Comprehensive Lake Management Plan

Little Rice Lake

Forest County

September 2019

COMPREHENSIVE LAKE MANAGEMENT PLAN
LITTLE RICE LAKE

SEPTEMBER 2019

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Forest County

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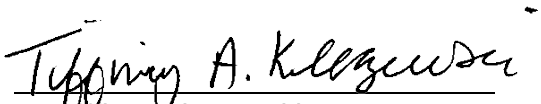

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1.0 Executive Summary

Little Rice Lake is a flowage created by a dam on the Upper Wolf River located in Forest County WI approximately 6 miles west of Crandon. The lake is 1219 acres in size with a maximum depth of 10 feet. The historical fish population has included northern pike, largemouth bass, black crappie, yellow perch, rock bass, bluegill, bullhead and white sucker. Recent severe winter fish kills have greatly reduced fish populations. The main uses of the lake include fishing, waterfowl hunting, canoeing/kayaking, recreational boating and ice fishing.

The residents on Little Rice Lake wanted to improve the health of the lake and the fishery. In 2016, the residents contacted Forest County to sponsor a WDNR (Wisconsin Department of Natural Resources) Lake Planning Grant. The grant was awarded in February 2017. A lake association was formed after the grant was awarded and has been the main participant in this project; Little Rice Lake Association (the Association) is referenced as such in this plan.

There are two main problems that will be addressed through this grant project. Extensive aquatic vegetation along the eastern and western shores of the lake that impede navigation and winter fish kills due to low oxygen levels. The private residence along Flowage Lane on the east side and along Yocum Road on the west side have limited to no access to the lake due to thick aquatic vegetation. The aquatic plant survey will be used to document plant species and density across the entire lake and in the problem areas. Additional mapping will be used to document the extent of the emergent and floating leaf beds of vegetation. The Shoreland Assessment will also be used to document vegetation in the near shore area. Appropriate management methods will be considered and a recommendation will be made to facilitate access in these areas.

Flambeau Engineering was contracted to write the grant and complete the project. The field work was completed in 2017 and the management plan completed in May 2019. The thick vegetation was affirmed throughout the north half of the lake and in the bays on the south half. Low dissolved oxygen levels were recorded during winter 2018/19.

RECOMMENDED MANAGEMENT PLAN

The following Active Goals form the structure of the Little Rice Lake Comprehensive Lake Management (CLM) Plan:

Active Goal: Manage aquatic plants to allow for access to open water.

Active Goal: Improve fishery by reducing/eliminating winter kill and improve habitat.

Active Goal: Protect fish and wildlife habitat.

2.0 Introduction

There are two main problems that will be addressed through this grant project; extensive aquatic vegetation along the eastern and western shores of the lake that impede navigation and winter fish kills due to low oxygen levels. The private residence along Flowage Lane on the east side and along Yocum Road on the west side have limited to no access to the lake due to thick aquatic vegetation. The aquatic plant survey will be used to document plant species and density across the entire lake and in the problem areas. Additional mapping will be used to document the extent of the emergent and floating leaf beds of vegetation. The Shoreland Assessment will also be used to document vegetation in the near shore area. Appropriate management methods will be considered and a recommendation will be made to facilitate access in these areas.

This document is the Comprehensive Lake Management (CLM) Plan for Little Rice Lake and discusses the following:

- Data collected on the lake including water quality, aquatic plant species, coverage and density and state of the fishery
- Stakeholder's goals and objectives
- Aquatic plant ecology
- 2017 aquatic plant survey
- Feasible aquatic plant management alternatives
- Selected suite of aquatic plant management options

Three public meetings were held to discuss the CLM Plan. The first was held on June 10, 2017 to kickoff the project and explain to the attendees the purpose of the project. Second, on August 3, 2018 to update the Association on the data that had been collected and last on June 1, 2019 to present the plan. A component of each presentation was AIS education. Attendees were given a refresher on both plant and animal AIS identification and impacts to lake resources.

The Association sought matching funds (66% State and 33% Association shares) from the Wisconsin Department of Natural Resources (DNR) Large Scale Lake Planning Grant program to collect data on the lake and write a Comprehensive Lake Management (CLM) Plan.

3.0 Baseline Information

3.1 Lake History and Morphology

Little Rice Lake is a flowage created by a dam on the Upper Wolf River located in Forest County WI approximately 6 miles west of Crandon. The lake is 1219 acres in size with a maximum depth of 10 feet. The historical fish population has included northern pike, largemouth bass, black crappie, yellow perch, rock bass, bluegill, bullhead and white sucker. Little Rice Lake has an extensive history of fish kills dating back to the 1940's. The most recent winter fish kills occurred in 2012/13, 2013/14 and again in 2018/19. These recent winter fish kills have reduced the fish population in the lake. The main uses of the lake include fishing, waterfowl hunting, canoeing/kayaking, recreational boating and ice fishing.

Historical human use of the area began with the Chippewa Indian harvest of wild rice on the lake, which at that time was a rice bed on the Wolf River. Many log drives in the late 1800s began at the lake. Two logging dams were operated on the Wolf River; one located about 2 miles north of the lake and the other was just below Little Rice Lake. The dam below the lake was rebuilt in 1910, parts of this dam remained until 1935 when the Town of Crandon and Forest County received approval from Works of Progress Administration to construct the dam at its present location. In 1952 the WI Conservation Department, now the Wisconsin Department of Natural Resources, agreed to purchase the dam and surrounding lands from the Town of Crandon and develop the Little Rice Wildlife Area. The Wisconsin Department of Natural Resources (DNR) owns and operates the dam and holds flowage easement rights to the 94' contour level identified in the original dam permit. The DNR manages the dam and the 1,200 acre flowage for a variety of public benefits including: hunting, fishing, trapping, outdoor recreation and to protect and enhance wildlife habitat for a variety of species. The current Little Rice Wildlife Area is located on the north end of the lake and provides access to the lake. Two boat landings, an access road and a picnic area were developed along with the wildlife area. Access locations and wildlife area are shown on the maps in the Figures Section. The south portion of the lake is in private ownership and consists of typical lake lots with a mix of seasonal cabins and year round homes.

Little Rice Lake is listed in state administrative code as an Outstanding Resource Water due to the abundant wild rice in the lake. This is the only species listed in the Natural Heritage Inventory that may be affected by the project. The surrounding wildlife area provides habitat that many species of wildlife, waterfowl, birds and amphibians use, some of which may be endangered.

The following summarizes the lake's physical attributes:

Table 1 – Little Rice Lake Physical Attributes

Lake Name	Little Rice Lake
Lake Type	Flowage
Surface Area (acres)*	1219
Shoreline Length (miles)	11.04
Open Water (acres)**	626
Shoreline Length (miles)	9.7
Maximum depth (feet)	10
Public Landing	Yes

*Based on water surface DNR Surface Water Data Viewer
**Based on open water in Spring 2017 aerial photo; much of the surface area of the lake is covered with bogs and thick vegetation.

There is ample opportunity for public access on the lakes. There are two landings on the lake: on the south end of the lake at the dam on Wolf River Dam Lane, on the east side of the lake off of Flowage Lane. The Little Rice Wildlife Area is located on the north portion of the lake. This 1900-acre property includes shoreline on the north and east sides of the lake and islands in the lake. The lake offers the following recreational opportunities and extended benefits for visitors and the local community:

- Recreational, pontoon boating
- Fishing, wildlife viewing
- Non-motorized watercraft use (canoeing/kayaking)
- Aesthetic beauty
- Important habitat for fish and wildlife
- Swimming
- Snowmobiling
- Cross country skiing/snowshoeing
- Revenue for local and surrounding communities including real estate taxes and tourism dollars

3.2 Water Quality

The following data was used in creating the Little Rice Lake CLM Plan. DNR Lake Water Quality Database indicates that the following water quality information is available:

- Water clarity (Secchi depth)
- Total phosphorus
- Chlorophyll a

These parameters are commonly used to determine water quality. Secchi depth is a measure of water clarity; higher Secchi depth indicates clearer water and deeper light penetration. Total phosphorus is a measure of nutrients available for plant growth. Chlorophyll a is a green pigment present in all plant life and necessary for photosynthesis; the amount present in lake water depends on the amount of algae suspended in the water column of a lake, higher chlorophyll a values indicate lower water quality.

The above parameters are used to evaluate the trophic status of a lake. The trophic status index (TSI) ranges along a scale from 0-100 and is based upon relationships between secchi depth and surface water concentrations of chlorophyll a, and total phosphorus. The higher the TSI the lower the water quality of the lake. The TSI of Little Rice Lake indicates mesotrophic conditions and good water quality.

In 2017 additional water quality parameters were evaluated including magnesium, calcium, total kjeldahl nitrogen, nitrate+nitrite, color, conductivity and dissolved oxygen. All of the water quality parameters mentioned above are further discussed in subsequent sections of this report.

3.3 Summary of Lake Fishery

Little Rice Lake is regularly fished by riparians and local residents; it was the number one activity on the lake based on the Lake User Survey. The lake supports a warm water fishery of northern pike, largemouth bass, perch, bluegill, black crappie, black bullhead and white sucker. The lake has a history of low oxygen during the winter months that has led to extensive fish kills. The latest fish kill was the winter of 2018/19 and a near 95% fish kill occurred in winter 2013/14. There was a one-time transfer of fish from Pine Lake to Little Rice Lake to boost the fish population following a winter kill. The following table lists the number of each species that was transferred in May 2016.

Table 2 - Fish Transfer from Pine Lake to Little Rice Lake May 2016

Species	Number	Size (in)
Bluegill	1381	5.0-7.4
Pumpkinseed	574	5.5-7.4
Black Crappie	35	7-10
Yellow Perch	7	6.5-10
Northern Pike	34	14-22

There is also a history of stocking of largemouth bass. The following table lists the stocking.

Table 3 - Largemouth Bass Stocking Little Rice Lake

Year	Number	Average Length (in)
1993	12,000	1.9
1991	12,190	3.00
1990	551	10.5
1982	24,000	3.00

Since there is a problem with depleted oxygen and winter fish kills, no further stocking of the lake will be supported by WDNR. If steps are taken to improve the conditions of the lake, such as installation of an aeration system to keep oxygen levels higher in the winter months, WDNR would reconsider stocking. Further discussion of the fishery is included in following sections.

3.4 Goals and Objectives

The objective of this project is to write a Comprehensive Lake Management Plan and to collect data to determine the health of the lake, investigate management options for nuisance aquatic vegetation and improve the fishery. There are several problems in the lake that the Association would like to address; increased aquatic plant growth that inhibits navigation and degraded fishery due to winterkill.

The Association identified the following goals for aquatic plant management on Little Rice Lake.

Active Goal: Manage aquatic plants to allow for access to open water

Active Goal: Improve fishery by reducing/eliminating winter kill and improve habitat

Active Goal: Protect fish and wildlife habitat.

4.0 Project Methods

Offsite and onsite research methods were used during this study. Offsite methods included a thorough review of available background information on the lake, its watershed, and water quality. An aquatic plant community survey, shoreland survey and water sample collection was completed onsite to provide the data needed to evaluate aquatic plant management alternatives and health of the lake.

4.1 Aquatic Plant Survey and Analysis

The aquatic plant community of the lake was surveyed on September 9, 2017 by Flambeau Engineering with assistance from the Association. The survey was completed according to the point intercept sampling method described by Madsen (1999) and as outlined in the DNR draft guidance entitled "Aquatic Plant Management in Wisconsin" (DNR, 2005). DNR research staff determined the sampling point resolution in accordance with the DNR guidance and provided a base map with the specified sample point locations. The map showing these points is included in the Appendix A. Latitude and longitude coordinates and sample identifications were assigned to each intercept point on the grid. Geographic coordinates were uploaded into a global positioning system (GPS) receiver. The GPS unit was then used to navigate to intercept points. At intercept points plants were collected by a specialized rake on a pole. The rake was lowered to the bottom and twisted to collect the plants. All collected plants were identified to the lowest practicable taxonomic level (e.g., typically genus and species) and recorded on field data sheets. Visual observations of aquatic plants were also recorded. Water depth and, when detectable, sediment types at each intercept point were also recorded on field data sheets.

The point intercept method was used to evaluate the existing emergent, submersed, floating-leaf, and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the DNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

- Taxonomic richness (the total number of taxa detected)
- Maximum depth of plant growth
- Community frequency of occurrence (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- Mean intercept point taxonomic richness (the average number of taxa per intercept point)
- Mean intercept point native taxonomic richness (the average number of native taxa per intercept point)
- Taxonomic frequency of occurrence within vegetated areas (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)
- Taxonomic frequency of occurrence at sites within the photic zone (the number of intercept points where a particular taxon (e.g., genus, species, etc.)

was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)

- Relative taxonomic frequency of occurrence (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)
- Mean density (the sum of the density values for a particular species divided by the number of sampling sites)
- Simpson Diversity Index (SDI) is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. SDI = 1-(Σ(Relative Frequency^2) Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.
- Floristic Quality Index (FQI) (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species.
  FQI = mean C * sqrt N
  C= coefficient of conservatism
  N= number of native species
  This formula combines the conservatism of the species present with a measure of the species richness of the site.

The collected data was used to create a series of maps of the aquatic vegetation. The maps include vegetation density, water depth, sediment type, and a map for each plant species.

4.2 Shoreland Assessment

DNR recommends an assessment of the fish and wildlife habitat including a characterization of shoreline habitat as part of the lake management plan if lake management recommendations are to be funded by a DNR Surface Water Grant. This assessment documents the current condition and level of development on each property on the lakeshore. It also collects data on the near shore area in the lake such as aquatic plant growth and location of all coarse woody habitat. DNR has prepared a draft "Lake Shoreland and Shallow Habitat Monitoring Field Protocol, May 27, 2016". This document outlines the procedure for surveying, assessing and mapping the habitat in the lakeshore area including the riparian buffer, bank and littoral zones. It was used to complete the assessment on the lake.

The Coarse Woody Habitat Survey was completed in spring 2017 when visibility on the lake was the best. All woody habitat meeting the criteria was documented using GPS and the DNR forms. The shoreland assessment took place in August 2017 when the shoreland vegetation was growing. Maps were prepared using the County GIS website

showing each, individual parcel along with its boundaries. Navigation to each individual parcel was aided using an app on a GPS enabled iPad; this was used to take georeferenced photos and record data to a spreadsheet.

4.3 Lake User Survey

A survey was written and provided to lake users to assess views and ideas on aquatic plant management, water quality, lake use, fishery and shoreland condition. Several examples of surveys were provided to the Association; they then chose the questions that were relevant to Little Rice Lake. They prepared a draft survey that was reviewed by DNR. The approved survey was mailed to land owners and lake users and returned to the Association to be tallied. The mailing list was created form the groups solicitation of "concerned citizens of Little Rice Lake". The results were used to guide the recommendations and future projects. Details and results of the survey are discussed later in this report.

5.0 Discussion of Project Results

5.1 Aquatic Plant Ecology

Aquatic plants are vital to the health of a water body. Unfortunately, people all too often refer to rooted aquatic plants as "weeds" and ultimately wish to eradicate them. This type of attitude, and the misconceptions it breeds, must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants (macrophytes) are extremely important for the well-being of a lake community and possess many positive attributes. Despite their importance, aquatic macrophytes sometimes grow to nuisance levels that hamper recreational activities.

When "managing" aquatic plants, it is important to maintain a well-balanced, stable, and diverse aquatic plant community that contains high percentages of desirable native species. To be effective, aquatic plant management in most lakes must maintain a plant community that is robust, species rich, and diverse. Appendix C includes a discussion about aquatic plant ecology, habitat types and relationships with water quality.

5.2 Aquatic Invasive Species

Aquatic Invasive Species (AIS) are aquatic plants and animals that have been introduced by human action to a location, area, or region where they did not previously exist. 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 a decline of a lake's ecology and interfere with recreational use of a lake. Common Wisconsin AIS include:

- Eurasian Watermilfoil
- Curly-leaf Pondweed
- Zebra Mussels
- Rusty Crayfish
- Spiny Water Flea
- Purple Loosestrife
- Phragmites
- Banded and Chinese Mystery Snails

The only AIS listed for Little Rice Lake is the Chinese Mystery Snail. The following link on the DNR website has detailed information on AIS in Wisconsin http://dnr.wi.gov/lakes/invasives/BySpecies.aspx. Appendix C2 provides additional information on these AIS.

5.3 2017 Aquatic Plant Survey

The full vegetation survey was completed on September 9, 2017. A total of 189 points of 820 were surveyed and vegetation was documented at 95 of these points. The remaining points were deeper than vegetation grows on this lake or the vegetation was too thick to enter (north end and bays). The aquatic macrophyte community of the lake included submersed, floating-leaf and emergent communities.

The following data represents the conditions of the aquatic plant community at the time of the survey conducted in 2017. The following table lists the taxa identified during the 2017 aquatic plant survey.

Table 4 – Little Rice Lake Taxa Identified in 2017 Aquatic Plant Survey

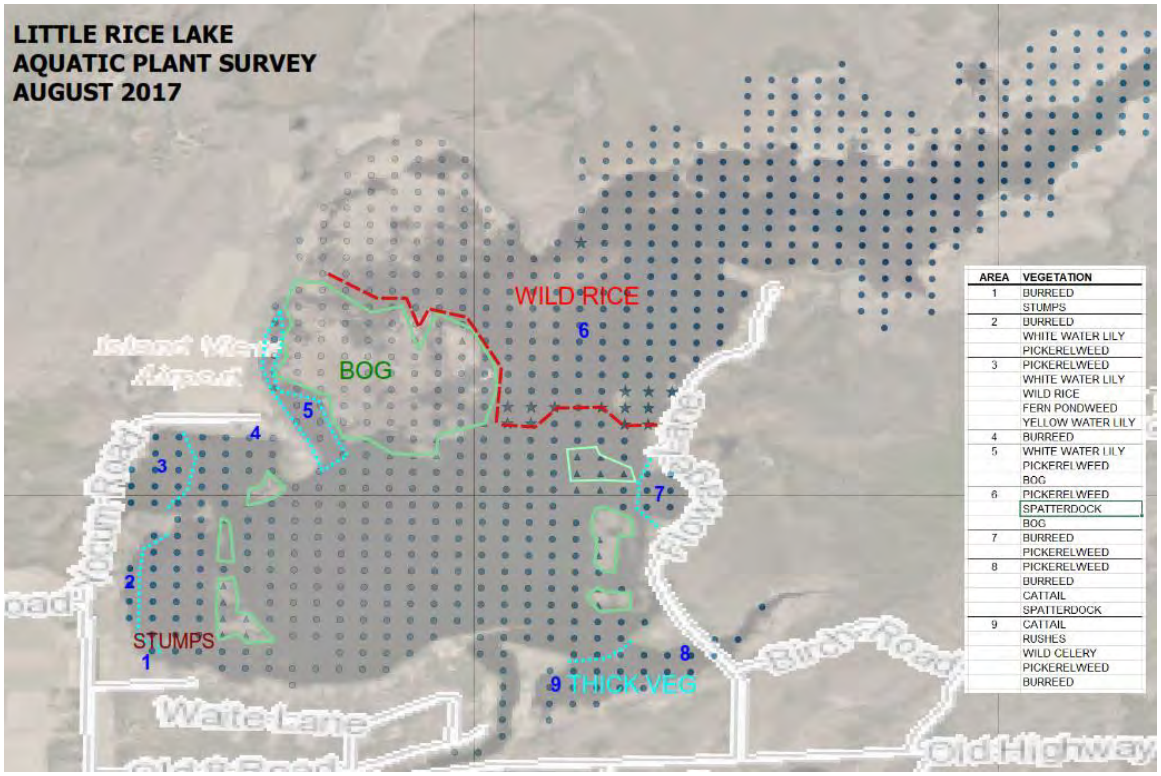
Plant Species	Frequency of Occurrence*	Relative Frequency of Occurrence**	No. Sites	Rake Fullness	No. of Visual Sitings
Bidens beckii (formerly *Megalodonta*), Water marigold	19	11	18	1	
Ceratophyllum demersum, Coontail	1	6	1	1	
Ceratophyllum echinatum, Spiny hornwort	1	6	1	1	
Chara sp., Muskgrasses	6.3	3.6	6	1	
Elodea canadensis, Common waterweed	12.6	7.2	12	1.08	
Lemna trisulca, Forked duckweed	2.1	1.2	2	1	
Myriophyllum heterophyllum, Various-leaved water-milfoil	3.16	1.8	3	1	
Myriophyllum sibiricum, Northern water-milfoil	15.8	9	15	1	
Najas flexilis, Slender naiad	5.3	3	5	1	
Nitella sp., Nitella	4.2	2.4	4	1	
Nuphar variegata, Spatterdock					3
Nymphaea odorata, White water lily	1	0.6	1	1	1
Potamogeton amplifolius, Large-leaf pondweed	1	0.6	1	1	
Potamogeton nodosus, Long-leaf pondweed	1	0.6	1	1	
Potamogeton praelongus, White-stem pondweed	3.2	1.8	3	1	
Potamogeton pusillus, Small pondweed	2.1	1.2	2	2	
Potamogeton robbinsii, Fern pondweed	3.2	1.8	3	1.3	
Sagittaria latifolia, Common arrowhead	1	0.6	1	1	
Schoenoplectus subterminalis, Water bulrush	2.1	1.2	2	1.5	
Sparganium sp., Bur-reed	9.5	5.4	9	1	1
Utricularia vulgaris, Common bladderwort	4.2	2.4	4	1	
Vallisneria americana, Wild celery	72.6	41.6	69	1.1	
Zizania palustris, Northern wild rice	3.2	1.8	3	1	
Aquatic moss	11.6		11	1	

*Frequency of Occurrence within vegetated areas.
**Relative Frequency of Occurrence at sites shallower than max depth of plants.

The most abundant aquatic plant identified during the aquatic plant survey based on the point intercept survey was wild celery, followed by water marigold and northern water-milfoil. These three species were the most dominant in the lake based on the point intercept survey but a large area of the lake could not be surveyed due to thick vegetation. The northern half of the lake is non-navigable with a motor boat due to wild rice and bogs. There are several bays in the south half of the lake that were non-

navigable due to a thick cover of floating leaf aquatic plants. The following map indicates the areas of wild rice and thick vegetation.

Figure 1 - Little Rice Lake Thick Vegetation



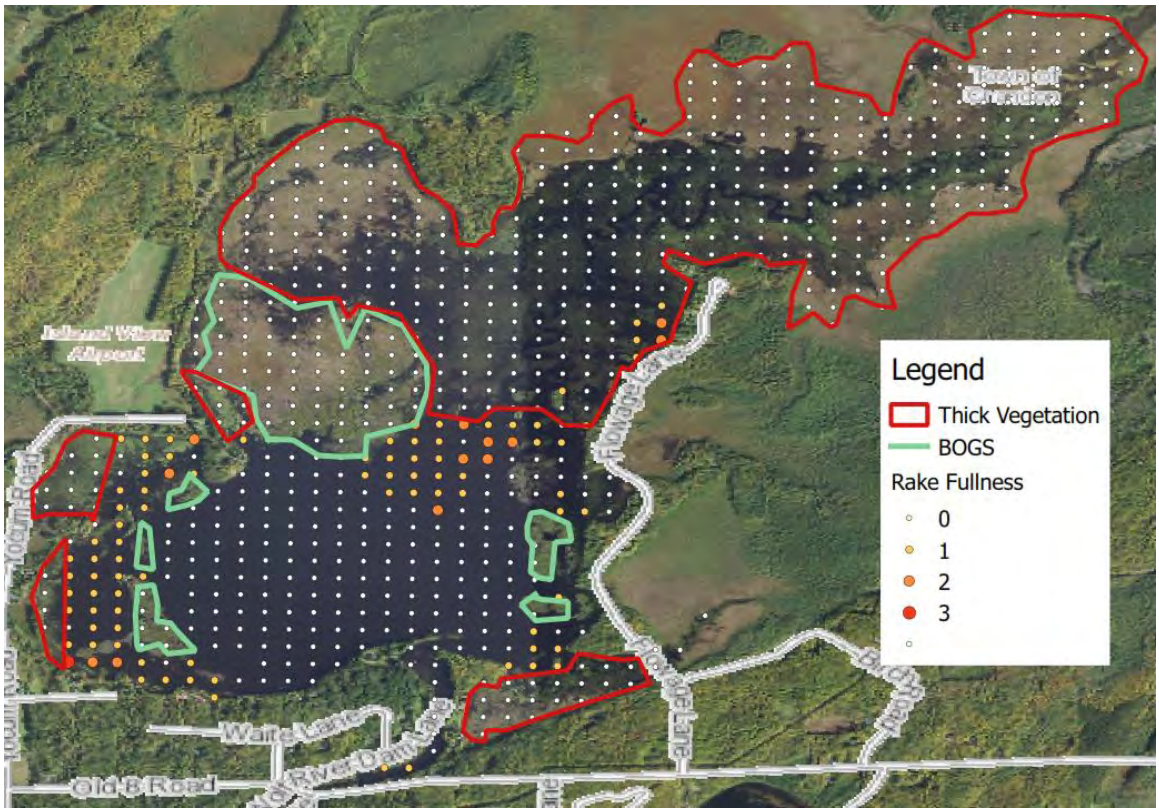
Vegetation was identified to a maximum depth of 7 feet (photic zone). Aquatic vegetation was detected at 60.5% of photic zone intercept points. A diverse plant community inhabited the lake during 2017. The Simpson Diversity Index value of the community was 0.79, taxonomic richness was 23 species (including visuals), and there was an average of 1.06 species identified at points that were within the photic zone. There was an average of 1.75 species present at points with vegetation present. The following table summarizes these overall aquatic plant community statistics.

Table 5 – Little Rice Lake - Summary of Aquatic Plant Survey Statistics

Statistic	Total
Total number of points sampled	189
Total number of sites with vegetation	95
Total number of sites shallower than maximum depth of plants	157
Frequency of occurrence at sites shallower than maximum depth of plants	60.51
Simpson Diversity Index	0.79
Maximum depth of plants (ft)	7
Average number of all species per site (shallower than max depth)	1.06
Average number of all species per site (veg. sites only)	1.75
Species Richness	22
Species Richness (including visuals)	23

The following figure show the coverage and density of vegetation found during the 2017 survey.

Figure 2 - Aquatic Plant Coverage and Density 2017



The RED symbol indicates high density vegetation (3 rake fullness), ORANGE - medium density (2 rake fullness) and YELLOW - low density (1 rake fullness). The areas outlined in red have very thick vegetation and were non-navigable.

5.3.1 Floating-Leaf Plants

The following floating-leaf aquatic plant species were identified during the 2017 aquatic plant survey.

- *Nuphar variegata* (spatterdock)
- *Nymphaea odorata* (white water lily)
- Lemna trisulca, Forked duckweed
- Vallisneria americana, Wild celery

5.3.2 Submersed Plants

The following submersed aquatic plant species were identified during the 2017 aquatic plant survey.

- Bidens beckii, Water marigold
- Ceratophyllum demersum, Coontail
- Chara sp., Muskgrass
- Elodea canadensis, Common waterweed
- Myriophyllum heterophyllum, Various-leaved water-milfoil
- Myriophyllum sibiricum, Northern water-milfoil
- Najas flexilis, Slender naiad
- Nitella sp., Nitella
- Potamogeton amplifolius, Large-leaf pondweed
- Potamogeton nodosus, Long-leaf pondweed
- Potamogeton praelongus, White-stem pondweed
- Potamogeton pusillus, Small pondweed
- Potamogeton robbinsii, Fern pondweed
- Utricularia vulgaris, Common bladderwort
- Aquatic moss

5.3.3 Emergent Plants

The following emergent plants were found in the 2017 surveys.

- Sagittaria latifolia, Common arrowhead
- Schoenoplectus subterminalis, Water bulrush
- Sparganium sp., Bur-reed
- Zizania sp., Wild rice

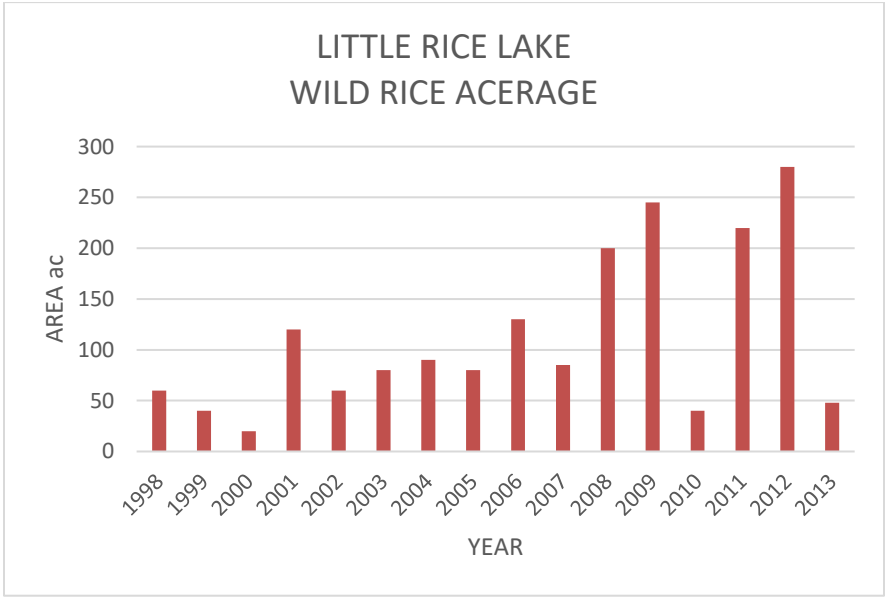
5.3.4 Wild Rice

Wild rice is well established in Little Rice Lake, is native to the Wolf River system and was present before the lake was created by the series of dams that were constructed over the last 100+ years. There are historic records of Native American use of this area for collecting wild rice. Wild rice is very beneficial to the lake ecosystem but can cause navigation problems. The following photo was taken from the GLIFWC (Great Lakes Indians Fish and Wildlife Commission) website that show the wild rice beds on the north end of Little Rice Lake in 2018 (Flowage Lane on right).

Figure 3 - Wild Rice Coverage 2018

The coverage of wild rice fluctuates over the years. The following figure indicates the coverage of wild rice each year as calculated by GLIFWC.

Figure 4 – Acreage of Wild Rice



The wild rice coverage in Little Rice Lake fluctuates over the years but appears to be trending up based on the above graph. The habitat in the north half of the lake is optimal for wild rice growth. Wild rice prefers flowing water as is present along the river channel; water depth of 0.5 to 3 feet (optimal 1-2 feet); clear water is preferred but in stained water depths of 1-2 feet provide adequate light penetration. Wild rice prefers slightly fluctuating water levels; stable during the growing season then slightly receding. Too much stability can hamper rice growth; in a dammed system the stable water level over many years may allow perennial plants to outcompete the rice. Several inches of organic muck is the preferred substrate but rice is tolerant of sand and gravel.

The following text discusses the importance of wild rice. This excerpt is taken from DNR website (http://dnr.wi.gov/topic/outdoorrecreation/activities/rice.html)

Though recognized as a prized food source for Native Americans, both historically and today, few people are aware of the importance of wild rice to many of Wisconsin's wildlife species. Capable of producing over 500 pounds of seed per acre, wild rice provides a nutrient-rich food source, offers refuge from predators and increases the overall vegetation structure on the landscape, in turn enhancing biodiversity.

Wild rice is most-often known for its importance to fall-migrating waterfowl. Mallard, blue-winged teal, ring-necked duck and wood duck consume wild rice, as do many other waterfowl species. In fact, a study conducted in wild rice country found the plant to be the most important food source for mallards during fall migration. In addition to a food source, wild rice provides several species of breeding ducks, Canada geese and trumpeter swans with a place to roost and loaf, and offers brood cover for their young. Because wild rice tends to occur in areas of gently flowing water, spring melt tends to expose these areas first, and the rice seed bank and associated invertebrate populations serve as a valuable food source for waterfowl during spring migration.

Common loons, red-necked grebes and muskrats commonly use wild rice for nesting materials. Muskrats forage heavily on the green shoots of wild rice during the spring. The presence of muskrats enhance the use of rice beds by some waterfowl species due to the small openings created amid dense cover. Additionally, muskrat houses are used as nesting sites by trumpeter swans and Canada geese, as perching sites for herons and eagles, and as sunning areas for turtles. Other species that forage on wild rice include beaver, white-tailed deer and moose.

A rich community of insects—both terrestrial and aquatic—is found among wild rice, providing a bountiful food source for blackbirds, bobolinks, rails and wrens. Wild rice is also a source of food for amphibian and fish populations, which in turn attract loons, herons and mink.

Wild rice beds exist as places of high biological diversity with numerous benefits that extend throughout the food chain. Protecting important areas where wild rice thrives will help ensure the persistence of many of Wisconsin's wildlife for all to enjoy.

5.4 Floristic Quality Index

Floristic Quality is a measure of biological integrity and relative disturbance; higher FQI numbers indicate higher floristic quality and biological integrity and a lower level of disturbance impacts. FQI varies around the state of Wisconsin and ranges from 3.0 to 44.6 with the average FQI of 22.2 (DNR, 2005). The FQI calculated from the 2017 aquatic plant survey data was 30.3.

This FQI value is higher than Wisconsin's northern region mean of 24.3 and suggests that Little Rice Lake has a lower level of disturbance when using aquatic plants as an indicator. The following plants observed in Little Rice Lake have a high FQI rating (C value >=7): water marigold, muskgrass, various-leaved watermilfoil, nitella, large-leaf pondweed, white-stem pondweed, small pondweed, fern pondweed, water bulrush, common bladderwort, wild rice.

