Shoreland Survey Report

for

Round Lake, 2016

Sawyer County, Wisconsin

Project initiated by:
Round Lake Property Owners Association

Survey and report completed by:
Aquatic Plant & Habitat Services, LLC
Sara Hatleli
N4888 Beck Rd.
Taylor, WI 54659
715-299-4604
Sarahatleli97@gmail.com

ABSTRACT

A survey of the riparian zone of Round Lake (WBIC 2395600) was completed in August 2016. Methods were modified from a draft protocol developed by the Wisconsin Department of Natural Resources. Surveyors estimated percent cover of shrub/herbaceous plants, tree canopy, impervious surfaces, and lawn at each tax parcel. All data were collected from a boat cruising slowly along shore. Presence and absence of runoff concerns were recorded and human modifications in the bank zone were estimated in the number of linear feet along shore. Maps were created of the percent cover in order to identify areas of concern based on their potential to impact water quality. Areas of concern had high impervious surface cover, high lawn cover, and/or low shrub/herbaceous cover.

Results suggest there are very few impervious surface concerns within the 35-foot riparian corridor. It should be noted, however, that the impervious surface cover does not include most buildings since the current statewide standard for setbacks is 75 feet. Estimating percent cover of impervious surface beyond 35 feet can be difficult depending on visual obstructions. It is also difficult to know a structure's size when observing from a boat. Results also suggest lawn cover is high in some areas and shrub/herbaceous cover is low in some areas. Maps revealed that the areas of high lawn cover are also those with low shrub/herbaceous cover, as would be expected. It is these areas that could be mitigated to protect water quality. Lawn and stairs/trails to the lake were the most common runoff concerns present in the riparian zone. Rip rap was the most common human modification in the bank zone.

Management recommendations include 1) Identify areas where improvement in riparian cover is a realistic possibility and reach out to those landowners. 2) Include regular appeals in newsletters and the website that call property owners to be stewards of water quality by having shoreland cover that is more shrub and herbaceous plants and less lawn. 3) Help and encourage landowners of newly developed sites to keep shoreland buffers and minimize impervious surface and lawn cover.

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INTRODUCTION

Shorelands & Water Quality

The water quality of a lake, stream, or river is directly impacted by its watershed. Land that is directly adjacent to a lake has more potential to impact the water quality than land that is greater distances from the water's edge and changes in land use have an impact on water quality. When waterfront land changes from forest-covered to a house, driveway, deck, garage, other structures, septic systems, lawns and sandy beaches, the water quality will be directly affected. It is the cumulative land cover change of many waterfront properties that leads to a decline in water quality.

Rain and snowmelt obviously flow downhill so precipitation will evaporate, transpire, flow downhill as surface runoff into the lake, or infiltrate into the ground. The precipitation that flows over land and directly into a lake can impair water quality, depending on the land characteristics. For example, the amount of phosphorus that enters a lake typically increases as land use changes from forested to residential (Panuska & Lillie, 1995 and Jeffrey, 1985). A developed site with a lawn will yield more runoff volume carrying phosphorus and nitrogen than a forested site (Graczyk et. al. 2003). Phosphorus is generally the key nutrient that leads to algae and nuisance aquatic plant growth. Higher primary productivity from plants and algae will then use more dissolved oxygen in the water as the plants and algae die and decompose each year releasing more phosphorus, thereby causing a downward spiral of higher phosphorus and lower oxygen. Dissolved oxygen is critical for aquatic animals, including fish. Phosphorus sources include human waste (leaky septic systems), animal waste (farm runoff), soil erosion, detergents, and fertilizers applied to lawns (Shaw et al. 2004). Developed sites have more impervious surface that does not allow precipitation to infiltrate into the soils. This precipitation becomes surface water runoff in higher volumes and at warmer temperatures than at non-developed sites (Galli, 1988). The warmer water that flows into the lake can lead to increased lake water temperatures, and as water temperatures increase the amount of dissolved oxygen it can "hold" will decrease. The combined impacts of increased water temperatures, lower dissolved oxygen, and higher phosphorus can all result from shoreland development.

