Note: Methodology, explanation of analysis and biological background on Scattering Rice Lake studies are contained within the Eagle River Chain-wide Management Plan document.

8.5 Scattering Rice Lake

An Introduction to Scattering Rice Lake

Scattering Rice Lake, Vilas County, is a shallow, lowland drainage lake with a maximum depth of 17 feet, a mean depth of 8 feet, and a surface area of approximately 263 acres. The lake is fed via the Deerskin River and has a surficial watershed of approximately 42,860 acres. Scattering Rice Lake flows into downstream Eagle Lake. During the 2012 and 2014 aquatic plant studies conducted by Onterra, 22 native aquatic plant species were located in the lake, of which wild celery (*Vallisneria americana*) was the most common. One non-native plant, Eurasian water-milfoil was observed growing in Scattering Rice Lake in 2012.

Field Survey Notes

The native plants wild celery (Vallisneria americana) and fern pondweed (Potamogeton robbinsii) were the most frequently encountered during the 2012 point-intercept survey. Two rare plants, Vasey's pondweed (Potamogeton vaseyi) and apline pondweed (P. alpinus) were also observed. A family of otters was observed feeding on mussels near the bog island in the southern area of the lake.

Photo 8.5 Scattering Rice Lake, Vilas County

Lake at a Glance* – Island Lake

Morphology	
Acreage	263
Maximum Depth (ft)	17
Mean Depth (ft)	8
Volume (acre-feet)	2,168
Shoreline Complexity	3.5
Vegetation	
Curly-leaf Survey Date	July 7, 2014
Comprehensive Survey Date	August 2, 2012
Number of Native Species	22
Threatened/Special Concern Species	Vasey's pondweed (*Potamogeton vaseyi*)
Exotic Plant Species	Eurasian water milfoil (*Myriophyllum spicatum*)
Simpson's Diversity	0.91
Average Conservatism	6.7
Water Quality	
Wisconsin Lake Classification	Shallow (Mixed), Lowland Drainage
Trophic State	Eutrophic
Limiting Nutrient	Phosphorus
Watershed to Lake Area Ratio	160:1

**These parameters/surveys are discussed within the Chain-wide portion of the management plan.*

8.5.1 Scattering Rice Lake Water Quality

Water quality data was collected from Scattering Rice Lake on six occasions in 2014/2015. Onterra staff sampled the lake for a variety of water quality parameters including total phosphorus, chlorophyll-*a*, and Secchi disk clarity. Please note that the data in these graphs represent were collected during the growing season (April-October), summer months (June-August) or winter (February-March) as indicated with each dataset. In addition to sampling efforts completed in 2014/2015, any historical data was researched and are included within this report as available.

Unfortunately, historical data for near-surface total phosphorus in Scattering Rice Lake are only available from one sample collected in 1979 (29.0 µg/L). In 2014, the average near-surface summer total phosphorus concentration was 43.0 µg/L, higher than the median value for other shallow, lowland drainage lakes (33.0 µg/L) throughout the state and other lakes within the Northern Lakes and Forests ecoregion (21.0 µg/L), but still within the *good* category for shallow, lowland drainage lakes. Given the limited amount of total phosphorus data from Scattering Rice Lake, it cannot be said if total phosphorus concentrations have increased, decreased, or remained the same over time.

Near-surface total phosphorus concentrations from 2014/2015 are compared with near-bottom total phosphorus concentrations collected during this same timeframe in Figure 8.5.1-1. As illustrated in the figure, near-surface and near-bottom total phosphorus concentrations were similar in spring and fall during turnover when water temperature and dissolved oxygen were relatively uniform throughout the water column. However, during the summer months in 2014, near-bottom total phosphorus concentrations were higher than near-surface concentrations, up to three times higher as measured in August 2014. The higher total phosphorus concentrations near the bottom are an indication that phosphorus is being released from bottom sediments. Phosphorus is released from bottom sediments when the overlying water becomes anoxic, or devoid of oxygen. When the lake stratifies, the bottom layer of water (hypolimnion) is no longer receiving atmospheric inputs of oxygen, and the decomposition of organic matter on the lake bottom depletes the oxygen.

The internal loading of phosphorus is a common occurrence in lakes that stratify during the summer, and for deeper lakes, it is often not a significant issue because the phosphorus-rich water near the bottom does not mix with surface waters until fall turnover. However, in shallow lakes like Scattering Rice Lake which can periodically mix during the summer, this phosphorus-rich water can be mixed with surface waters where the phosphorus is now available for use by free-floating algae. As a result, internal phosphorus loading in shallow lakes can fuel nuisance algae blooms. Temperature and dissolved oxygen profiles collected on Scattering Rice Lake in 2014 indicate that the lake transitions between periods of stratification and mixing, likely dictated primarily by wind events.

Like total phosphorus, chlorophyll-*a* data from Scattering Rice Lake are very limited. Chlorophyll-*a* data are available from one sample in July of 1979 (10.1 µg/L) and from the samples collected in 2014. The 2014 summer average chlorophyll-*a* concentration was 25.8 µg/L, higher than the median value for shallow, lowland drainage lakes in Wisconsin (9.4 µg/L) and for lakes within the Northern Lakes and Forests ecoregion (5.6 µg/L). The higher level of algae within Scattering Rice Lake is expected given the higher concentrations of phosphorus.

The 2014 summer average chlorophyll-*a* concentration for Scattering Rice Lake falls within the *fair* category for shallow, lowland drainage lakes. Given the limited amount of chlorophyll-*a* data, it is not possible to determine if any trends in algal abundance are occurring at this time.

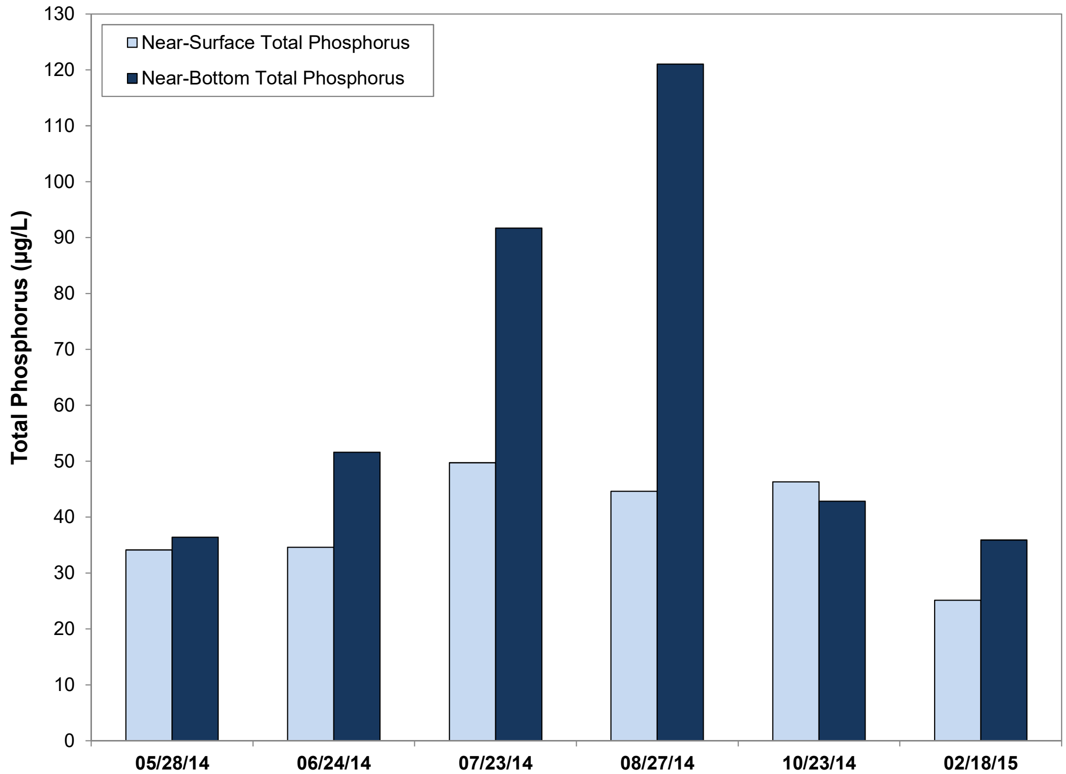


Figure 8.5.1-1. Scattering Rice Lake 2014 growing season and winter 2015 near-surface and near-bottom total phosphorus concentrations.

The 2014 total phosphorus and chlorophyll-*a* concentrations measured in Scattering Rice Lake exceed the recreational use thresholds of 40 µg/L and 20 µg/L, respectively, that have been established in accordance with the Clean Water Act. While Scattering Rice Lake has not yet been placed on the list of impaired waters, or waterbodies which do not meet water quality standards under the Clean Water Act, the WDNR is currently collecting water quality data to determine if the lake should be placed on the impairment list.

While total phosphorus and chlorophyll-*a* data are limited from Scattering Rice Lake, Secchi disk transparency data are available from 1979, 1996-1998, 2000-2005, and 2014 (Figure 8.5-1-2). The weighted average summer Secchi disk transparency value of 5.1 feet falls within the *good* category for shallow, lowland drainage lakes and is comparable to the median value for other shallow, lowland drainage lakes in Wisconsin but is lower than the median value for other lakes within the Northern Lakes and Forests ecoregion. Secchi disk transparency was lower in 2014 than what has been recorded in the past; however, trends analysis indicates that no trends, positive or negative, in Secchi disk transparency have occurred over the time period for which data are available.

Secchi disk clarity is influenced by many factors, including plankton production and suspended sediments, which themselves vary due to several environmental conditions such as precipitation, sunlight, and nutrient availability. In Scattering Rice Lake as well as the other lakes in the Eagle River Chain of Lakes, a natural staining of the water plays a role in light penetration, and thus water clarity, as well. The waters of Scattering Rice Lake contain naturally occurring organic acids that are washed into the lake from nearby wetlands. The acids are not harmful to humans or aquatic species; they are by-products of decomposing terrestrial and wetland plant species. This natural staining may reduce light penetration into the water column, which reduces visibility and also reduces the growing depth of aquatic vegetation within the lake.

True color measures the dissolved organic materials in water. Water samples collected in May and July of 2014 were measured for this parameter, and were found to be 50 Platinum-cobalt units (Pt-co units, or PCU). Lillie and Mason (1983) categorized lakes with 0-40 PCU as having low color, 40-100 PCU as medium color, and >100 PCU as high color.