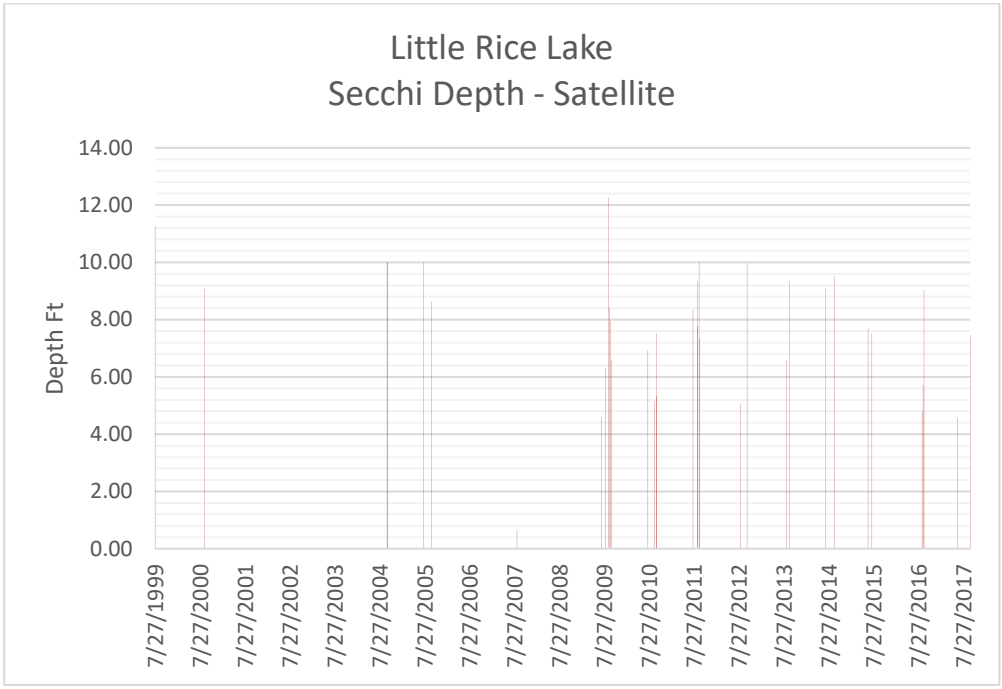
5.5 Water Quality

The water quality of the lake indicates mesotrophic conditions with moderate nutrient levels, water clarity, productivity of aquatic plants and fish populations. A comparison to data collected in 2000 indicates stable water quality with little change in the water quality parameters. There is limited water quality data for Little Rice Lake; what is available is discussed below.

5.5.1 Water Clarity

Water clarity based on secchi disk readings is available from 2000 and 2014. In August 2000 the depth was 3.3 ft and in August 2014 it was 7 feet. There is more data available from the satellite data on predicted secchi disk depth; data from 1999 to 2017 is available. The average based on this information is 7.7 feet and ranges from 0.67 to 12.25 feet indicating fair water clarity and mesotrophic conditions. The Northeast Wisconsin average Secchi Disk reading in 2004 was 7.4 feet (WI Citizen Lake Monitoring Training Manual).

Figure 5 - Little Rice Lake - Secchi Depth



Based on the graph above, the water clarity has remained relatively stable and is not trending up or down.

5.5.2 Total Phosphorus and Chlorophyll *a*

Total phosphorous (TP) and chlorophyll a are parameters that are frequently used to determine water quality in lakes. Following is an explanation of each.

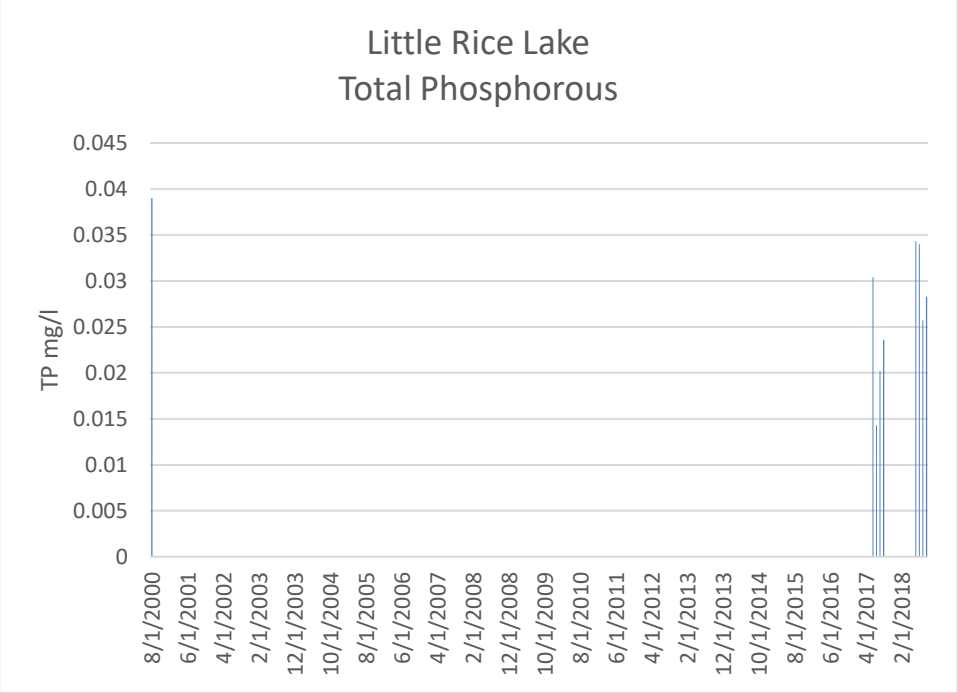
Total Phosphorus (TP) - a measure of nutrients available for plant growth; high concentrations can promote excessive plant growth. In more than 80% of Wisconsin lakes phosphorous is the key nutrient affecting the amount of algae and plant growth. Phosphorous comes from a variety of sources, many of which are human related and include animal and human waste, soil erosion, detergents, septic systems and runoff from agricultural land and lawns. On lakes with high development in the near shore area fertilization of lawns and failing septic systems can contribute high amounts of phosphorous to the water.

Chlorophyll a - is green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae suspended in the water column of a lake. Chlorophyll a is used as a common indicator of water quality; higher chlorophyll a values indicate lower water quality.

Following is a discussion of the total phosphorous and chlorophyll a concentrations in the lake over the years of data. Little Rice Lake has an average phosphorus reading of 0.0278

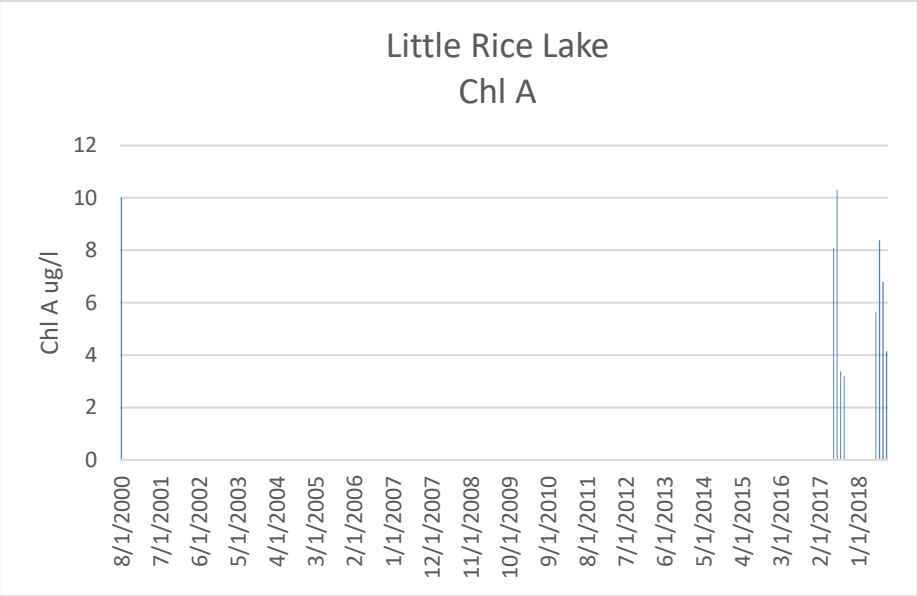
mg/l. The total phosphorus has varied from 0.014 mg/l to 0.039 mg/l indicating good water quality and mesotrophic conditions. The following graphs illustrate the historical phosphorus measurements on the lake.

Figure 6 - Little Rice Lake – Total Phosphorous



The chlorophyll *a* concentration in Little Rice Lake has an average of 6.66 ug/l indicating good water quality and mesotrophic conditions; data ranged from 10.3 ug/l to 3.19 ug/l. The average for Northern WI lakes is 13 ug/l, values over 30 ug/l indicate very poor water quality. The following graphs show the Chlorophyll a concentrations for Little Rice Lake.

Figure 7 - Little Rice Lake– Chlorophyll a



5.5.3 Additional Water Quality Parameters

Additional water quality parameters were measured to compare to data collected in 2000. Magnesium, calcium, total kjeldahl nitrogen (TKN), nitrate + nitrite, color and conductivity were measured in 2017. Following are the results of these parameters from 2000 and 2017.

Parameter	Aug 2000	Aug 2017	WI Average
Magnesium (mg/l)	4.4	4.48	8
Calcium (mg/l)	9	9.14	12
TKN (mg/l)	1.06	0.62	0.025 to 2.6
Nitrate + Nitrite (mg/l)	0.016	ND	0.32

The comparison of results indicated that the water quality hasn't changed significantly from 2000 to 2017. The results are below the Wisconsin average or in the range indicating the lake has better water quality than most lakes in Wisconsin.

There are several lakes in this area on the Wolf River; Pine Lake is located directly upstream of Little Rice and Upper Post Lake and Lower Post Lake are directly downstream. The following lists a comparison of water quality parameters for these lakes.

Table 6 – Comparison to Adjacent Wolf River Impoundments

Parameter	Unit	Little Rice	Pine	Upper Post	Lower Post
TP	mg/l	0.0278	0.0306	0.0407	0.0267
Secchi	ft	5.15	6.27	3.38	7.91
Chl A	ug/l	6.66	17.8	26.291	11.76
Nitrate + Nitrite	mg/l	0.016	0.043	0.032	0.049
TKN	mg/l	0.84	0.479	0.845	0.608
Conductivity	uhmos/cm	80	106.72	101.5	124
Color	su	100	15	65	60
Magnesium	mg/l	4.44	4.3	6.1	6.2
Calcium	mg/l	9.07	10.15	10.6	14.65

(Values are average of all samples in SWIMS database)

The data above indicates Little Rice Lake has better water quality than the adjacent lakes in the Wolf River system. The lower TP and Chl A indicate a lower potential for plant growth and algae blooms. The lower conductivity, magnesium and calcium are likely due to the low development on the lake; higher values of these parameters indicate higher dissolved solids which typically increase on highly developed lakes. Little Rice appears to have a deeper, stained color that the other lakes on the system; this is likely due to the wetlands around the lake and the substrate of the lake which is historic wetlands. All of the lakes listed, besides Little Rice, are very developed. Nearly every available lot on these lakes is developed with a cabin or home; many have a pier and boat lifts. Other than the developed shoreline, all the above lakes have similar watersheds consisting mainly of forest and wetlands. The relatively low development on Little Rice Lake may account for the better water quality.

5.5.4 Trophic State Index

Trophic State Index (TSI) values are assigned to a lake based on total phosphorus, chlorophyll *a*, and water clarity values. The TSI is a measure of a lake's biological productivity. The TSI used for Wisconsin lakes is described below.

Table 7 - TSI Description

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.	> 24	>7	<6.5
Little Rice Lake	53	Eutrophic	27.8	6.66	7.71

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et. al.

The lake is on the low end of being eutrophic which will likely result in decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only. Since this lake is shallow and most of the area of the lake is flooded wetland, it may have exhibited these characteristics since it was created and may not have progressed over time.

5.6 Lake History

A number of dams, at different locations and elevations, have been present on the Wolf River at Little Rice Lake since the late 1800's. These dams were built to facilitate log drives in the 1870's and 1880's; log drives ended in 1917. Part of the log dam remained until 1935 when a Works Progress Administration constructed a dam at the current location with a head of eight feet. The dam was completed in 1936 and flooded in 1938. The current dam has a structural height of 8 ft and hydraulic height of 5 ft. In 1952, the WI Conservation Department (DNR predecessor) purchased and developed the Little Rice Wildlife Area. The surface area of the lake appears to have changed over the years. The following photos shows the surface are of the lake in October 1938.

Figure 8 - Little Rice Lake October 1938

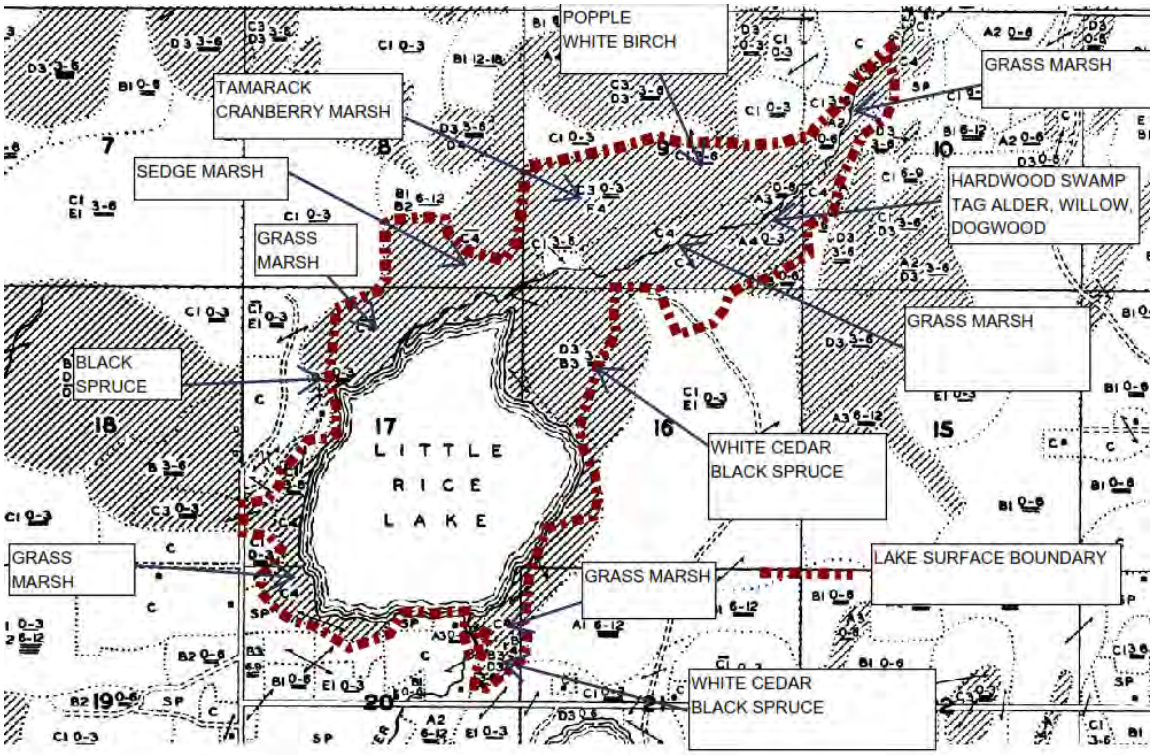
The following figure shows the surface are in 1938 and the current lake surface.

Figure 9 - 1938 Basin vs Current Lake Surface

The blue line above roughly outlines the lake basin in 1938; this is the current area of the lake that has limited plant growth, deeper water (6 – 10 ft) and no navigation problems due to plant growth. The current dam has a hydraulic head of 5 feet; meaning it holds back 5 ft

of water. Any area of the lake that has less than 5 feet of water was riparian land before the dam was constructed. The vast majority of the land that was flooded was wetland. The following map shows the land use prior to flooding of the area.

Figure 10 - Land Use of Lake Basin Prior to Flooding



The maroon line above outlines the lake surface. The majority of the flooded land was grassy marsh with stands of black spruce, tamarack, white cedar, tag alder, willow and dogwood. This substrate is rich in nutrients and this along with the shallow water in these areas promotes heavy plant growth.

5.7 Fishery

The fish population in Little Rice Lake is an area of concern for lake users. One of the top uses of the lake is for fishing; from a boat, shore and through the ice. Little Rice suffers from low oxygen during winter months and as a result winter fish kills. Oxygen levels were measured through the ice in March 2019. The following figure shows the locations of the measurements.

Figure 11 – Winter 2019 Dissolved Oxygen

A dissolved oxygen (DO) profile was taken at each point. The following table lists the oxygen and temperature at each point.

Table 8 - DO March 22, 2019

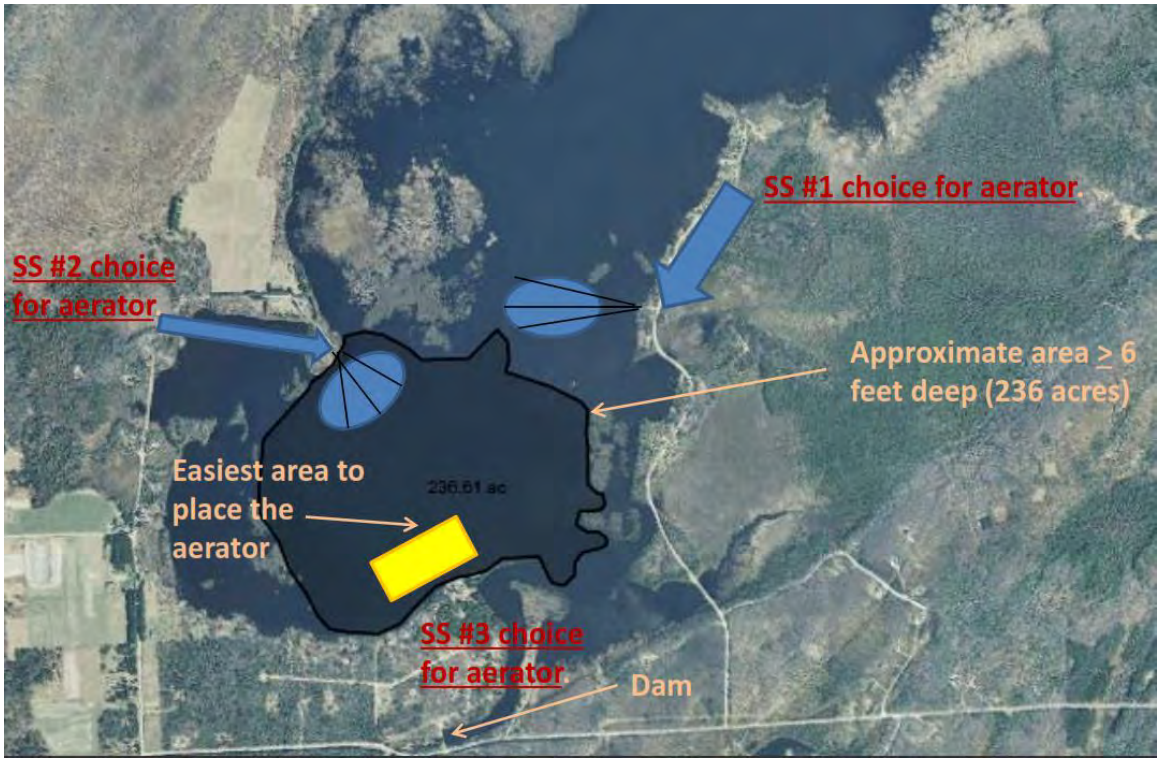
Site	Depth (ft)	DO (mg/l)	Temp ^{o} C	
961	2	1.07		
	3	1.02		
	4	0.44		
	5	0.23		
	6	0.18		
	7	0.17		
	7.5	bottom		
962	2	1.55		
	3	0.62		
	4	0.5		
	5	0.25		
	6	0.19		
	6.2	bottom		
963	2	2.87		
	3	1.92		
	4	1.74		
	5	0.52		
	6	0.23		
	6.5	bottom		
964	2	4.7		
channel	3	3.89		
	4	3.2	1.9	
	5	0.58	2.6	
	6	0.33	2.8	
	6.2	bottom		
965	2	3.05	0.7	
	3	1.35	0.9	
	4	0.33	1.2	
	5	0.17	1.6	
	6	0.14	2.1	
	6.1	bottom		
966	3	4.49	1.3	
channel	3.5	bottom		
967	1	7.31	0.7	culverts

This data indicates that the areas where there is adequate oxygen for fish is in the main channel or where flowing water is entering the lake. Bluegill, Largemouth Bass, White Perch, and Yellow Perch are considered warmwater fish and depend on dissolved oxygen

levels above 5 mg/L. They will avoid areas where DO levels are below 3 mg/L, but generally do not begin to suffer fatalities due to oxygen depletion until levels fall below 2 mg/L. The mean DO levels should remain near 5.5 mg/L for optimum growth and survival. The freshwater fish most tolerant to DO levels include fathead minnows and northern pike. Northern pike can survive at dissolved oxygen concentrations as low as 0.1 mg/L for several days, and at 1.5 mg/L for an infinite amount of time. Fathead minnows can survive at 1 mg/L for an extended period with only minimal effects on reproduction and growth. (https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/).

To improve the over winter oxygen conditions, aeration of the lake is recommended. There have been discussions in the past regarding installing an aeration system. The following figure shows the locations suggested by DNR for system placement.

Figure 12 – Suggested Aeration System Locations



The three main considerations for locating an aeration system are (from DNR guidelines):

1. In or near the deepest part of the lake – utilize warm bottom water to create large open water area
2. Centrally located – get good water circulation and easy for fish to migrate to
3. Near electricity – system runs on electricity; if not available, diesel and solar powered units are available.

Further discussions with Greg Matzke, DNR fish biologist, would be needed to discuss

logistics in choosing the location, details on design, installation, operation, permitting and funding. A lake implementation grant may be available to reimburse cost of materials and installation of the system.

To improve fish habitat, a project that could be pursued is installation of fish sticks. These are large trees that are installed along the shoreline to provide coarse woody habitat in the near shore area. There is some coarse woody debris in the lake but most of it has been in place for many years and has decomposed to the bole of the tree. A "new" tree with branches provides excellent habitat for fish and other wildlife in the lake. This activity requires a permit submitted by the shoreland land owner and is eligible for the healthy lake grant.

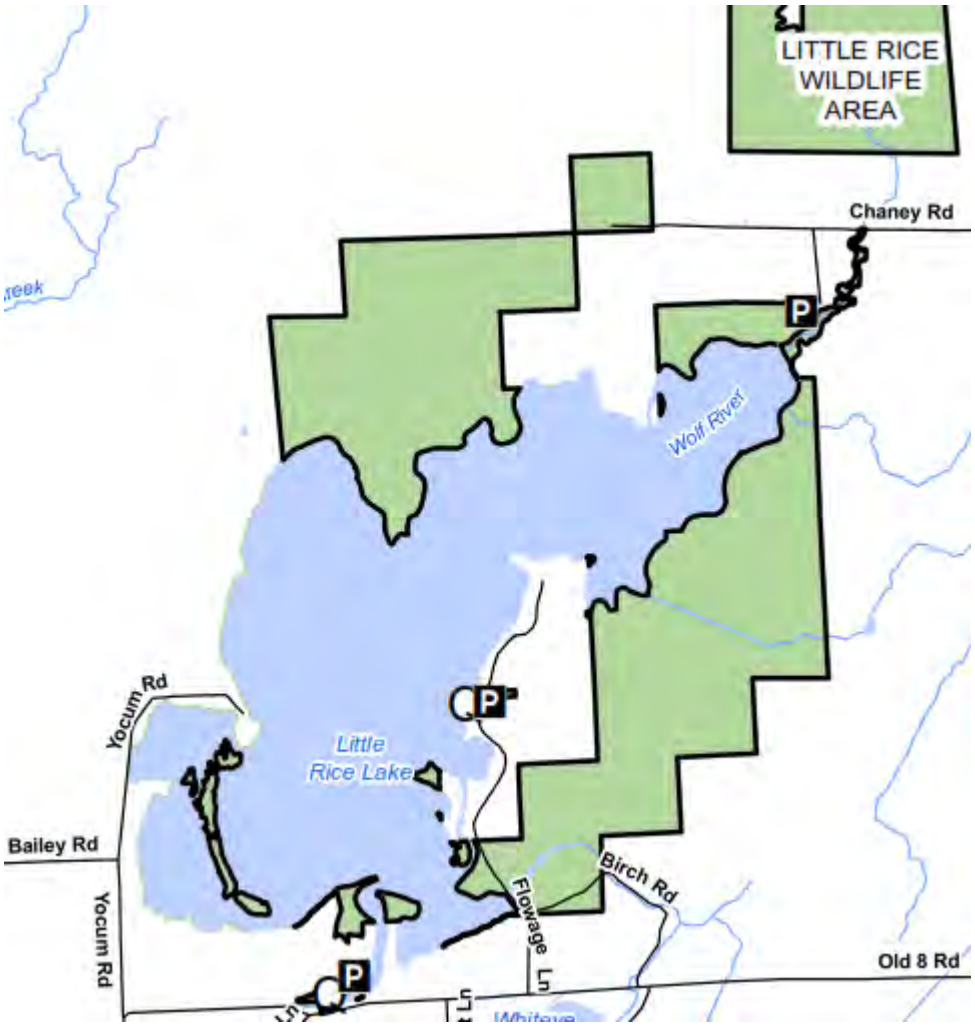
5.8 Shoreland Assessment

The coarse woody habitat portion of the shoreland survey was completed on June 7, 2017. A total of 140 pieces of wood meeting the criteria were mapped and rated in 6.4 miles of shoreline. All pieces of wood greater than 4 inches in diameter and 5 feet long located in 2 feet of water or shallower were recorded. Only 32 of the pieces of wood had branches; the vast majority has deteriorated to the point that only the bole of the tree is left. Although this deteriorated wood still provides habitat, trees with branches provide more diverse habitat. Wood was found at the following locations on the lake.

Figure 13 - Coarse Woody Habitat June 7, 2017

There are a total of 124 parcels along the shoreline of Little Rice Lake. Of these, 20 are owned by the State of Wisconsin and are part of the Little Rice Wildlife Area. The following map shows the public (state) land around the lake.

Figure 14 - Public Land on Little Rice Lake



The remaining parcels are privately owned. The development on the lake is relatively low compared to other lakes on the Wolf River system. The low development is likely a key component to the good water quality on the lake.

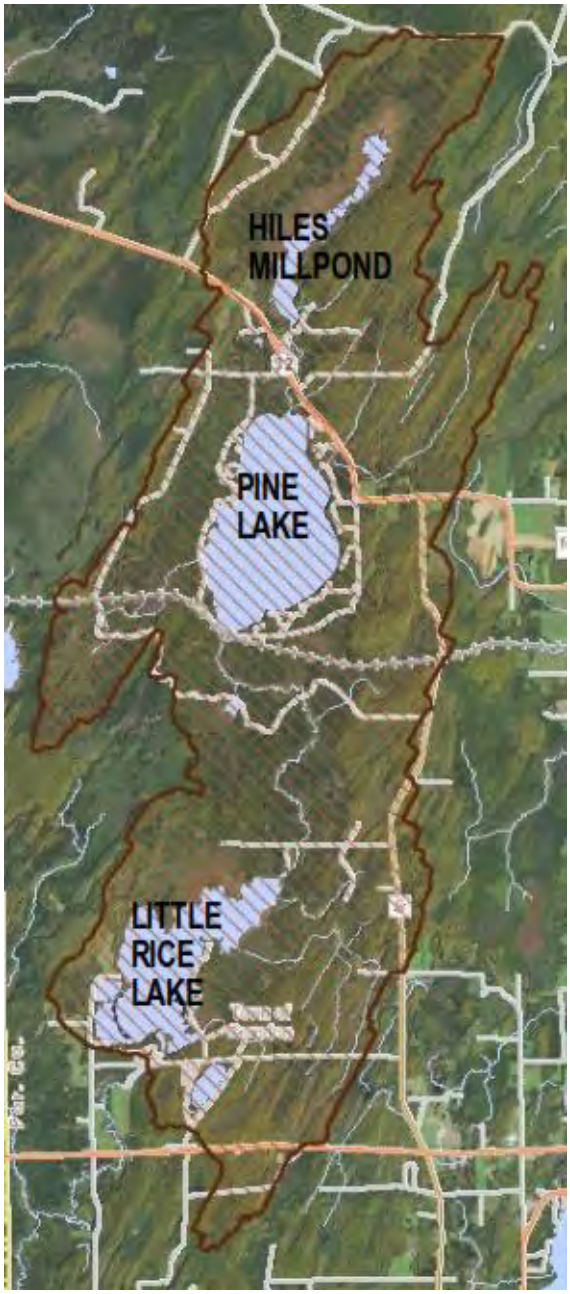
The privately owned parcels are in relatively good condition with good tree canopy, adequate herbaceous (grass) layer, few shoreline structures (boat houses, riprap, seawalls) and good near shore aquatic plants. All of the lots had either some tree canopy or a shrub/herb layer present; 96% of the lots had a shrub/herb layer. Only 15% of the lots had a mowed lawn that covered 40% or more of the shoreland area (within 35 ft of the ordinary high water mark). Very few buildings consisting of boat houses or sheds were noted in the shoreland;

only 11% of the lots had a building. Most of the developed lots contained a pier; 43% had a pier and a total of 50 boats were documented; only 10% had a boat lift. The nearshore vegetation was good with 85% of the shoreline having some type of floating leaf and/or emergent vegetation; the density varied greatly from a few plants to very thick, non-navigable vegetation. Data sheets of the shoreland assessment are included in Appendix I. A DVD with all parcel photos is included also.

5.9 Watershed

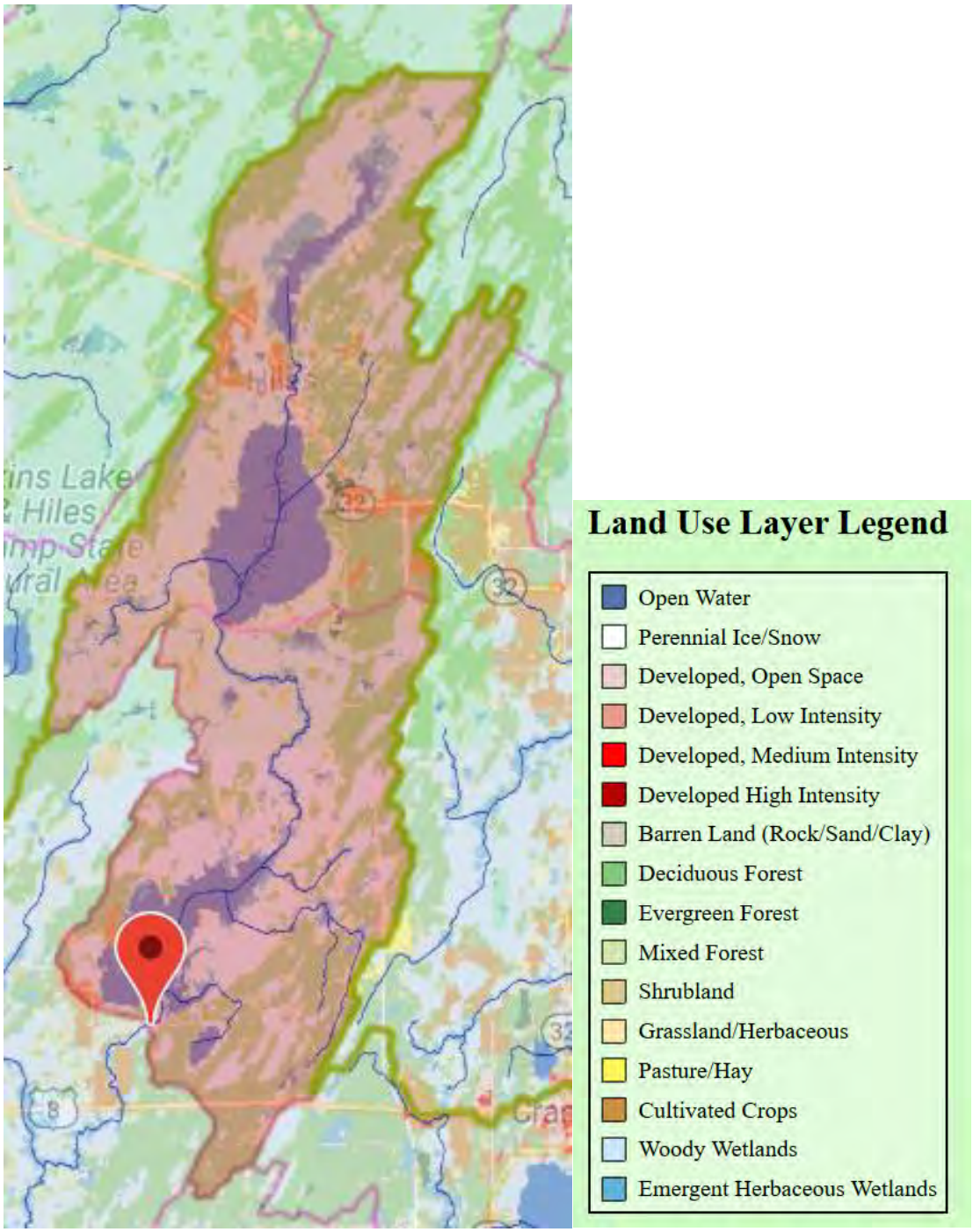
The watershed of Little Rice Lake is very large in comparison to the surface area of the lake. The watershed is 26,665 acres and the surface area of the lake is 1219 acres; only 4.5% of the watershed. The watershed includes Pine Lake, a highly developed, 1684 acre lake, and Hiles Millpond, both upstream of Little Rice Lake. The following figure shows the watershed of Little Rice Lake.

