a lack of vegetation and bare sediment.

Starry Stonewort has been documented and verified by the Wisconsin DNR on Upper Nemahbin Lake in 2024 for the first time. DNR staff observed starry stonewort near a resident's pier on the southeast corner of the lake during a DASH pre-supervision check.

Starry stonewort was introduced into the Bark River between Upper and Lower Nemahbin Lakes. It was positively identified in August of 2019. At that time locations of starry stonewort were isolated to the Bark River and the boat launch within this channel. The map includes areas that were isolated using silt curtains to contain the plant to the specific areas. Annual DASH removals have taken place at the launch the past several years in an attempt to contain the population and prevent further spread from that area.

Figure 12: Locations of starry stonewort at the boat landing in 2019.

Starry stonewort was introduced to the boat launch and channel area in 2019, where first introduced to WI in 2014, it has been learned that starry stonewort is a very difficult species to control, as no control methods have proven to be successful (i.e. the plant always returns shortly after, sometimes in greater quantities). This species behaves differently in different waterbodies and does not always grow to nuisance levels or cause navigational concern. For example, in one unmanaged population, Pike Lake in Washington County, have a slight decline in the overall frequency of starry stonewort over time. For these reasons, Department policy currently only supports control of starry stonewort in situations where it is causing navigational/recreational impairment (such as 'topping out'), or in confined locations with heavy boat traffic such as launches and channels. Ideally, native plants in Upper Nemahbin will provide good competition and starry stonewort will integrate into the plant community without causing navigational or recreational impairments and not require active management.