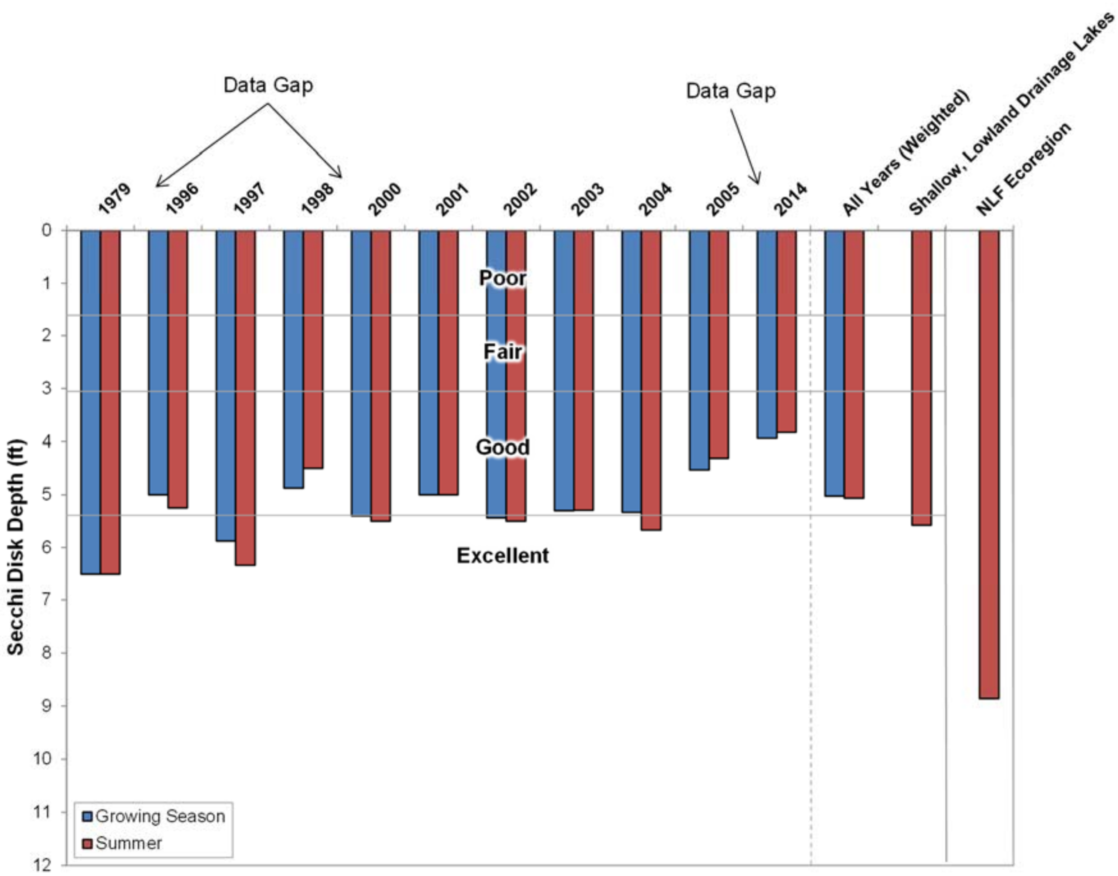


Figure 8.5.1-2. Scattering Rice Lake, statewide deep, lowland drainage lakes, and regional Secchi disk clarity values. Mean values calculated with summer month surface sample data. Water Quality Index values adapted from WDNR PUB WT-913.

Scattering Rice Lake Trophic State

The Trophic State Index (TSI) values calculated with Secchi disk, chlorophyll-*a*, and total phosphorus values range in values spanning from upper mesotrophic to eutrophic (Figure 8.5.1-3). In general, the best values to use in judging a lake's trophic state are total phosphorus and chlorophyll-*a* because water clarity can be influenced by factors other than algae; therefore, relying primarily on total phosphorus and chlorophyll-*a* TSI values, it can be concluded that Scattering Rice Lake is in a eutrophic state.

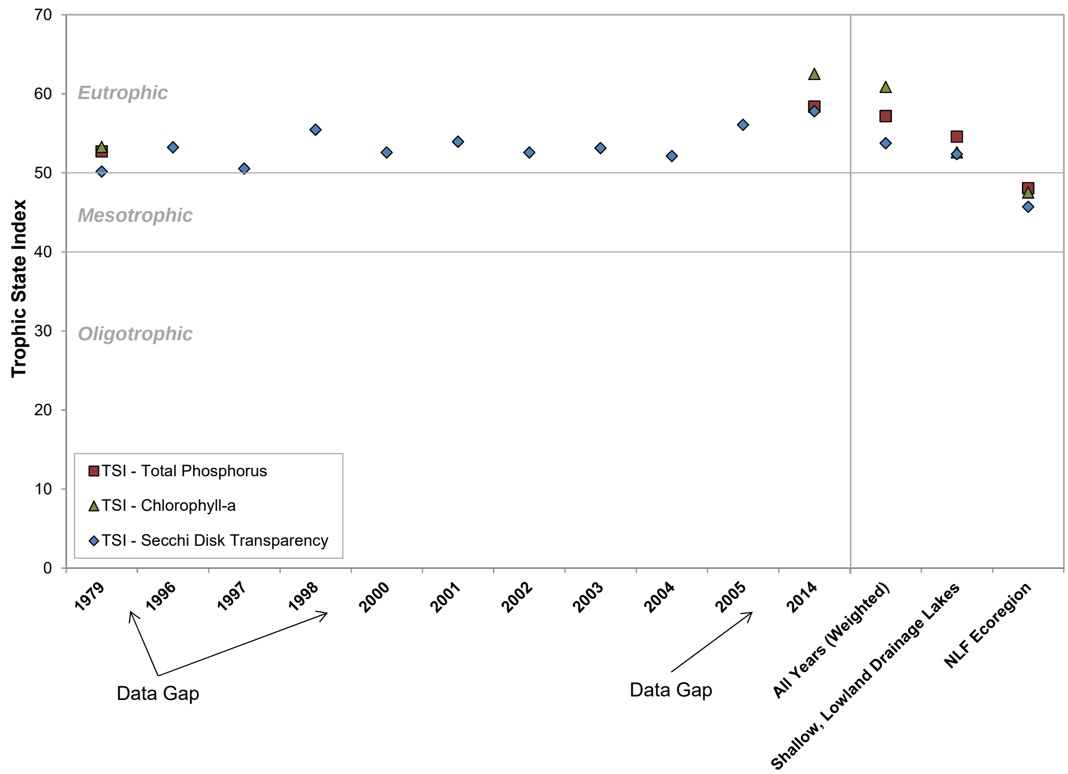


Figure 8.5.1-3. Scattering Rice Lake, statewide shallow, lowland drainage lakes, and regional Trophic State Index values. Values calculated with summer month surface sample data using WDNR PUB-WT-193.

Dissolved Oxygen and Temperature in Scattering Rice Lake

Dissolved oxygen and temperature profiles were created during each water quality sampling trip made to Scattering Rice Lake by Onterra staff. Graphs of those data are displayed in Figure 8.5.1-4 for all sampling events. As discussed previously, the temperature and dissolved oxygen profiles illustrate that Scattering Rice Lake weakly stratifies during the summer months, but increases in water temperature near the bottom over the summer indicate periodic mixing. In February of 2015, oxygen levels remained sufficient throughout most of the water column to support most aquatic life in northern Wisconsin lakes.

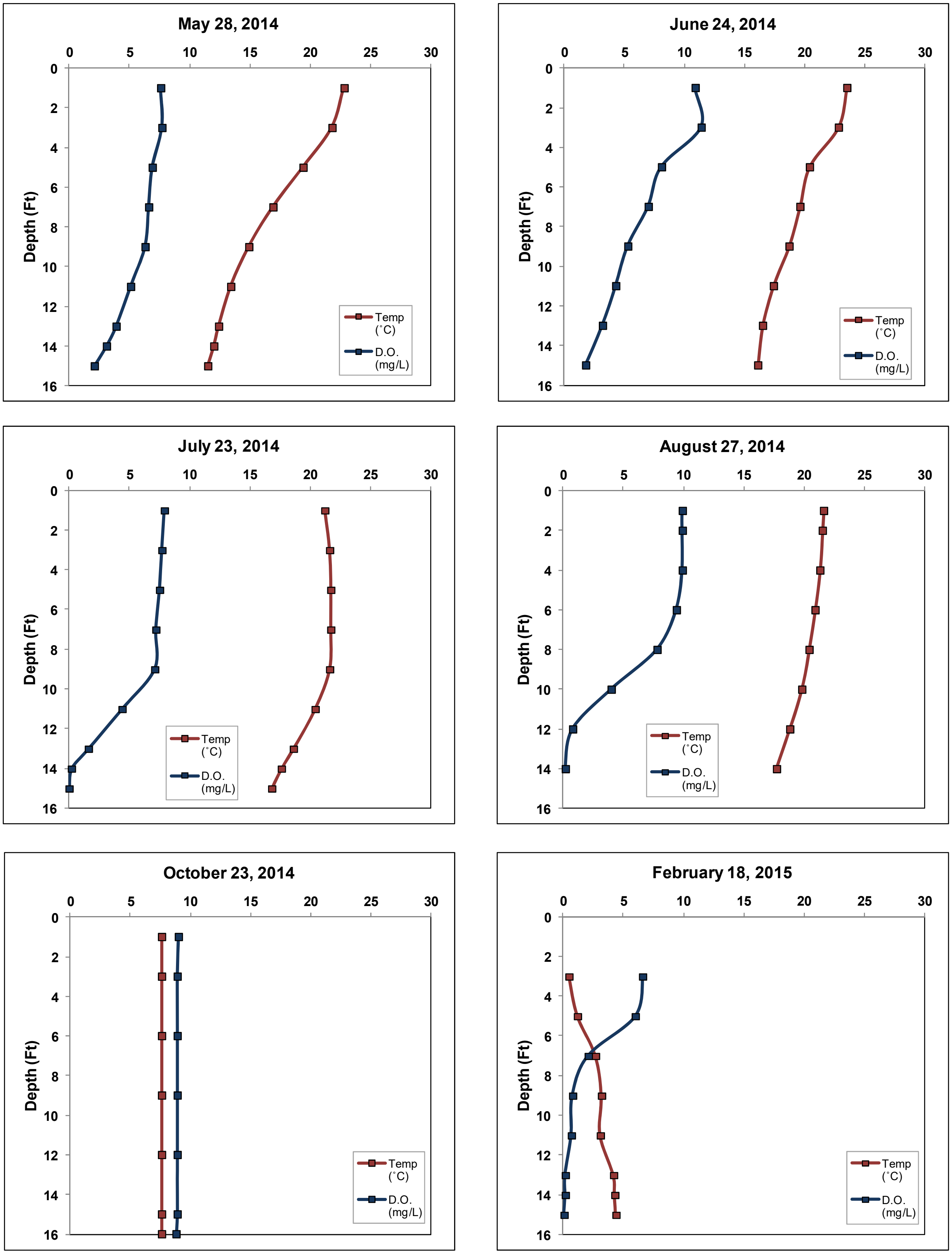


Figure 8.5.1-4. Scattering Rice Lake 2014/2015 dissolved oxygen and temperature profiles.

Additional Water Quality Data Collected at Scattering Rice Lake

The water quality section is centered on lake eutrophication. However, parameters other than water clarity, nutrients, and chlorophyll-*a* were collected as part of the project. These other parameters were collected to increase the understanding of Scattering Rice Lake's water quality and are recommended as a part of the WDNR long-term lake trends monitoring protocol. These parameters include; pH, alkalinity, and calcium.

As the Chain-wide Water Quality Section explains, the pH scale ranges from 0 to 14 and indicates the concentration of hydrogen ions (H^+) within the lake's water and is thus an index of the lake's acidity. Scattering Rice Lake's surface water pH was measured at roughly 7.5 during May and 7.8 during July of 2014. These values are near or slightly above neutral and fall within the normal range for Wisconsin lakes. Fluctuations in pH with respect to seasonality is common; in-lake processes such as photosynthesis by plants act to reduce acidity by carbon dioxide removal while decomposition of organic matter add carbon dioxide to water, thereby increasing acidity.

A lake's pH is primarily determined by the amount of alkalinity that is held within the water. Alkalinity is a lake's capacity to resist fluctuations in pH by neutralizing or buffering against inputs such as acid rain. Lakes with low alkalinity have higher amounts of the bicarbonate compound (HCO_3^-) while lakes with a higher alkalinity have more of the carbonate compound of alkalinity ($CO_3^{=}$). The carbonate form is better at buffering acidity, so lakes with higher alkalinity are less sensitive to acid rain than those with lower alkalinity. The alkalinity in Scattering Rice Lake was measured at 36.6 and 44.1 mg/L as $CaCO_3$ in May and July of 2014. This indicates that the lake has a substantial capacity to resist fluctuations in pH and has a low sensitivity to acid rain.

Samples of calcium were also collected from Scattering Rice Lake during 2014. Calcium is commonly examined because invasive and native mussels use the element for shell building and in reproduction. Invasive mussels typically require higher calcium concentrations than native mussels. The commonly accepted pH range for zebra mussels is 7.0 to 9.0, so Scattering Rice Lake's pH of 7.5 – 7.8 falls within this range. Lakes with calcium concentrations of less than 12 mg/L are considered to have very low susceptibility to zebra mussel establishment. The calcium concentration of Scattering Rice Lake was found to be 10.4 mg/L in May and 9.11 mg/L in July of 2014, which are below the optimal range for zebra mussels. Plankton tows were completed by Onterra staff during the summer of 2014 and these samples were processed by the WDNR for larval zebra mussels. These samples were found to be negative for zebra mussel veligers.