Figure 15 - Little Rice Lake Watershed



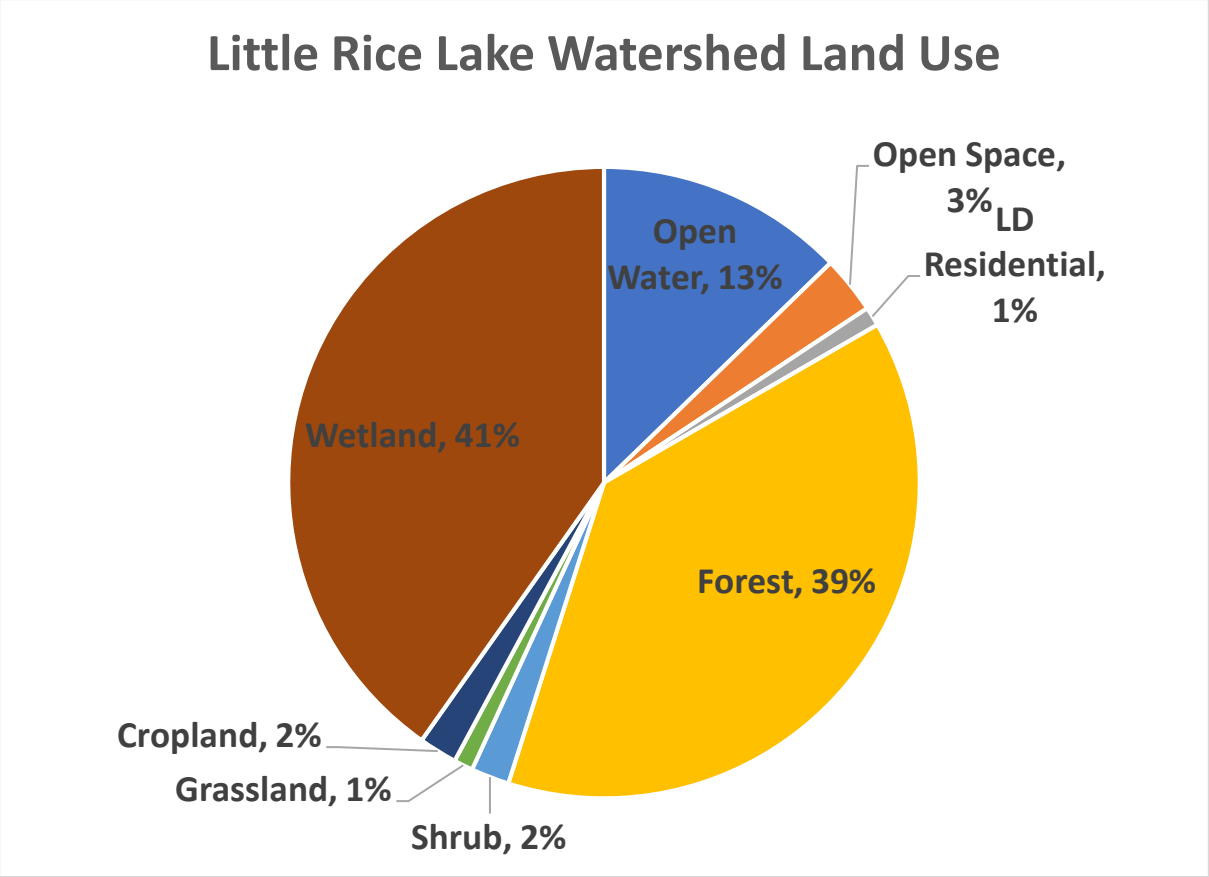
The vast majority, 80%, of the watershed is undeveloped forest and wetland. The following figure shows the land use in the watershed.

Figure 16 - Little Rice Lake Watershed Land Use



The following chart indicates all land use and the percentage of the total land in the watershed.

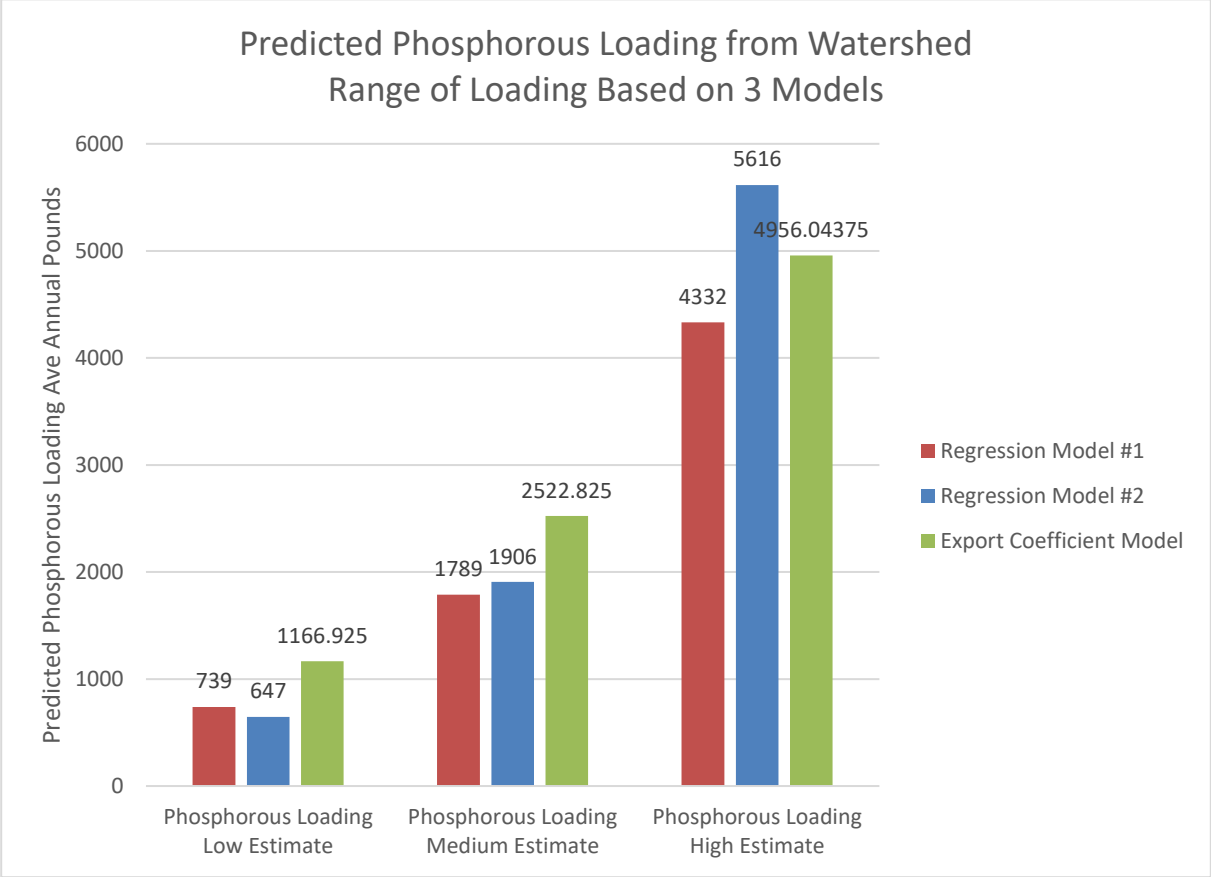
Figure 17 - Little Rice Lake Watershed Land Use



The undeveloped, natural watershed contributes to the good water quality of Little Rice Lake; there were no areas of concern noted in the watershed.

Phosphorous loading from the watershed has been estimated by WDNR. The following data is from WDNR Surface Water WILakeData spreadsheet. Three models are used to predict Low, Medium and High average annual loading of phosphorous. The following graph indicates the predictions of the three models for the average annual phosphorous loading in pounds.

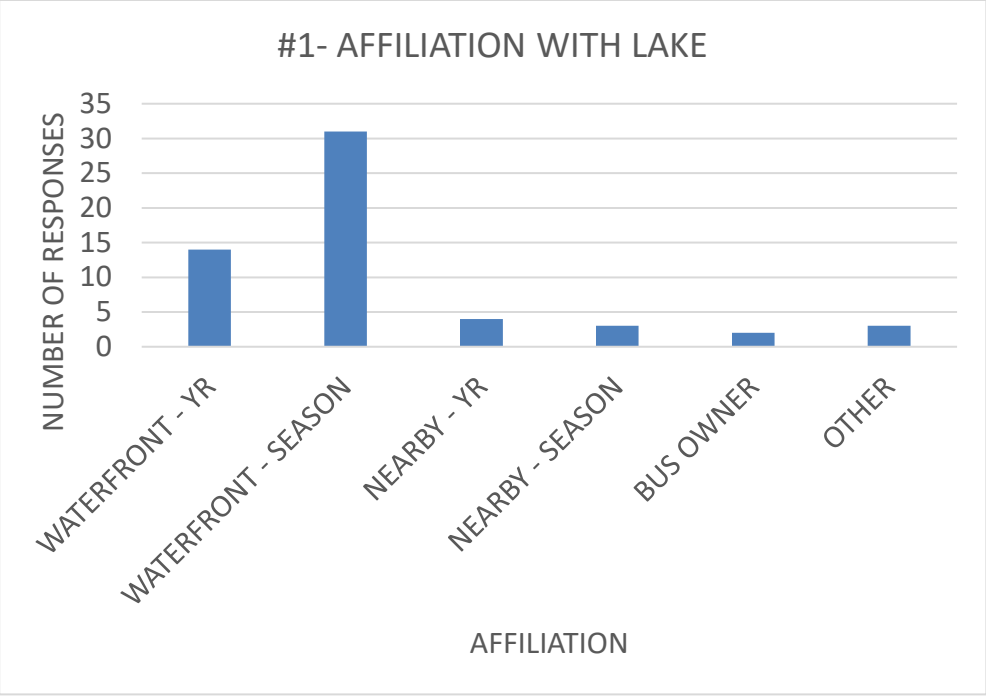
Figure 18 – Predicted Phosphorous Loading from Watershed



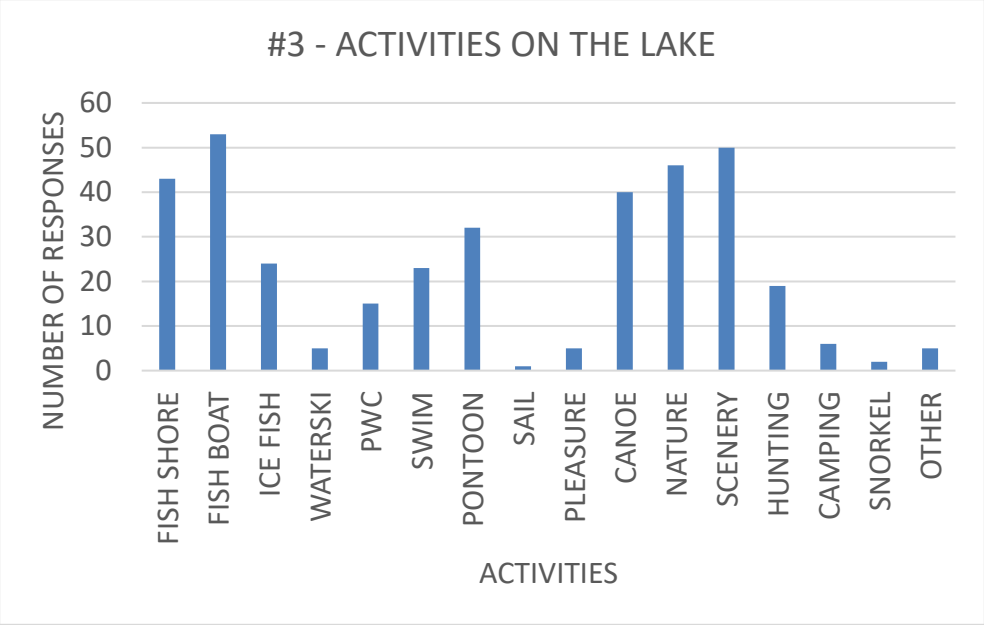
The phosphorous loading to Little Rice Lake is relatively low based on the low development throughout the watershed. Higher phosphorous loading comes from land used such as agriculture, residential, commercial and industrial.

5.10 Lake User Survey

A lake user survey was prepared and distributed by mail to the respondents. A total of 56 surveys were received out of 110 distributed (51% response rate). The survey indicates that the lake is highly used for fishing and enjoying nature but lake users are not satisfied with the condition of the lake. Recreation and aesthetics are greatly diminished by the dense aquatic vegetation and the low fish populations. Following are responses to some of the questions.

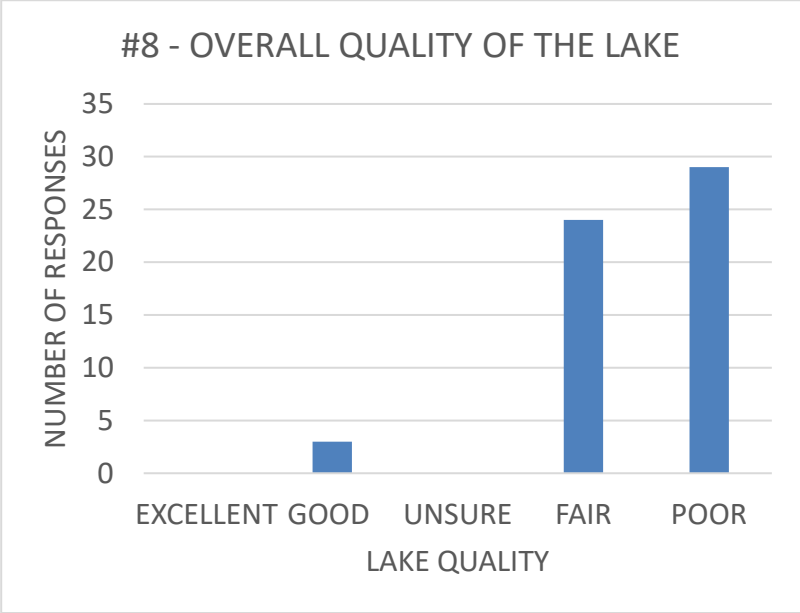


The majority of the respondents are waterfront owners that use the property seasonally.



The most popular use of the lake is fishing followed by enjoying scenery and nature. 95% of the respondents fish on the lake either from shore, boat or on the ice. 90% enjoy the scenery and nature.

There is dissatisfaction with the recreation on the lake. 40% are somewhat satisfied but more than 50% are not too or not at all satisfied with recreation on the lake.

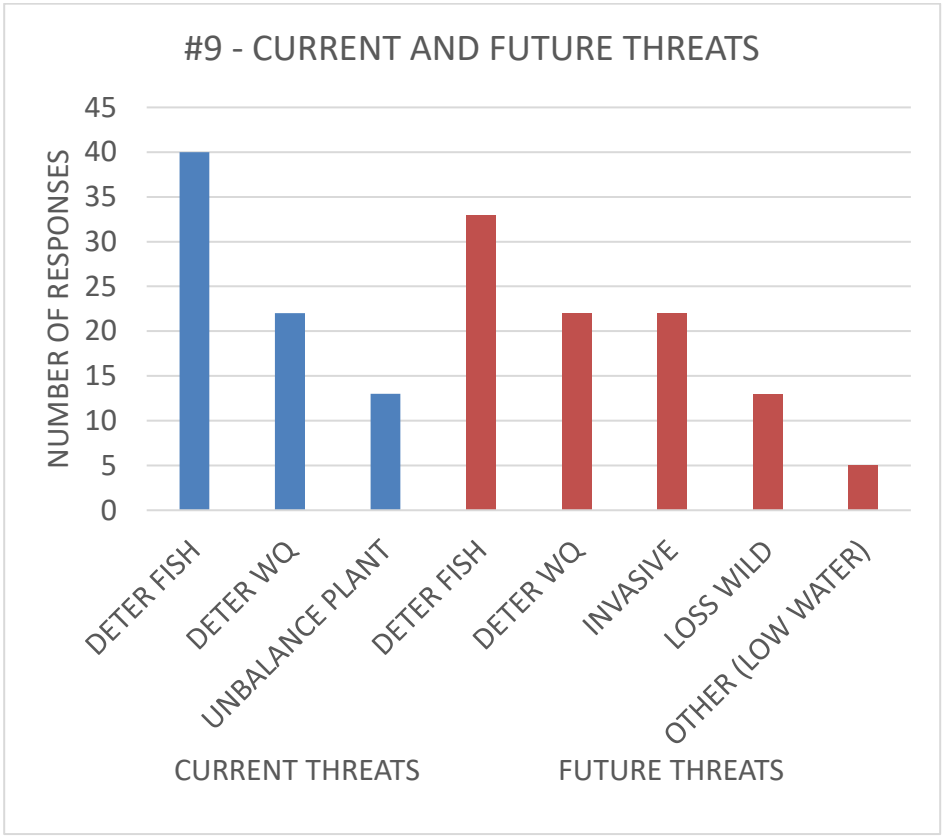


Lake users do not rate the quality of the lake well. 43% rate the quality as fair and 52% rate it as poor.

The low ratings on recreation and quality appear to be due to perceived excess plant growth. The top three concerns are:

1. Excess wild rice
2. Excess wild rice
3. Excess plant growth
4. Low gamefish population

Another top concern was insufficient fish habitat.



The top current and future threats were thought to be deteriorating fish populations and deteriorating water quality.

6.0 Management Alternatives and Recommendations

Based on the goals of the stakeholders as mentioned in section 3.6, several management alternatives are available for this CLM plan. Some general alternatives are discussed below. More information on management alternatives is included in Appendix E. Currently, the Northern Region of the DNR is working under an aquatic plant management strategy that is officially titiled Aquatic Plant Management Strategy, Northern Region DNR, Summer, 2007 (working draft), or commonly referred to the NOR Region CLM Strategy (Appendix H). This strategy lays out an approach for acceptable aquatic plant management in Northern Region lakes. The strategy protects native aquatic plant communities in northern Wisconsin and does not allow permits to control native plants unless documented circumstances of nuisance levels exist. The following management alternatives are based on the approaches described in the NOR Region CLM Strategy, and incorporate recommendations of Flambeau Engineering.

6.1 Aquatic Plant Maintenance **Alternatives**

The maintenance alternative may be used at a lake in which a healthy aquatic plant community exists and invasive and non-native plant species are generally not present. The maintenance alternative is a protection-oriented management alternative because no significant plant problems exist or no active manipulation is required. This alternative can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community.

6.1.1 Aquatic Invasive Species Monitoring

In order to monitor for new AIS in the future, a strong Citizen Lake Monitoring program that surveys for AIS is highly recommended. In some lake systems, native aquatic plants "hold their own" and AIS never grow to nuisance levels; in others however, vigilant and active management is required. This can be based on several things including water quality. Little Rice Lake residents should implement a Citizen Lake Monitoring program for AIS.

The University of Wisconsin-Extension Lake's Program provides training and coordinates the Citizen Lake Monitoring Program. More information about the program is available by contacting:

Paul Skawinski
715-346-4853
Paul.Skawinski@uwsp.edu

Sandy Wickman
715-365-8951
Sandra.Wickman@wisconsin.gov

Or at the following website: https://dnr.wi.gov/lakes/clmn/

If AIS is found follow the steps in the AIS Rapid Response Plan included in Appendix J.

6.1.2 Clean Boats/Clean Waters Campaign

Measures for the prevention of the introduction of new AIS to the lake should be a priority. To prevent the spread of AIS into Little Rice Lake, a monitoring program such as Clean Boats/Clean Waters (CBCW) is an excellent choice. This program is carried out by trained volunteers who inspect the incoming boats at public launches. Signage also accompanies the use of CBCW to inform lake users of proper identification of AIS and boat inspection procedures. Education of the public, along with private property owners, about inspecting watercraft for AIS before launching a boat or leaving access sites on other lakes could help prevent new AIS infestations. Contact with lake users at this time is a great way to distribute other educational materials. Lake residents participate in the Clean Boats/Clean Waters program. The busiest landings should be monitored during weekends and holidays to interact with the most lake users. Association members should be trained so there are plenty of people to staff the landings. More information and training schedule can be found at http://dnr.wi.gov/lakes/cbcw/.

6.1.3 Aquatic Plant Protection and Shoreline Management

Protection of the native aquatic plant community is needed to slow the spread of EWM, CLP and other AIS from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Additionally, EWM and CLP can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Properties with seawalls, manicured lawn to waters edge and active erosion would be good candidates for shoreland restorations. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the waters edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat, erosion prevention and it may deter geese from entering the shoreland area. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. A relatively new Wisconsin law prohibits the application of turf fertilizer containing phosphorus except in certain circumstances. Phosphorous containing fertilizer may be used when planting a new lawn or when a soil test indicates the soil is low in phosphorous. Fertilizer may not be applied to impervious surfaces or frozen ground under the new law. More information can be found in Wisconsin Statute 94.643. The fertilizers that were commonly used for lawns and gardens have three major plant macronutrients: Nitrogen, Phosphorus, and Potassium. These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are "Phosphorus limited", meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the lake is a good practice. Local retailers and lawn care companies can provide soil test kits to determine a lawn's nutrient needs. Of course, properties with an intact natural buffer require very little maintenance, and no fertilizers.

Another possible source of nutrients to a lake is the septic systems surrounding the lake. Septic systems should be properly installed and maintained in order to prevent improperly treated wastewater, which carries substantial nutrients, from reaching the lake. Property owners who are not sure if their septic system is adding nutrients to the lake should contact a professional inspector and have their system assessed.

6.1.4 Public Education and Involvement

The Association should continue to keep abreast of current AIS issues throughout the County. The County Land Conservation Department, the DNR Lakes Coordinator, and the UW Extension are good sources of information. Many important materials can be ordered at the following website: http://www.uwsp.edu/cnr/uwexlakes/publications/

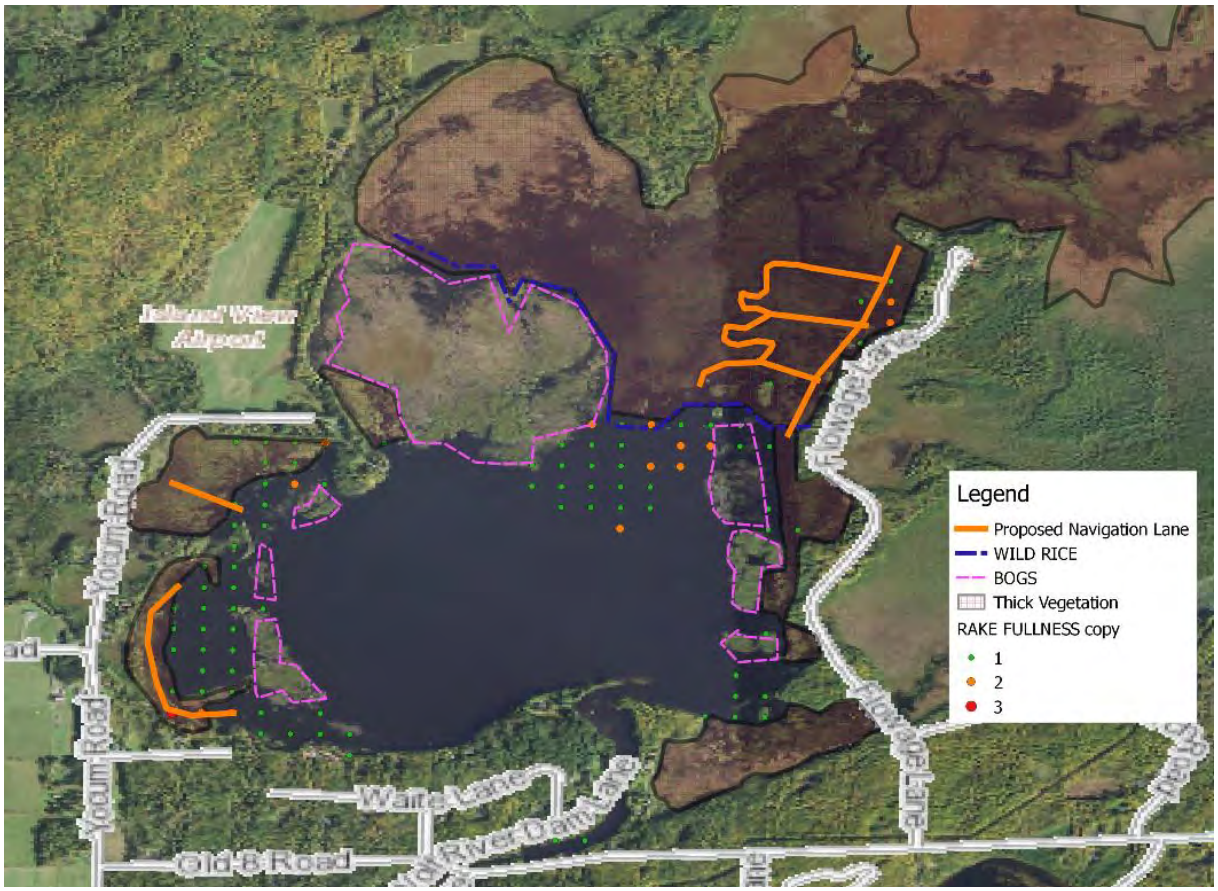
Appendix G includes resources for further information about public education opportunities. This also includes the institutional framework of the lake including the organizations that play a role in management of the lake. The organization, role and contact information is provided.

6.2 Aquatic Plant Manipulation Alternatives

This management alternative may be used when aquatic plants present some sort of problem that must be dealt with or manipulated by human action. The nuisance level of native vegetation in areas of Little Rice Lake would likely qualify for some type of management to allow access to shoreland. Aquatic plant management to maintain navigation lanes is recommended if the Association would like to actively manage the vegetation.

A main navigation channel up to 50 feet wide can be maintained in the northern half and the south bays to improve navigation. The following figures shows possible location of the main navigation lane.

Figure 19 – Possible Main Navigation Lane



The main navigation lane above is based on vegetation density in 2017; the northern lanes follows the river channel as seen on an aerial photo taken in 2017. The location of the lanes should be determined by DNR, GLIFWC and the Association to choose locations that provide access for the residents and minimize ecological impact.

Individual navigation lanes from the main navigation lane to the shoreland can be maintained up to 30 feet wide. DNR would like to minimize the number of navigation channels to avoid as much impact as possible to the wild rice. There are a number of options to manage the vegetation to keep these navigation lanes open.

6.2.1 Harvesting

Harvesting may be a viable alternative for nuisance native plants in some areas of Little Rice Lake. Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto a transport and taken to the disposal site. Harvesting can be used to create navigation lanes in water 3+ feet deep. A navigation lane up to 50 feet wide could be maintained by harvesting as near to the shore as possible in the areas that access is needed. Individual

property owners could then manually remove vegetation to create a lane up to 30 feet wide out to the main navigation lane. A permit is required for harvesting.

There are pros and cons to harvesting as follows.

Pros

- Immediate results
- Minimal impact to lake
- Removes some nutrients from the lake

Cons

- Not selective in species removal
- Can remove small fish and reptiles
- Initial cost of harvester is high
- Consider storage, maintenance, operation

A contractor with a harvester may be a better option than purchasing a machine.

6.2.2 Mechanical Removal

A relatively inexpensive and simple option may be mechanical removal of the vegetation in the main navigation lane. This may be achieved through attaching a drag or cutter to a boat and motoring through the lane. This should begin early in the spring and continue as needed throughout the summer. A permit is needed for mechanical removal.

6.2.3 Chemical Herbicide Treatment

Native vegetation is generally not managed with herbicide in Wisconsin waters. In the case of Little Rice Lake native vegetation has become so thick in some areas of the lake that it has reached nuisance levels by severely limiting navigation. Navigation lanes can be treated with herbicide but it may not be effective and annual treatments are usually required. The herbicides that are used require a long contact time to effectively kill the vegetation; when treating small areas the contact time is difficult to achieve and results can vary greatly. This would be an expensive option and would provide short term relief at best. It is difficult to impossible to predict the effectiveness of chemical treatments on lakes and the vegetation will return after an unknown period of time. It would also be difficult to obtain a permit for a treatment due to the wild rice beds in the lake.

The estimated cost to treat the main navigation lanes in the two south bays ranges from $2000 to $6500; this does not include the individual lanes. A permit is needed for herbicide treatment.

6.2.4 Dredging

Dredging navigation lanes may be an option that will provide relativity long term relief from the nuisance vegetation. Dredging of a navigation lane up to 50 ft wide may be funded through the Recreational Boating Facilities grant. Dredging navigation lanes would remove

the existing vegetation and deepen the channels to provide navigation even during lower water levels.

Pros

- Plants are removed along with sediment
- Increases water depth
- Removes nutrient rich sediments
- Most effective when soft sediments overlay harder substrate
- For extremely impacted systems
- Removes soft bottom sediments that may have high oxygen demand

Cons

- Expensive
- Increases turbidity and releases nutrients
- 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
- Sediment/bogs may shift and fill in navigation lanes
- Substrate may not be able to be dredged; historic wetlands

Extensive planning, permitting and funding is required for dredging projects.

6.2.5 Drawdown

Drawdown of water level can be a very effective tool in managing certain native vegetation. During a drawdown the water levels are lowered to expose the bed of the lake where the vegetation is present; the winter temperatures freeze and dry the plants and roots killing them. Many native plants respond well to fluctuating water levels and there is typically an increase in diversity and density of native aquatic plants following a drawdown. Native plants usually rebound within the first summer after refilling the reservoir. Certain emergent plants benefit from a drawdown and need lowered water levels to germinate and reproduce. Bulrushes are one of the plants that usually come back in abundance after a drawdown. The drawdown may also have a positive effect on wild rice as it is used as a management tool to increase wild rice production. Although, if significant sediment compaction is achieved it may decrease the area that favors wild rice by increasing water depth.

Drawdowns also help to turn back the clock on the aging process a flowage undergoes. The drawdown knocks back the vegetation that grows in abundance as a flowage ages. It also aids in sediment compaction, especially in the mucky areas of the lake. These areas can experience compaction of up to 12 inches after a drawdown.

Drawdowns do have negative impacts also; mainly to the recreational use of the lake. This can be minimized as the drawdowns are typically over-winter events. When the lake is drawn down there is limited access to the water and use is very limited on the lake. There is a

popular belief that drawdowns negatively impact fish populations but that has not been scientifically proven. There are area lakes that have periodic drawdowns and have not noticed a negative impact to the fishery. The fish become more concentrated in the water that is available so there is likely more predation that occurs that thins out the smaller fish. There is also the belief that the fish will be "fished out" when they are concentrated; but with the increase in natural prey they are not so likely to take the anglers bait.

A winter drawdown may be an option to reduce the amount of floating-leaf and submersed native vegetation. The drawdown could reduce the nuisance vegetation and may increase other emergent species such as bulrush, bur-reed, sedges, spikerush and wild rice. The sediment compaction in these areas would be a benefit also, providing greater water depths to keep the density of nuisance vegetation down for a longer period of time. As with any management technique the results and the length of control vary greatly based on site specific conditions. Further investigation to assess lakebed elevations and dam capabilities would need to be made if this option is considered.

Extensive permitting and planning are needed for a drawdown.

6.2.6 Individual Navigation Lanes

This method may be used by individual property owners if vegetation is causing issues near the shoreline. This is a good alternative in the shallow area less than 3 feet deep where the harvester is not allowed. If wild rice is present, a permit is required for manual removal.

Manual removal consists of physically removing plants using bodily force and hand tools. Manual removal efforts include hand raking, hand cutting and hand pulling unwanted plants. This method is most effective when plants are pulled or cut as near the sediment as possible and all plant material is removed from the lake. Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water where property owners can weed the aquatic garden. Hiring laborers to remove aquatic vegetation is an option, but also increases cost. Scuba divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include the low cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants, and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants include the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significant sized population is quite labor intensive. Again, hiring laborers to remove aquatic vegetation is an option, but also increases cost.

Manual removal of these plants is allowed at individual properties (except wild rice in the northern region), under Wisconsin law, to a maximum width of 30 feet (recreational zone). The intent is to provide pier, boatlift or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the site is not located in a Sensitive Area, there is no wild rice present and maximum width cleared does not exceed the 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot

area would require a permit from the DNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix F). If the site of manual removal is located in a Sensitive Area a permit is required. Manual removal is cautioned because it could open a niche for non-native invasive aquatic plants to occupy. Removal of native plants also destroys habitat for fish and wildlife.

Limited manual removal of native vegetation is recommended for individual property owners where nuisance conditions occur. The area of removal should be kept to a minimum and a maximum width 30 feet is allowed. A navigation lane just wide enough for watercraft used is recommended. If lanes for fishing from the dock are required an area a few feet wide could be cleared to provide casting opportunities. A permit is needed if wild rice is present.

7.0 Conclusion and Recommended Action Plan

Little Rice Lake is a healthy lake with good water quality and abundant native aquatic vegetation. The two problems on the lake that are the focus of this project are excess aquatic plant growth in several locations that impeded navigation and winter fish kills. The following Active Goals are recommended to improve these conditions on the lake.

7.1 Recommended Active Goals

The recommended action plan includes actions for Little Rice Lake based on the Maintenance Alternative and Aquatic Plant Manipulation Alternative listed above in Section 6. The goals listed below are meant to be a guideline used to manage the lake; these goals should be evaluated and revised as needed to fit the changing needs of the lake. Lakes are dynamic systems and flexibility is needed when managing them. The Association board has approved the following active goals. It will be up to residents of Little Rice Lake and the Association to determine the actions, find the funding, and gather the individuals needed to implement the active goals.

Active Goal: Manage aquatic plants to allow for access to open water

Action 1 – Determine where access is needed and create a plan

- Figure 18 indicates Main Navigation Lanes based on the density of plants in 2017/18; this lane location should be determined by the Association, DNR and GLIFWC.
- Choose a method, prepare a plan and apply for a permit.

Action 2 – Decide on method(s): harvest, mechanical, manual and/or dredging

- Harvesting, manual or mechanical removal are the recommended options for the main navigation lane at this time. Any of these methods may be used for individual lanes as conditions permit.
- Hiring a contractor with a harvester is recommended at this time. The following must be considered:
    - Where the harvesting is feasible based on the size/configuration of the harvester?
    - When will harvesting take place? Plan to harvest when plants start to impede navigation but not so thick it is impossible to navigate.
    - Will it be needed more than once a season?
    - Where will harvested vegetation be disposed of?
- Mechanical removal by cutting or dragging may be used for the main and individual navigation lanes. The following must be considered:
    - Will it be needed more than once a season? Begin early in the growing season when plants are most susceptible to disturbance and continue as needed throughout the season.
    - Where will vegetation be disposed of?
- Manual removal (handpulling) may be used for the individual lanes; consider where vegetation will be disposed of. Begin early when biomass is low; continue throughout the season as needed.
- Dredging may be further investigated in the future; this is a costly option that requires extensive planning and permitting.

- Continued use – if navigation on the lanes with a motor boat is started early in the season and continues on a regular basis the plants will tend not to grow in that area due to the continued disturbance.

Timing – choose a method for the following year by fall of the current year. Begin plans for necessary permits. If harvesting is chosen, begin looking for a contractor in fall for the following year.

Action 3 – Procure funds for the chosen method; apply for grants

- Continue to raise money to fund the chosen methods
- Navigation channel dredging may be eligible for a Recreational Boating Facilities Grant.