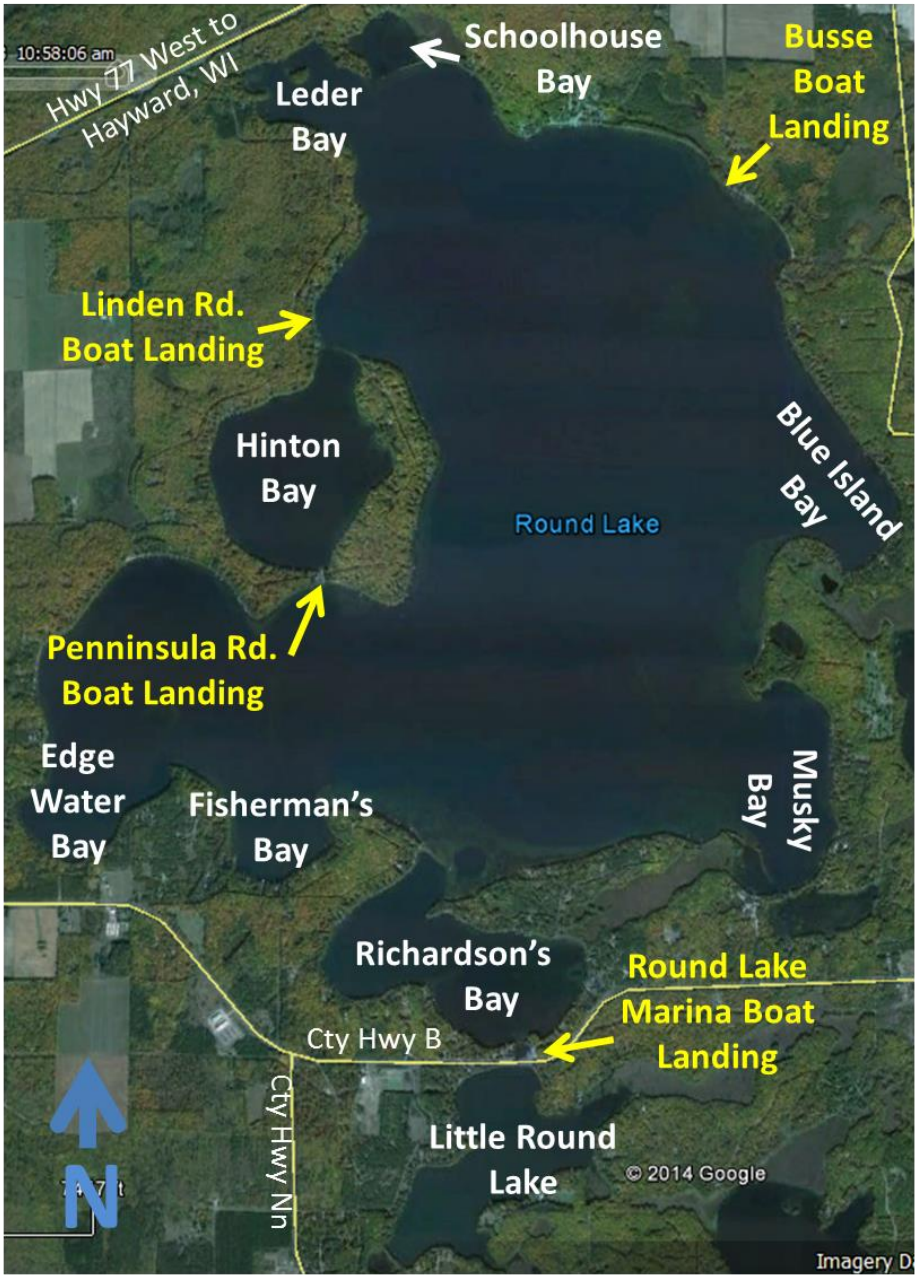
Study Site

Round Lake is a seepage lake located in Sawyer County, Wisconsin with a surface area of 3,324 acres (WBIC 2395600). The maximum depth is 74 feet and the mean depth is 33 feet. Round Lake is situated approximately 7 miles east of Hayward, Wisconsin. Water clarity for Round Lake is very high and the lake is considered oligotrophic with low nutrients and sparse vegetation. The water clarity (Secchi depth) average from 2005-2013 was 22 feet in the main basin and Hinton Bay and 19 feet in Richardson's Bay. Average total phosphorus levels from 2005-2013 were 8 µg/l in the main basin and Hinton Bay and 10 µg/l in Richardson's Bay. Average chlorophyll-*a* trophic state index values from 2005-2013 were 31 in the main basin and Hinton Bay and 34 in Richardson's Bay. These values all support an oligotrophic classification for Round Lake and suggest the water quality is currently very good or excellent. Further information on the current state of water quality in Round Lake and explanation of water quality is available in the Aquatic Plant Management Plant 2015-2019 (Hatleli, 2015).