True color is a measure of water clarity once suspended material (i.e. algae, sediments) has been removed is called true color. True color measures the amount of light scattered and absorbed by organic materials dissolved within the water. Many lakes in the northern region of Wisconsin have natural dissolved organic materials from decomposing plant material delivered from wetlands within the watershed. These give the water a tea-like color and decrease water clarity. Scattering Rice Lake had an average true color value of 50.0 SU (standard units), indicating the water is most often lightly tea-colored. Lakes with large areas of forests and wetlands within their watersheds tend to have tea-colored or stained water, as these dissolved organic materials within the lake's water originate from decaying vegetation within the watershed.

8.5.2 Scattering Rice Lake Watershed Assessment

Scattering Rice Lake's watershed is approximately 42,860 acres in size. Compared to its surface area of 263 acres, this makes for a large watershed to lake area ratio of 160:1.

Exact land cover calculation and modeling of nutrient input to Scattering Rice Lake will be completed towards the end of this project (in 2016-2017). By this time, the latest satellite imagery (and thus the most accurate land cover delineation) will be available. Additionally, when water quality sampling of the upper reaches of the chain is completed, these results will be input to predictive models and thus make the modeling of nutrient input to the entire chain more accurate.

8.5.3 Scattering Rice Lake Shoreland Condition

Shoreland Development

As mentioned previously in the Chain-wide Shoreland Condition Section, one of the most sensitive areas of the watershed is the immediate shoreland area. This area of land is the last source of protection for a lake against surface water runoff, and is also a critical area for wildlife habitat. In late summer of 2014, Scattering Rice Lake's immediate shoreline was assessed in terms of its development. Scattering Rice Lake has stretches of shoreland that fit all of the five shoreland assessment categories. In all, 2.8 miles of natural/undeveloped and developed-natural shoreline were observed during the survey (Figure 8.5.3-1). This constitutes about 63% of Scattering Rice Lake's shoreline. These shoreland types provide the most benefit to the lake and should be left in their natural state if at all possible. During the survey, 0.8 miles of urbanized and developed–unnatural shoreline (17%) was observed. If restoration of the Scattering Rice Lake shoreline is to occur, primary focus should be placed on these shoreland areas as they currently provide little benefit to, and actually may harm, the lake ecosystem. Scattering Rice Lake – Map 1 displays the location of these shoreline lengths around the entire lake.

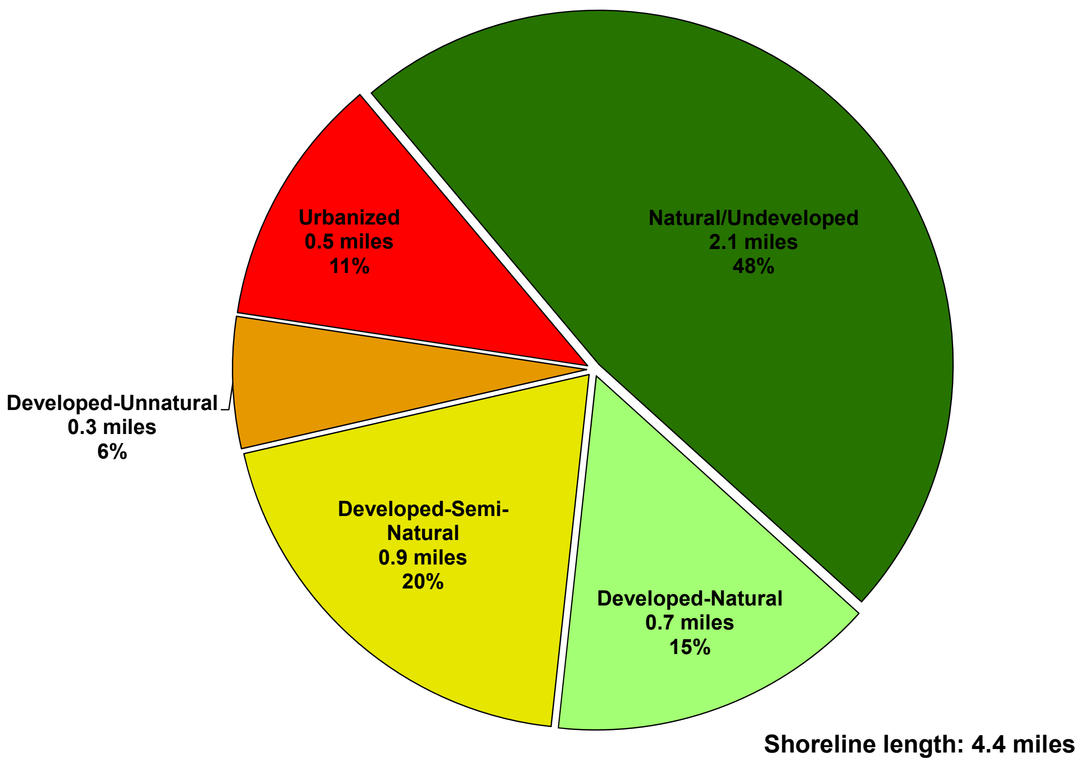


Figure 8.5.3-1. Scattering Rice Lake shoreland categories and total lengths. Based upon a late summer 2014 survey. Locations of these categorized shorelands can be found on Scattering Rice Lake – Map 1.

Coarse Woody Habitat

A survey for coarse woody habitat was conducted in conjunction with the shoreland assessment (development) survey. Coarse woody habitat was identified, and classified in several size categories (2-8 inches diameter, >8 inches diameter and cluster) as well as four branching categories: no branches, minimal branches, moderate branches, and full canopy. As discussed in the Eagle River Chain-wide document, research indicates that fish species prefer some branching as opposed to no branching on coarse woody habitat, and increasing complexity is positively correlated with higher fish species richness, diversity and abundance.

During this survey, 155 total pieces of coarse woody habitat were observed along 4.4 miles of shoreline, which gives Scattering Rice Lake a coarse woody habitat to shoreline mile ratio of 36:1 (Figure 8.5.3-2). Locations of coarse woody habitat are displayed on Scattering Rice Lake – Map 2. To put this into perspective, Wisconsin researchers have found that in completely undeveloped lakes, an average of 345 coarse woody habitat structures may be found per mile (Christensen et al. 1996).

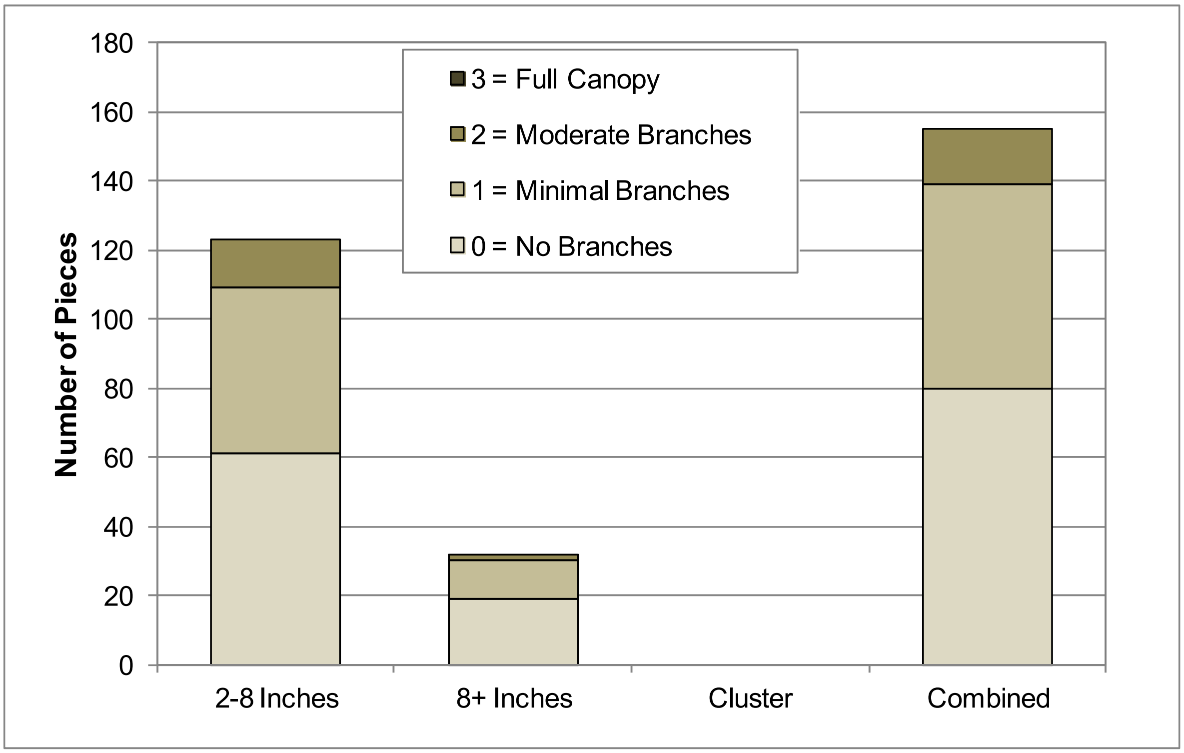


Figure 8.5.3-2. Scattering Rice Lake coarse woody habitat survey results. Based upon a late summer 2014 survey. Locations of Scattering Rice Lake coarse woody habitat can be found on Scattering Rice Lake – Map 2.

8.5.4 Scattering Rice Lake Aquatic Vegetation

An early season aquatic invasive species survey was conducted on Scattering Rice Lake on July 7, 2014. While the intent of this survey is to locate any potential non-native species within the lake, the primary focus is to locate occurrences of curly-leaf pondweed which should be at or near its peak growth at this time. During this meander-based survey of the littoral zone, Onterra ecologists did not locate any occurrences of curly-leaf pondweed.

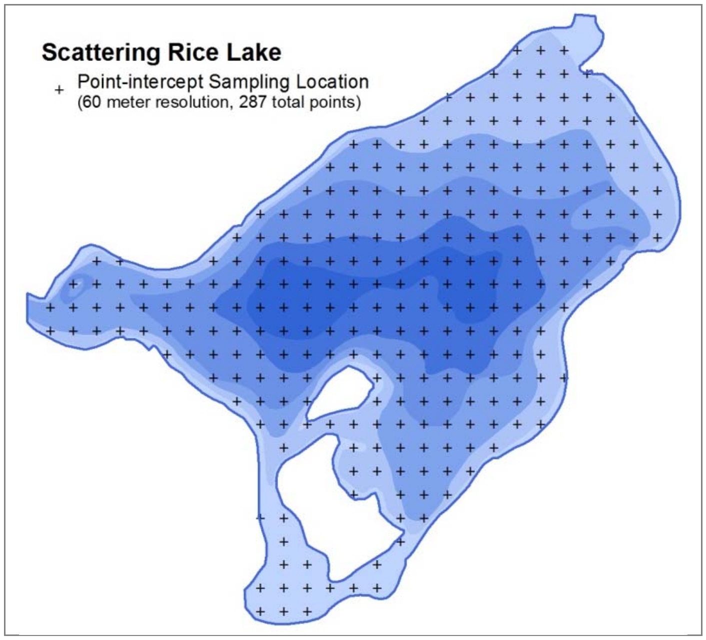


Figure 8.5.4-1. Point-intercept locations on Scattering Rice Lake.

The whole-lake aquatic plant point-intercept survey was conducted on Scattering Rice Lake by Onterra on August 2, 2012 (Figure 8.2.4-1), while the aquatic plant community mapping survey was conducted on July 30, 2014. During these surveys, a total of 35 aquatic plant species were located, two of which are considered to be a non-native, invasive species: Eurasian water milfoil and purple loosestrife (Table 8.5.4-1). One native plant species located, Vasey's pondweed (*Potamogeton vaseyi*), is listed by the Wisconsin Natural Heritage Inventory Program as a species of 'special concern' because it is rare or uncommon in Wisconsin and there is uncertainty regarding its abundance and distribution within the state.