Timing – Begin fund raising immediately. Begin grant writing at least 3 months prior to due date. See details on grants below.

Action 4 – Apply for necessary permits

- Permits are needed through WDNR for harvesting, mechanical removal and dredging. Permits are also needed for manual removal if wild rice is present in the affected area. The following link has information on aquatic plant management and the permitting process https://dnr.wi.gov/lakes/plants/

Timing – Begin permit process in fall for the following year. Prepare plans and be sure funding will be in place for the proposed control method.

Active Goal: Improve fishery by reducing/eliminating winter kill and improve habitat.

Action 1 – Discuss aeration plan with Greg Matzke, Tom Carlson and Scott VanEgeren. Determine best location, design, operation and maintenance schedule, responsible parties.

Action 2 – Apply for Lake Plan Implementation grant to fund materials and installation costs of the system.

Action 3 – Discuss fish sticks with Greg Matzke, Tom Carlson and Scott VanEgeren. Determine best locations, source of trees, installation.

Action 4 – Apply for Healthy Lakes grant to fund fish sticks.

Timing – Schedule meetings immediately to begin planning process. Apply for grants by due dates listed in the following section.

Future goals

- Set target oxygen level to reach goal of preventing fish kill
- Measure oxygen levels throughout winter months
- Set goal for how much and which type of fish habitat is desired

Active Goal: Protect fish and wildlife habitat.

Action 1 – Keep aquatic plant management to a minimum.

- Create lanes only where access is needed and vegetation is too thick to navigate. Keep main navigation lane width to 30 ft or less and individual

lane width to 15 ft or less (as recommended by DNR and Mole Lake Tribal Biologists).
- Choose the method with the least impact to the lake.

Action 2 – Continue water quality monitoring.
- Participate in the Citizen Lake Monitoring Network (CLMN) and monitor for total phosphorous, chlorophyll a, secchi depth and dissolved oxygen monthly May to September. Continue dissolved oxygen monitoring during winter months.

Action 3 – Keep the shorelines healthy and in a natural state.
- Create/maintain a 30 ft buffer along the shoreline of native herbs, shrubs and trees.
- Do not fertilize the lawn or do so responsibly.
- Maintain septic systems to keep nutrients and pathogens from entering the lake.

Action 4 - Monitoring for AIS including Eurasian Water Milfoil, Curlyleaf Pondweed
- Get trained in CLMN protocol for invasive species and monitor the lake throughout the growing season.
- Prevent the introduction of new AIS into the lake through watercraft inspection at the landings (Clean Boats Clean Waters, CBCW); target busy times such as holidays and other high traffic days.
- Maintain AIS signage at all public accesses including illegal to launch and illegal to transport signage.
- Provide AIS training in identification and monitoring for all interested parties on both lakes.

Funding – AIS Education, Planning, Prevention grants may be available to assist with costs of training, monitoring and CBCW program. A Healthy Lakes Grant may be available for shoreland restorations including native plantings for buffers.

7.2 Pursue Grant Funding to Implement Actions

There are a number of grants available through DNR to implement actions outlined in this plan and to complete further research and projects on Little Rice Lake. Contact the local DNR Lake Coordinator if you plan to pursue grand funding before the grant application deadline. Following is a brief description of the grants available through DNR.

Small Scale Lake Management Planning

Funding Amount: $3,000
Local Match: 33%
Purpose: funding to collect and analyze information needed to protect and restore lakes and watersheds.
Application Deadline: December 10
Eligible Projects:
- Lake monitoring such as water quality and aquatic plants
- Lake education such as activities that will collect/disseminate information about lakes to educate public on lake use, lake ecosystem and lake management techniques

- Organization development such as assist management units in formation of goals/objectives for management of lake
- Studies/assessments to implement management goals and expanding monitoring.

Large Scale Lake Management Planning

Funding Amount: $25,000
Local Match: 33%
Purpose: funding to collect and analyze information needed to protect and restore lakes and watersheds.
Application Deadline: December 10
Eligible Projects:

- Gathering and analysis of physical, chemical and biological information
- Describing present and potential land uses in watershed and on shoreline
- Reviewing jurisdictional boundaries and evaluating ordinances that relate to zoning, sanitation or pollution control or surface use
- Assessment of fish, aquatic life, wildlife and their habitats
- Gathering and analyzing information from lake property owners/users
- Developing, evaluation, publishing, distributing alternative courses of action and recommendations in a lake management plan

Lake Protection Grant

Funding Amount: $200,000
Local Match: 25%
Purpose: Funding for large, complex, technical projects for lake protection
Application Deadline: February 1
Eligible Projects:

- Purchase of land or conservation easements
- Restoration of wetlands and shorelands to protect water quality
- Development of local regulations to protect lakes and education activities necessary to implement them
- Lake management plan implementation project recommend in DNR approved plan
    - Watershed management projects
    - Lake restoration
    - Diagnostic feasibility studies

Aquatic Invasive Species Education, Planning and Prevention Grant

Funding Amount: $150,000
Local Match: 25%
Purpose: Educate lake users on AIS
Application Deadline: December 10
Eligible Projects:

- Educational programs including workshops, training or coordinating volunteer monitors.
- Develop prevention and control plans for AIS
- Monitor, map and assess waterbodies for AIS or studies that will aid in prevention AIS
- Watercraft inspection and education projects (CBCW). Inspectors must be trained and staff boat launch facilities a minimum of 200 hours between May 1 and October 30. Limited to $4,000 per boat launch facility.

Aquatic Invasive Species Established Population Control Project

Funding Amount: $200,000
Local Match: 25%
Purpose: Provide for eradication/substantial reduction and long term control of AIS with goal of restoring native species.
Application Deadline: February 1
Eligible Projects:

- Department approved control activities recommended in control plan
- Experimental or demonstration project in DNR approved plan
- Purple loosestrife bio-control project

Aquatic Invasive Species Early Detection and Response

Funding Amount: $20,000
Local Match: 25%
Purpose: Detect and respond to pioneer populations of AIS
Application Deadline: As approved
Eligible Projects: Identification and removal by approved methods of small, pioneer population of AIS. Localized beds must be present less than 5 years and less than 5 acres in size or less than 5% of lake area. Control of recolonization following completion of an established population control project is eligible.

Recreational Boating Facilities

Funding Amount: $250,000+
Local Match: 50%
Purpose: Channel dredging
Application Deadline: As approved
Eligible Projects: Dredging of navigation channels once in 10 years.

7.3 Closing

This Comprehensive Lake Management Plan was prepared in cooperation with the Little Rice Lake Association and Forest County. It includes the major components outlined in the DNR comprehensive lake management plan guidance. The "Recommended Action Plan" section of this report can be used as a stand alone document to facilitate nuisance native plant management activities for the lakes. This section outlines important monitoring and management activities. The greater CLM Plan document and appendices provides a central source of information for the lake's aquatic plant community information, the overall lake ecology, and sources of additional information. If there are

any questions about how to use this CLM Plan or its contents, please contact Flambeau Engineering, Inc.

This CLM Plan should be updated periodically (5-10 years) to reflect current aquatic plant problems, and the most recent acceptable management methods. Information regarding aquatic plant management and protection is available from the DNR website: https://dnr.wi.gov/lakes/plants/ or from Flambeau Engineering upon request.

8.0 References

While not all references are specifically cited, the following resources were used in preparation of this report.

Borman, Susan, Robert Korth, and Jo Temte, *Through the Looking Glass, A Field Guide to Aquatic Plants*, Wisconsin Lakes Partnership, 1997

Carlson, R. E., A trophic state index for lakes. Limnology and Oceanography, 22:361-369, 1977

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Getsinger, Kurt D., and H.E. Westerdahl, *Aquatic Plant Identification and Herbicide Use Guide, Volume II Aquatic Plants and Susceptibility to Herbicides*, U.S Waterways Experiments Station, Technical Report A-88-9, 1988

Madsen, John, *Point Intercept and Line Intercept Methods for Aquatic Plant Management, Aquatic Plant Control Technical Note MI-02*, February 1999

Nichols, Stanley A. *Distribution and habitat descriptions of Wisconsin lake plants*, Wisconsin Geological and Natural History Survey Bulletin 96, 1999

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Wetzel, Robert G., *Limnology*, 1983

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Wisconsin Department of Natural Resources, *Aquatic Invasive Species Website (*http://dnr.wi.gov/invasives/aquatic/), Accessed September 2018

Wisconsin Department of Natural Resources, *Fish Stocking Website,* (http://infotrek.er.usgs.gov/doc/DNR_biology/Public_Stocking/StateMapHotspotsAllYears.htm), Accessed September 2018.

Figures

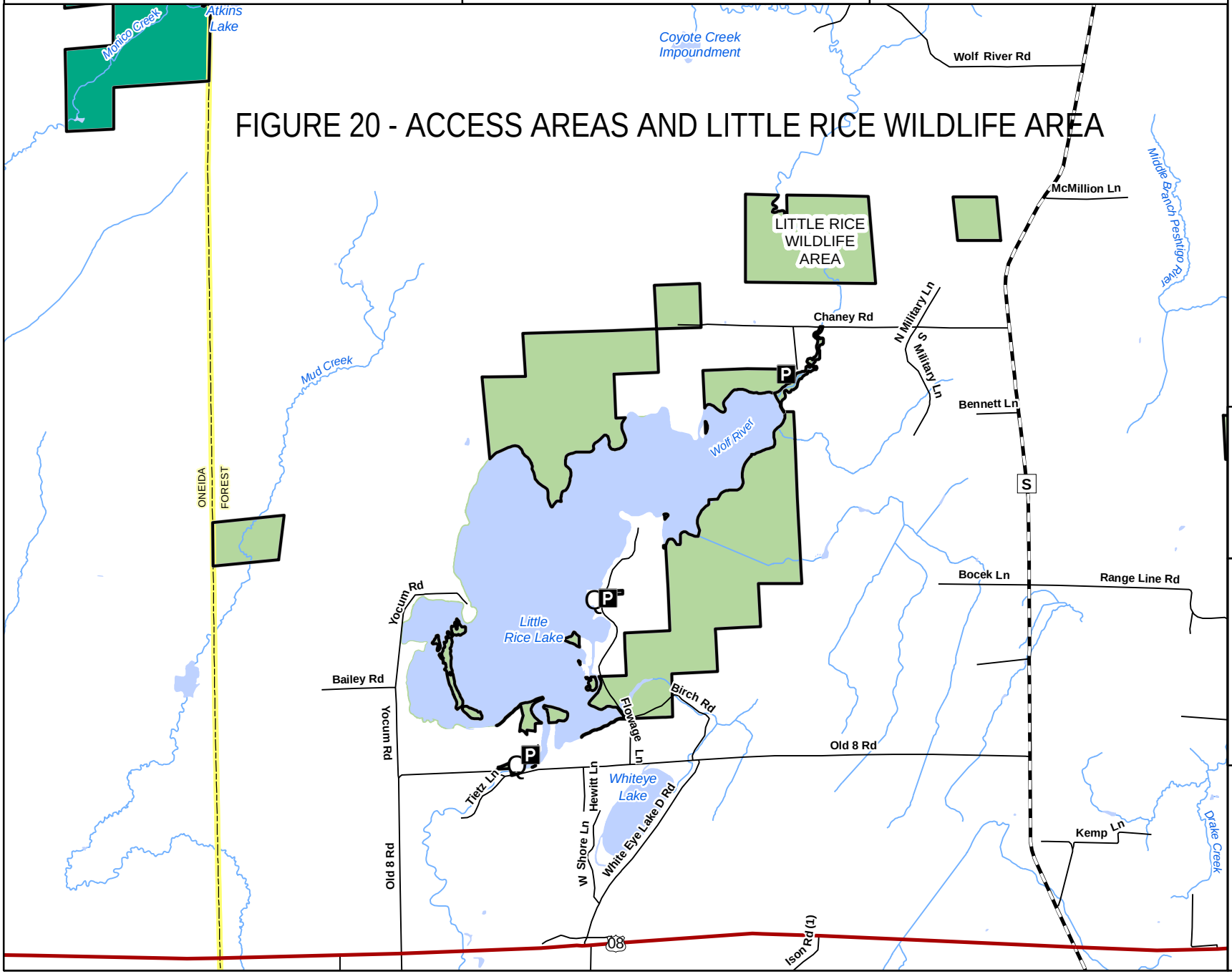
LITTLE RICE WILDLIFE AREA

FOREST COUNTY

PLEASE RESPECT LANDOWNERS' RIGHTS AND OBSERVE ALL PROPERTY POSTINGS
See map legend for the activities allowed on the property or contact the DNR Service Center for more property information.

For more information:
PROPERTY MANAGER
C/O RHINELANDER SERVICE CENTER
107 SUTLIFF AVE
RHINELANDER, WI 54501
715-365-8999

FIGURE 20 - ACCESS AREAS AND LITTLE RICE WILDLIFE AREA



DNR Managed Land

- Open DNR Wildlife Land
- Other DNR Land

Easement Use

- Hunting and Fishing
- Fishing Only
- Hunting Only
- Open, No Hunting or Fishing
- Seasonally Closed
- Ice Age Trail
- State Trail
- Q Boat Access - Ramp
- Boat Access - Carry In
- P Parking Area

0 1,750 3,500 Feet

5280 feet = 1 mile

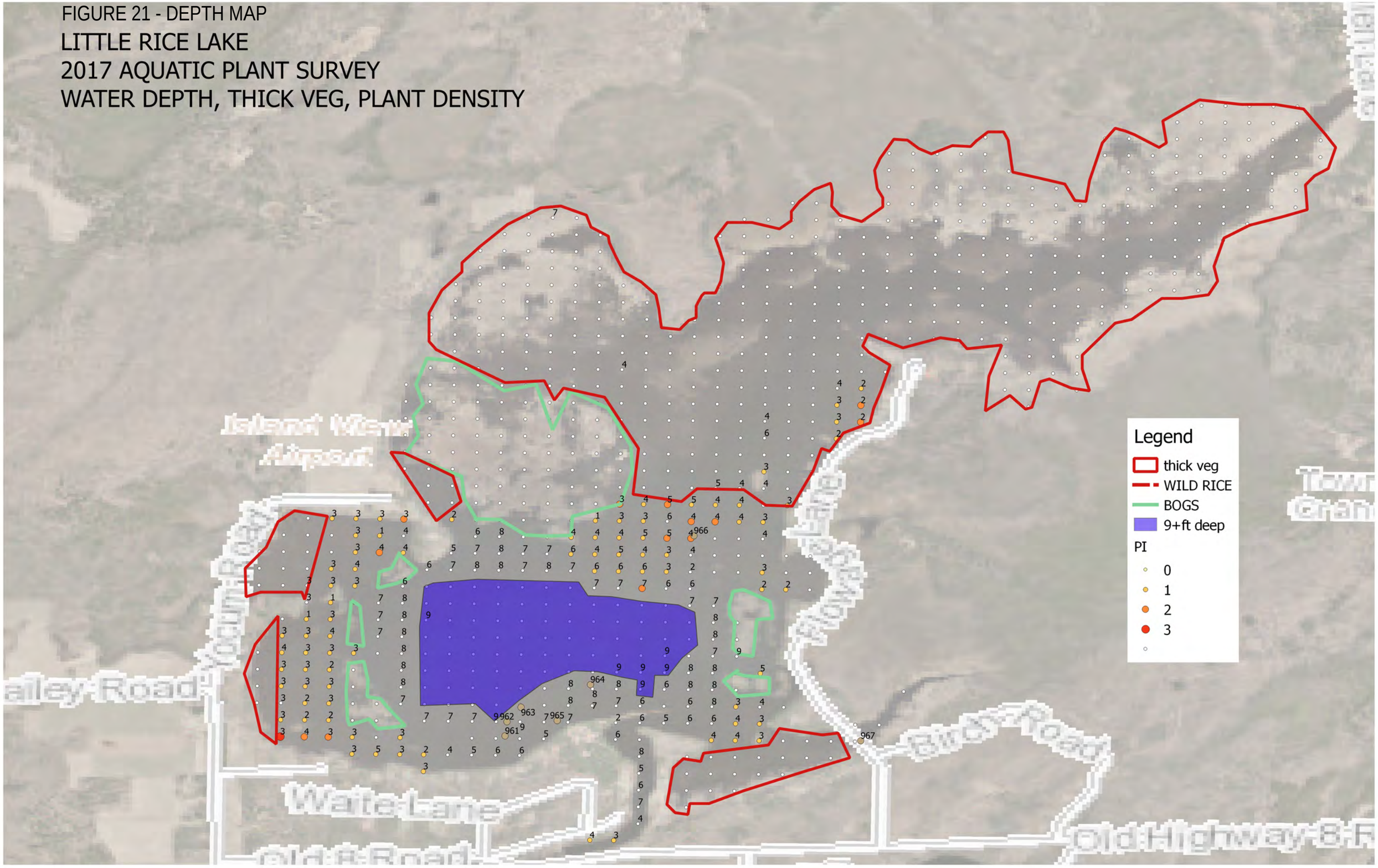
The data shown on this map have been obtained from various sources, and are of varying age, reliability and resolution.This map is not intended to be used for navigation, nor is this map an authoritative source of information about legal land ownership or public access. Users of this map should confirm the ownership of land through other means in order to avoid respassing. No warranty, expressed or implied, is made regarding accuracy, applicability for a particular use, completeness, or legality of the information depicted on this map.

Wisconsin Department of Natural Resources

Featured property funded in part by Knowles-Nelson Stewardship Fund
WM-7860 kmh
Last Revision Date: September 18, 2015
dnr.wi.gov

FIGURE 21 - DEPTH MAP

LITTLE RICE LAKE
2017 AQUATIC PLANT SURVEY
WATER DEPTH, THICK VEG, PLANT DENSITY

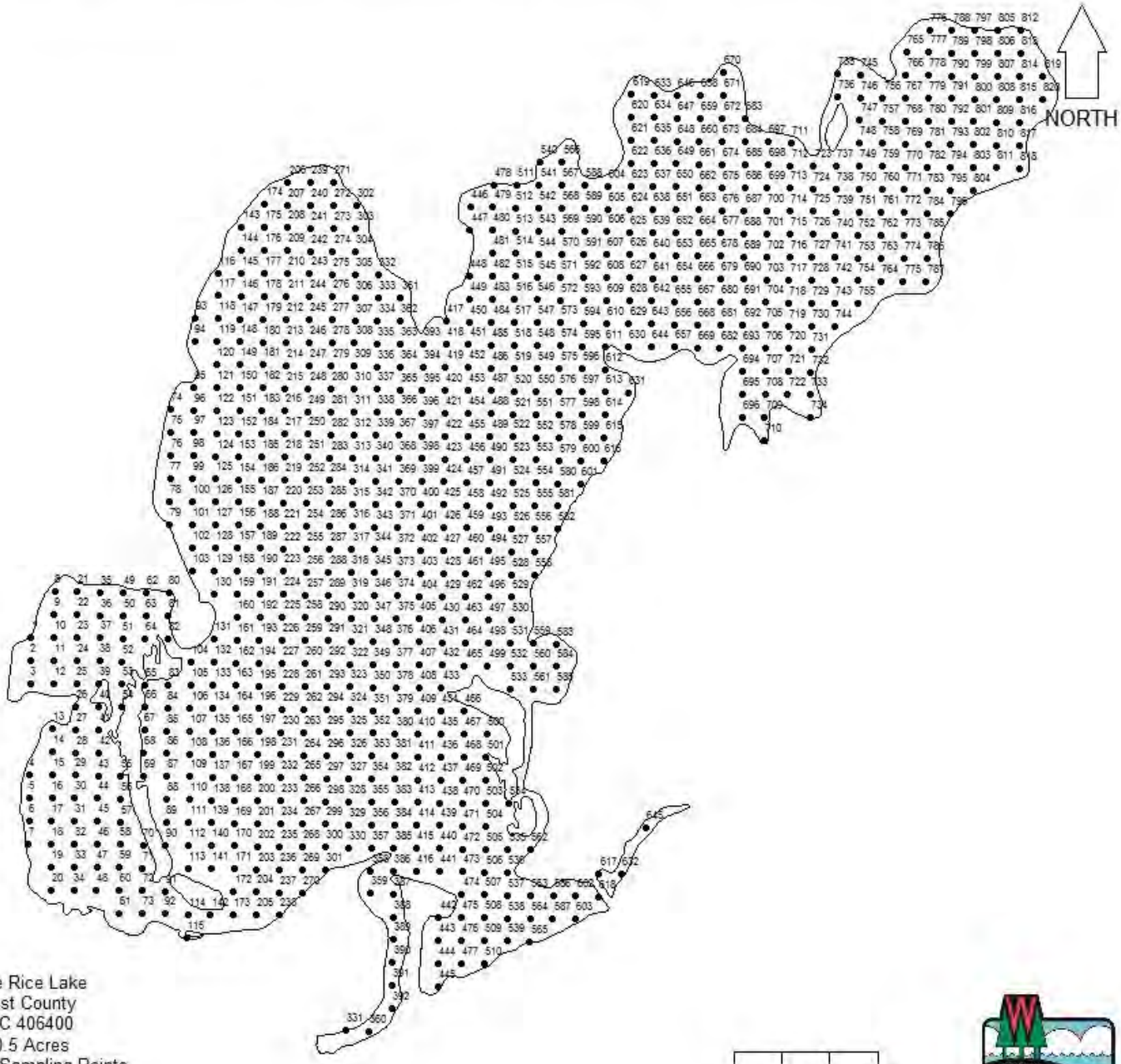


Appendix A

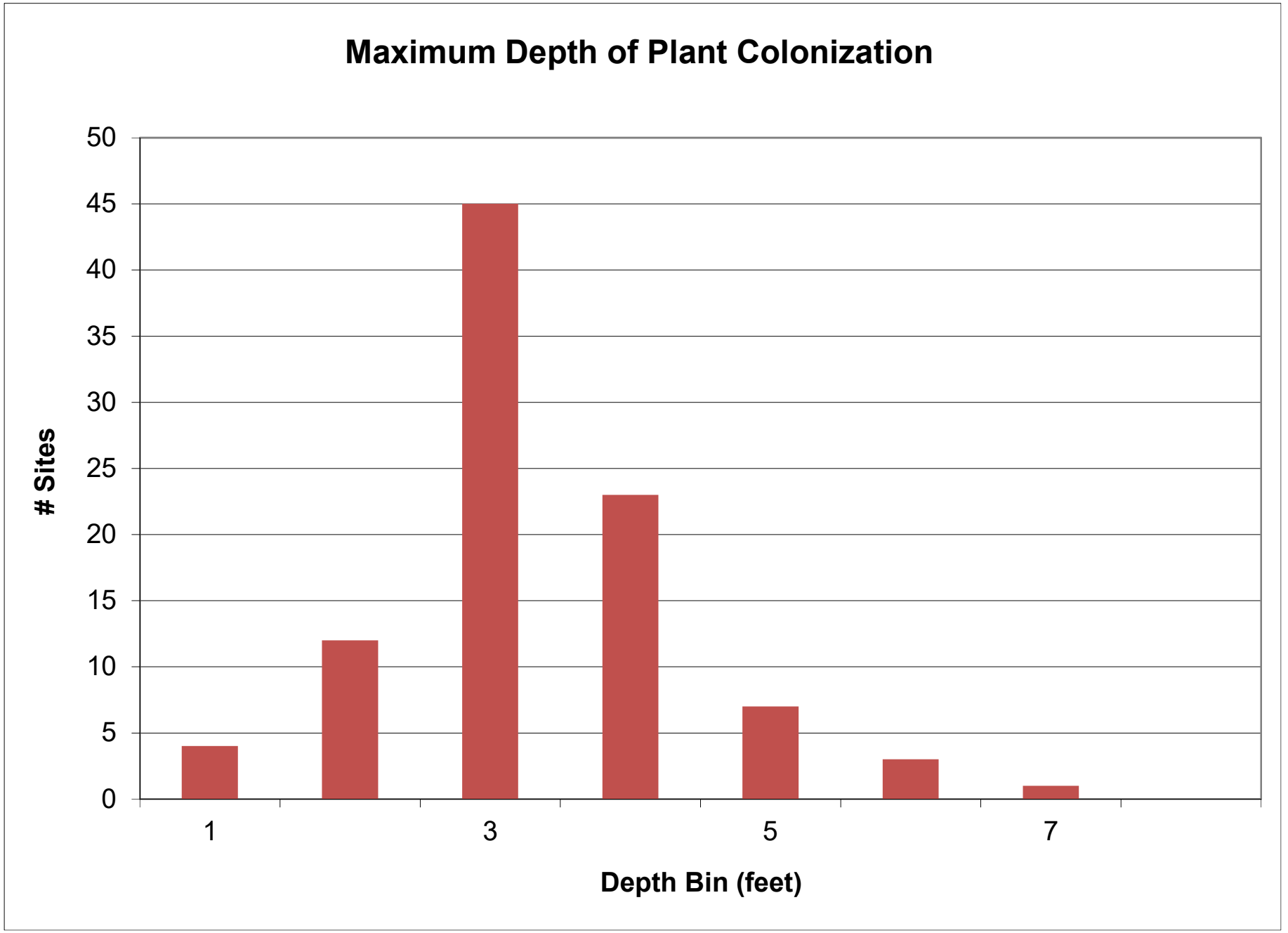
Aquatic Plant Statistics

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1		**STATS**	Total vegetation	Bidens beckii (formerly Megalodonta), Water marigold	Ceratophyllum demersum, Coontail	Ceratophyllum echinatum, Spiny hornwort	Chara sp., Muskgrasses	Elodea canadensis, Common waterweed	Lemna trisulca, Forked duckweed	Myriophyllum heterophyllum, Various-leaved water-milfoil	Myriophyllum sibiricum, Northern water-milfoil	Najas flexilis, Slender naiad	Nitella sp., Nitella	Nuphar variegata, Spatterdock	Nymphaea odorata, White water lily	Potamogeton amplifolius, Large-leaf pondweed	Potamogeton nodosus, Long-leaf pondweed	Potamogeton praelongus, White-stem pondweed	Potamogeton pusillus, Small pondweed	Potamogeton robbinsii, Fern pondweed	Sagittaria latifolia, Common arrowhead	Schoenoplectus subterminalis, Water bulrush	Sparganium sp., Bur-reed	Utricularia vulgaris, Common bladderwort	Vallisneria americana, Wild celery	Zizania sp., Wild rice	Aquatic moss	
2	**Lake**	LITTLE RICE																										
3	**County**	FOREST																										
4	**WBIC**	406400																										
5	**Survey Date**	09/08/17																										
6		**INDIVIDUAL SPECIES STATS:**																										
7		**Frequency of occurrence within vegetated areas (%)**		18.95	1.05	1.05	6.32	12.63	2.11	3.16	15.79	5.26	4.21		1.05	1.05	1.05	3.16	2.11	3.16	1.05	2.11	9.47	4.21	72.63	3.16	11.58	
8		**Frequency of occurrence at sites shallower than maximum depth of plants**		11.46	0.64	0.64	3.82	7.64	1.27	1.91	9.55	3.18	2.55		0.64	0.64	0.64	1.91	1.27	1.91	0.64	1.27	5.73	2.55	43.95	1.91	7.01	
9		**Relative Frequency (%)**		10.8	0.6	0.6	3.6	7.2	1.2	1.8	9.0	3.0	2.4		0.6	0.6	0.6	1.8	1.2	1.8	0.6	1.2	5.4	2.4	41.6	1.8		
10		Relative Frequency (squared)	0.21	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00		
11		**Number of sites where species found**		18	1	1	6	12	2	3	15	5	4		1	1	1	3	2	3	1	2	9	4	69	3	11	
12		**Average Rake Fullness**	1.16	1.00	1.00	1.00	1.00	1.08	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	2.00	1.33	1.00	1.50	1.00	1.00	1.13	1.00	1.00	
13		**#visual sightings**												3	1									1				
14		**present (visual or collected)**		present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	present	
15																												
16		**SUMMARY STATS:**																										
17		**Total number of sites visited**	**189**																									
18		**Total number of sites with vegetation**	**95**																									
19		**Total number of sites shallower than maximum depth of plants**	**157**																									
20		**Frequency of occurrence at sites shallower than maximum depth of plants**	**60.51**																									
21		**Simpson Diversity Index**	**0.79**																									
22		**Maximum depth of plants (ft)****	**7.00**																									
23		**Number of sites sampled using rake on Rope (R)**	**0**																									
24		**Number of sites sampled using rake on Pole (P)**	**0**																									
25		**Average number of all species per site (shallower than max depth)**	**1.06**																									
26		**Average number of all species per site (veg. sites only)**	**1.75**																									
27		**Average number of native species per site (shallower than max depth)**	**1.06**																									
28		**Average number of native species per site (veg. sites only)**	**1.75**																									
29		**Species Richness**	**22**																									
30		**Species Richness (including visuals)**	**23**																									

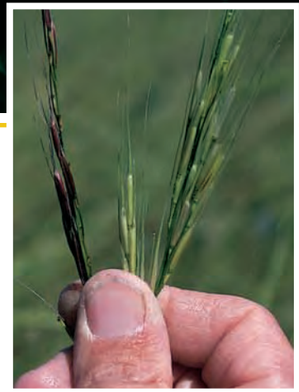
Sampling maps created using the 24K hydro layer available from the WDNR in spring 2015.
We suggest checking these maps against the most recent aerial imagery or by field verification.
If major discrepancies exist, please notify DNR Baseline Aquatic Plants Survey at DNRBASELINEAQUATICPLANTS@wisconsin.gov.



Little Rice Lake
Forest County
WBIC 406400
1200.5 Acres
820 Sampling Points
77m between points


Maximum Depth of Plant Colonization
Sites
50
45
40
35
30
25
20
15
10
5
0
1
3
5
7
Depth Bin (feet)


2018 GLIFWC PHOTO



WILD RICE

Ecology • Harvest • Management

Need More Information?

For harvest regulations or management information contact one of the agencies listed below. For additional copies of this brochure, contact the Great Lakes Indian Fish and Wildlife Commission.

Wisconsin DNR
101 South Webster Street
Box 7921
Madison, WI 53707
(608) 266-2621
TDD: (608) 267-6897
Website: www.dnr.state.wi.us

Minnesota DNR
500 Lafayette Road
St. Paul, MN 55155-4040
(888) 646-6367
Out of State: (651) 296-6157
TTY: (800) 657-3929
Website: www.dnr.state.mn.us

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)
P.O. Box 9
Odanah, WI 54861
(715) 682-6619
Website: www.glifwc.org

This brochure was created with the assistance and support of the following:

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)

Wisconsin Department of Natural Resources (WDNR)

Circle of Flight

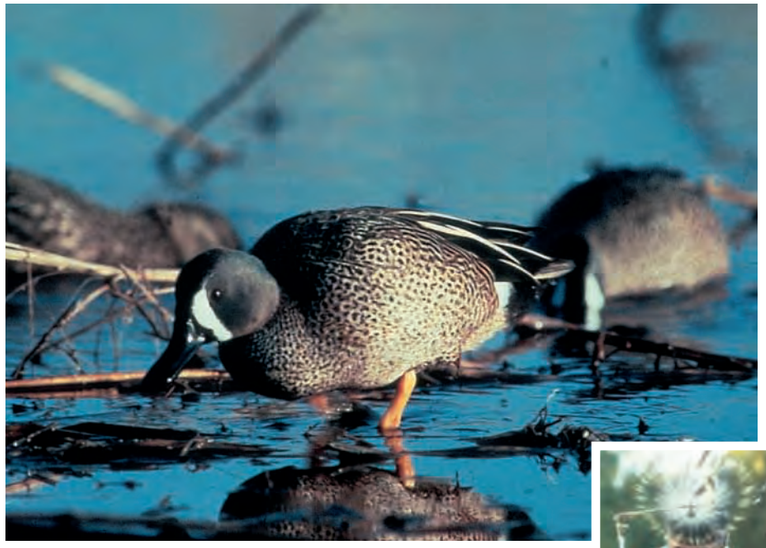
Minnesota Department of Natural Resources (MDNR)

U.S. Fish and Wildlife Service (USFWS)

North American Waterfowl Management Plan

Ecological Significance

Wild rice is important in the ecology of many lakes and streams. Its nutritious seeds have long been recognized as a valuable waterfowl food. Within its core range in Minnesota and northern Wisconsin there may be no food more important to waterfowl, being readily and heavily consumed by mallards, blue-winged teal, ring-necked ducks,



wood ducks and other species. Wild rice also benefits breeding waterfowl, providing roosting and loafing areas to adults, and essential brood cover for the young.

Wild rice's other ecological contributions are often less appreciated. From the muskrat that feeds on a tender spring shoot, to the invertebrate that lives on the fall's dying straw, wild rice benefits a wide range of species because of the food, cover, or physical structure it adds to the environment. The habitat it provides species ranging from moths to moose and snails to rails adds to the biological diversity of the wetlands where it is found.

Wild rice can also help maintain water quality by binding loose soils, tying-up nutrients and slowing winds across shallow wetlands. These factors can increase water clarity and reduce algae blooms. Wild rice is an ecological treasure.

Cultural Significance

To the Anishinaabe (Chippewa or Ojibwa) it is ***manoomin***, a term derived from "Manitou," meaning Great Spirit and "meenum," meaning delicacy. It is the "food that grows on water," whose presence fullfilled the prophecies foretold in the story of the Anishinaabe's migration from the east. Considered a special gift from the Manitou, this "spirit food" has been a central component of Native American culture in the rice region for hundreds of years, featuring in the lives of the Dakota and the Menominee (who took their name from this plant) as well as the Ojibwa. The August, or Rice Making Moon, signaled the harvest season, which was a time for celebrations of thanksgiving. Its distribution influenced inter-tribal battles and the placement of Indian reservations.

Manoomin had great importance to early European explorers as well. Their journals contain many references to the plant they found growing on the lakes and riverways they traversed. As a staple food of the voyageurs, it helped the regional fur trade flourish.

Because of its significance, wild rice's presence in Wisconsin and Minnesota is well documented. Current maps of the historic rice range are dotted with names originating from this plant. Numerous lakes, rivers or towns are named Rice or Manoomin, or bear related names such as "Poygan," derived from the Menominee word for gathering rice. It is believed that no other plant has contributed to more geographic names in all of North America!