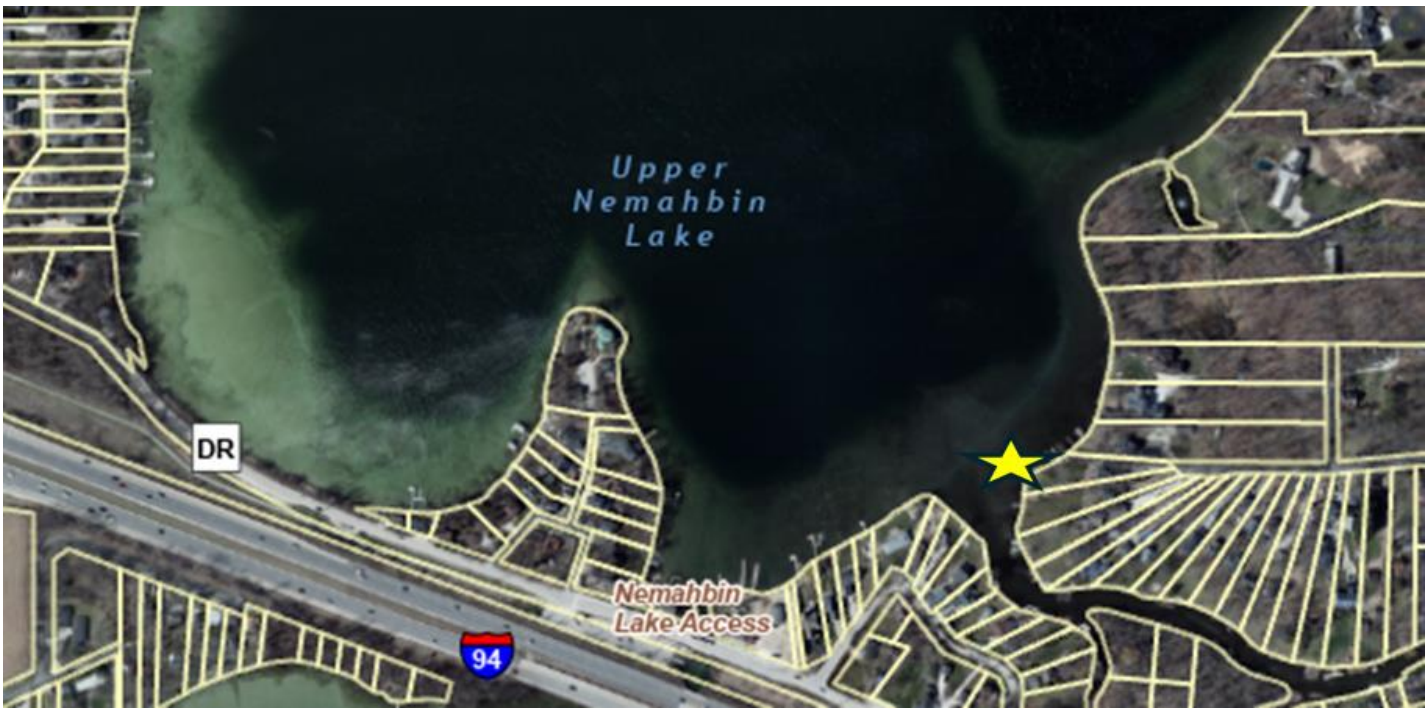


Figure 13: Location of Starry stonewort found in Upper Nemahbin Lake 2024

Figure 14 Verified sample of starry stonewort from Upper Nemahbin Lake 2024

Starry stonewort is a non-native invasive species. Monitoring for this species needs to be continued in both Upper and Lower Nemahbin. The Bark River boat landing is the main access point to Upper and Lower Nemahbin. It would be in the best interest of property owners of Upper and Lower Nemahbin and Lower Nashotah to work together and financially support each other in not only managing starry stonewort, but any invasive species in these lakes. Starry stonewort is relatively new to Wisconsin and there has been no perfect management tool to eliminate starry stonewort.