As discussed in the primer section, sediment data were collected at each sampling location within the littoral zone during the point-intercept survey. Approximately 22% of the point-intercept locations within littoral areas contained sand, 78% contained fine, organic sediments (muck), and 0% contained rock. The majority of the shallow, near-shore areas contained sand and/or rock, while the deeper areas of the littoral zone were comprised of muck. Like terrestrial plants, different aquatic plant species are adapted to grow in certain substrate types; some species are only found growing in mucky substrates, others only in sandy areas, and some can be found growing in either. Lakes that have varying substrate types generally support a higher number of plant species because the different habitat types that are available.

During the 2012 point-intercept survey, aquatic plants were found growing to a maximum depth of 9 feet, similar to 10 feet recorded in 2006. The water within the Lower Eagle River Chain of Lakes is considered 'stained,' or contains higher amounts of dissolved organic compounds which gives the water a tea-like color. These compounds scatter light and limit the amount that can penetrate vertically into the water column. Thus, the growth of aquatic plants within the chain's lakes is restricted to shallower areas where they can receive enough light to photosynthesize.

Table 8.5.4-1. Aquatic plant species located in Scattering Rice Lake during 2006 and 2012 point-intercept surveys.

Growth Form	Scientifc Name	Common Name	Coefficient of Conservatism (C)	2006 (NEI)	2012/2014 (Onterra)
E	*Calla palustris*	Water arum	9		I
	Carex utriculata	Common yellow lake sedge	7		I
	Eleocharis palustris	Creeping spikerush	6		I
	Lythrum salicaria	Purple loosestrife	Exotic		I
	Pontederia cordata	Pickerelweed	9	X	X
	Sagittaria latifolia	Common arrowhead	3		I
	Schoenoplectus tabernaemontani	Softstem bulrush	4		I
FL	*Nuphar variegata*	Spatterdock	6	X	X
	Nymphaea odorata	White water lily	6	X	X
FL/E	*Sparganium androcladum*	Shining bur-reed	8		X
	Sparganium eurycarpum	Common bur-reed	5		I
Submergent	*Bidens beckii*	Water marigold	8	X	X
	Ceratophyllum demersum	Coontail	3	X	X
	Elodea canadensis	Common waterweed	3	X	X
	Heteranthera dubia	Water stargrass	6	X	X
	Myriophyllum sibiricum	Northern water milfoil	7	X	X
	Myriophyllum spicatum	Eurasian water milfoil	Exotic	X	I
	Najas flexilis	Slender naiad	6		X
	Nitella spp.	Stoneworts	7		X
	Potamogeton alpinus	Alpine pondweed	9		X
	Potamogeton amplifolius	Large-leaf pondweed	7	X	X
	Potamogeton epihydrus	Ribbon-leaf pondweed	8		X
	Potamogeton natans	Floating-leaf pondweed	5	X	I
	Potamogeton pusillus	Small pondweed	7	X	X
	Potamogeton richardsonii	Clasping-leaf pondweed	5	X	X
	Potamogeton robbinsii	Fern pondweed	8	X	X
	Potamogeton spirillus	Spiral-fruited pondweed	8	X	X
	*Potamogeton vaseyi**	Vasey's pondweed	10	X	X
	Potamogeton zosteriformis	Flat-stem pondweed	6	X	X
	Utricularia minor	Small bladderwort	10		X
	Utricularia vulgaris	Common bladderwort	7	X	X
	Vallisneria americana	Wild celery	6	X	X
S/E	*Sagittaria cristata*	Crested arrowhead	9		I
	Sagittaria sp. (rosette)	Arrowhead sp. (rosette)	N/A	X	
FF	*Lemna trisulca*	Forked duckweed	6		X
	Lemna turionifera	Turion duckweed	2	X	
	Riccia fluitans	Slender riccia	7		X
	Spirodela polyrhiza	Greater duckweed	5	X	

E = Emergent, FL = Floating Leaf; FL/E = Floating Leaf and Emergent; S/E = Submergent and Emergent, FF = Free-floating
X = Located on rake during point-intercept survey; I = Incidental Species
** = Species listed as 'special concern' in Wisconsin*

Of the 120 point-intercept sampling locations that fell at or below the maximum depth of plant growth in 2012, approximately 24% contained aquatic vegetation. This is lower than what was found in the 2006 survey where approximately 36% of the littoral sampling locations contained aquatic vegetation. Map Scat-2 displays the point-intercept locations that contained aquatic vegetation in 2012, and the total rake fullness (TRF) ratings at those locations. Most of the aquatic vegetation in 2012 was located within shallower areas of the lake. Nineteen percent of the point-intercept locations had a total rake fullness rating of 1, 17% had a total rake fullness rating of 2, and 8% had the highest total rake fullness rating of 3. Total rake fullness ratings were not recorded during the 2006 survey, so a comparison cannot be made.

Table 8.5.4-1 displays the aquatic plant species located in Scattering Rice Lake during the 2006 Northern Environmental, Inc. (NEI) and Onterra 2012 point-intercept surveys. All of the species recorded in 2006, except for arrowhead sp. (rosette), turion duckweed, and greater duckweed, were recorded in 2012. Arrowhead sp. (rosette) was only recorded at two sampling locations in 2006, so it is likely it just went undetected during the 2012 point-intercept survey due to its low abundance. Both turion duckweed and greater duckweed are small, free-floating species that were also recorded in low abundance in 2006. An additional 15 native aquatic plant species were located in Scattering Rice Lake in 2012 that had not been recorded in 2006, including two environmentally sensitive species, alpine pondweed and small bladderwort.

Of the 25 aquatic plant species recorded on the rake during the 2012 point-intercept survey, wild celery, fern pondweed, coontail, and slender naiad were the four-most frequently encountered (Figure 4.5-2). Wild celery, or tape grass, was the third-most abundant aquatic plant encountered in 2012 with a littoral occurrence of approximately 19%. This species has bundles of long submersed leaves that are flat and ribbon-like which emerge from a basil rosette and provide excellent structural habitat for aquatic organisms. Spreading rapidly via rhizomes, wild celery is often found growing in large colonies where their extensive root systems stabilize bottom sediments. In mid- to late-summer, the coiled flower stalks of wild celery can be observed at or near the surface, and following pollination, large banana-shaped seed pods can also be seen. These seed pods have been shown to be an important food source for waterfowl (Borman et al. 1997).

Fern pondweed was the second-most abundant plant in Scattering Rice Lake in 2012 with a littoral occurrence of approximately 13%. As its name suggests, has the appearance of a fern's leaf and is a common pondweed found in lakes in northern Wisconsin. This plant generally grows in dense beds which creep along the bottom of the lake, where they provide excellent structural habitat for aquatic invertebrates and fish.

Coontail was the third-most frequently encountered aquatic plant in Scattering Rice Lake in 2012 with a littoral occurrence of approximately 13%. Resembling the shape of a raccoon's tail, coontail is arguably one of the most common aquatic plant species in Wisconsin. Able to grow in a range of conditions, its dense whorls of stiff leaves provide excellent habitat for macroinvertebrates and other wildlife.

Slender naiad, the fourth-most abundant aquatic plant in Scattering Rice Lake in 2012 with a littoral occurrence of nearly 11%, is one of three native naiads that can be found in Wisconsin. Being an annual, it produces numerous seeds on an annual basis and is considered to be one of the most important food sources for a number of migratory waterfowl species (Borman et al.

1997). In addition, slender naiad's small, condensed network of leaves provide excellent habitat for aquatic invertebrates.

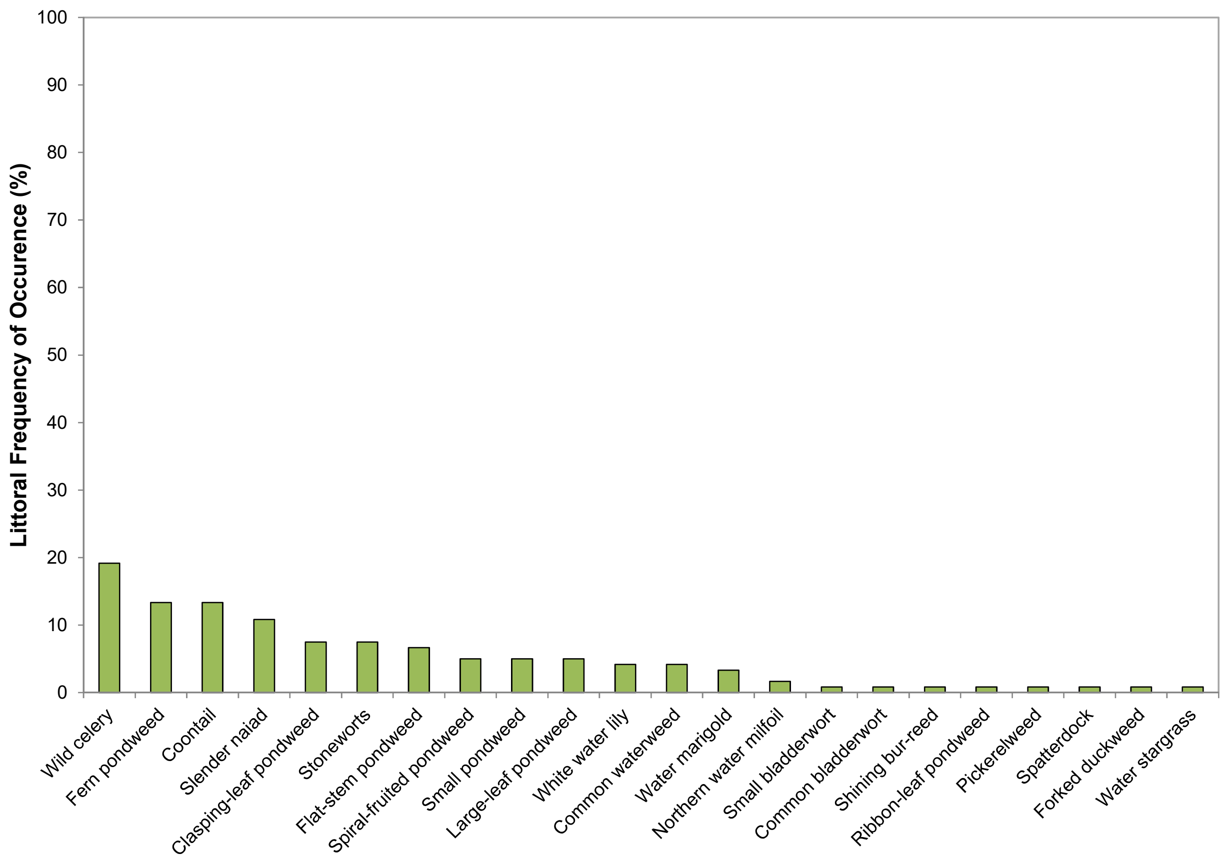


Figure 8.5.4-2. Scattering Rice Lake 2012 aquatic plant littoral frequency of occurrence. Created using data from 2012 aquatic plant point-intercept survey. Non-native species are indicated in red.

To determine if the 2008-2012 Eurasian water milfoil control project on Scattering Rice Lake had any detectable impacts to the native aquatic plant community, and to determine if the control project was successful at reducing the Eurasian water milfoil population, Chi-square distribution analysis ($\alpha = 0.05$) was used to determine if there were any statistically valid changes in the occurrences of aquatic plant species from 2006 to 2012. Unlike the other lakes within the chain that only had spot treatments targeting specific areas for Eurasian water milfoil control over the course of the project, Scattering Rice Lake underwent a low-dose, whole-lake liquid 2,4-D treatment in 2010 with the intent of targeting Eurasian water milfoil at the lake-wide level.

Figure 4.5-3 displays the littoral occurrences of Eurasian water milfoil and native aquatic plant species that had a littoral occurrence of at least 5% in one of the two surveys. The figure divides the plants into dicots and non-dicots, as dicots are thought to be more susceptible to the 2,4-D herbicide treatments that have occurred in Scattering Rice Lake. As illustrated, the occurrence of Eurasian water milfoil in Scattering Rice Lake was reduced by a statistically valid 100%, from an occurrence of nearly 18% in 2006 to 0% in 2012. While Eurasian water milfoil was not recorded during the 2012 point-intercept survey, it is still present in very low abundance Scattering Rice Lake.