A Historic Decline

Unfortunately, many historic rice beds have been lost. Rice can be hurt by pollution, large boat wakes, exotic species, and other factors. Especially damaging are changes in water levels. The lakes and rivers which support rice have frequently been dammed, and even small increases in depth can destroy the habitat for this species. Although it is impossible to measure exactly how many acres of rice have disappeared, it is clear the loss has been substantial.

Habitat Requirements

Water Flow: Rice does best in the presence of flowing water, with rivers and flowages being optimal examples. Rice also does well in lakes that have an inlet and outlet. In lakes with relatively little flow, rice may persist, but will typically vary more in abundance from year-to-year.

Water Depth: This is perhaps the most critical element. Rice grows in about 0.5-3 feet of water, with 1-2 feet being optimal.

Water Clarity/Color: Clear water is preferred, as very dark or turbid water limits sunlight penetration and may hinder early plant development. However, rice beds can be supported on moderately stained waters, particularly where water depths are limited to about 2 feet or less.

Water Fluctuations: Generally annual fluctuations should not be too great, and water levels during the growing season should be stable or gradually receding. However, too much stability in water level over many years may be detrimental. The loss of year-to-year fluctuations, as may occur where water levels are artificially controlled, may lead to perennial plants out-competing rice. Some natural fluctuations should be maintained, even if it means an occasional poor year for rice.

Sediment Type: Several inches of soft organic muck is considered optimal. However, rice is fairly tolerant and beds exist on a wide variety of bottom types including sand and gravel. Extremely soft or flocculent bottoms may be unsuitable, but moderately flocculent sites may be a preferred habitat niche.

THE LIFE CYCLE

Wild rice is an annual aquatic grass. Its life cycle is fairly simple: The seed drops off the plant in August or September and usually sinks rapidly into the sediment near the mother plant. The seed remains dormant in the mud until spring when warming water and low oxygen conditions stimulate germination. Although most seed will usually germinate the first spring, some may remain dormant for five or more years. This extended dormancy allows wild rice to survive occasional crop failure.

Next the plant goes through several distinct growth phases. By late May and early June the plant is in the **submerged leaf stage** during which a cluster of 1-4 underwater basal leafs form. By mid-June the plant is in the **floating leaf stage**, when ribbon-like leaves lay flat on the water's surface. This is generally considered the most critical stage; the plant is buoyant and high winds or a rapid increase in water levels can uproot or drown entire beds.

By the end of June one or more **aerial shoots** have begun to develop. These shoots will continue to grow into August, reaching a height of 2-8 feet above the water. Multiple shoots, up to 10 or more, are most common where the water is shallow and the plant density is low.

As early as late July, **flowering** begins. Both male and female flowers develop on the same stalk, the female above the male. The female flowers open first, followed 3-4 days later by the male flowers. The pollen is wind-borne. This timing difference in flower opening promotes cross pollination.

In August and September the seeds develop and mature. Seeds on a single stalk reach maturity over a 10-14 day period, with the highest seeds maturing first. Ripening is also affected by sediment type, water depth, weather, and other factors. Ripe seed drops into the sediment, unless harvested by humans or wildlife. An acre of good rice beds can yield over 500 pounds of seed.

This gradual, uneven ripening means rice can be harvested repeatedly during the season, which may extend for up to 3-4 weeks on a particular lake. Different water bodies will also ripen at slightly different times, so the harvest season may last six weeks if fair weather holds.

Rice abundance can vary widely from year to year, especially on the most "lake-like" beds. The rule-of-thumb for lake beds: A typical four year period will include a bumper year, two fair years, and a bust (see photos left and right).

Totogatic Lake 1996 - a bust year.

Totogatic Lake 1995 - a bumper crop.

Ecology · Harvest · Management

Human Harvest

Harvesting wild rice can be a deeply rewarding experience. A fall day spent gathering this grain can yield a year's worth of memories to be relived each time the harvest is savored. The grain is nutritionally rewarding as well. Low in fat but high in protein, fiber, B vitamins and minerals, manoomin is nutritionally higher than white rice, oats, barley, wheat or rye. Gatherers of the wild crop often enjoy knowing their harvest hasn't been treated with commercial fertilizers, herbicides or insecticides.

Harvest typically begins in mid to late August and peaks 2-3 weeks later. The timing of the peak will vary from site to site. However, there is consistency from year to year, with river beds generally being earlier than lakes, and with the same lakes being relatively early or late each season.

Harvest methods haven't changed much in the last century. Allowable harvest techniques vary slightly from state to state, but all reflect traditional tribal methods, requiring the rice to be harvested from canoes or small boats with the use of smooth, wooden ricing sticks.

Generally, two people rice as a team. One moves the canoe through the rice bed using a long push-pole while the other "knocks" the grain. The knocker uses one ricing stick to bend the rice stalks over the boat, and the second to lightly stroke the seed heads, dislodging the ripe grain. It's important to knock gently. If the seeds don't drop with a gentle stroke, the rice isn't sufficiently ripe. Try a different site, or come back in a couple of days. Excessive force will only break the stems, preventing them from being harvested again.

Seed size, like ripening dates, varies by location but is quite consistent from year-to-year at each site. Seed size does not affect the flavor or quality of the rice.

A ricing trip may yield anywhere from a few pounds of rice to more than 200! But since even intensive hand harvesting removes only about 15% of the annual yield, abundant seed remains for wildlife and to reseed the bed.

Freshly harvested rice (referred to as "green" rice) can be used for sowing, but if your goal is food for the table, the rice will need to be finished. Finishing rice involves reducing the moisture content through parching, and removing the sheath that covers the seed. Traditional finishing is labor intensive and involves parching, "dancing" to loosen the hulls, and winnowing the rice (see photos). Some people greatly enjoy this part of the process while others prefer to have professionals, who have mechanized parts of the process, finish their rice for them.

Scattered across rice country are places you can bring your green rice for finishing. Finishers may charge a fee, or may keep a portion of your rice (typically 20%) in lieu of payment. A hundred pounds of green rice usually yields from 35-60 pounds of finished rice. The color of finished rice may vary from green-grey to black, but the color is more influenced by finishing techniques than by the origin of the seed.

Delicious Yet Easy to Cook

The unique, nutty flavor of wild manoomin is unmatched. It cooks in only 30-40 minutes, and since cooked rice yields 3-4 times its dry weight, a little goes a long way. Manoomin is highly versatile. You can start your day with it cooked as a breakfast cereal or in muffins or pancakes. Have it for dinner in soups, side dishes or casseroles, or "pop" it for a nutritious and tasty bed-time snack. Hundreds of recipes can be found in general or specialty cookbooks, or even on the Internet! Explore various cooking techniques and recipes, or come up with your own!

A Few Words about Cultivated or Paddy-grown Wild Rice

Paddy-grown wild rice is commonly found in supermarkets and road side stands at a significantly lower price than hand-harvested, wild grown manoomin. Although it may appear quite similar to natural wild rice, it is a fairly different product. Paddy rice differs genetically and may be grown commercially using fertilizers, herbicides or insecticides. It is also mechanically harvested and is often finished somewhat differently than natural wild rice. If you are interested in natural wild rice, check the label; Wisconsin and Minnesota require cultivated wild rice to be labeled as such.

Freshly harvested rice

Finished rice

Seeding

Research

Successful test seeding

Aerial surveys are used to monitor abundance

Management

Although wild rice has declined in abundance from historic levels, there is hope this trend may be reversed. A growing interagency effort is underway to manage and restore wild rice. Tribal, state, federal and private natural resource organizations and interested individuals are working to promote this special resource. Public support is essential for these efforts to succeed. With your help, we can try to ensure that manoomin remains a viable part of our wetland ecosystems.

Wild Rice Management Can Take Several Forms:

Abundance Monitoring is important to determine whether or not rice is continuing to decline in abundance. Because of the high variability in abundance from year-to-year, only long term studies will answer this question. Abundance monitoring can also be used to direct harvesters to the most productive stands and save unnecessary trips to waters with poor stands.

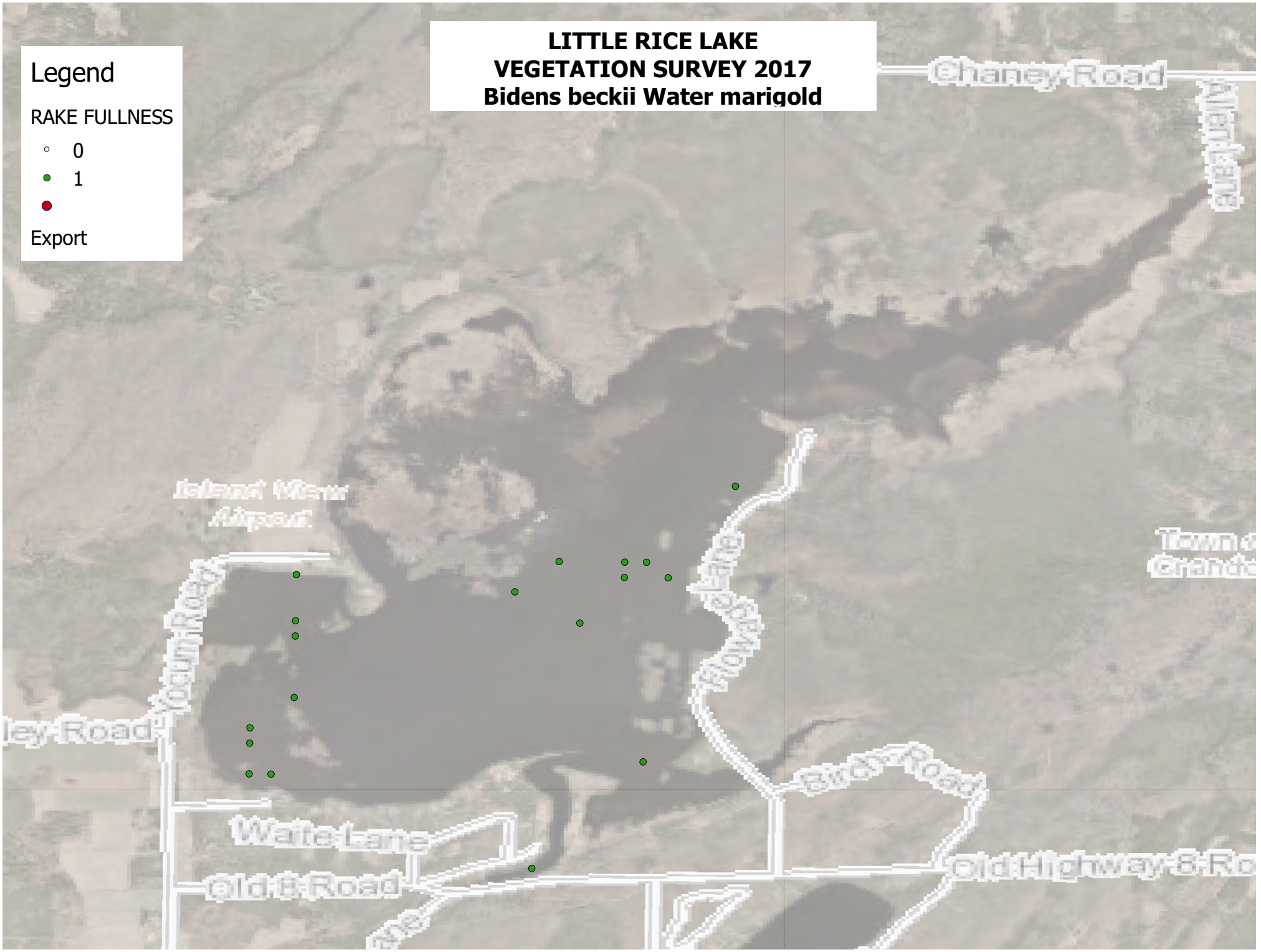
Restoration and Enhancement includes seeding rice at historic sites and introducing rice to sites with suitable habitat, such as artificial impoundments. It can also involve restoration of historical habitat conditions (such as water levels) or protection of rice beds from negative environmental impacts.

Harvest Monitoring can occur on individual waters or across broad areas. It can help biologists determine if wild rice abundance is adequate to meet the human demand or be used to monitor the effectiveness of restoration efforts. In Wisconsin, a sample of state and tribal harvesters are surveyed each year to estimate harvest. Contemporary annual harvest estimates from off-reservation waters within the state have varied from 34,000 to over 110,000 pounds.

Research can increase our understanding and appreciation of this unique plant. It may also improve our ability to restore lost beds or increase the likelihood of success when introducing rice at new sites. Current research includes efforts to understand the genetic variability of wild rice.

Appendix B

Aquatic Plant Maps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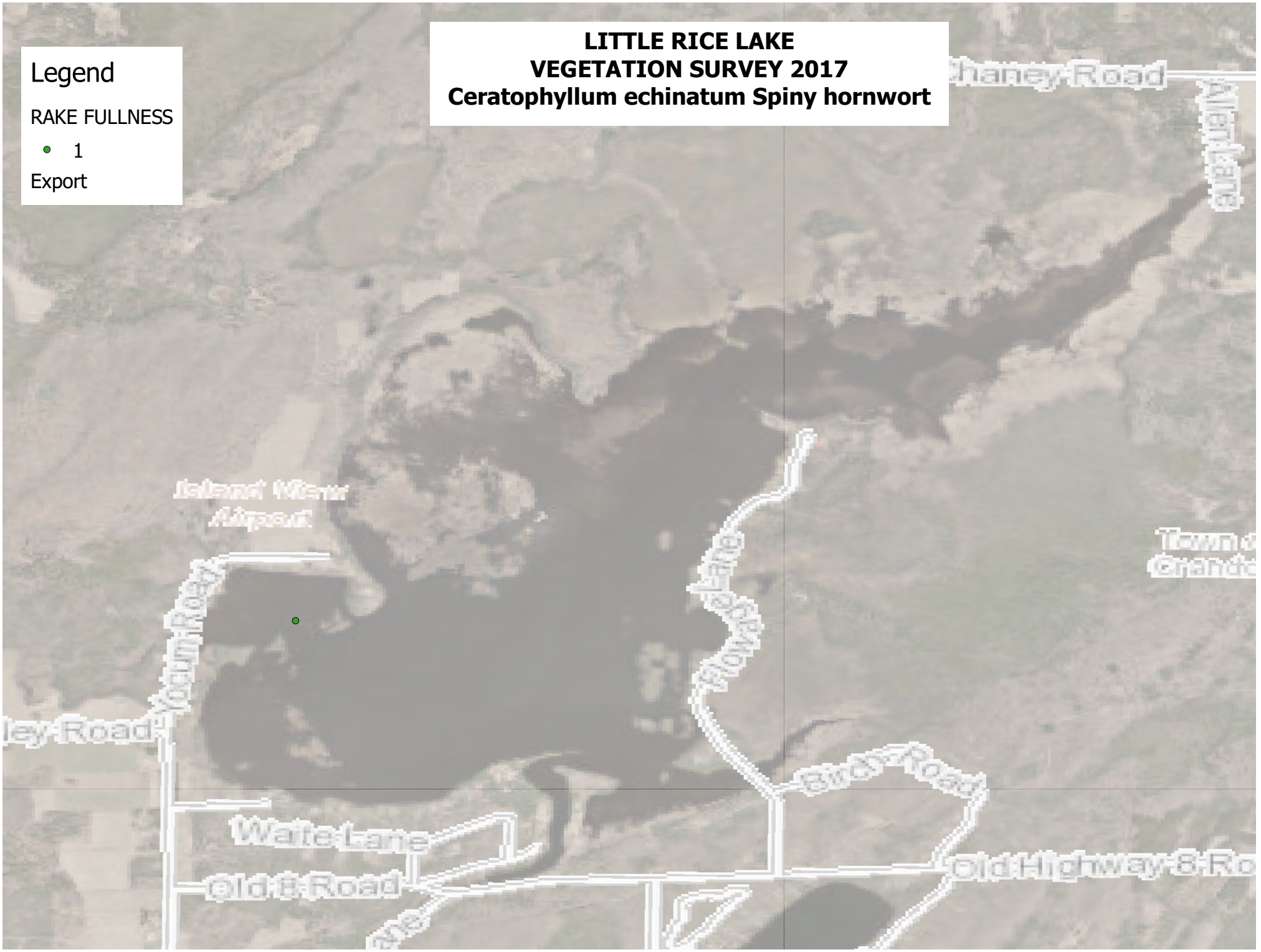
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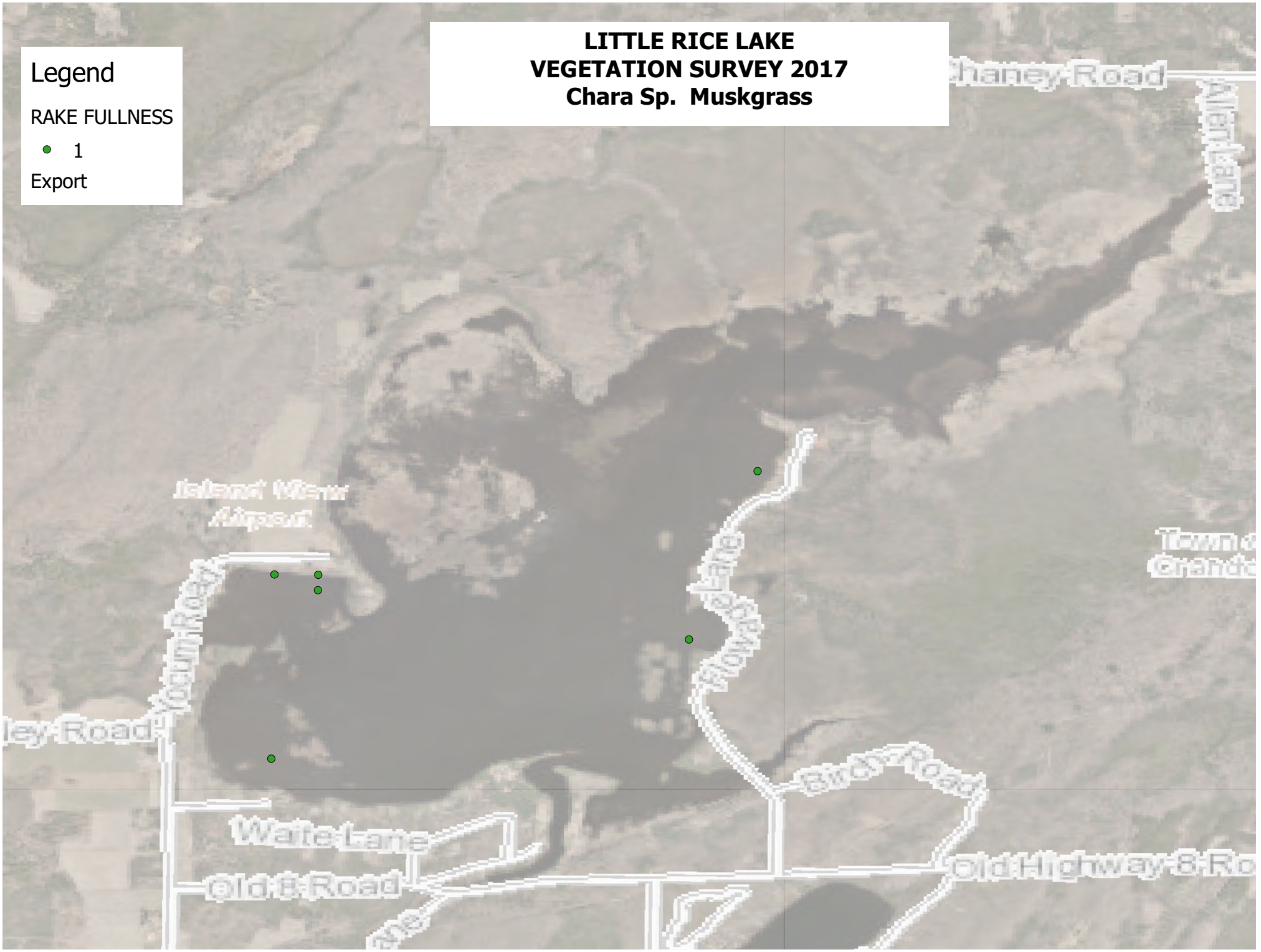
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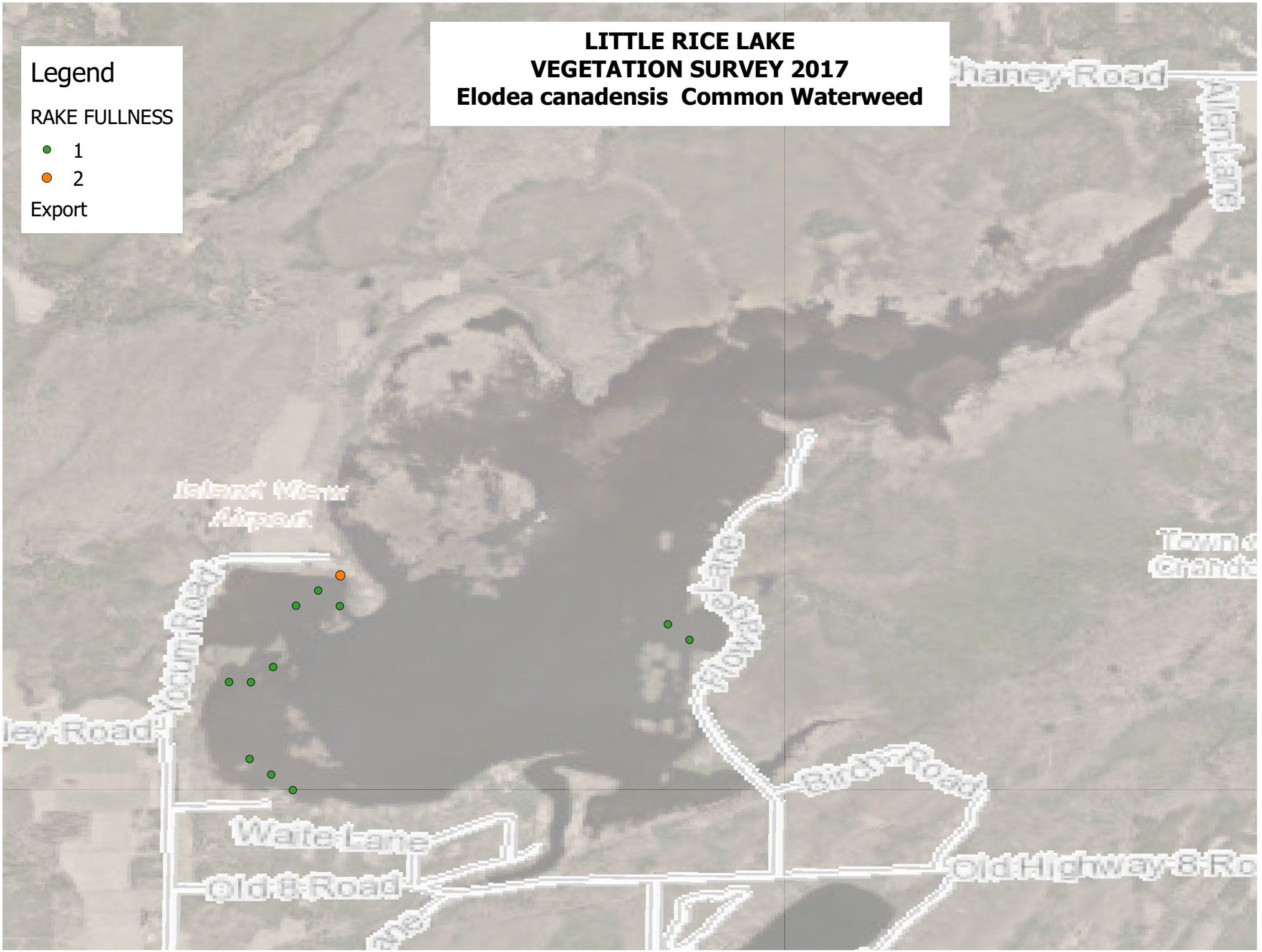
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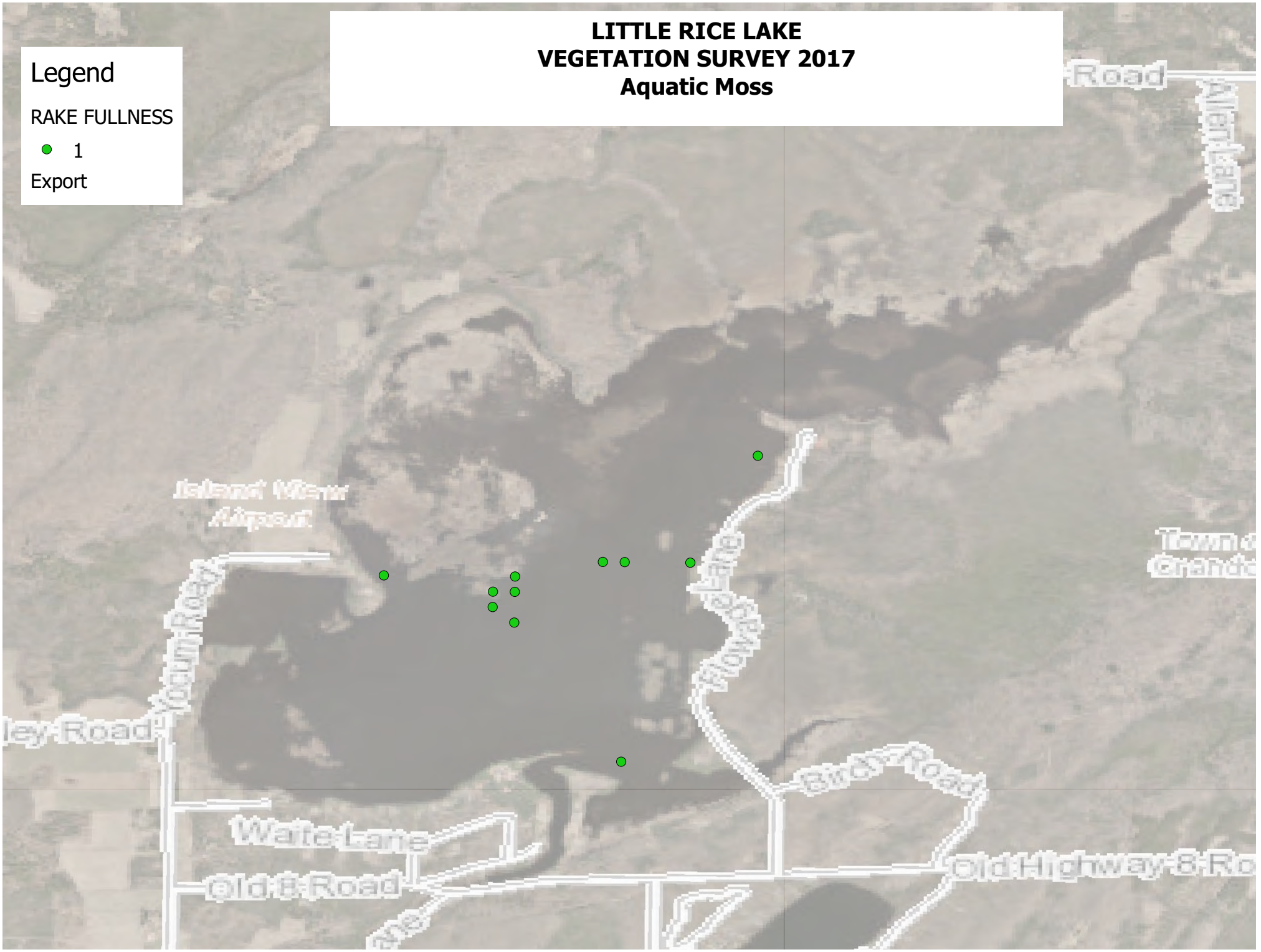
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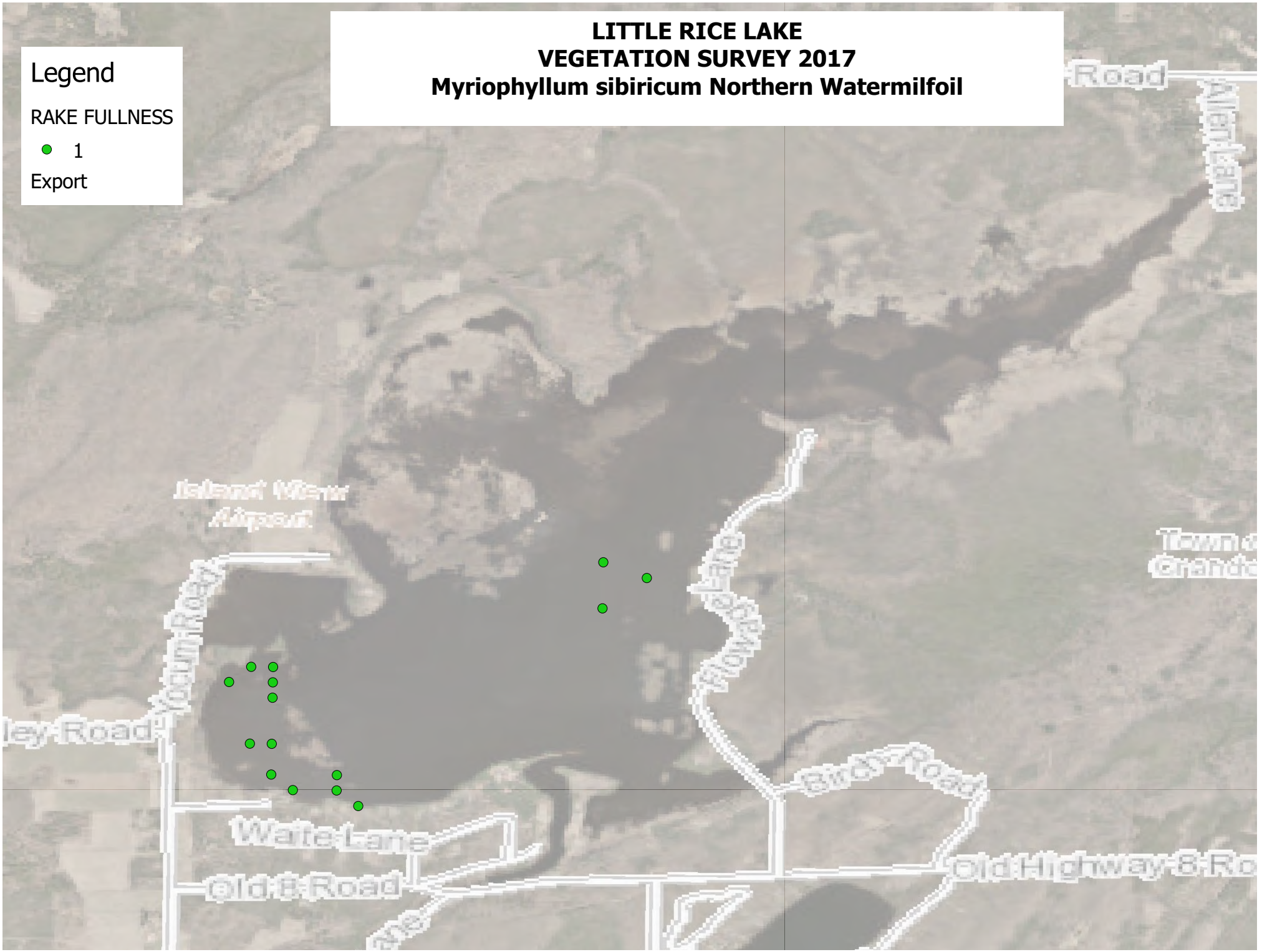
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Myriophyllum sibiricum Northern Watermilfoil
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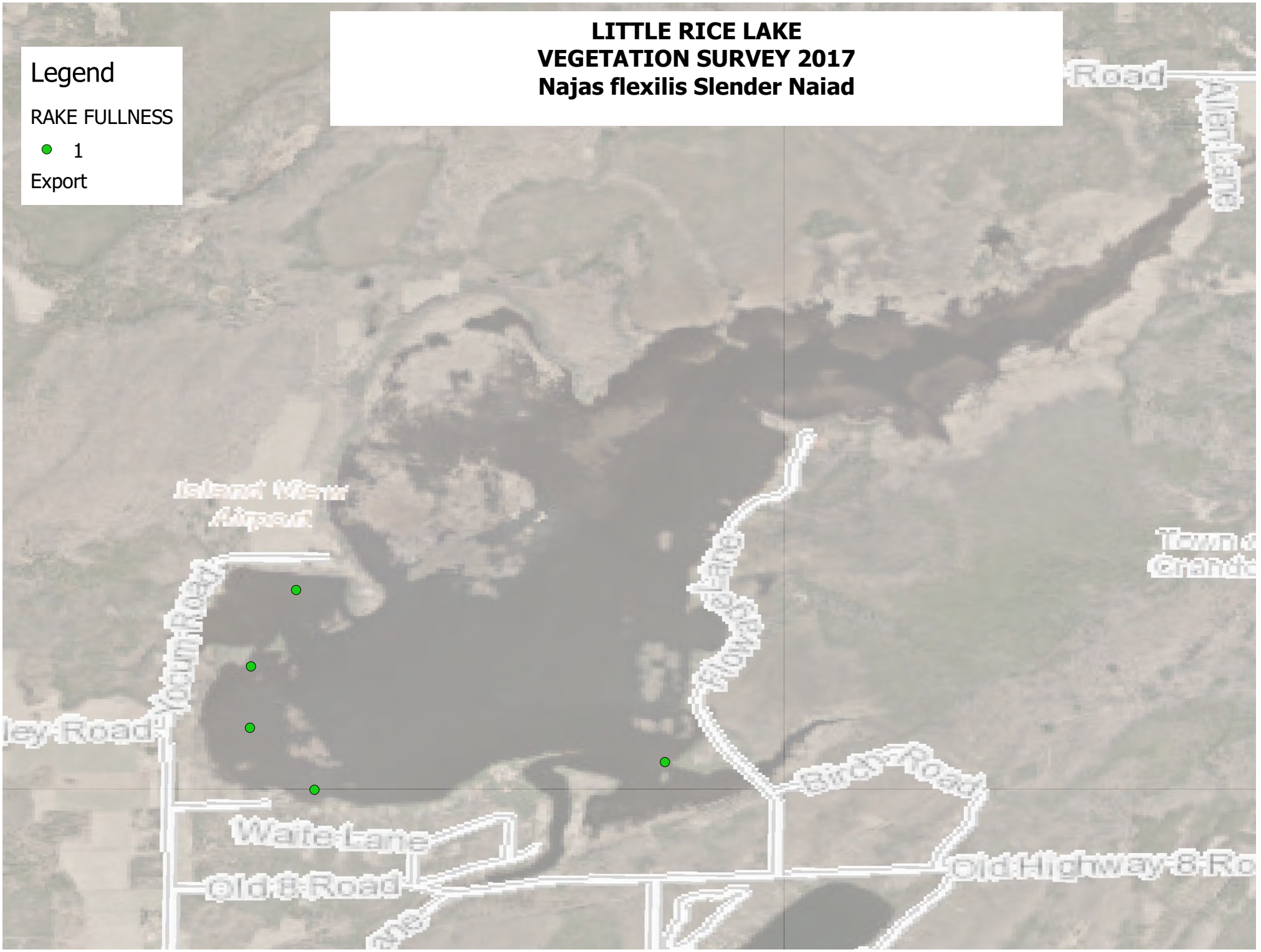
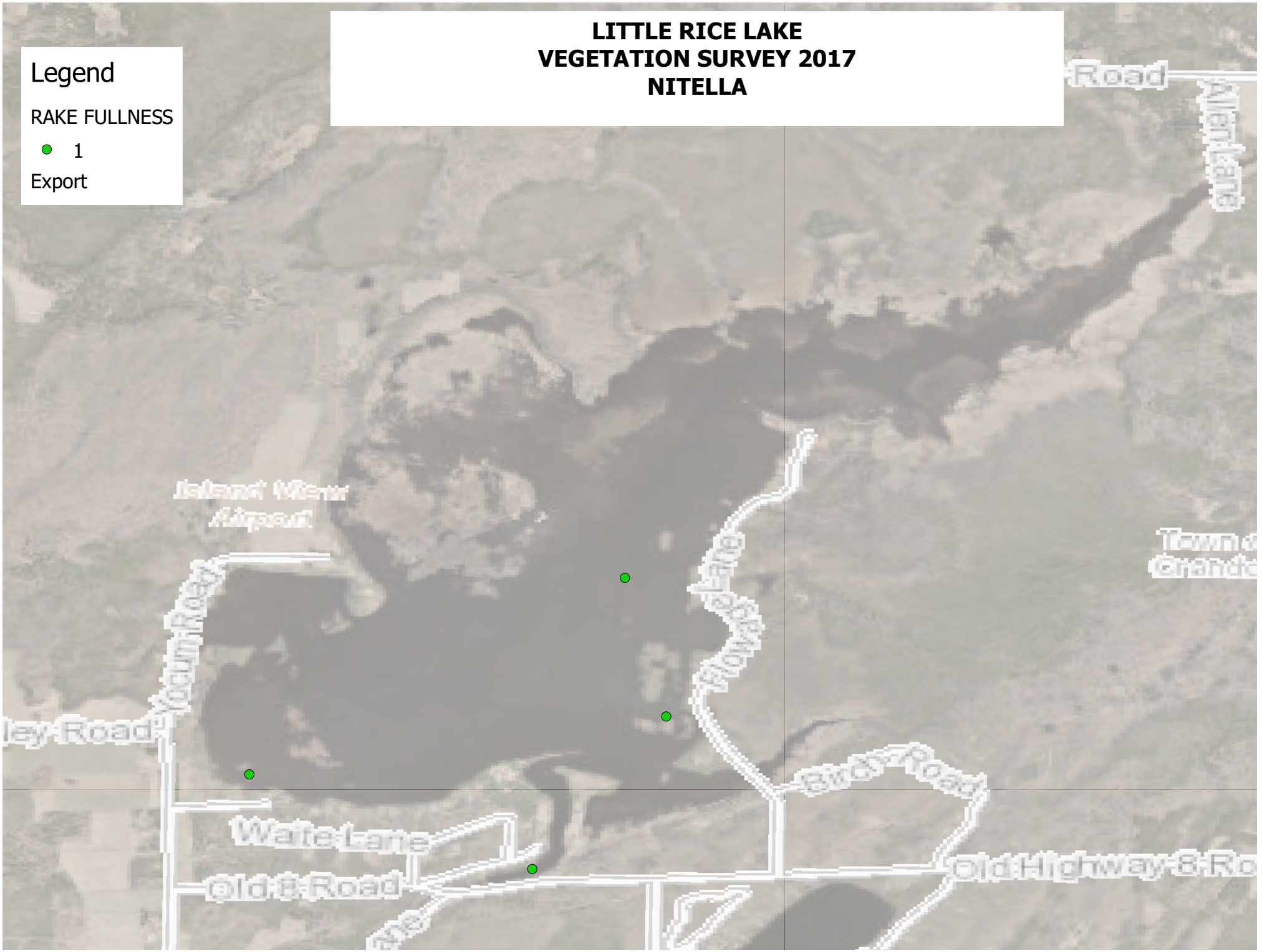
Najas flexilis Slender Naiad