Project Goals and Objectives

The Round Lake Property Owners Association (RLPOA) and Aquatic Plant and Habitat Services LLC (APHS) updated the Aquatic Plant Management Plan to serve the lake from 2015-2019. That plan includes an objective to conduct a shoreline buffer survey of Round Lake to identify areas of development where shoreland improvements could help protect water quality (page 55). A shoreland survey of Little Round Lake had already been completed in 2012. The RLPOA partnered with APHS to conduct a shoreland survey of Round Lake in 2016. This report details the results of that survey with emphasis on shoreland characteristics and their connection with water quality.

Figure 1 – Round and Little Round Lake Map



METHODS

Field methods were modified from a draft protocol developed by the Wisconsin Department of Natural Resources and the survey was completed in August 2016. Variables selected for the survey were those in the 35-foot riparian zone that have the greatest impact on water quality and were easily observed from the lake. Sawyer County Lands Records office provided tax parcel geographic information system (GIS) data. Parcel data were loaded into QGIS (QGIS, 2016) along with Sawyer County satellite imagery from WisconsinView[1]. Georeferenced field maps were generated and loaded onto Avenza Maps, a smartphone application. Surveyors made observations from a boat as they navigated slowly around the entire lake using georeferenced maps to track their locations in relation to tax parcels on shore (Figure 2, Table 1). The last eight digits of the tax parcel identification number were used to reference the parcels.

Figure 2 and Table 1 list the type of data collected. Percent canopy cover values range from 0% to 100% regardless of the other percent cover categories because tree canopies could overlap with the other categories. For example, tree branches may shade patio, lawn, and herbaceous plants. The sum of all "ground layers" (shrub/herbaceous plants, impervious surface, lawn, and other) had to equal 100%. Shrubs and herbaceous plant cover often overlapped so their combined percent cover was estimated. Percent covers were recorded in multiples of 5%. For example, if impervious surface only included a couple of stairs on a 100 foot long parcel, 5% cover was reported.

Figure 2 – Shoreland Data Sheet (modified from WDNR)

RIPARIAN ZONE

Percent Cover in Riparian	Percent	
Canopy	☐	(0-100)
Shrub ☐ Herbaceous ☐		
Shrub/Herbaceous	☐	sum=100
Impervious surface	☐	
Manicured lawn	☐	
Agriculture	☐	
Other (e.g. duff, soil, mulch)	☐	
description:_____		

Runoff Concerns in Riparian or Entire Parcel	Present in Riparian
Point source	☐
Channelized water flow/gully	☐
Straight stair/trail/road to lake	☐
Lawn/soil sloping to lake	☐
Bare soil	☐
Sand/silt deposits	☐
Other	☐
description:_____	

BANK ZONE

Human modifications	Length (ft)
Vertical sea wall	
Rip rap	
Other erosion control structures	
Artificial beach	
Bank erosion > 1 ft face	
Bank erosion < 1 ft face	

[1] http://wisconsinview.ssec.wisc.edu/

Table 1 – Shoreland Variables & Descriptions

Percent Cover In Riparian – Estimated % Cover When Visualizing from Above		
Canopy		Canopy cover of trees at least 16 feet tall (up to 100%).
Shrub √ Herbaceous √	Sum of all Variables = 100%	Boxes checked if that type of cover is present in the riparian zone. Shrub = woody plants with multiple stems and small trees less than 16 feet tall. Herbaceous = plants without woody stems (grasses, sedges, forbs).
Shrub / Herbaceous		Estimated % of shrub and herbaceous cover combined.
Impervious surface		Area where all or a majority of the precipitation is released as runoff (e.g. rooftops, sidewalks, driveways, parking lots, concrete, boulders, decks, compacted gravel/soil, boats flipped over on shore and riprap.
Manicured lawn		Grass that is mowed short.
Agriculture		Fields planted in rows or grasslands used for grazing livestock.
Other		Cover types that are not on the data sheet, such as duff, bedrock, gravel, bare soil, sand, and mulch.
Description		Description of "other" cover type.
Runoff Concerns in riparian		
Point source		Water running directly to the lake, could be a pipe directing storm water, gray water, or other water sources.
Channel water flow/gully		Sharp indentation into the ground where water flows downhill and has eroded away the soil.
Straight stair / trail / road to lake		Stairs, dirt or paved trails, or roads that lead directly to the lake and would cause rainfall to flow into the water. Straight roads to the lake may be old, private boat landings.
Lawn / soil sloping to lake		The land slopes toward the lake and lacks natural vegetation that would prevent runoff/erosion (e.g., slope covered by lawn, bare soil, gravel, mulch) .
Bare soil		Non-vegetated ground that could be eroded in a rain storm.
Sand / silt deposits		Pile of fine sediments (< 2 mm diameter) that collected at a site due to erosion.
Other		Other runoff concerns that are not listed on the data sheet.
Description		Description of "other" runoff concern.
Bank Zone Human Modifications		
Vertical sea wall		Upright structure that is steeper than 1.5 feet vertical to one foot horizontal installed parallel to the shore to prevent the sliding or slumping of the land and to protect the adjacent upland from wave action.
Rip rap		Rock or concrete piles used to armor shorelines and prevent erosion.
Other erosion control structure		Any other type of erosion control structure on the shoreline; may include inert materials (rocks) at the bank toe and biological materials on the upper portion of the bank, non-treated wood, live stakes and posts, jute netting, biologs, fiber rolls and mats, logs, and branches.
Artificial beach		Sand that has been dumped onto the shoreline to create a beach (versus sand that is naturally present).
Bank erosion >1ft face		Estimated length (to the nearest 10 feet) of shoreline with eroding banks that are less than or greater than 1 foot face (vertical height).
Bank erosion <1ft face		
Shore land variables and definitions from WDNR draft Shoreland Habitat Monitoring Field Protocol, Nov. 2015		