Five native aquatic plant species exhibited statistically valid reductions in their littoral occurrence from 2006 to 2012 (Figure 4.5-3). These include coontail, northern water milfoil, spatterdock, flat-stem pondweed, and common waterweed. Like Eurasian water milfoil, coontail, northern water milfoil, and spatterdock are dicots, and are susceptible to types of treatments that have occurred on Scattering Rice Lake. Flat-stem pondweed and common waterweed are monocots, and were not historically believed to be sensitive to dicot-selective herbicides like 2,4-D. However, emerging research being conducted by the WDNR and US Army Corps of Engineers indicates that both flat-stem pondweed and common waterweed may be prone to decline following low-dose, whole-lake 2,4-D treatments. Five other native aquatic plant species saw statistically valid increases in their occurrence from 2006 to 2012, while the occurrences of three others were not statistically different (Figure 4.5-3).

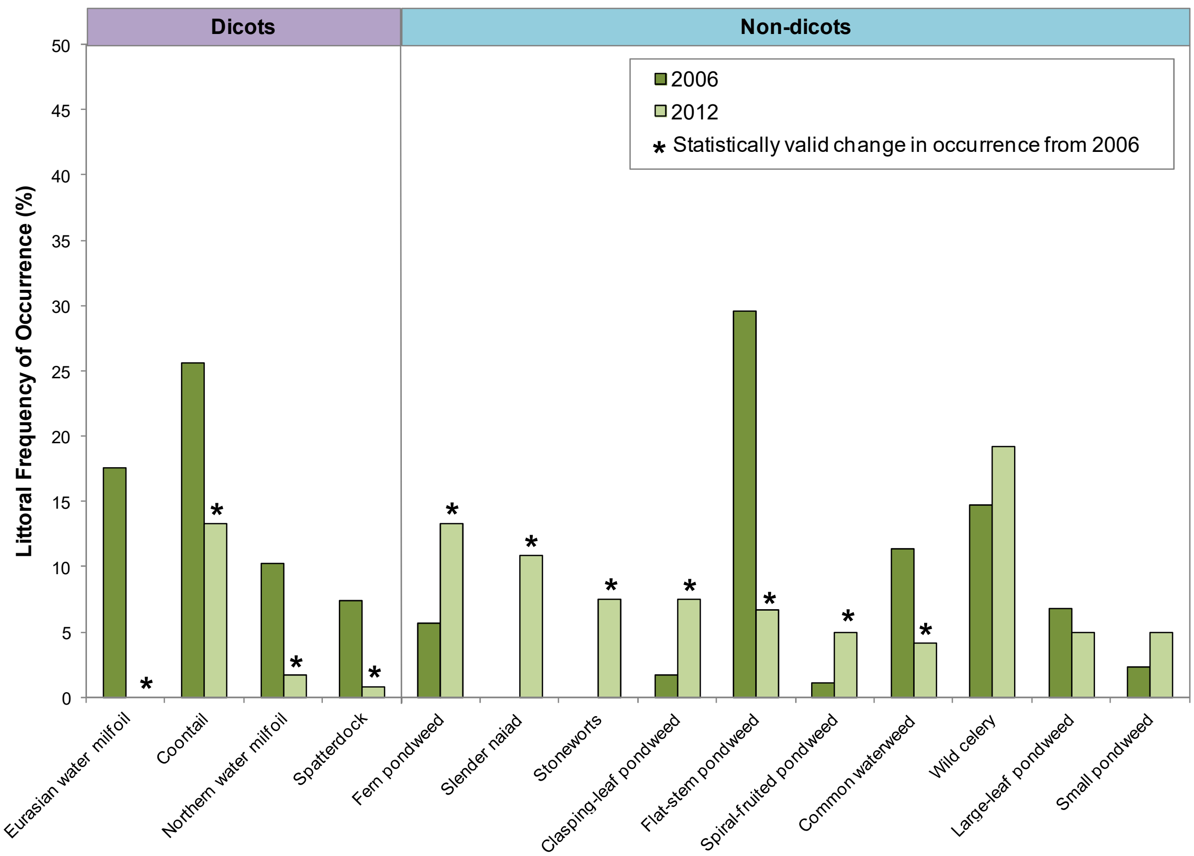


Figure 8.5.4-3. Scattering Rice Lake littoral frequency of occurrence of select aquatic plant species from 2006 and 2012 point-intercept surveys. Please note that only those native species with an occurrence of at least 5% in one of the two surveys are displayed. Created using data from 2006 and 2012 point-intercept surveys.

As discussed in the primer section, the calculations used for the Floristic Quality Index (FQI) for a lake's aquatic plant community are based on the aquatic plant species that were encountered on the rake during the point-intercept survey and does not include incidental species. For example, while a total 33 native aquatic plant species were located in Scattering Rice Lake during the 2012 survey, 25 were encountered on the rake and eight were incidentally located. These 25 native species and their conservatism values were used to calculate the FQI of Scattering Rice Lake's aquatic plant community in 2012 (equation shown below). The FQI was also calculated based on the species located during the 2006 survey.

FQI = Average Coefficient of Conservatism * √Number of Native Species

Figure 8.2.4-4 compares the FQI components of Scattering Rice Lake from the 2006 and 2012 point-intercept surveys to median values of lakes within the Northern Lakes and Forests Lakes (NLFL) Ecoregion as well as the entire State of Wisconsin. In 2012, Scattering Rice Lake's native species richness (25) is significantly higher than the median values for lakes within the ecoregion and the state. The average conservatism value in 2012 (6.9) is slightly higher than the ecoregional median but above the state median. Combining Scattering Rice Lake's 2012 native species richness and average conservatism values yields an exceptionally high FQI value of 34.6, which greatly exceeds the ecoregional and state median values (Figure 8.2.4-4). The FQI values from 2012 are also higher than those calculated from point-intercept survey in 2006, indicating that the quality of Scattering Rice Lake's aquatic plant community has not been degraded by the Eurasian water milfoil control project. This analysis indicates that Scattering Rice Lake's aquatic plant community is of higher quality than the majority of lakes within the ecoregion and the entire state.

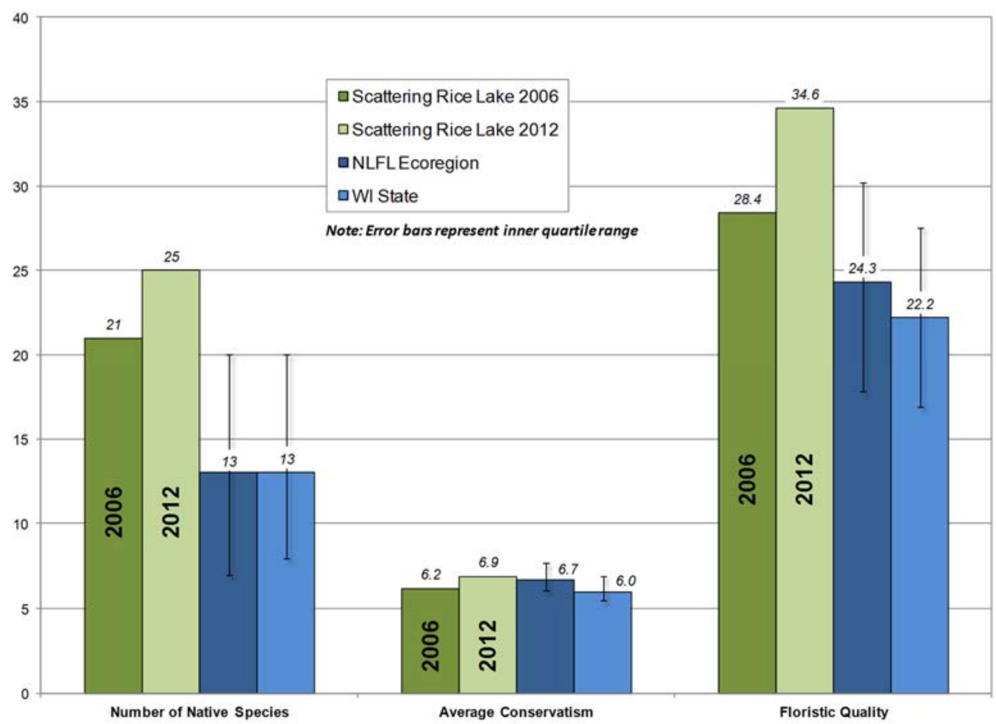


Figure 8.5.4-4. Scattering Rice Lake Floristic Quality Index values. Created using data from 2006 and 2012 point-intercept surveys. Analysis follows Nichols (1999) where NLFL = Northern Lakes and Forests Lakes Ecoregion.

As explained in the primer section, lakes with diverse aquatic plant communities have higher resilience to environmental disturbances and greater resistance to invasion by non-native plants. In addition, a plant community with a mosaic of species with differing morphological attributes provides zooplankton, macroinvertebrates, fish, and other wildlife with diverse structural habitat and various sources of food. Because Scattering Rice Lake contains a high number of native aquatic plant species, one may assume the aquatic plant community also has high species diversity. However, species diversity is also influenced by how evenly the plant species are distributed within the community.

While a method for characterizing diversity values of fair, poor, etc. does not exist, lakes within the same ecoregion may be compared to provide an idea of how Scattering Rice Lake's diversity value ranks. Using data obtained from WDNR Science Services, quartiles were calculated for 109 lakes within the NLF Ecoregion (Figure 8.2.4-5). Using the data collected from the 2012 point-intercept survey, Scattering Rice Lake's aquatic plant community was shown to have exceptionally high species diversity with a Simpson's diversity value of 0.92, falling above the upper quartile value for lakes in both the ecoregion and the state. Scattering Rice Lake's 2012 diversity was the same diversity calculated from data collected during the 2006 point-intercept survey (0.82).

Figure 8.2.4-6 displays the relative frequency of occurrence of aquatic plant species in Scattering Rice Lake from the 2012 point-intercept survey and illustrates relative abundance of species within the community to one another; the aquatic plant community is not overly dominated by a single or few species, which would create a less-diverse community.

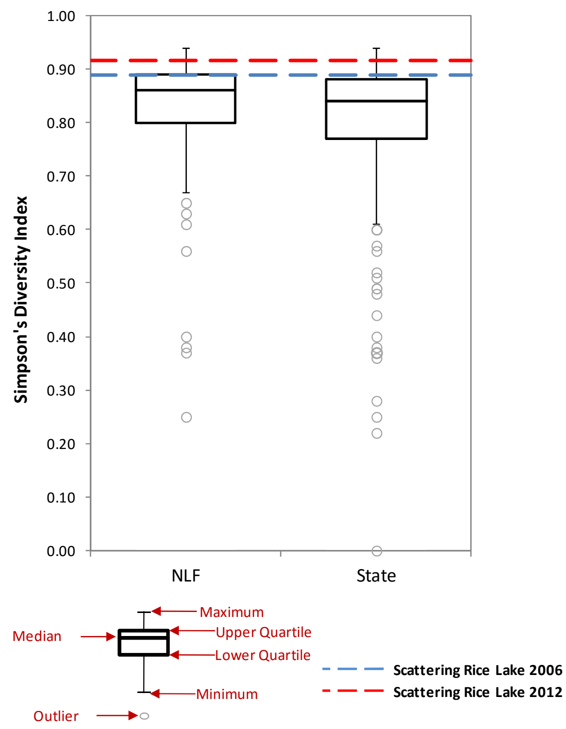


Figure 8.5.4-5. Scattering Rice Lake species diversity index. Created using data from 2006 and 2012 point-intercept surveys. Ecoregion data provided by WDNR Science Services.