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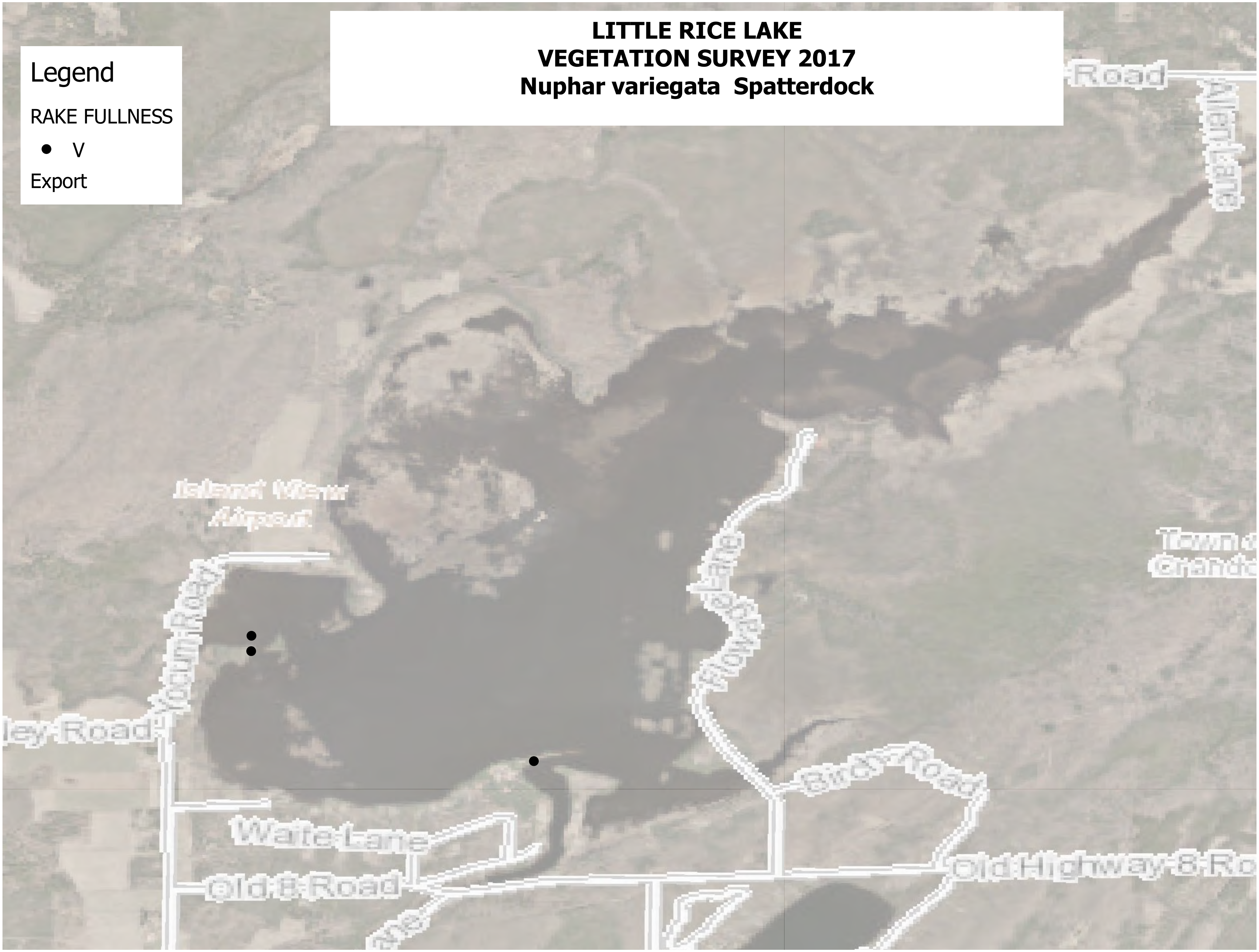
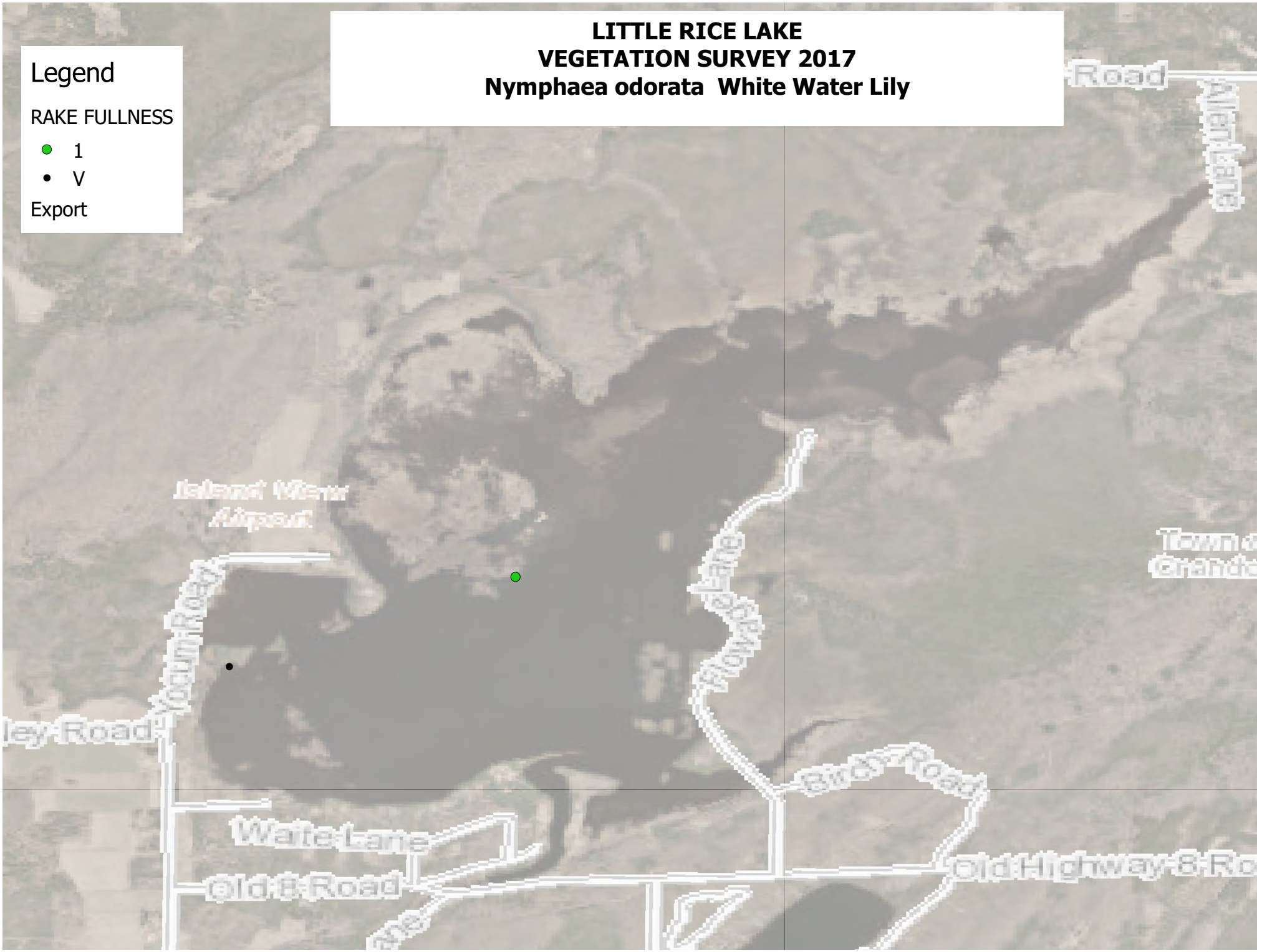
Nuphar variegata Spatterdock

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Nymphaea odorata White Water Lily
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Potamogeton amplifolius Large-leaf Pondweed
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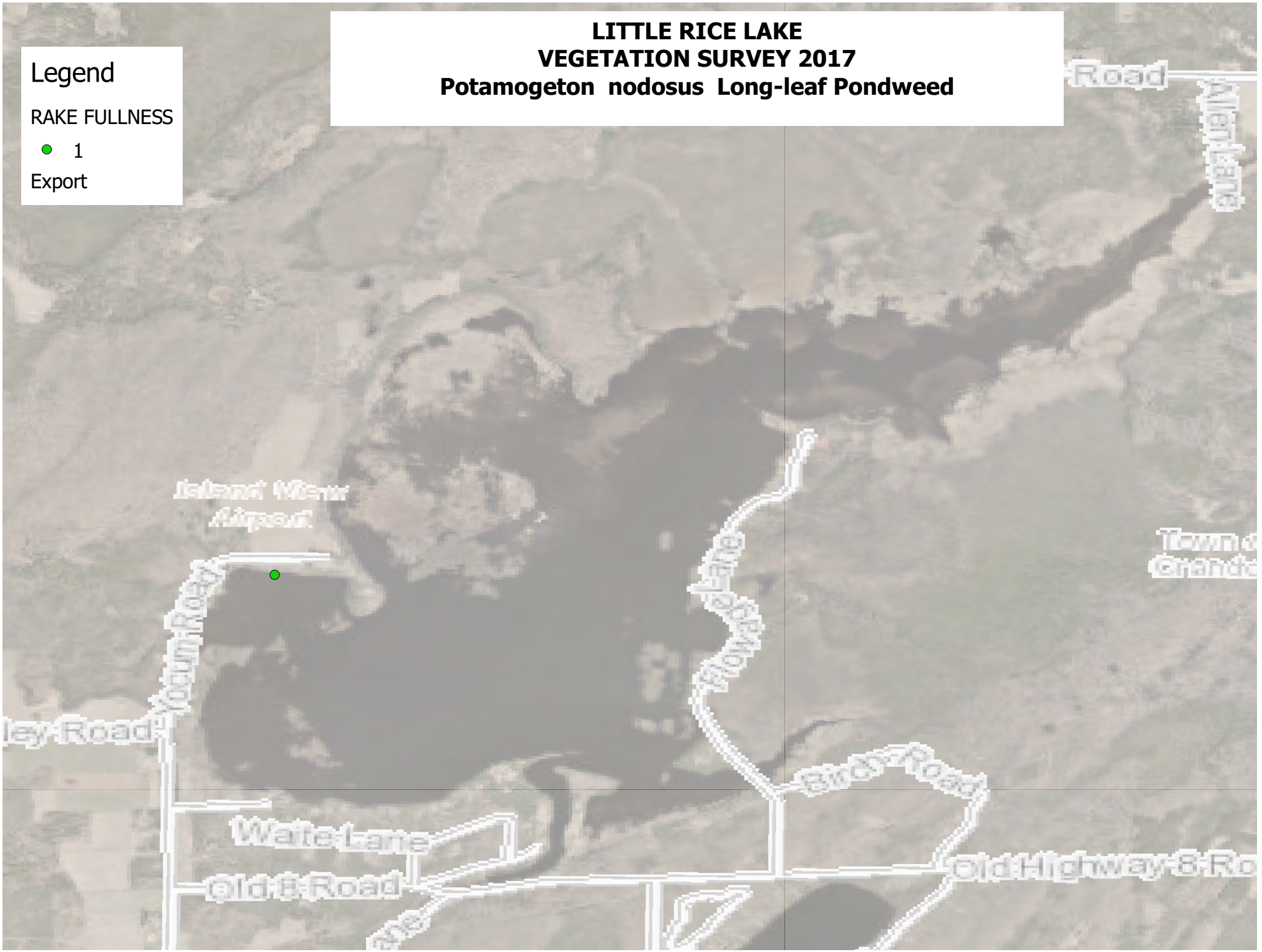
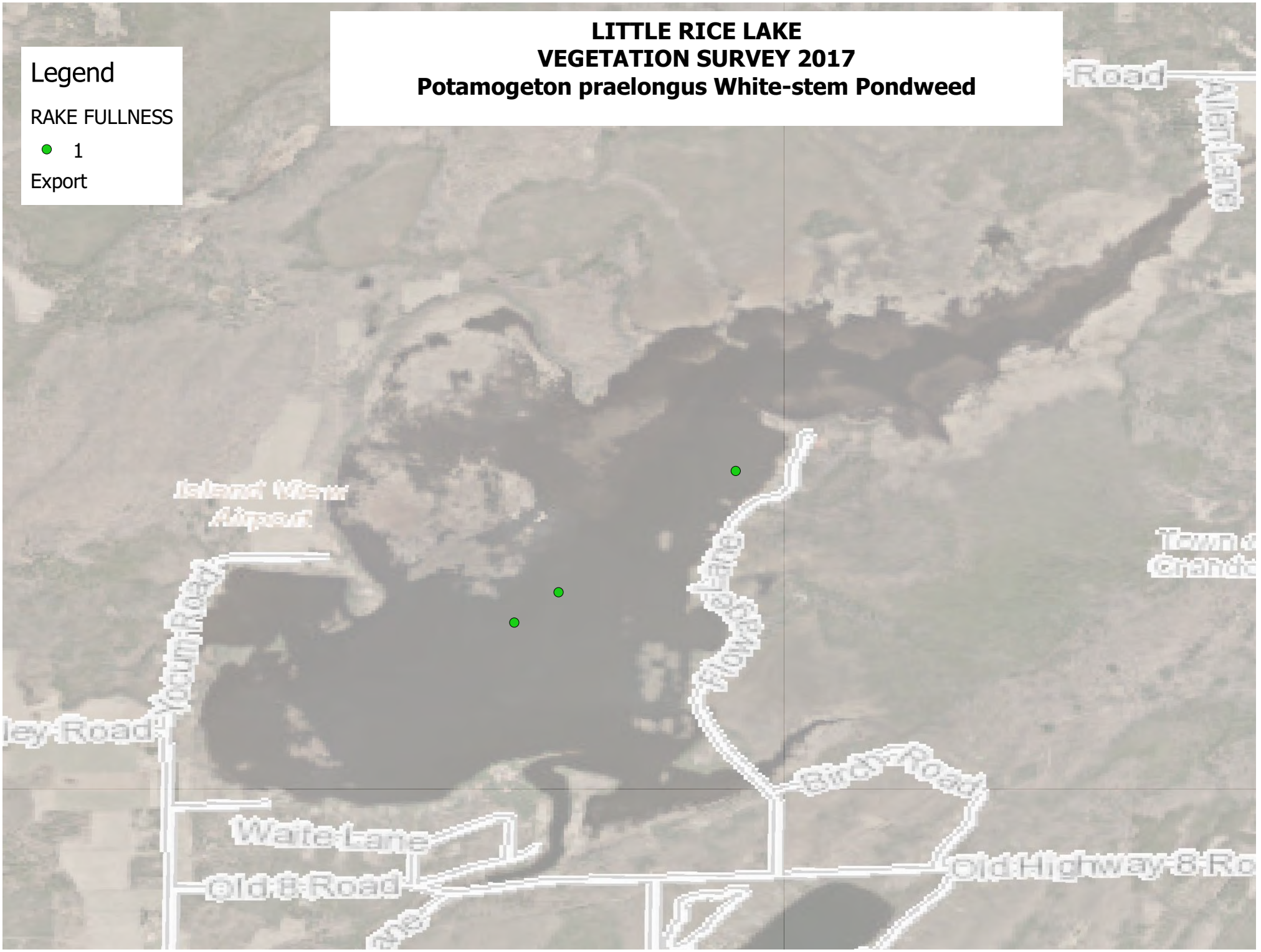
Potamogeton nodosus Long-leaf Pondweed

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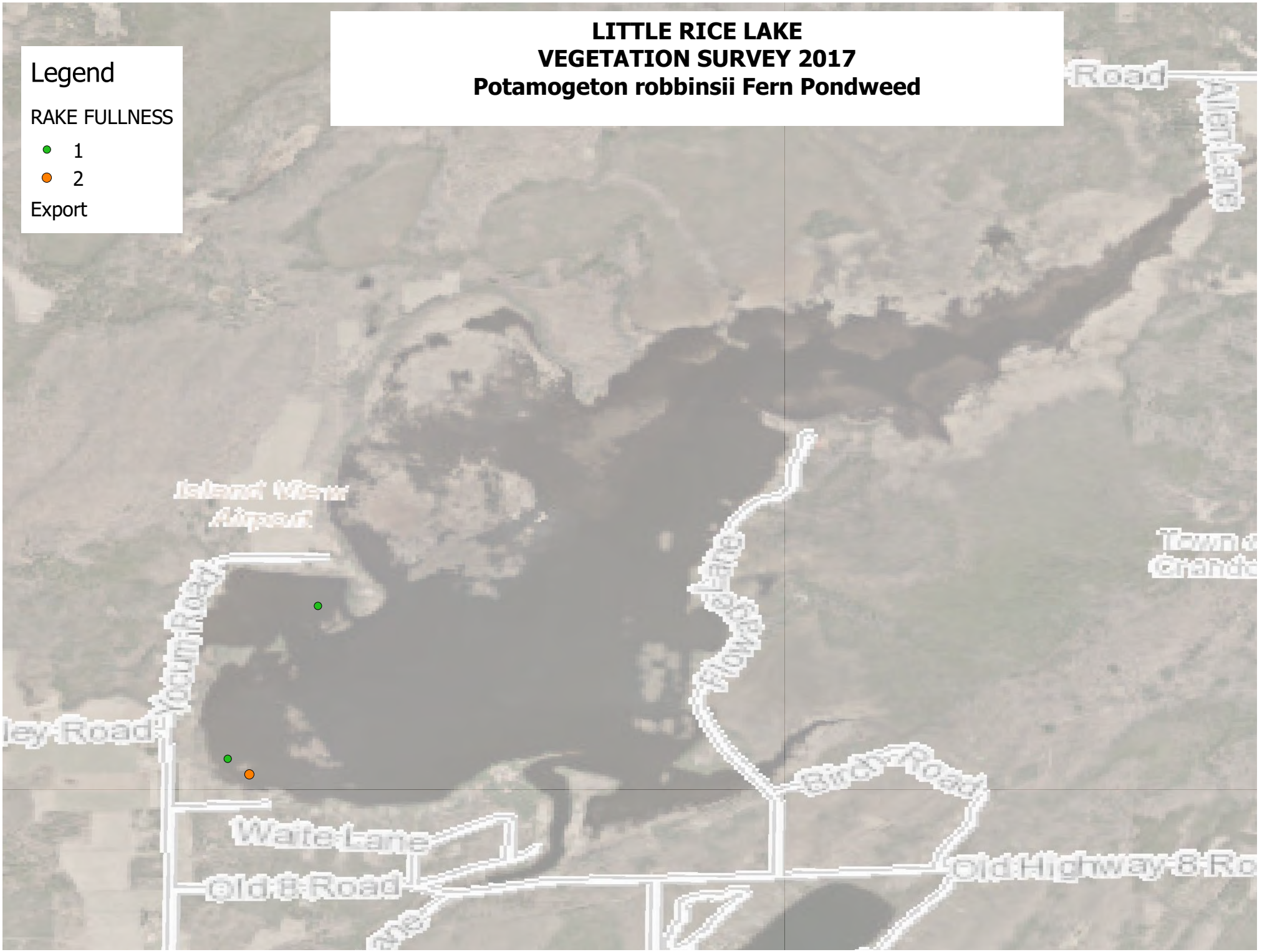
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Potamogeton robbinsii Fern Pondweed
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LITTLE RICE LAKE
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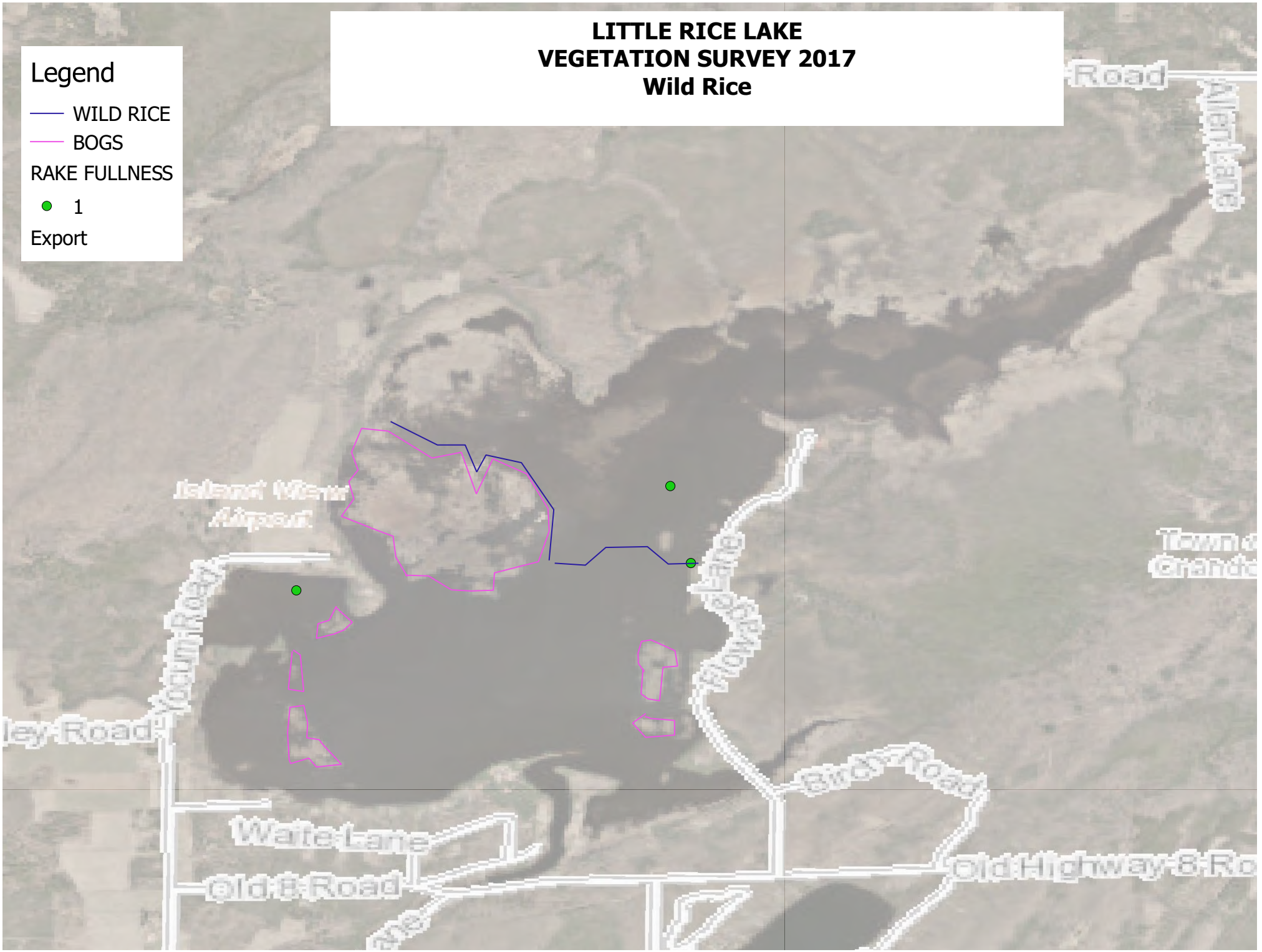
Wild Rice



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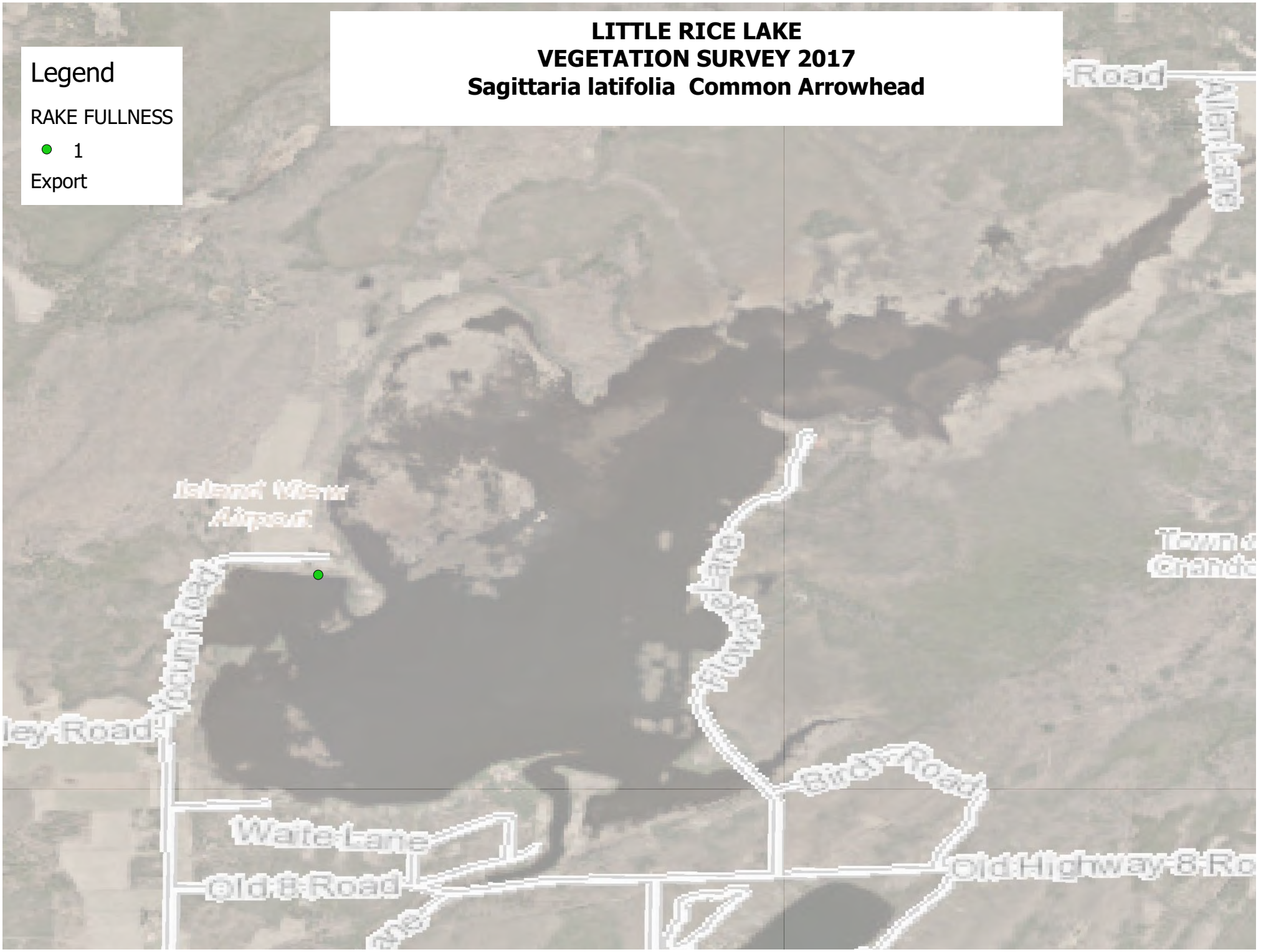
Sagittaria latifolia Common Arrowhead