Management Recommendations

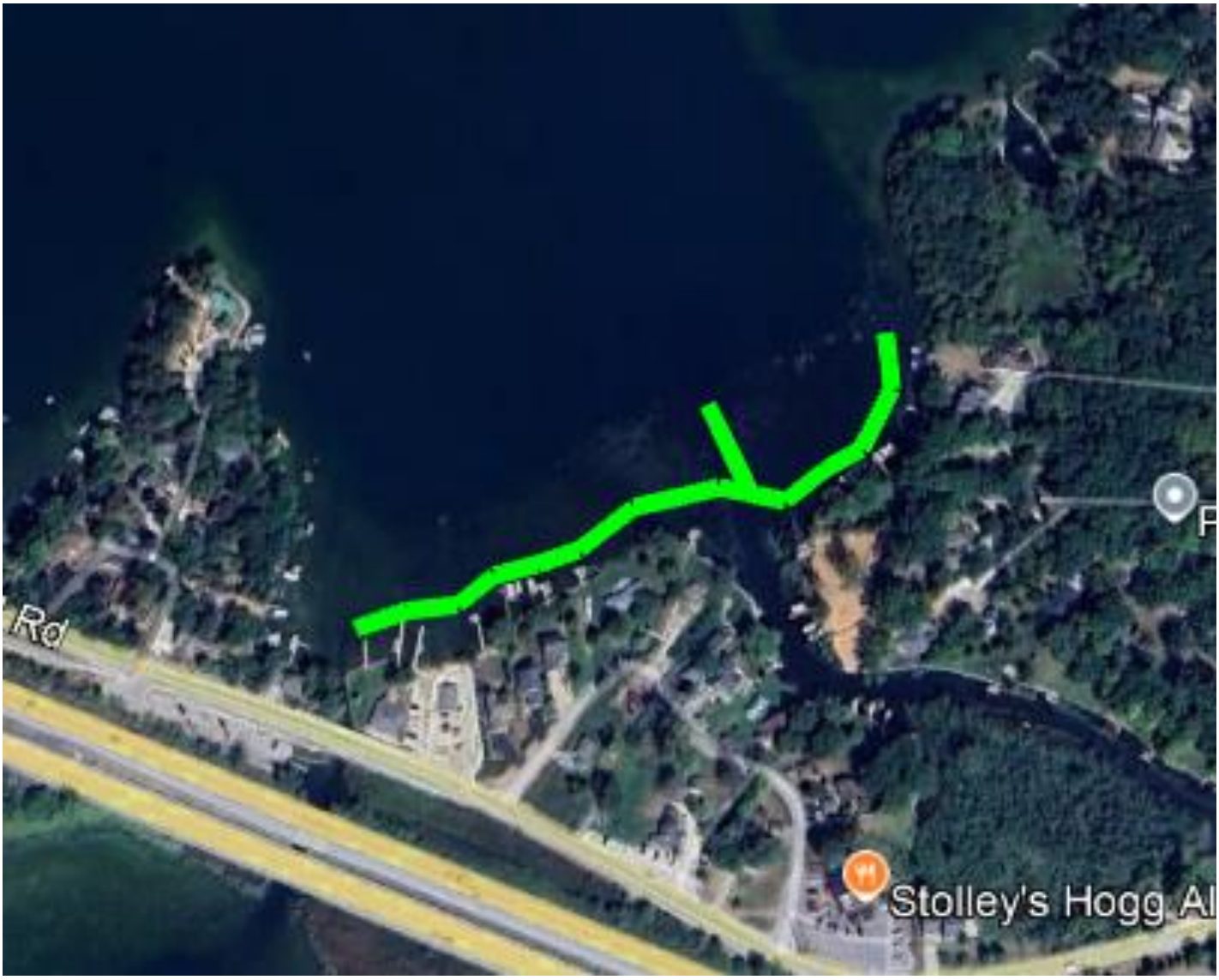
Eurasian Water Milfoil

Aquatic Biologists, recommends annual meandering surveys for EWM to monitor distribution and density. The current amount of EWM does not warrant any herbicide control. Due to the low quantity and density of EWM currently in the lake, integrated pest management strategies can prevent the widespread distribution of EWM if implemented soon after detection. In the next five years, DASH should be used in areas of EWM are ¼ to ½ acre in size. There are four isolated locations of Eurasian water milfoil. Each of these locations are individual survey points. All four locations had a rake sample of 1. Three of these locations are in near or adjacent to each other in the southeast bay. DASH could be used in these locations as EWM is most likely dispersed between the survey points. There is one isolated survey point with EWM in the southwest bay that is too small of an aera to be considered for DASH.

Herbicides to selectively control EWM in spring should be considered once areas become 2 acres and larger. Aquatic Biologists recommends the use of the herbicide ProcellaCOR EC in any future treatment areas. ProcellaCOR EC is selective herbicide when used at specific rates targeting EWM. This product has shown to have little to no effects on native vegetation and has proven results on Upper Nemahbin Lake when used in 2020. Dosage and rates are dependent on size of treatment area, location, density of plants, and depth of treatment area.

It is important to note that ProcellaCOR EC is classified as a WSSA Group 4 Herbicide. Weed populations may contain or develop biotypes that are resistant to ProcellaCOR EC and other Group 4 herbicides. If herbicides with the same mode of action are used repeatedly at the same site, resistant biotypes may eventually dominate the weed. Unless ProcellaCOR EC is used as part of an eradication program or in a plant management system where weed escapes are aggressively controlled, do not use ProcellaCOR EC should not be used alone in the same treatment area for submersed and emergent plant control for more than 2 consecutive years, unless used in combination or rotated with an herbicide with an alternate mode of action.

UNLMD has indicated a concern for navigation impediments due to dense aquatic vegetation on the southeast shore of the lake. Mechanical harvesting should be considered in this area for relief to access the main lake. Harvest could happen along the south shore to the inlet. Please see map below. The harvesting map shows a path going east to west, 20ft wide and approximately 1400 feet long. Harvesting along this area would allow boats from the south shore and southeast shore to access the main lake.



Starry Stonewort

Starry stonewort should continue to be monitored. Annual point intercept surveys can help determine the overall distribution in the lake. Aquatic Biologists recommends sub-point intercept surveys if and when starry stonewort is identified in an area. The sub-point intercept survey is a point intercept survey with closer survey points. This survey will help determine the spread and density within a given area. The sub-point intercept surveys can be repeated like the whole lake point intercept surveys to determine any changes in the population of the species.