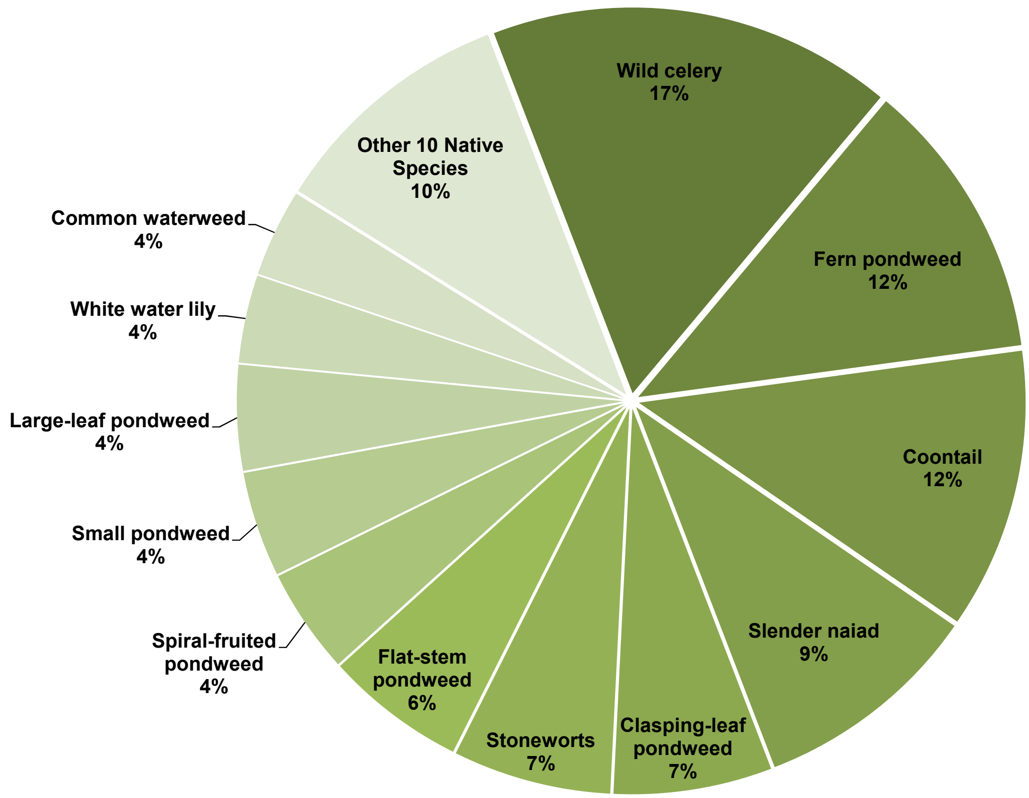


Figure 8.5.4-6. Scattering Rice Lake 2012 aquatic plant relative frequency of occurrence. Created using data from 2012 aquatic plant point-intercept survey.

The 2014 aquatic plant community mapping survey revealed that Scattering Rice Lake contains approximately 21.3 acres of emergent and floating-leaf aquatic plant communities (Table 8.5.4-2, Scattering Rice Lake – Map 4). Eleven emergent and floating-leaf aquatic plant species were located in the lake in 2012 and 2014 (Table 8.5.4-2). These plant communities provide valuable fish and wildlife habitat important to the ecosystem of the lake. The community map represents a 'snapshot' of the important emergent and floating-leaf plant communities, and a replication of this survey in the future will provide a valuable understanding of the dynamics of these communities within Scattering Rice Lake. This is important, because these communities are often negatively affected by recreational use and shoreland development.

Table 8.5.4-2. Acres of emergent and floating-leaf aquatic plant communities in Scattering Rice Lake. Created using data from 2014 aquatic plant community mapping survey.

Plant Community	Acres
Emergent	0.0
Floating-Leaf	17.6
Mixed Emergent & Floating-Leaf	3.7
Total	**21.3**

8.5.4 Scattering Rice Lake Implementation Plan

The Implementation Plan below is a result of collaborative efforts between Scattering Rice Lake stakeholders, ERCLA, and ecologists/planners from Onterra. This plan provides goals and actions created to protect the quality and integrity of Scattering Rice Lake and will serve as reference for keeping stakeholders on track and focused upon these science-driven management activities. While the lakes within the Lower Eagle River Chain of Lakes are relatively similar in terms of their water quality and aquatic plant communities, each lake possesses its own unique attributes. This uniqueness leads to the need to create individual plans aimed at managing the specific needs of each individual lake. Some of the lakes within the Lower Eagle River Chain have more complicated management needs than others, but in general most lakes' needs center on protecting the current quality of the lake and restoring/protecting immediate shoreland areas.

However, a couple management challenges specific to Scattering Rice Lake were also discussed. These include the buildup of sediment in the lower reaches and at the mouth of the Deerskin River and measured phosphorus and chlorophyll-*a* concentrations that are higher than watershed modeling predicted. As is discussed in the Chain-Wide Water Quality Section (Section 3.1), of the Phase I and Phase II lakes studied thus far, Cranberry, Catfish, Voyageur, and Eagle Lakes had relatively similar water quality while Scattering Rice Lake's nutrient and algae levels were slightly higher. Scattering Rice Lake's Implementation Plan illustrates how Scattering Rice Lake stakeholders should proceed in implementing lake-specific goals as well as applicable portions of the Chain-wide Implementation Plan for their lake.

Scattering Rice Management Goal 1: Instill an Understanding of the Cause of Increased Sedimentation within the Deerskin River and the Feasibility of Sediment Removal to Scattering Rice Lake Stakeholders

Management Action:	Educate Scattering Rice Lake stakeholders on the cause of sedimentation within the Deerskin River, its effects on the lake, and the feasibility of sediment removal.
Timeframe:	Initiate 2016
Facilitator:	Suggested: Scattering Rice Lake Planning Committee
Description:	During the Phase II Planning Committee Meetings, one of the concerns the Scattering Rice Lake Planning Committee brought forward was the relatively recent buildup of sediment within the lower reaches and in the mouth of the Deerskin River. The buildup of sediment at the mouth of a river is a natural process due to the reduction in water velocity and its inability to no longer carry sediment particles. However, the relatively recent and rapid buildup of sediment noted by Scattering Rice Lake riparians is due to the removal of a dam in the early 2000s approximately 3.5 miles upstream from Scattering Rice Lake. This dam was removed due to safety concerns as well as for restoration of the river, which is designated a Class II trout stream. Prior to its removal, the dam produced a small reservoir on the Deerskin River, which over time accumulated sediment. Following

the removal of the dam, this accumulated sediment has been making its way downstream and settling within the lower reaches of the Deerskin River where water velocity slows. Consequently, Scattering Rice Lake riparians have noted a reduction in water depth from the mouth of the Deerskin River upstream to the culvert at Rangeline Road.

After noting the increased sedimentation, Scattering Rice stakeholders contacted the Wisconsin Department of Natural Resources (WDNR) and were told that the increased sedimentation was to be expected and that it could take decades or longer for the sediment from the now drained reservoir to make its way downstream. The WDNR indicated that large-scale dredging of this portion of the Deerskin River and Scattering Rice Lake was not a feasible option, and the reasons for this were discussed at the Phase II second planning meeting. These reasons are as follows:

1) Hydraulic dredging is costly due to labor, permitting, and disposal. Dredging expenses cost anywhere from about $10-$15 per cubic yard of sediment removed. This equates to a cost of approximately $50,000 to $73,000 to remove 3 feet of sediment over one acre.
2) Hydraulic dredging represents a large disturbance to the aquatic environment. Dredging resuspends bottom sediments and nutrients and also opens up new areas for colonization by pioneering, invasive plant species like EWM.

The Scattering Rice Lake Planning Committee understood that hydraulic dredging of the Deerskin River was not a feasible option. However, they want to educate other Scattering Rice Lake stakeholders on why dredging is not a feasible option, what impact the sediment has on the lake, and what they can do if sediment is building up around their pier or boat lift.

In terms of the sediment's impact on the lake, the buildup of organic sediment in the river and near the mouth will likely lead to increased aquatic plant growth in these areas. Surveys conducted by Onterra ecologists have found mainly native aquatic plant species in this area, and while EWM was in high abundance within this area in the recent past, active management has greatly reduced its occurrence in this area. If aquatic plant growth increases around riparian's piers, they can manually remove (hand-pull/rake) these plants within an area 30 feet wide and as far out into the lake/river that they need to. However, this 30-foot wide area must include their pier or boatlift within it. All aquatic plants and fragments that are removed must be collected and removed from the water.

If sediment has accumulated around a pier or boat lift, lake riparians can manually remove a total of two cubic yards of sediment per year without submitting a WDNR permit. However, if motorized equipment is to be used, a WDNR permit will be required. The Scattering Rice Lake Planning Committee will educate other lake stakeholders with this information at their annual meeting and/or through ERCLA's Newsletter.

Action Steps:

1. See description above.

Scattering Rice Management Goal 2: Gain Further Insight into Scattering Rice Lake Internal Phosphorus Recycling

Management Action: Conduct additional water quality data from Scattering Rice Lake in 2016.

Timeframe: Initiate December 2015

Facilitator: Scattering Rice Lake Planning Committee with assistance from Onterra

Description: As discussed within the Chain-Wide Water Quality Section (Section 3.1) and the Scattering Rice Lake Water Quality Section (Section 8.5.1), the total phosphorus and chlorophyll-*a* data collected from Scattering Rice Lake in 2014 are higher than can be accounted for in phosphorus loads entering from the watershed. The data indicate that this is likely due to a naturally occurring phenomenon known as internal phosphorus loading, or internal phosphorus recycling. While the 2014 data indicate this is occurring, additional water quality data including the collection of temperature and dissolved oxygen profiles at regular intervals over the course of the growing season, would bring about a higher level of confidence that internal phosphorus loading is occurring.

This additional water quality sampling is proposed to occur in Scattering Rice Lake in 2016. Onterra ecologists would collect near-surface and near-bottom total phosphorus from the lake's deep hole in April/May, June, July, August, and October 2016, and through the ice in February 2017. Near-surface chlorophyll-*a* concentrations would also be measured during the open-water sampling events. Onterra will also lend a temperature/dissolved oxygen probe for use by Scattering Rice Lake volunteers to collect temperature and dissolved oxygen profiles at the lake's deep hole once per week from May through August 2016. These data will allow for a determination of how often Scattering Rice Lake mixes over the course of the growing season and an estimate of how much phosphorus is released from bottom sediments into the overlying water column. Funding for this monitoring would be sought within the Phase III WDNR AIS-

Education, Planning and Prevention Grant being submitted in December 2015.

Action Steps:

1. Scattering Rice Planning Committee recruits volunteer(s) to collect/record a temperature/dissolved oxygen profile at the lake's deep hole once per week from May – August 2016.
2. Consultant solidifies sampling design.
3. Create preliminary project cost estimate.
4. Additional cost of monitoring to be included within the WDNR AIS-EPP Phase III grant being applied for in December of 2015.

Chain-wide Implementation Plan – Specific to Scattering Rice Lake

Chain-wide Management Goal 1: Maintain Current Water Quality Conditions

Management Action: Continue water clarity monitoring in Scattering Rice Lake through the WDNR Citizen Lake Monitoring Network (CLMN).

Timeframe: Continuation of current effort

Facilitator: Dennis Burg, current Scattering Rice Lake CLMN volunteer

Description: Monitoring water quality is an important aspect of every lake management planning activity. Collection of water quality data at regular intervals aids in the management of the lake by building a database that can be used for long-term trend analysis. Early discovery of negative trends will likely aid in an earlier definition of what may be causing the trend.

The Citizens Lake Monitoring Network (CLMN) is a WDNR program in which volunteers are trained to collect water quality data on their lake. Volunteers trained as a part of the CLMN program begin by collecting Secchi disk transparency data annually. If funding is available, the lake group may enter into the *advanced program* and collect water chemistry data (chlorophyll-a and total phosphorus). The Secchi disk readings and water chemistry samples are collected three times during the summer and once during the spring. As a part of this program, these data are automatically added to the WDNR database and available through their Surface Water Integrated Monitoring System (SWIMS).