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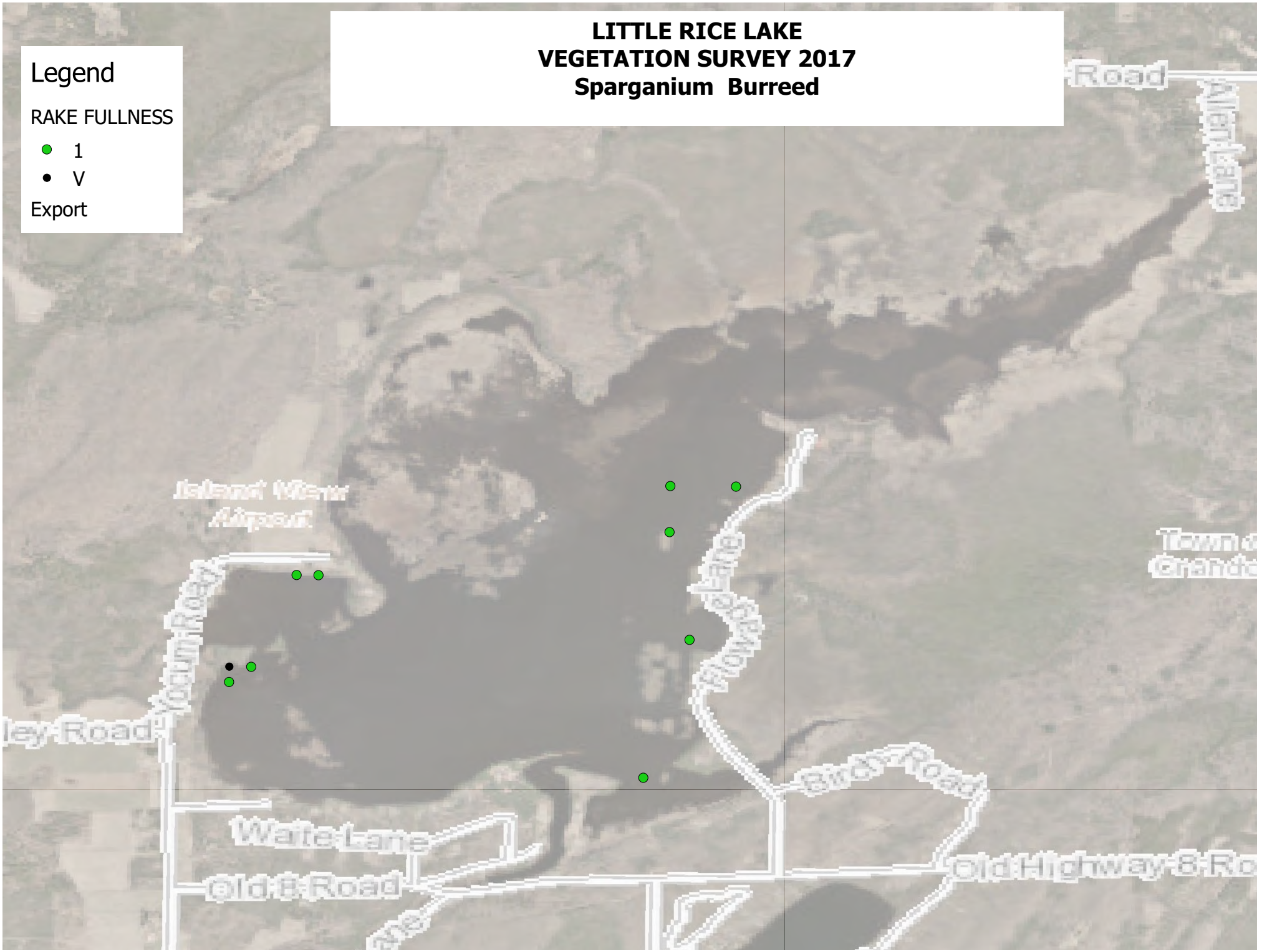
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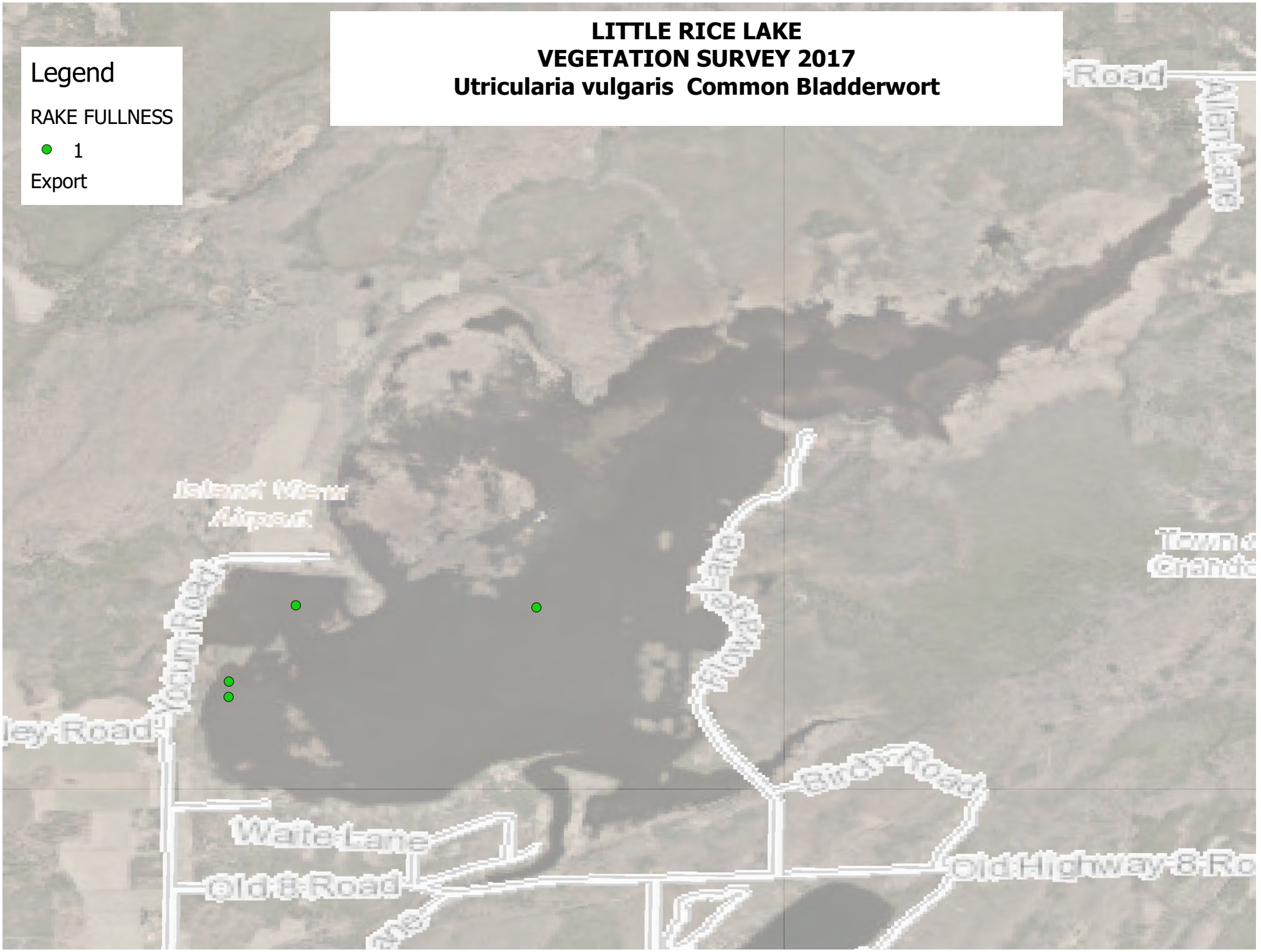
VEGETATION SURVEY 2017
Utricularia vulgaris Common Bladderwort



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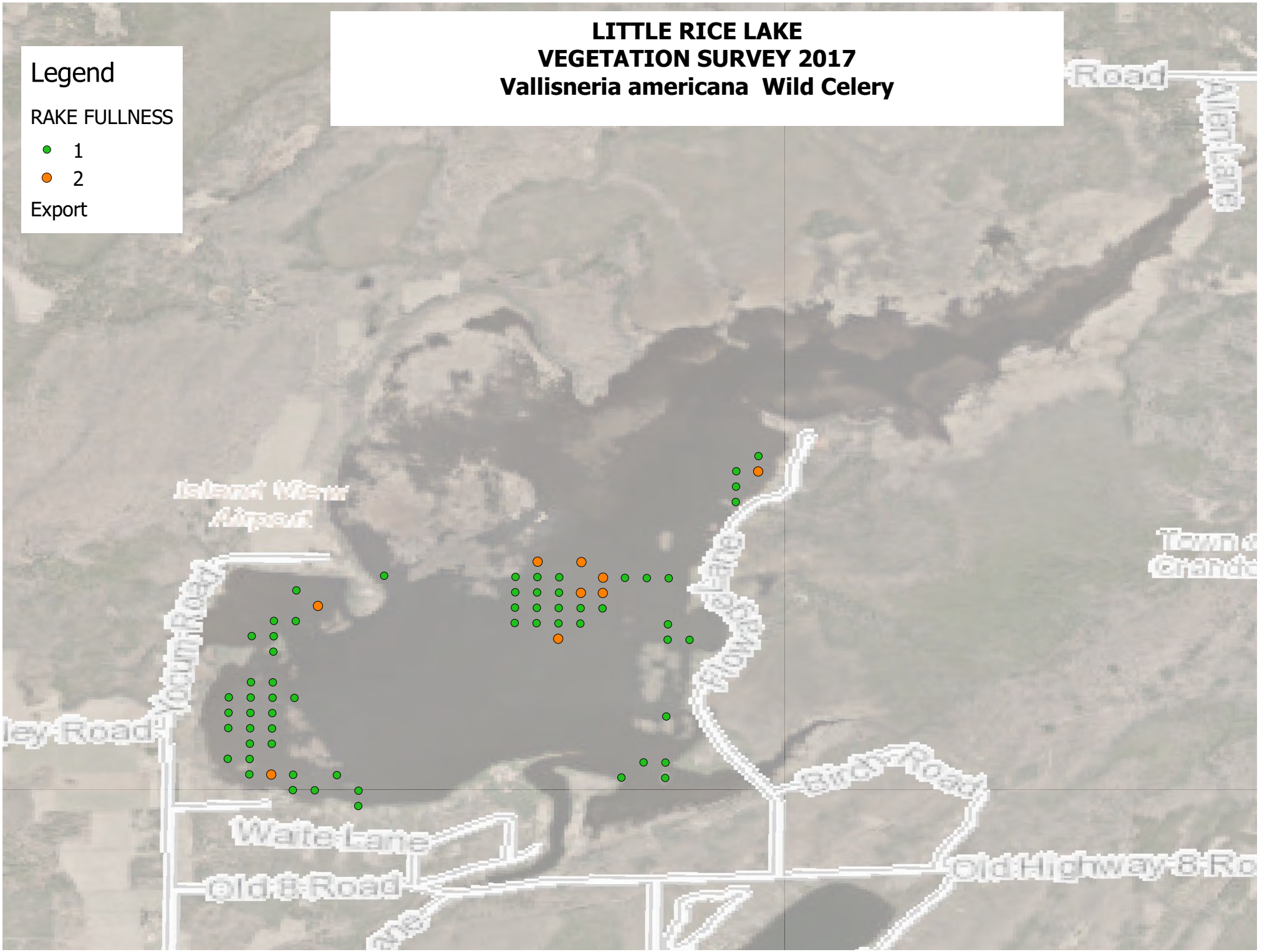
Vallisneria americana Wild Celery



Appendix C

Importance of Aquatic Plants to Lake Ecosystem

Aquatic Invasive Species

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).

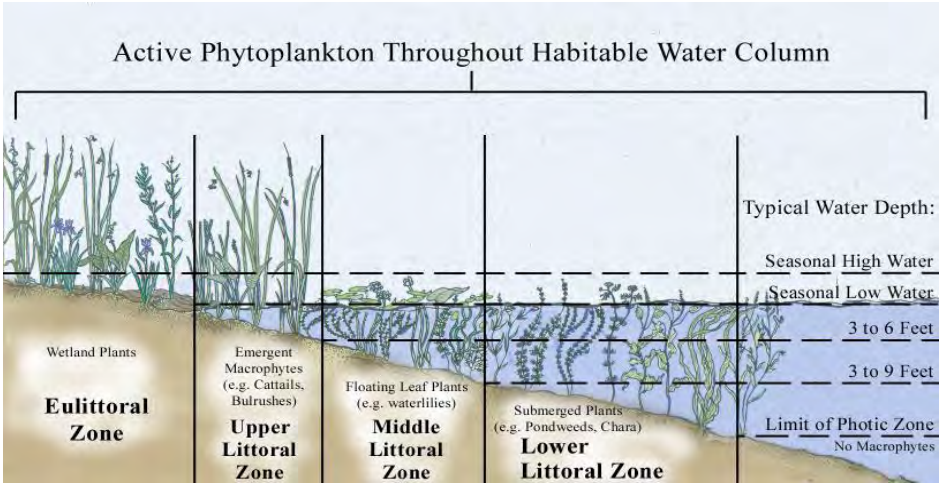
Eulittoral Zone: Includes the area between the highest and lowest seasonal water levels, and often contains many wetland plants.

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.

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.

Appendix D

Descriptions of Aquatic Plants

Description of Plants
LITTLE RICE LAKE 2017

Water marigold (Bidens beckii)

- Submersed
- Native; primarily in northern and eastern WI
- Found in soft sediment, clear water lakes from ankle deep to 3 meters deep
- Flowers attract insects, provide forage, shelter and shade to fish, shorebirds consume fruit.

Coontail (Ceratophyllum demersum)

- Submersed
- Native and common in WI
- Tolerant of low light conditions and will grow in water several meters deep
- Offer prime habitat in winter due to stiff whorls and lack of other vegetation at this time of year

Spiny hornwort (Ceratophyllum echinatum) *

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

Muskgrass (Chara sp)

- Submersed
- Native; common in WI
- Found in hard water, prefers muddy or sandy substrate in deeper water
- Favorite waterfowl food, provides valuable fish habitat for young trout, largemouth and smallmouth bass

Common waterweed (Elodea Canadensis)

- Submersed plant up to 1 m long
- Native and common in WI
- Found in water depths from ankle to several meters deep, most abundant in fine sediments rich in organic matter
- Provide shelter and grazing opportunities for fish, food for muskrats and waterfowl.

Northern watermilfoil (Myriophyllum sibiricum)

- Submersed
- Native and common throughout WI
- Found in soft sediments in fairly clear water up to 4 meters deep; sensitive to reduced water clarity and declines in lakes that are becoming eutrophic

- Consumed by waterfowl; provide invertebrate habitat; provides shade, shelter and forage for fish.

Slender Naiad (Najas flexilis)

- Submersed
- Native and common throughout WI
- Grows in wide range of depth from very shallow to several meters deep
- One of most important waterfowl plant; stems, leaves and seeds are consumed by variety of ducks; important to marsh birds and muskrats; provides food and shelter for fish+

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 variegate)

- 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, bever; 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

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

Long-leaf pondweed (Potamogeton nodosus)

- Submersed
- Native; scattered throughout WI

- More common in flowing water; found in water 1 meter deep in a variety of sediment types; tolerates turbid water
- Grazed by waterfowl and mammals; provides invertebrate habitat

White-stem pondweed (Potamogeton praelongis)

- Submersed
- Native and common in northern WI
- Found in soft sediment in water from 1 to 4 meters deep in lakes with good water clarity
- Fruit grazed by waterfowl, portions consumed by mammals; provides valuable habitat for musky

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)

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)

- Emergent
- Native; scattered in WI

- Deep to shallow marshes and along lake shores
- Food source for waterfowl, grazed by muskrats

Floating-leaf burreed (Sparganium fluctuans)

- Submersed
- Native and common in WI
- Found in quiet water, muddy sediment

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

Wild Rice

- Emergent
- Sprouts from seed, found in silt or muck, win water 10 cm to 1m deep, in moving water
- Valued by waterfowl, muskrats and humans

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	Mostly used for water-milfoil and duckweed	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads
			Applied as liquid, can be combined with copper treatment	Rapid action	Toxic to aquatic invertebrates
				Limited direct toxicity on fish and other animals	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	Effective on EWM for 1 to 4 years with aggressive follow-up treatments	Affects many non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations. These plants are important to combat invasive species
			Must be applied during early growth stage	Applied at very low concentration	Requires long contact time: 60-90 days
			Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Slow decomposition of plants may limit decreases in dissolved oxygen	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments, EWM has the potential to develop resistance
				Low toxicity to aquatic animals	Unknown effect of repeat whole-lake treatments on lake ecology
e.	Glyphosate (Rodeo)	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants such as purple loosestrife	Effective control for 1-5 years
			Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Ineffective in muddy water
			Applied as liquid spray or painted on loosetrife stems	Non-toxic to most aquatic animals at recommended dosages	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.

Costs: 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.

Hydroraking/rototilling: 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.

Advantages: 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.

Disadvantages: 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

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-

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;

(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.**

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 30.07, 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; **correction made under s. 13.92 (4) (b) 7., Stats., Register March 2011 No. 663.**

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.

(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 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.

Appendix G

Resource for Additional Information

Additional Resources

Lake Association

Little Rice Lake Association, Inc.
PO Box 211
Crandon, WI 54520

Forest County

Land and Water Conservation Department

- Shoreland Restoration Cost Share
- Land and Water Management Plan Forest County

715-478-1387
lcc@co.forest.wi.us
https://forestcountylandandwater.org/

Zoning Department

- Shoreland Zoning Ordinance
- Floodplain Zoning Ordinance
- Shoreland Restoration Information
- Shoreland Alteration/Grading Permit

715-478-3893
fczone@co.forest.wi.us

Forest County Association of Lakes

Facilitate education, research and sharing between organizations, governmental bodies and the general public.

President: Pam Schroeder
Email: pschroed0214@gmail.com
Phone: 715-473-3803

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/

Forest County Land Conservation

http://www.co.forest.wi.gov/localgov_departments_details.asp?deptid=388&locid=145

Aquatic Invasive Species - County or Tribal Coordinator

https://dnr.wi.gov/lakes/invasives/ContactsByCounty.aspx?location=21

WDNR Contacts

Great Lakes Outreach/Monitoring Specialist

AMANDA SMITH
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County or Tribal Coordinator

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wriscproject@gmail.com

Report a New Finding

ALAN WIRT
715-365-8905
Alan.Wirt@wisconsin.gov

Grants - Applying and Technical Assistance

Scott Van Egeren
715-471-0007
Scott.VanEgeren@wisconsin.gov

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Grants - Financial Administration

Laura MacFarland
608-257-2424
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Aquatic Plant Management

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Little Rice Lake Dam Owner/Operator
Little Rice Wildlife Area

Tom Carlson, Wildlife Biologist
(715) 218-8218
Thomas.Carlson@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.

Appendix I

Shoreland Assessment

LITTLE RICE LAKE SHORELAND ASSESSMENT AUGUST 2017

Parcel Label	Owner	Shoreline_length_feet	Canopy_pc	Shrub_p	Herb_p	Shrub_Herb_pc	Impervious_pc	Lawn_pc	Buildings_n	Boats_n	piers_n	boat_lift_n	raft_n	boathouse_n	Emergents_p	Floating_p	Plant_removal_p	sea_wall_L	riprap_L	trail_p	Ag_pc	Other_pc	firepits_n	structures_riparian_oth	human_riparian_descri	point_source_p	channelized_flow_p	slope_p	bare_soil_p	sand_deposit_p	runoff_other_p	runoff_description	erosion_control_L	beach_L	greater_1ft_L	less_1ft_L	marina_n	structures_littoral_othe	structures_littoral_dess	exposed_canopy_p	exposed_shrub_p	exposed_herb_p	exposed_mow_p	exposed_till_p	Notes
012-0012-40-000	TERRY L THOMPSON ET AL	140	100	1	1	100									1	1																													
012-0012-80-000	DANIEL R YOCUM	1370	100	1	1	100									1	1																													
012-0013-00-000	STATE OF WISCONSIN	5230	100	1	1	100									1	1																													
012-0013-30-000	JEFFERY NOLAN	3020		1	1	100									1	1																													
012-0013-40-000	STATE OF WISCONSIN	2000	80	1	1	100									1	1																													
012-0013-50-000	JEFFERY NOLAN	1250	80	1	1	100									1	1																													
012-0013-60-000	STATE OF WISCONSIN	2960		1	1	100									1	1																													
012-0013-80-000	JEFFERY NOLAN	2100		1	1	100									1	1																													
012-0014-30-000	DAVID CHANEY ET AL	1400	10	1	1	100									1	1																													
012-0014-30-001	CAROLYN BAILEY	1850	10	1	1	100									1	1																													
012-0014-80-000	STATE OF WISCONSIN-DNR	1620	40	1	1	100									1	1																													
012-0014-90-000	DAVID CHANEY ET AL	855	100	1	1	100									1	1																													
012-0015-00-000	DAVID CHANEY ET AL	800	100	1	1	100									1	1																													
012-0015-20-000	STATE OF WISCONSIN	900	100	1	1	100									1	1																													
012-0028-60-000	STATE OF WISCONSIN	2820		1	1	100									1	1																													
012-0028-70-000	MICHAEL G MACAULEY	1770	100	1	1	100	100																																						
012-0028-80-000	JACK W NELSON	110	80	1	1	80		20							1	1																													
012-0028-90-000	ROBIN M ORTIZ	125	100	1	1	100									1	1																													
012-0029-00-000	STEVEN J ARMSTRONG ET U	30	100	1	1	100									1	1																													
012-0029-10-000	CAROL A FULLER	90	60	1	1	60		40		3	1	1				1																													
012-0029-20-000	AARON HOWERTON ET UX	100	50	1	1	20		80		2	1	1				1																													
012-0029-30-000	STEVEN SANDER	150	100	1	1	90		10		1	1				1	1																													
012-0029-40-000	DAVID CAMPBELL JR ET UX	100	100	1	1	100						1			1	1																													
012-0029-50-000	MICHAEL G MACAULEY	580	100	1	1	100									1	1																													
012-0029-60-000	AARON A HOWERTON ET U	95	70	1	1	100									1	1																													
012-0029-70-000	MICHAEL G MACAULEY	780	60	1	1	50	20	30	5	6	2				1	1																													
012-0029-80-000	ALOIS R BOCEK ET AL	215	100	1	1	100									1	1																													
012-0029-90-000	RICHARD G & ROSALIE A RO	55	0			0		100		2	1					1		55																											
012-0030-00-000	RONDA NOLAN	200	100	1	1	100									1	1																													
012-0030-10-000	GARY L BERO ET UX	130	100	1	1	100									1	1																													
012-0030-20-000	MARTIN THYSSEN	180	100	1	1	100									1	1																													

Parcel Label	Owner	Shoreline_length_feet	Canopy_pc	Shrub_p	Herb_p	Shrub_Herb_pc	Impervious_pc	Lawn_pc	Buildings_n	Boats_n	piers_n	boat_lift_n	raft_n	boathouse_n	Emergents_p	Floating_p	Plant_removal_p	sea_wall_L	riprap_L	trail_p	Ag_pc	Other_pc	firepits_n	structures_riparian_oth	human_riparian_descri	point_source_p	channelized_flow_p	slope_p	bare_soil_p	sand_deposit_p	runoff_other_p	runoff_description	erosion_control_L	beach_L	greater_1ft_L	less_1ft_L	marina_n	structures_littoral_othe	structures_littoral_des	exposed_canopy_p	exposed_shrub_p	exposed_herb_p	exposed_mow_p	exposed_till_p	Notes
012-0030-30-000	BRUCE SHILTS ET UX	240	10					100		1	1	1				1			240																										
012-0030-40-000	JOSEPH D BAUGNET	60	100	1	1	100									1	1																													
012-0030-50-000	JAY BARTA ET UX	90	10				20	80	1							1		90																												
012-0030-60-000	BRUCE SHILTS ET UX	80	90	1	1	90		10								1																													
012-0030-70-000	MARY L CRASS	70	20	1	1	20	10	70	1	1	1	1			1	1																													
012-0030-80-001	JOSEPH D BAUGNET	110	50	1	1	50		50		2	2				1	1																													
012-0030-90-000	JAMES D RUPERT ET AL	75	0	1	1	50		50		2	1	1			1	1																													
012-0031-00-000	ROBERT EVERS	85	50	1	1	40		60		1	1		1			1			50																										
012-0031-10-000	MARTIN THYSSEN	185	70	1	1	70	10	20	1	1	1	1			1	1																													
012-0031-20-000	GARY BOCEK ET UX	117	80	1	1	80		20			1				1	1																													
012-0031-30-000	GARY L BERO ET UX	117	70	1	1	60		40		2	1				1	1			50																										
012-0031-40-000	ROBERT L PHILLIPS	65	40	1	1	100									1	1																													
012-0032-20-000	GLENN A LASSANSKE	100	100	1	1	100									1	1																													
012-0032-30-000	FREDERICK J DRAVES	140	80	1	1	70		30							1	1																													
012-0032-40-000	RICHARD W SHRIEVER	150	0	1	1	100									1	1																													
012-0032-50-000	ROBERT E BURT	170	90	1	1	90		10							1	1																													
012-0032-60-000	HARRY THURIN ET UX	850	100	1	1	100				1	1				1	1																													
012-0032-80-000	STATE OF WISCONSIN	90	90	1	1	90	10								1	1																													
012-0032-90-000	DENNIS D PIERSON	100	100	1	1	90		10			1				1	1																													
012-0033-00-000	STEVEN J BRAUNREITER ET	322	100	1	1	100									1	1																													
012-0033-10-000	STEVEN L HUEBNER	645	90	1	1	90		10		1	2				1	1																													
012-0033-60-000	LEO U DEBRUIN ET UX	800	90	1	1	90		10		2	2				1	1																													
012-0034-20-000	JOHN YOCUM ET UX - TRUS	1580	100	1	1	100									1	1																													
012-0034-50-000	JOHN YOCUM ET UX - TRUS	1650	100	1	1	100									1	1																													
012-0034-60-000	ROLLAND YOCUM - TRUSTE	910	90	1	1	100									1	1												1	1						20										
012-0034-70-000	ALBERT THOMPSON ET UX	295	100	1	1	100					1				1	1																													
012-0034-80-000	JOHN YOCUM	1150	90	1	1	100	0	0							1	1																													
012-0034-90-000	CARLOS J HERNANDEZ ET U	375	0	1	1	100									1	1																													
012-0034-90-001	JEFFREY R ANTONUK	820	100	1	1	100									1	1																													
012-0035-00-000	EUGENE A WICKHAM ET AL	625	100	1	1	100									1	1																													
012-0035-10-000	GARY J BOLLE ET UX	410	100	1	1	100									1	1																													
012-0035-10-004	THOMAS JOHN BOUCHER E	1325	100	1	1	100									1	1																													

Parcel Label	Owner	Shoreline_length_feet	Canopy_pc	Shrub_p	Herb_p	Shrub_Herb_pc	Impervious_pc	Lawn_pc	Buildings_n	Boats_n	piers_n	boat_lift_n	raft_n	boathouse_n	Emergents_p	Floating_p	Plant_removal_p	sea_wall_L	riprap_L	trail_p	Ag_pc	Other_pc	firepits_n	structures_riparian_oth	human_riparian_descri	point_source_p	channelized_flow_p	slope_p	bare_soil_p	sand_deposit_p	runoff_other_p	runoff_description	erosion_control_L	beach_L	greater_1ft_L	less_1ft_L	marina_n	structures_littoral_othe	structures_littoral_des	exposed_canopy_p	exposed_shrub_p	exposed_herb_p	exposed_mow_p	exposed_till_p	Notes
012-0035-20-000	MICHAEL R BRAUNREITER I	165	100	1	1	100									1	1																														
012-0035-30-000	HERBERT P ADAMS	300	80	1	1	100									1	1																														
012-0035-30-001	MICHAEL R BRAUNREITER I	160	100	1	1	95					1	3			1	1																														
012-0035-30-002	MICHAEL R BRAUNREITER I	115	100	1	1	100									1	1																														
012-0035-40-000	STATE OF WISCONSIN	4140		1	1	100									1	1																														
012-0035-50-000	STATE OF WISCONSIN	3680		1	1	100									1	1																														
012-0040-00-000	STATE OF WISCONSIN	2060	100	1	1	100									1	1																														
012-0040-10-000	BRIAN E LOWERR ET UX	145	100	1	1	100					1				1	1				1																										
012-0040-20-000	DANE B CARTER	160	100	1	1	80		20		1	1					1				1				1																				
012-0040-20-001	TODD W HEPNER	170	100	1	1	100					1				1	1																														
012-0040-20-002	DOCKRY, CHRISTOPHER & (	145	100	1	1	100					1				1	1																														
012-0040-20-003	DAVID L CHRISTENSEN ET U	150	100	1	1	80				2	1		1		1	1								1																				
012-0040-20-004	DENISE E SMITH	170	100	1	1	80		20		2	1		1																																
012-0040-20-005	RICHARD A LANDVATTER ET	140	100	1	1	100				1	1	1								1																										
012-0040-20-006	RICHARD A LANDVATTER ET	165	100	1	1	100																																									
012-0040-20-007	STATE OF WISCONSIN-DNR	720	100	1	1	100																																									
012-0040-20-008	STATE OF WISCONSIN-DNR	150	100	1	1	100									1	1																														
012-0040-20-009	STATE OF WISCONSIN-DNR	270	100	1	1	100									1	1																														
012-0040-30-000	DARRELL E WEBER	540	100	1	1	100									1	1																														
012-0040-50-000	STATE OF WISCONSIN	590	100	1	1	100																																									
012-0040-60-000	WILLIAM E VERHAGEN	200	100	1	1	100																																									
012-0040-60-001	HENRY S BOYARS ET UX	400	60	1	1	50		50			2				1	1							1																							
012-0040-80-000	ARCHIE H REID SR	70	100	1	1	70	10	20	1	1																																				
012-0040-90-000	STEVEN SCHMITZER	115	80	1	1	70		30		1	1				1	1																														
012-0041-00-000	JUSTIN PETERS	50	100	1	1	80	20		1		1																																			
012-0041-10-000	MARIA LITTLETON ET AL	500	100	1	1	100					1																																			
012-0041-20-000	MARIA LITTLETON ET AL	144	100	1	1	100																																									
012-0041-30-000	TIMOTHY E FLANNERY ET U	490	100	1	1	90		10		1																																				
012-0041-40-000	RICHARD GLENN PETERS	100	100	1	1	20	30	50	1	2	1																																			
012-0041-50-000	VINCENT CONWAY ET UX	90	70	1	1	50	10	40	1	2	2																																			
012-0041-70-000	DEAN GOBERT	245	100	1	1	100					1				1	1																														
012-0041-80-000	SHARON L BREVIK REVOCA	308	80	1	1	40	10	30		1	1					1							1	1																						

Parcel Label	Owner	Shoreline_length_feet	Canopy_pc	Shrub_p	Herb_p	Shrub_Herb_pc	Impervious_pc	Lawn_pc	Buildings_n	Boats_n	piers_n	boat_lift_n	raft_n	boathouse_n	Emergents_p	Floating_p	Plant_removal_p	sea_wall_L	riprap_L	trail_p	Ag_pc	Other_pc	firepits_n	structures_riparian_oth	human_riparian_descri	point_source_p	channelized_flow_p	slope_p	bare_soil_p	sand_deposit_p	runoff_other_p	runoff_description	erosion_control_L	beach_L	greater_1ft_L	less_1ft_L	marina_n	structures_littoral_othe	structures_littoral_des	exposed_canopy_p	exposed_shrub_p	exposed_herb_p	exposed_mow_p	exposed_till_p	Notes
012-0041-90-000	THOMAS G ALBER	280	70	1	1	20		80		1	1					1																													
012-0042-00-000	GARY M KOTLAREK	295	80	1	1	40	10	50	1	1	2					1																													
012-0042-10-000	THOMAS G ALBER	305	70	1	1	20		80								1																													
012-0042-20-000	TIMOTHY T DRAGER	455	100	1	1	100									1	1																													
012-0042-30-000	WILLIAM M WENNINGER E	165	100	1	1	100									1	1																													
012-0042-40-000	BETTY L WALENTOWSKI	770	100	1	1	100									1	1																													
012-0042-40-001	ALPHA JEAN SCHALLOCK	200	100	1	1	100									1	1																													
012-0042-60-000	SHELLEY ROBLES	150	80	1	1	100									1	1																													
012-0042-70-000	RANDALL J LEGATH ET UX	60	10	1		20		80			1				1	1																													
012-0042-80-000	MARK H HARTMANN ET UX	320	90	1	1	80		20							1	1																													
012-0042-90-000	MARK H HARTMANN ET UX	385	100	1	1	80		20								1																													
012-0043-00-000	BRANDON W WILSON	210	100	1	1	95					1				1	1				1																									
012-0043-10-000	LISA A ALLRED	135	100	1	1	100									1	1																													
012-0043-20-000	STATE OF WISCONSIN	3250		1	1	100									1	1																													
012-0043-50-001	MICHAEL J HRIBAR	178	100	1	1	100									1	1																													
012-0043-50-002	RICKY M ZELLNER ET UX	205	80	1	1	60		40								1			80																									
012-0043-50-003	PATRICK K LARSCHEID ET U	170	80	1	1	95				1	1					1				1																									
012-0043-50-004	STEVEN L MOTIFF ET UX	150	100	1	1	100										1																													
012-0043-50-005	DAVID E O'BRIGHT ET UX	230	80	1	1	100				1	1	1								1																									
012-0043-50-006	MARK T HEIMSCH ET UX	150	100	1	1	100									1	1				1																									
012-0043-50-007	DAVID S SCHANSBERG	550	80	1	1	80		10		1	1				1	1				1									1	1															
012-0043-50-008	JAMES R CLEMENS ET UX	145	100	1	1	100					1				1	1				1																									
012-0043-50-009	JAMES R CLEMENS ET UX	145	100	1	1	100									1	1																													
012-0045-40-000	DAVID FOX	300	70	1	1	70	20	10	1	3	3				1	1																													
012-0045-60-001	STATE OF WISCONSIN CON	200	50	1	1	50	50				1																																	
012-0047-60-000	STATE OF WISCONSIN	2300	100	1	1	100									1	1																													
012-0047-90-000	MICHAEL C KOLLASZAR ET	1200	100	1	1	100									1	1																													

Appendix J

AIS Rapid Response Plan

WISCONSIN DEPARTMENT OF NATURAL RESOURCES' RESPONSE FRAMEWORK FOR INVASIVE SPECIES

May 12, 2017

SCOPE AND PURPOSE

This document was developed by the Wisconsin Department of Natural Resources' Department Invasive Species Team (DIST) as an internal protocol for responding to newly detected populations of suspected invasive species. This framework cannot and does not attempt to provide answers or solutions to all of the issues associated with response activities. Rather, this document provides a framework to assist any manager in responding thoroughly, professionally, and effectively to the many challenges that result from new invasions.

This framework will be used when:

- A terrestrial invasive species is found in a county where it is listed as Prohibited, OR
- An aquatic invasive species is found in a county where it is listed as Prohibited or Restricted, OR
- An invasive species is discovered in an area of the state where it has not been previously documented

AND:

- Legal access is granted for entry onto the property the species is found on

Stepped enforcement procedures should be considered in lieu of or in concert with this response framework when legal access to populations in question is not granted, or the report is a result of a complaint or allegation submitted via the DNR's Violation Hotline. This framework, if not used initially, can be re-entered at any time. Stepped enforcement procedures can be found in the Bureau of Law Enforcement's Invasive Species Compliance Guidance.

This framework will not be used when the species is one of the following: white nose syndrome, emerald ash borer or gypsy moth. Wisconsin has species-specific plans already in place that should be followed when these species, or any future species with specific statewide plans, are found.

Additionally, the department purposefully did not prepare detailed "response plans" for individual species that have not yet invaded since responses must be guided by case-specific facts. How a species invades – their number, density and distribution, proximity to other known invasions, the time of year, land or water use, and numerous other factors – determines what actions are possible, prudent, and useful. Some pre-planning efforts for future invasions can be very valuable, but there is a limit to the level of response planning that is useful until an invasion actually occurs. For example, an understanding

of the species' biology, habitats invaded, possible actions, and real and potential constraints is very helpful in advance of an invasion. Similarly, establishing communication networks with potential partners and stakeholders ahead of an invasion can be useful.

The department works closely with federal, interstate, state, and local partners on the development of rapid response plans and research options for controlling invasive species. As planning and research efforts proceed, we will incorporate findings and recommendations into the Wisconsin Department of Natural Resources' Response Framework for Invasive Species.

HOW TO USE THIS DOCUMENT

This document is operational in nature; therefore, the activities outlined below focus on the steps to verify a new population of invasive species and the actions that would follow a confirmed introduction. The actions are not necessarily arranged in the order they should be performed; some activities may or should be implemented simultaneously, and other tasks will occur in differing orders depending on types of discovery, timing, and available resources. Some of the tasks identified may be ongoing, while others will need to be implemented quickly following review and approval. Not all items in this document will be relevant to all invasions. Nevertheless, managers should consider each item as they proceed to plan and implement responses to new invasions. Additional resources to assist with response efforts will be provided as hyperlinks throughout this document, as well as outlined in Appendix A (p. 21).

* * *

ACKNOWLEDGEMENTS

Special thanks to Eric J. Kasza, Planning Coordinator in the Office of Invasive Species Coordination and New York State Department of Environmental Conservation Albany, New York 12233-1052 for allowing Wisconsin liberal use of New York state's Rapid Response Framework for Invasive Species in preparation of this document.

* * *

This document was prepared by Amanda Perdzock, WDNR, with the assistance and approval of the Department's Invasive Species Team.

THE INVASIVE SPECIES RESPONSE PROCESS OVERVIEW & CHECKLIST

Early Detection & Reporting (p. 6)

- ☐ Report new populations of suspected invasive species on the DNR website at http://dnr.wi.gov/topic/Invasives/report.html or by contacting the Invasive Species Program Specialist at invasive.species@wisconsin.gov.
- ☐ Document possible invasives with photographs when possible

Verification (p. 7)

- ☐ Interview the reporter to validate the detection
- ☐ Get verification of identification by a recognized expert, accredited lab, or herbarium
- ☐ Voucher a specimen, when appropriate
- ☐ Conduct a site visit to verify location and population size
- ☐ For Prohibited species, obtain a definitive confirmation of identification via a second expert and/or biological analysis

Communication (p. 9)

- ☐ Notify appropriate resource managers at the local, regional, state, and national levels
- ☐ Notify local stakeholders and consider a local or statewide press release
- ☐ Select members for management team and identify a lead coordinator
- ☐ Establish an internal communications plan
- ☐ Begin planning external communications

Assessment (p. 12)

- ☐ Delimit the population and determine demographics of population
- ☐ Determine appropriate timeline based on level of threat
- ☐ Compile a knowledge base – literature reviews and species expert interviews
- ☐ Prevent the spread – identify dispersal vectors/pathways and restrict where feasible
- ☐ Begin marshalling resources – estimate needs and identify potential sources

Planning (p. 14)

- ☐ Decide on a reasonable and feasible control action (containment, eradication, partial or temporary suppression, or no action)
- ☐ Determine which management actions to undertake for selected control
- ☐ Secure permits, if needed

Implementation (p. 17)

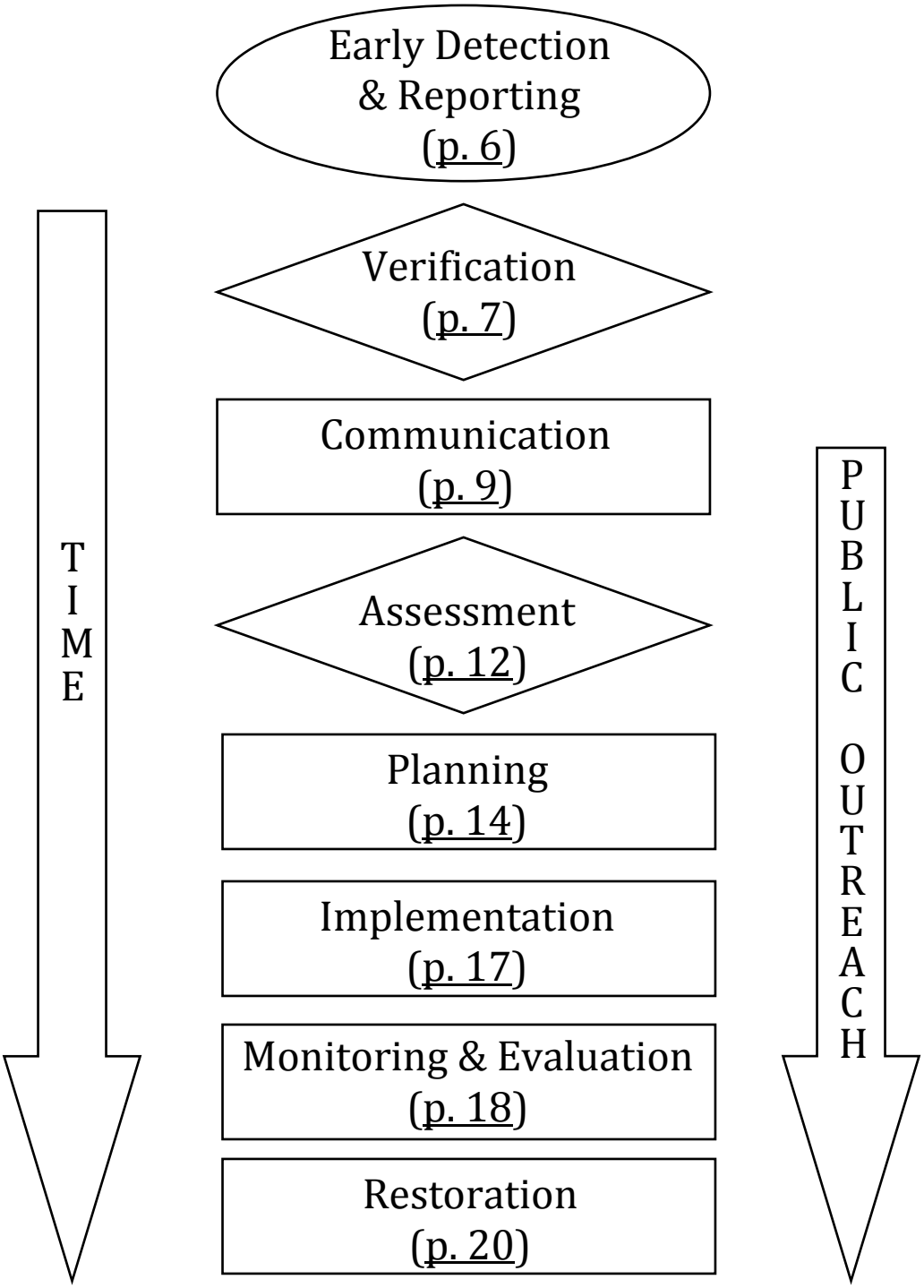
- ☐ Lead coordinator facilitates implementation of response plan
- ☐ Continue public outreach efforts

Monitoring & Evaluation (p. 18)

- ☐ Monitor progress and adapt the plan, as needed
- ☐ Conduct response action effectiveness monitoring – evaluate the effectiveness of the response
- ☐ Conduct surveillance monitoring – confirm that the population was contained
- ☐ Document and disseminate findings and "lessons learned"

Restoration (p. 20)

- ☐ Develop and implement a site restoration plan to restore impacted areas, if needed


Early Detection & Reporting (p. 6)
Verification (p. 7)
Communication (p. 9)
Assessment (p. 12)
Planning (p. 14)
Implementation (p. 17)
Monitoring & Evaluation (p. 18)
Restoration (p. 20)
TIME
PUBLIC OUTREACH

EARLY DETECTION & REPORTING

Why Early detection of new invasions is critical to any effective and appropriate response effort. To be most effective, a response to a new introduction should occur quickly during the "pioneering" stage, when the identified populations are still small and manageable. Note that the term "quickly" is subject to the biology and context of each individual invasion. Importantly, this means that for some species, response could continue for years when a species spreads slowly and can be effectively contained.

How

1. New populations of invasive species in Wisconsin should be reported by:
   - Visiting the Invasive Species webpage and filling out the appropriate form

   OR
   - Contacting the Invasive Species Program Specialist at invasive.species@wisconsin.gov.

2. Reporting of invasive species will vary depending on the type of species discovered and their status as defined by Wisconsin Administrative Code Chapter NR 40:

   Prohibited
   - Report all occurrences of Prohibited species.

   Restricted
   - Report all Restricted aquatic and wetland species
   - Report new county occurrences of terrestrial plants
   - Report all occurrences of jumping worm

   Non-regulated
   - Report species previously unknown in the state

3. Invasives should be documented with photographs when possible, to assist with initial identification and verification.

When Prohibited and Restricted species should be reported as soon as possible after discovery.

VERIFICATION

Why Since many species have look-alikes, verification is needed to confirm the accuracy of a report. Verification also assists with determining the condition (age, reproductive status, vigor, etc.) of an infestation, and ensures that everyone is handling reports consistently and judiciously.

How

1. The verification process will vary based on the classification of the invasive species under NR 40. Species that are classified as Prohibited require a more thorough verification process than those which are Restricted. If a species was not previously known to be in the state, a DIST representative will have to be consulted/notified to assist with verification and status determination.
   Note: If the species found is in an aquatic environment, refer to the department's Suspected New AIS Discoveries - Communication Protocol for proper verification procedures.

2. Interview the reporter(s) to validate the species and ensure the appropriate report form from the Invasive Species webpage has been filled out.

   a. Record details of the location such as: County, Township, City/Village, street address, name of waterbody, land unit area, landmarks, boat landing name, highway mile, and landownership where the suspect invader was found. Get GPS coordinates if possible.

   b. Collect contact information from the reporter(s).

   c. Secure an estimate of the number of the individuals found and the extent of the infestation.

   d. Obtain a photograph (with scale indicator), if possible. In the case of terrestrial plants, this maybe the first step of the procedure if the description of the plant is insufficient to rule out a species look-alike.

   e. Secure a specimen for vouchering, when possible.

   f. Document the date of sighting(s).

   g. Note other relevant conditions at the site (access limitations, possible transport vectors, etc.)

   h. Determine who owns land for terrestrial and wetland species, and get landowner's contact information when possible.

3. Validate identification as soon as possible via examination of a physical sample.

   a. When feasible, arrange for a site visit by at least one recognized expert. Be sure to notify landowners prior to site visits.

b. If recognized experts cannot feasibly reach the site within a reasonable time frame, arrange to have samples and/or other evidence (e.g., photographs) hand-delivered or sent via express mail service to the most accessible recognized expert. If a recognized expert does not reside in the state, out of state specialists may be consulted.

c. Prior to shipping samples, obtain guidelines from recognized experts (and use any existing protocols) regarding handling of the sample, desired quantity, where and how to deliver the sample, etc.

d. If private land must be accessed to obtain a specimen or verify an occurrence, contact the landowner prior to collecting the specimen. If the landowner is unreachable, or denies entry onto land, contact the local warden to explore options for legal access.

e. It may be necessary to initiate stepped enforcement if legal access is not obtained.

4. For Prohibited species, obtain a definitive confirmation of the invasive species via a second expert and/or a biological analysis (e.g., genetic, histological, etc.) when deemed necessary by department invasive species staff.

When Verification should occur as soon as possible after species discovery, but prior to any control actions. Samples for verification can be collected at the same time that the species is initially discovered, or in a subsequent site visit. Further response activities should not be taken until a definitive confirmation of identification is made.

COMMUNICATION

Step I- Initial Notification

Why The objectives are to ensure that all parties that may affect a response decision are quickly engaged and to rapidly inform all other interested parties. The when and how of contacting individuals will differ based on species type, size of invasion, and location of new discovery. This section will provide some general guidelines of contacts that need to be made after a discovery is made. For aquatic invasive species, follow the Suspected New AIS Discoveries – Communication Protocol.

How

1. Notify all relevant natural resource managers, which may include property managers, local program members, and DIST program members.

    a. Note that for many organizations, only primary contacts will be notified. Those primary contacts will then be responsible for further notification within their organization (i.e., a primary contact for a state agency would be responsible for contacting other key officials within their state agency).

    b. Secure verification of notifications to confirm that all relevant contacts did, in fact, receive notification (e.g., Internet list server response confirmation requirement, phone list call-backs, etc.).

2. Contact landowner(s) if they were not the initial observer.

3. Contact the initial observer of the new population of invasive species to inform them on the verification of the species.

4. Notify any local Cooperative Invasive Species Management Areas. They may be able to assist with verification, landowner contacts, control efforts, and communication. They should also be contacted prior to the media when media contact is necessary.

5. Disseminate information on definitively confirmed invasions through appropriate mechanisms.

6. Consider if general public/media notification is appropriate. If so, work with the local DNR public affairs staff to identify a spokesperson for the response initiative and follow the Media Communications Protocol. Be sure to contact the Office of Communication whenever a potentially controversial and/or high profile case occurs. It is also good to contact the Office of Communication whenever response efforts result in positive outcomes as well.

7. All media contacts should be documented following the fact sheet: Working with the News Media.

8. Copy the Agency Tribal Liaison,, on communications between tribal entities and the DNR. Meetings with tribal members or representatives should be recorded via the department's Meeting Reporting site.

When Notify all relevant natural resource managers as soon as practical after a physical sample is visually confirmed to be an invasive species by a recognized expert. Notify the division administrator when the species is listed as Prohibited and landowner(s) will not cooperate or multiple reports suggest the invasive is widespread, or a landowner does not have resources to respond to an important discovery.

Step II – Defining Roles, Responsibilities, and Internal Communication

Why The objective is to activate a predetermined response management system that expedites decision-making, information sharing, avoids duplication, and minimizes authority conflicts, while preserving flexibility for adaptive management.

How

1. The lead agency or organization with authority where the initial sighting(s) occurred convenes a meeting of all relevant managers and selects a management team and lead coordinator. The management team will assess the risk and analyze all potential management options. The lead coordinator will coordinate all management activities. At a minimum, all organizations that have jurisdiction within the infestation area should be notified of this meeting. (See Appendix B on p. 23 for descriptions of roles and responsibilities)

2. Create agreement on reporting process between internal and partner response staff. Develop a response management system as needed. The Incident Command System (ICS), a management system designed to assist with the development and implementation of response plans, should be used and may be necessary for securing federal grants.

3. Establish a schedule for frequent management team meetings to resolve operational issues that cross jurisdictional interests.

Step III - Planning External Communications

Why The objective is to develop a joint information center to ensure consistent and effective communication to resource managers and interested external stakeholders, including the media and public when appropriate.

How

1. Determine priority messages and desired behavior changes to achieve rapid response goals.

2. Identify public groups who are (1) impacted by the invasion, (2) potential vectors of spread, and/or (3) potential management partners.

3. Prioritize public groups by impact (size, relative risk, and probability of participation) to strategically target priority audiences first.

4. Identify existing resources (materials, experts, research) and efforts with your selected messages and/or target audiences.

5. *If you are disseminating public information with no action request:*
    a. Select the information you want to share.
    b. Identify audiences who will want or benefit from the information.
    c. Identify outlets and media formats that will reach your audiences.
    d. Work with appropriate team, partners and department staff to create and disseminate information.

6. *If you are requesting an action:*
    a. Select the action you want to request.
    b. Identify the barriers and benefits to the action (e.g. knowledge, attitude, physical).
    c. Develop strategies to assist your audiences with the desired action (decrease barriers, increase benefits).
    d. Pilot your campaign with your target audience (small scale with two-way communication).
    e. Implement your campaign and evaluate the results for future changes.

7. Identify a staff member to track and coordinate public and partner outreach.

When The timing of releasing information will vary depending on the situation. When asking for public assistance in identifying and reporting Prohibited species, it may be very soon after verification. For some species, media notification should not occur until all response efforts are planned or initiated. For aquatic invasives, refer to the Suspected New AIS Discoveries – Communication Protocol for timing of communication.

ASSESSMENT

Step I – Delimiting the Invasion and Compiling Knowledge Base

Why The objective is to rapidly provide information to guide subsequent management decisions, including survey design.

How

1. For regulated species, review information compiled by the Species Assessment Group (SAG) as needed. Compile existing information on the species through literature searches and interviews with experts on the species. If there have been past rapid responses to this species in Wisconsin, then first look for already compiled information. Program specialists within the department can direct individuals to the information that has been compiled for their program.

2. Determine the geographic extent of the infestation. Survey efforts should follow existing regional or national protocols.

3. Determine demography of infestation (e.g., age structure). These efforts should follow existing state, regional or national protocols. Where possible, surveys should assess maturity and reproduction condition of the populations at infested site(s).

4. Identify and survey nearby facilities, habitats or resources (e.g., campgrounds, boat launches, wetlands, beaches, areas with disturbed habitat, etc.) that are especially vulnerable to invasion.

5. Identify dispersal vectors (including movement by humans, fish and wildlife, water flow, and other physical processes) and pathways, and evaluate associated risks. Also identify any nearby facilities, habitats or resources (e.g., nearest known population, ports, railheads, boat launches, vendors, etc.) that could serve as a source or pathway of invasion.

6. Ensure that field surveys are completed and the results are reported using agreed upon methods.

7. Identify ways the new invasion may threaten the state's economic, ecological, and recreational resources.

8. Determine if financial resources are available for response activities. Keep in mind that some funding sources require actions that may go beyond the steps required within this framework. If no state funds are available to deal with a population, it may be possible to transfer the responsibility for response efforts to local stakeholders or the landowner. Funding sources should be taken into consideration as early in the response process as possible since sources may have an impact on the planning and implementation processes. A link containing possible funding sources can be found in Appendix A.

Note: As per NR 40, the landowner is ultimately responsible for containing and controlling Prohibited species on their property.

9. In certain situations, a letter of cooperation and/or a permit may be issued in response to the discovery of a new invasion. Such letters and permits would dictate response procedures. Permit requirements must be complied with.

Step II - Marshalling Resources

Why The objective is to provide sufficient resources (personnel, equipment, materials, contractors, funding) to initiate control actions and associated activities, including acquisition of required permits.

How

1. Develop estimates for personnel time, facilities and equipment needs, and funding.

2. Identify potential sources for personnel, facilities, equipment, and funds.

3. Secure commitments for needed personnel, facilities and equipment, and funds.

4. Ensure mechanism for dispersal of funds is in place, and when funds are needed, the flow of dollars occurs expeditiously. The sooner department finance staff are engaged, the sooner funding can be obtained.

When Steps within the assessment phase may begin as soon as a population is discovered and verified.

PLANNING

Why The objective is to evaluate all the available information and then decide which response action (eradication or containment/mitigation) and which management action (hand-pulling, dredging, herbicide, etc.) is reasonable and appropriate.

How Develop a response plan. The response plan ensures that everyone is working in concert toward agreed upon goals. The plan should provide a coherent means of communicating the overall response objectives in the context of both operational and support activities. At the simplest level, the plan must have the following three elements:

a. What do we want to do?
b. Who is responsible for doing it?
c. How do we communicate with each other?

1. Decide the proper level of control based on analysis of the specific nature of the invasion, including population dynamics and pathways of spread. It is important to weigh several factors: the costs of eradication, the likelihood of success, and in the absence of eradication, the expected impact or costs of the invader and the monitoring ability. Consider the following:

    a. Risk to environment, human health, economy, etc.
    b. Anticipated cost of eradication effort and follow-up monitoring (relative to available funding)
    c. Available resources (personnel, equipment, etc.)
    d. Regional and local distribution – single vs. multiple, continuous vs. patchy, isolated vs. widespread
    e. Landscape context – upstream vs. downstream, edge vs. interior, etc.
    f. Age of infestation
    g. Neighbors' actions/inaction
    h. Other available management or response plans, including plans that may already be in place
    i. Pathways/source – identified, controlled, eliminated, etc.
    j. Species track record of eradication/control
    k. Survey and assessment confidence
    l. Habitat type(s)
    m. Life stage(s) present
    n. Time of year in relation to reproduction, migration, etc.
    o. Landownership – public vs. private, willing landowner vs. unwilling landowner
    p. Amount of water in the system to be treated. Consider the following:
        1) Potential for drawn down or flows reduced before treatment
        2) Flow sources, including springs, and the potential to regulate that flow
    q. Land use patterns locally and regionally
    r. Presence of state or federally listed rare, threatened or endangered species. Note: An Endangered Resources (ER) Review completed through the Natural Heritage Inventory (NHI) Portal is required for any activity

conducted, funded or approved by the DNR (internal and external portals available). A project is exempt from needing an ER Review if the activity is included in the No/Low Broad Incidental Take Permit/Authorization (See table 1 and 2) or if the ER Preliminary Assessment printout from the NHI Public Portal shows a result of 'no endangered resources present'

s. Presence of critical habitat if in a waterbody
t. Special status, including:

    1) Water use designation (e.g., drink water)
    2) Wild, Scenic or Recreational River designation
    3) Outstanding or Exceptional Resource Waters
    4) State natural area
    5) Historic sites
    6) Cultural resources
    7) Department of Defense or other restricted access areas
    8) Tribal lands

2. Consider potential management actions:

    a. Physical/Mechanical activities
    b. Biological activities (Biocontrols)
    c. Chemical activities
    d. Regulatory activities
    e. No action taken

    Note: All pesticide use on DNR lands or waters by DNR staff must follow Manual Code 4230 and guidance provided on the Pesticide Use on DNR Lands intranet site.

3. Assess potential impacts of management actions. Consider the following:

    a. Air Quality
    b. Soils
    c. Cultural Resources
    d. Water Resources
    e. Fish and Wildlife including threatened, endangered, and species sensitive to potential management actions
    f. Human Health
    g. Sociocultural Environment
    h. Vegetation diversity including threatened, endangered, and species sensitive to potential management actions
    i. Economic Conditions
    j. Visual Resources and Recreation
    k. Effectiveness of various treatment methods

4. Decide on control action, if any. Propose a single course of action or offer alternatives to decision-makers and brief as needed using methods decided upon during the communication planning phase.

5. Secure required permits, if needed. Make sure to satisfy all regulatory requirements, including permits, licenses, certifications, concurrence, etc. (See Appendix C on p. 24 for a list of possible permits)

6. Develop a monitoring plan for assessing success of response efforts post implementation of response plan. (See Monitoring and Evaluation section, p. 18)

When Most planning will occur prior to the initiation of control activities. As implementation proceeds, plans should be adjusted as needed following an adaptive management approach.

IMPLEMENTAION

Why The objective is to implement the eradication or control strategies.

How

1. Facilitate implementation of the response plan.

2. Continue public outreach efforts if appropriate. Make sure the public is well informed on response activities and progress by providing information updates as needed.

3. Comply with rules and regulations developed for emergencies, quarantines, or wash and inspection requirements. Identify loop-holes and additional regulatory needs.

4. Agencies collaborate to coordinate and deploy field resources; implement ICS if needed.

5. Restrict dispersal pathways where feasible, including:

    a. Isolate infested areas as needed to prevent spread. Install physical barriers, if needed.

    b. Assess the likely movement of infested vehicles, equipment, and materials to identify risk and inspection needs at other vulnerable areas.

    c. Establish wash and inspection requirements on vehicles and equipment, if needed.

    d. Use established procedures for equipment disinfection to ensure that personnel do not unintentionally spread the invasive species (See recommendations on the department's Best Management Practices page).

    e. Ensure proper disposal or treatment of any species or materials that may be removed from an infested area (See recommendations on the department's Best Management Practices page).

6. Engage Law Enforcement to investigate and, if possible, control the source of the introduction if necessary. For more information see Invasive Species Rule Compliance & Stepped Enforcement Process and Guidance.

7. Document efforts (e.g., take pictures) throughout the response process. These will be very useful when reporting on the response efforts.

When Implementation will continue for as long as it takes to meet management objectives. Follow up monitoring and control may be necessary after desired levels of containment or control are achieved.

MONITORING & EVALUATION

Why The objectives are to 1) Provide information and data on treatment effectiveness, effects on native species, and possibly ecosystem recovery AND 2) Provide surveillance for reinfestation or spread to additional locations.

How

1. Monitor the status of the invasive species population. Monitoring activities should be carried out in coordination with other program field operations, if possible.

2. Select appropriate ecological indicators and timeframes for monitoring to assess the status and trends in invasive and native species populations.

3. Two types of monitoring should be conducted: treatment effectiveness monitoring and surveillance monitoring for the return of invasives.

   For Treatment effectiveness monitoring, consider:
   - The frequency and density of the target organism within the control area.
   - The frequency, density and richness of non-target organisms within the control area.
   - The habitat characteristics of the control area that may affect the outcome of a given treatment.
   - Water or sediment samples to estimate residuals from a chemical treatment, if a chemical control was done. This will help to determine the duration of effective treatment.

   For surveillance monitoring, consider:
   - The area around the control effort should be surveyed for additional invasive populations.
   - Habitat characteristics that could affect the suitability of the area to the establishment of an invasive species population should be taken into consideration. The habitats surveyed should be those that are suitable for establishment.

4. Disseminate findings through an easily accessible database and list server, or using any other alternative routes of communication decided upon during the development of the project's communication plan.

5. Monitor eradication/control progress and the impacts of selected methods on the environment and other organisms.

6. Consult management team and adjust eradication/control methods based on new information. Selected methods may be adjusted to improve effectiveness and/or to reduce or minimize impacts.

7. Conduct a follow-up evaluation of response organizations and other interest groups to identify opportunities for improving rapid response capacity. Disseminate "lessons learned" to other interested organizations as needed.

When Monitoring should be done several days, weeks, or months after the initial control effort depending on the species and area being controlled. In cases of apparent eradication, monitor at least one year after control activities to check for any subsequent infestation.

RESTORATION

Why The objective is to bolster the system to encourage the recovery of native plants and animals, which will ideally return natural ecological function while discouraging reinvasion by invasive species.

How

1. Collaborate with partners to share existing restoration protocols and contract specifications relating to invasive species.

2. Develop a site restoration plan to restore damaged areas (e.g., roads, lawns, boat launches, staging areas, etc.) and ecosystem functions, if applicable. Restoration plans will vary based on the targeted ecosystem and will take into consideration the types of species that should be present, when the species should be present, and whether restoration efforts are appropriate for the target site.

3. Implement restoration plan.

4. Monitor restoration projects to track the control of invasive species and the re-establishment of native species.

When In many cases it will be best to wait until the invasive species is mostly contained or removed to begin restoration. If native species are incorporated too early, it may prevent the use of pesticides or other necessary control methods.

Appendix A – Useful Links

Scope and Purpose

- Report a Violation: http://dnr.wi.gov/Contact/Hotline.html
- Bureau of Law Enforcement's Environmental Enforcement Handbook: https://sp.dnr.enterprise.wistate.us/org/AD/Bureau-LE/Stepped%20Enforcement%20Process/Environmental%20Enforcement%20Handbook%20(Rev.%202.2013).pdf

Species Specific Plans

- White nose syndrome: http://wiatri.net/inventory/bats/
- Emerald ash borer: http://datcpservices.wisconsin.gov/eab/reporteab.jsp or 1-800-462-2803
- Gypsy moth: http://gypsymoth.wi.gov/ or 1-800-642-MOTH (6684)

Early Detection & Reporting

- Report new populations: http://dnr.wi.gov/topic/Invasives/report.html
- Wisconsin Administrative Code Chapter NR 40: http://docs.legis.wisconsin.gov/code/admin_code/nr/001/40.pdf

Verification

- List of regulated invasive species under NR 40: http://dnr.wi.gov/topic/Invasives/classification.html
- For verification steps for aquatic invasive species, also refer to the Suspected New AIS Discoveries – Communication Protocol (https://dnrx.wisconsin.gov/swims/downloadDocument.do?id=118813642)

Communication

- For notification steps for aquatic invasive species, also refer to the Suspected New AIS Discoveries – Communication Protocol (https://dnrx.wisconsin.gov/swims/downloadDocument.do?id=118813642)
- Media Communication Protocol: http://intranet.dnr.state.wi.us/int/caer/ce/DNR_DraftMediaProtocols_020615workingversion.pdf
- Working with the News Media: http://intranet.dnr.state.wi.us/int/caer/ce/MediaProtocolFactSheet_20150205.pdf
- Tribal contact reporting: https://sp.dnr.enterprise.wistate.us/org/dnr/Team-TAI/Lists/Meeting%20Reporting%20%20All%20Staff/AllItems.aspx
- Incident Command System (ICS): http://www.fema.gov/incident-command-system

Assessment

- Potential Funding Sources: http://invasivespecies.wi.gov/financial-assistance/

Planning

- Wisconsin State listed rare, threatened or endangered species: http://dnr.wi.gov/topic/endangeredresources/etlist.html
- Federally listed rare, threatened or endangered species: http://www.fws.gov/midwest/endangered/lists/wisc-spp.html
- Natural Heritage Inventory Internal DNR Portal: http://intranet.dnr.state.wi.us/int/land/er/nhi_portal/
- Natural Heritage Inventory External Public Portal: http://dnr.wi.gov/topic/ERReview/PublicPortal.html
- No/Low Broad Incidental Take Permit/Authorization webpage: http://dnr.wi.gov/topic/ERReview/ITNoLowImpact.html
- Table 1 of the No/Low Broad Incidental Take Permit/Authorization: http://dnr.wi.gov/topic/ERReview/documents/NoLowImpactActivities.pdf#page=5
- Table 2 of the No/Low Broad Incidental Take Permit/Authorization (for use by DNR staff and ER Certified Reviewers only): http://intranet.dnr.state.wi.us/int/land/er/nhi_portal/pdf/NoLowImpactbyTaxa.pdf
- Critical Habitat Areas: http://www.fws.gov/midwest/endangered/lists/wisc-spp.html
- Water use designation: http://dnr.wi.gov/topic/surfacewater/usedesignations.html
- List of Outstanding and Exceptional Resource Waters (ORW and ERW): http://dnr.wi.gov/topic/surfacewater/orwerw.html
- State Natural Areas: http://dnr.wi.gov/topic/lands/naturalareas/
- Cultural Resources: http://dnr.wi.gov/topic/Lands/CulturalRes/
- Pesticide Use Intranet Site: http://intranet.dnr.state.wi.us/pesticides/

Implementation

- Best Management Practices (BMP) to minimize the spread of invasive species: http://dnr.wi.gov/topic/invasives/bmp.html
- Invasive Species Rule Compliance & Stepped Enforcement Process and Guidance: http://intranet.dnr.state.wi.us/int/es/science/invasives/pe/SEoverview.pdf

Monitoring & Evaluation

Restoration

Appendix B – Suggested Roles and Responsibilities

The management team will:

1. Determine the extent of the infestation and pathways for potential spread.
2. Determine the risk to the environment, human health, economy, etc.
3. Identify constraints and limitations, including jurisdictional issues, legislative authority, funding, permitting, personnel training, access to private lands, gaps in knowledge, and ecological uncertainties.
4. Determine if eradication/control is possible and select the appropriate method(s) to be employed.
5. Consult with legal services when necessary.

The lead coordinator will:

1. Coordinate management team notification operations.
2. Facilitate creation of a response management system involving lead representatives of each local, tribal, state, provincial, and/or federal government that has legal authority over the response.
3. Represent (i.e. be the spokesperson for) the management team.
4. Facilitate a collaborative decision-making process that considers cascading levels of authority within individual agencies.
5. Facilitate development of response priorities.

The above actions should take into account the roles, relationships, and inter-agency agreements among:

- All affected states (e.g., Governor, state agencies, etc.)
- Federal agencies (e.g., USFWS, USDA, NOAA, USACOE, etc.)
- Tribes
- Local governments
- Other interested parties, such as NGOs, universities, nurseries, marinas, etc.

Appendix C – Permit and Regulatory Considerations

1. Consider an Emergency Rule as an option. A formal determination of emergency can facilitate numerous aspects of regulatory processes.

2. Identify all State/Federal regulatory requirements, including any applicable emergency provisions. A partial list of State/Federal permits and regulatory reviews that may apply include:

    a. US Army Corps of Engineers Section 10 permit for any work in, over, or under navigable waters of the United States.

    b. US Clean Water Act Section 404 permit from the US Army Corps of engineers for the discharge of dredged or fill material into waters of the United States.

    c. US Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 18 authorizes the Environmental Protection Agency (EPA) to allow states to use a pesticide for an unregistered use in the United States for a limited time if EPA determines that emergency conditions exist. The uses are requested for a limited period of time (no longer than 1 year), to address the emergency situation only. If the need is immediate, a state agency may issue a crisis exemption that allows the unregistered use for 15 days. Under FIFRA, registrations and product labeling may restrict uses of pesticides. Each registration specifies the plants/sites on which it may be applied. Restricted-use pesticides are limited to use by pesticide applicators who are certified, or to people under supervision of a certified applicator.

    d. US Endangered Species Act Section 7 consultations with the National Marine Fisheries Service (NMFS) for marine and anadromous species, or the U.S. Fish and Wildlife Service (FWS) for fresh-water and wildlife, for any "action" that may affect listed species or their designated habitat in the United States.

    e. WDNR Chapter NR 40 Invasive Species Identification, Classification and Control aimed at the prevention of new AIS introductions and to support the state in enforcement in controlling or eradicating pioneer populations.

    f. WDNR Chapter NR 109 Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations establishes procedures for issuing permits for mechanical aquatic plant control and prohibits the launching of watercraft or equipment that has attached aquatic plants or zebra mussels.

    g. WDNR Chapter NR 107 Aquatic Plant Management establishes procedures and permitting for the control of aquatic plants using chemicals registered and labeled by the EPA.

h. Wisconsin Pest Control Pollutant Discharge Permits are general permits for pest control treatment projects that have a pollutant discharge into a waterbody.

3. Identify all local regulatory requirements, including any applicable emergency provisions.

4. Identify any cooperative agreements with other agencies/organizations (e.g., MOUs, MOAs, etc.).

5. Assign lead person from each regulatory agency to facilitate permit approval in a timely manner within their respective agency.

6. Consult with DNR to determine if an environmental assessment or environmental impact statement is required.

7. Determine timeframe necessary for meeting all regulatory requirements.