Volunteers from Scattering Rice Lake have been collecting water quality data intermittently since 1993. Scattering Rice Lake is not currently enrolled in the advanced water program and is currently collecting water clarity data. As is discussed within the Chain-Wide

Implementation Plan, if additional funding should become available to include additional lakes within the chain in the advanced monitoring program, Scattering Rice Lake and Watersmeet have been given priority due to their positions within the chain. Scattering Rice Lake currently has an active volunteer (Dennis Burg) who collects and enters water quality data into the WDNR's SWIMS database on an annual basis. Scattering Rice Lake (and ERCLA) recognizes the importance of continuing this effort which will supply them and resource managers with valuable data about their lake. Moving forward, it is the responsibility of Dennis Burg, the current CLMN volunteer, to notify Dave Mueller, the current chair of the ERCLA Lakes and Shores Committee and coordinator of the chain's CLMN volunteers, when a change in the collection volunteer occurs or is needed. Dave (or the current Lakes and Shores Committee chair) will contact Sandra Wickman (715.365.8951) or the appropriate WDNR/UW Extension staff to ensure the proper training occurs and the necessary sampling materials are received by the new volunteer.

Action Steps:

1. Dennis Burg, current CLMN volunteer, continues to collect water quality data and enter data into WDNR SWIMS database.
2. Dennis Burg, current CLMN volunteer, notifies Dave Mueller or current Lakes and Shores Committee chair when a new Scattering Rice Lake volunteer is needed.

Chain-wide Management Goal 2: Lessen the Impact of Shoreline Development on the Eagle River Chain of Lakes

<u>Management Action:</u> Investigate restoring highly developed shoreland areas on the Eagle River Chain of Lakes.

Description: As part of the planning project, the entire shoreline of Scattering Rice Lake was categorized based on the amount of development present. The results of this survey revealed that approximately 17% (0.8 miles) of the shoreline are in an urbanized or developed-unnatural state, 20% (0.9 miles) is in a developed-semi-natural state, and 63% (2.8 miles) is in a developed-natural or natural/undeveloped state. Continuing research indicates that the shoreland zone is a critical component of a lake's ecology through providing both pollutant buffering and wildlife habitat. In addition, natural shoreland areas also increase the lake's aesthetic appeal.

ERCLA's Shores Subcommittee will be working with Quita Sheehan from the Vilas County Land and Water Department to gather information on initiating and conducting shoreland restoration projects. The Shores Subcommittee will serve as a contact point for property owners who are interested in pursuing shoreland restoration on their property. Interested property owners may contact ERCLA for more information on shoreland restoration plans, financial assistance, and benefits of implementation.

<u>Management Action:</u> Preserve natural shoreland areas on the Eagle River Chain of Lakes.

Description: While approximately 17% of Scattering Rice Lake's shoreline is in a highly-developed state, approximately 63% of the shoreline contains little to no development. Preservation of these natural areas is very important for the lake's overall health, and owners of these properties should be educated on the benefits their shoreland is providing to Scattering Rice Lake and to the entire chain.

The shoreland areas delineated as Natural and Developed-Natural should be prioritized for education initiatives and physical preservation. The ERCLA Shores Subcommittee will work with appropriate entities to research grant programs and other pertinent information that will aid ERCLA in preserving the Scattering Rice River Chain's shoreland. This would be accomplished through education of property owners, or direct preservation of land through implementation of conservation easements or land trusts that the property owner would approve of. Scattering Rice Lake stakeholders may assist in this management action by attending educational events held by ERCLA and by aiding in distributing ERCLA materials to Scattering Rice Lake property owners.

<u>Management Action:</u> Investigate with WDNR and private landowners to expand coarse woody habitat in the Eagle River Chain of Lakes.

Description: During the Scattering Rice Lake shoreland assessment, approximately 36 pieces of coarse woody habitat (CWH) per shoreline mile were observed. Often, property owners will remove downed trees, stumps, etc. from a shoreland area because these items may impede watercraft navigation shore-fishing or swimming. However, these naturally occurring woody pieces serve as crucial habitat for a variety of aquatic organisms, particularly fish, and also aid in reducing shoreline erosion.

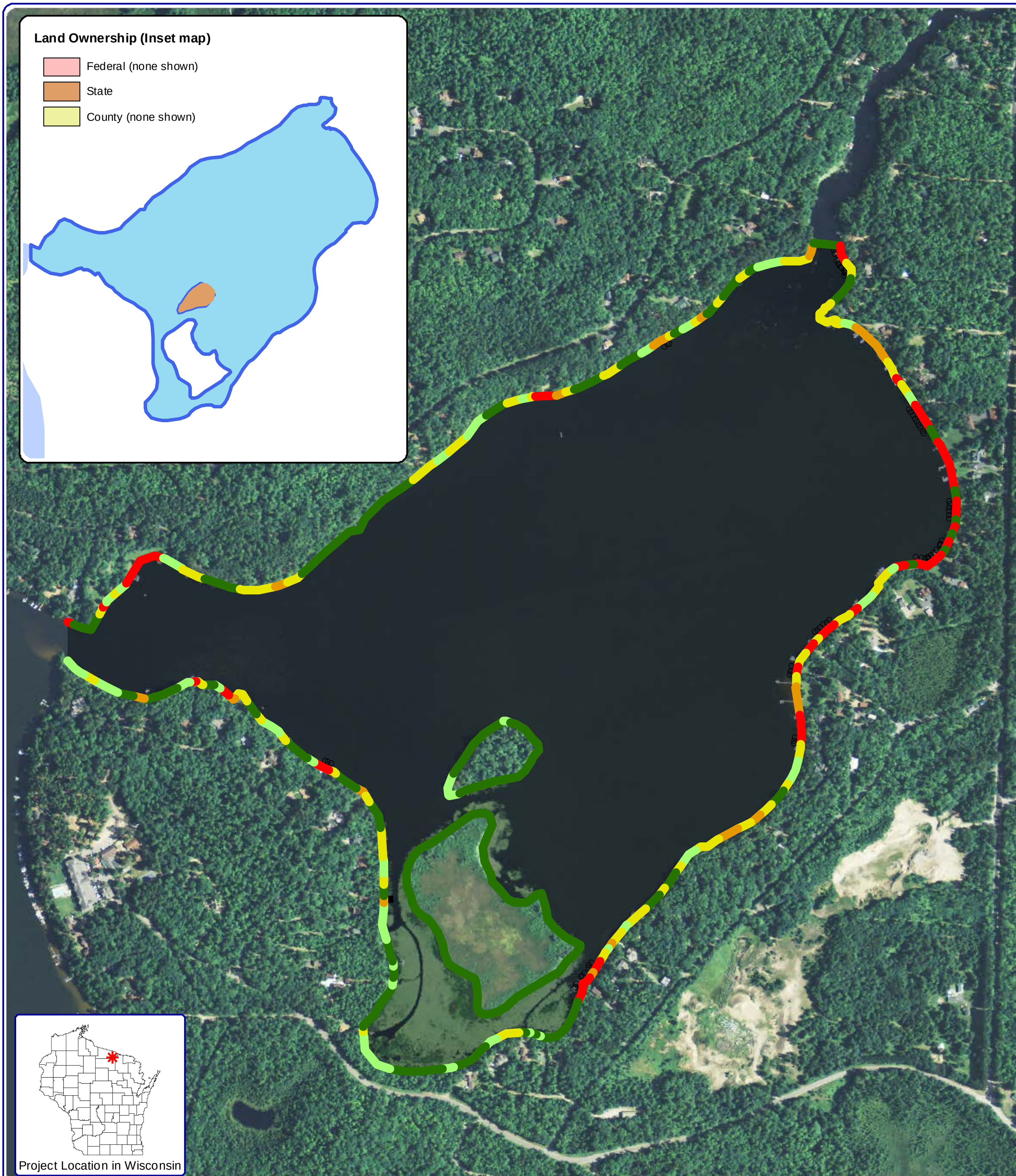
The ERCLA Shores Subcommittee will encourage its membership to implement coarse woody habitat projects along their shoreland properties. Habitat design and location placement would be determined in accordance with the WDNR fisheries biologist. Scattering Rice Lake stakeholders interested in implementing a coarse woody habitat project along their property or who have questions about the benefits of coarse woody habitat should contact ERCLA.

Chain-wide Management Goal 3: Actively Manage Existing and Reduce the Likelihood of Further Aquatic Invasive Species Establishment within the Eagle River Chain of Lakes

Management Action:	Continue annual monitoring of aquatic invasive species on the Lower Eagle River Chain of Lakes.
Description:	Of the aquatic invasive species currently present in the Lower Eagle River Chain of Lakes, Eurasian water milfoil, purple loosestrife, pale-yellow iris, and garden yellow loosestrife are currently being actively managed. Scattering Rice Lake stakeholders may participate in a variety of ways to aid in managing aquatic invasive species in Scattering Rice Lake and throughout the chain. Those who are interested in participating in aquatic invasive species monitoring and management should contact ERCLA. Scattering Rice Lake stakeholders can keep themselves up to date on aquatic invasive species matters through attending WDNR training sessions, media releases, or participating in Scattering Rice Lake Association and ERCLA meetings. Scattering Rice Lake stakeholders can also participate in the active annual monitoring of Eurasian water milfoil, purple loosestrife, pale-yellow iris, and garden yellow loosestrife on Scattering Rice Lake and/or volunteer to conduct watercraft inspections at designated boat landings in accordance with the Clean Boats Clean Waters Program. Additionally, Scattering Rice Lake stakeholders can also report sightings of aquatic invasive species to ERCLA and remove occurrences of purple loosestrife, pale-yellow iris, and/or garden yellow loosestrife on their property in accordance with methods determined by ERCLA and the Vilas County Invasive Species Coordinator.

Management Goal 4: Continue and Expand Awareness and Education of Lake Management and Stewardship Matters to Eagle River Chain of Lakes Riparians and the General Public

Management Action:	ERCLA will continue to promote stakeholder involvement and inform stakeholders of various lake issues as well as the quality of life on the Eagle River Chain of Lakes.
Description:	Scattering Rice Lake stakeholders can assist in the implementation of this action by actively participating in ERCLA-associated educational initiatives. Participation may include attending presentations and trainings of educational topics, volunteering at local and regional events, participating in ERCLA committees, or simply notifying ERCLA of concerns regarding Scattering Rice Lake and its stakeholders.



N
W E
S

790

Feet

Legend

Natural/Undeveloped
Developed-Natural
Developed-Semi-Natural
Developed-Unnatural
Urbanized

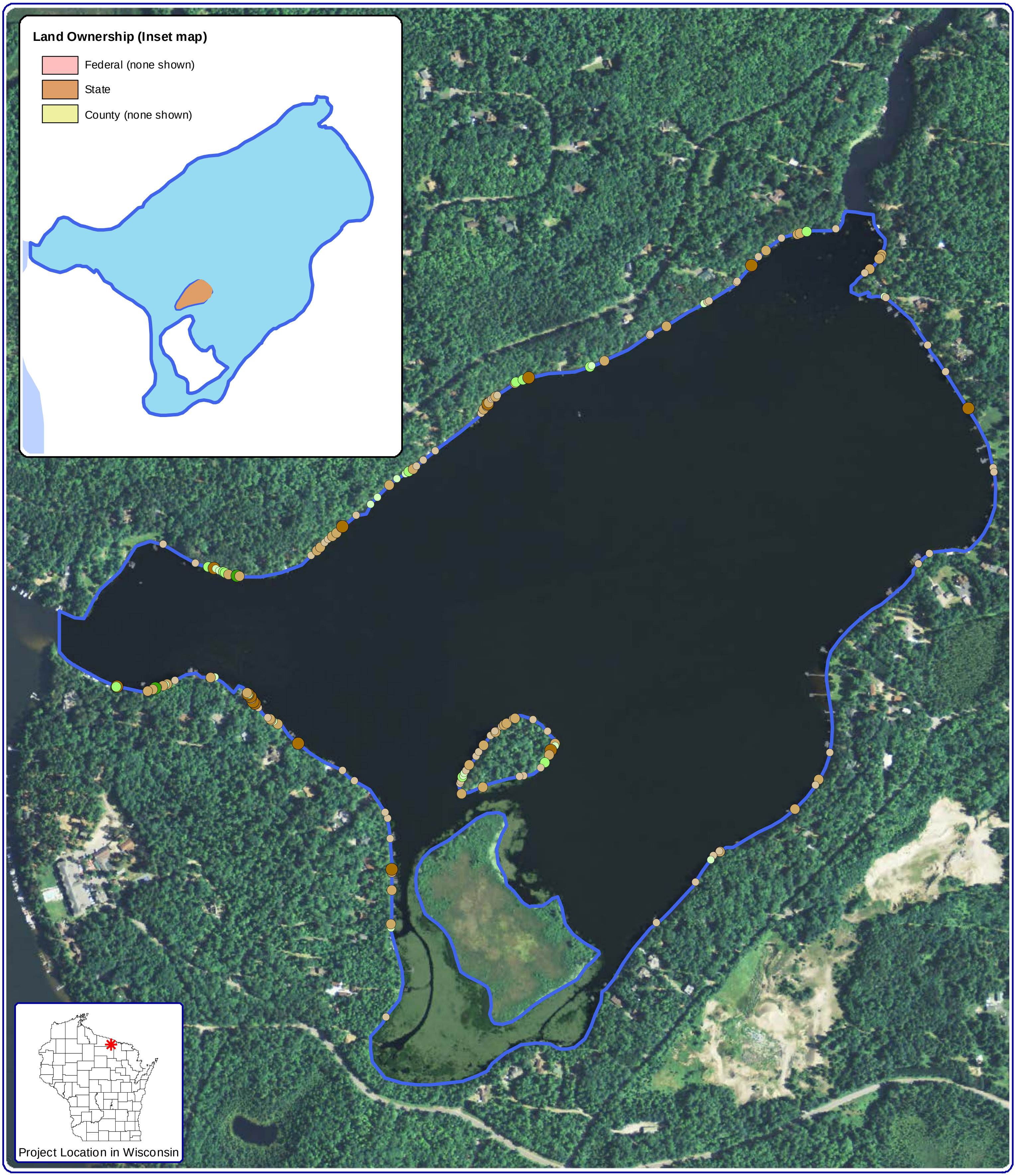
Seawall

Masonary/Wood/Metal
Rip-Rap

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Orthophotography: NAIP, 2013
SCA Survey: Onterra, 2014
Map date: October 13, 2014
Filename: ScatteringRice_Map1_SCA_2014.mxd

Scattering Rice Lake - Map 1
Lower Eagle River
Chain of Lakes
Vilas County, Wisconsin
2014 Shoreland
Condition Assessment



750
Feet

Legend

2-8 Inch Pieces	8+ Inch Pieces	Cluster of Pieces
No Branches	No Branches	No Branches
Minimal Branches	Minimal Branches	Minimal Branches
Moderate Branches	Moderate Branches	Moderate Branches
Full Canopy	Full Canopy	Full Canopy

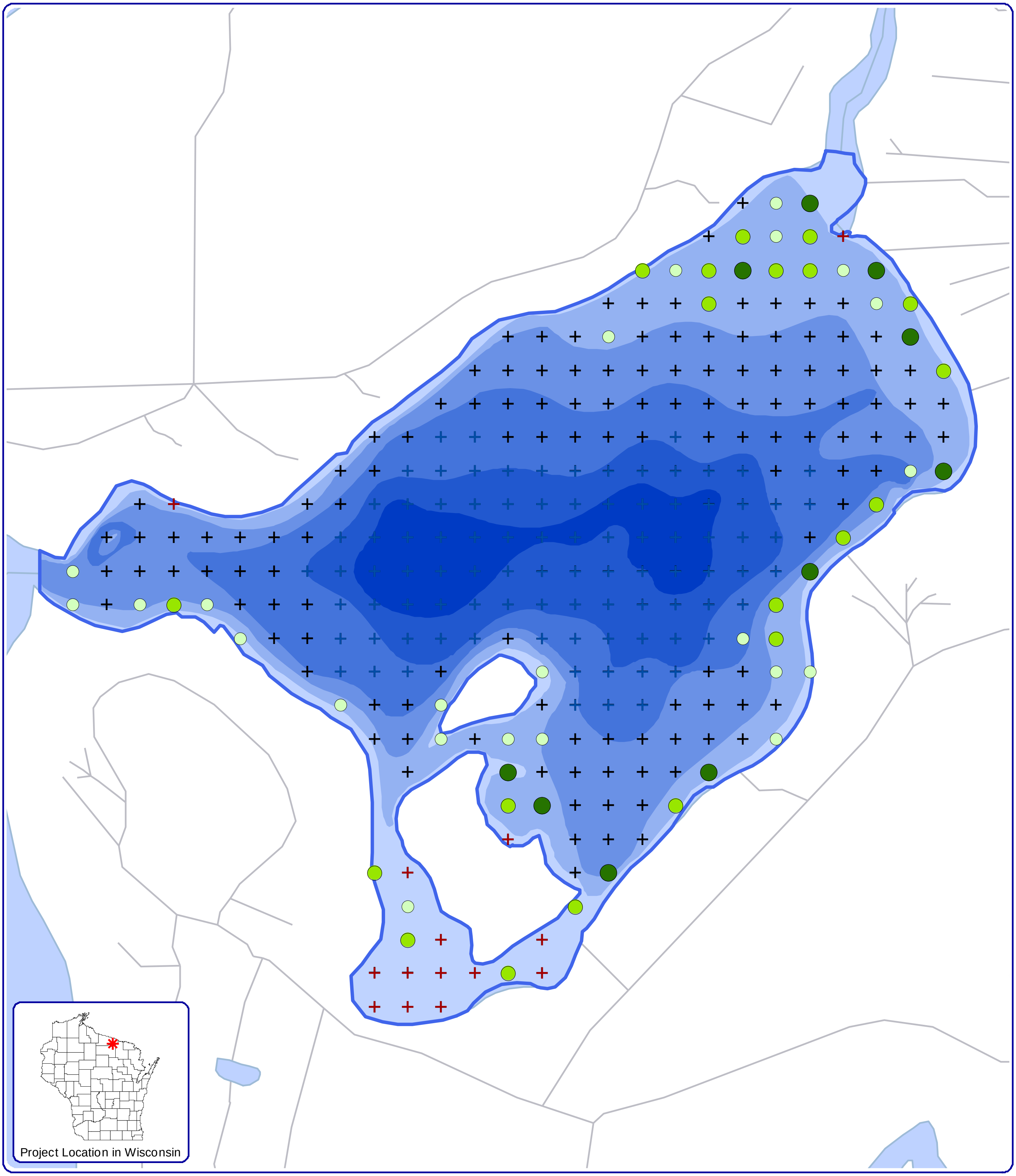
Scattering Rice Lake - Map 2

Lower Eagle River
Chain of Lakes
Vilas County, Wisconsin

2014 Course Woody Habitat

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Orthophotography: NAIP, 2013
SCA Survey: Onterra, 2014
Map date: October 13, 2014
Filename: ScatteringRice_Map2_CWH_2014.mxd



770

Feet

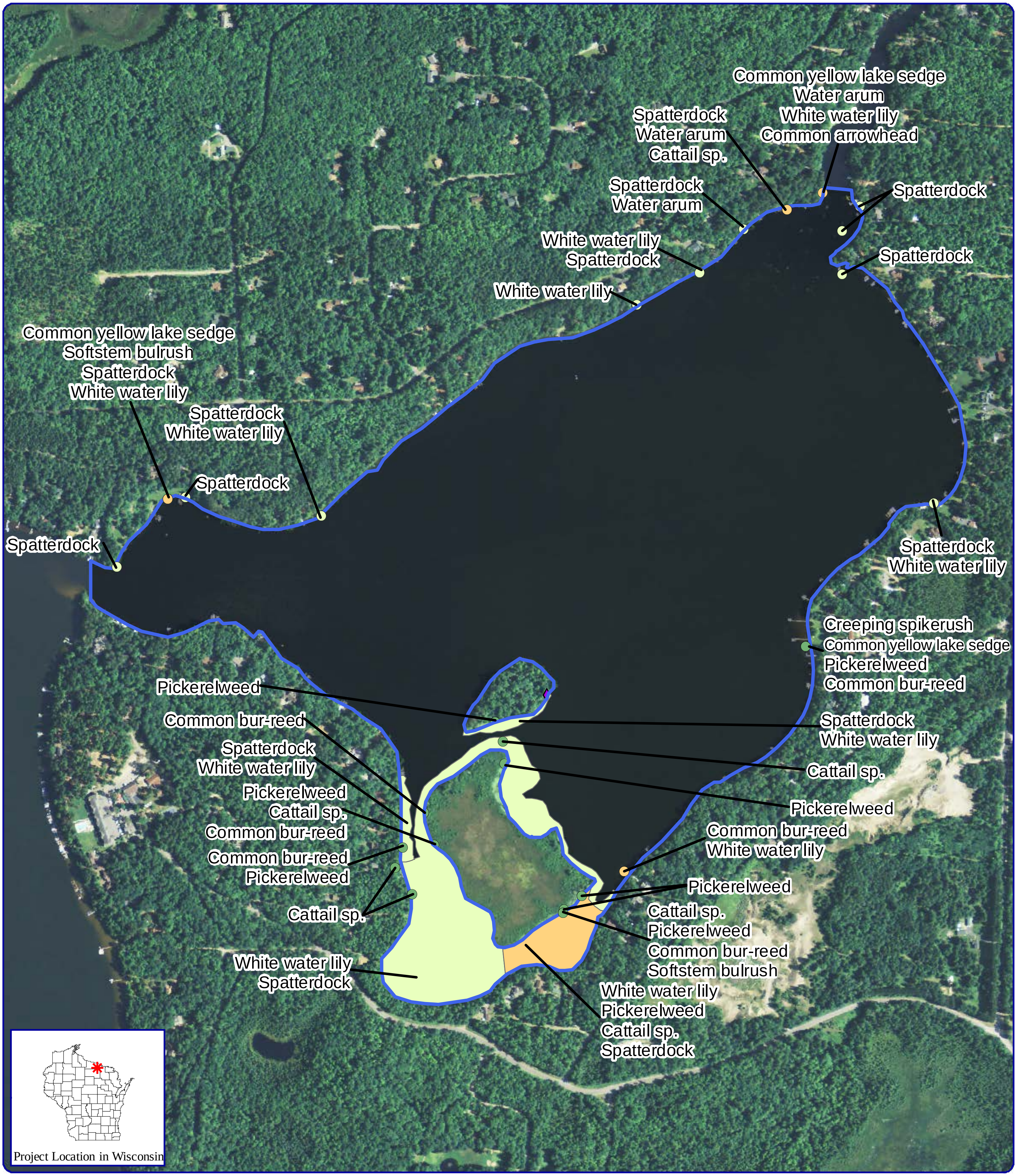
Legend

- + No Vegetation
- ○ Total Rake Fullness = 1
- ● Total Rake Fullness = 2
- ● Total Rake Fullness = 3
- + Greater Than Max Depth of Plants
- + Non-Navigable

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Plant Survey: Onterra, 2012
Map date: October 13, 2014
Filename: ScatteringRice_Map3_TRFPI_2012.mxd

Scattering Rice Lake - Map 3
Lower Eagle River
Chain of Lakes
Vilas County, Wisconsin
2012 Aquatic
Plant Distribution



N E S W

800

Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Orthophotography: NAIP, 2013
Plant Survey: Onterra, 2014
Map date: October 13, 2014
Filename: ScatteringRice_Map4_Comm_2014.mxd

Legend

Small Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent
- Purple loosestrife

Large Plant Communities
- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Scattering Rice Lake - Map 4
Lower Eagle River
Chain of Lakes
Vilas County, Wisconsin
Emergent & Floating-Leaf Aquatic Plant Communities