RESULTS

Percent Cover in Riparian Zone

Shoreland data was collected for a total of 552 land parcels. Percent cover of lawn, shrub/herbaceous plants, and lawn were the most common cover types in the riparian zone while a few cover types were classified as "other". The combinations of those cover types totaled 100% at each parcel. The areas of concern are the darker red areas in Figure 4, which illustrates where there is high lawn and impervious surface coupled with low shrub and herbaceous cover. We would expect higher negative impacts to water quality in these areas based on the percent cover types yielded in the survey. Areas of concern were scattered throughout the riparian zone, but there appears to be concentration near the Linden Street Boat Landing, Hinton Bay, and Richardson Bay.

Many land parcels (41%) had 90-100% shrub and herbaceous cover within the 35-foot riparian zone (Figure 3, Table 2). There was at least 60% shrub and herbaceous cover at three-fifths of the parcels, but lower shrub and herbaceous cover (less than 60%) at the remaining two-fifths of parcels. Shrubs are woody plants with multiple stems and small trees less than 16 feet tall while herbaceous plants are plants without woody stems such as grasses, sedges, forbs, etc. Low shrub and herbaceous cover are the orange and red areas in Figure 7.

Impervious surfaces were the least common cover type in the riparian zone with 86% of parcels having less than 20% impervious surfaces (Figure 3, Table 2). This cover type includes the area where all or the majority of precipitation is released as runoff (e.g. rooftops, sidewalks, driveways, parking lots, concrete, boulders, stone, wooden decks, compacted gravel/soil, and boats flipped over on shore). Rocks used for rip rap also count as impervious surface. Very few areas of concern are illustrated in the map of impervious surfaces (Figure 5).

Lawn was a moderately common cover type in the riparian zone with one-third of parcels having greater than 40% lawn cover (Figure 3, Table 2). Lawn is grass that is mowed short illustrated as orange and red areas in Figure 6. Many of the areas with high lawn cover are the same areas as those with low shrub and herbaceous cover. Only 16% of parcels had riparian cover of 10% or higher that was classified as "other". Some types of "other" riparian cover were sand, bare soil, duff, flowers, and mulch.

Canopy cover less than 60% was documented at nearly half the parcels. The canopy includes the cover of trees that are at least 16 feet tall. Because the tree canopy can overlap the other riparian cover types, canopy cover could range from 0%-100% independent of the other riparian cover types. Figure 8 illustrates low canopy cover with orange and red areas.

Table 2 - Number of Parcels with Riparian Cover Types

Percent Cover	Number of Parcels with Corresponding Cover Type											
	Canopy		Shrub & Herbaceous		Impervious		Lawn		Impervious & Lawn		Other	
<10%	15	3%	47	9%	285	52%	301	55%	146	27%	464	84%
10-19%	36	7%	40	7%	189	34%	34	6%	121	22%	42	8%
20-29%	55	10%	31	6%	49	9%	29	5%	66	12%	13	2%
30-39%	58	11%	35	6%	15	3%	19	3%	27	5%	8	1%
40-49%	38	7%	27	5%	6	1%	19	3%	15	3%	4	1%
50-59%	22	4%	34	6%	1	0%	33	6%	24	4%	3	1%
60-69%	66	12%	17	3%	4	1%	31	6%	33	6%	6	1%
70-79%	34	6%	33	6%	0	0%	30	5%	29	5%	2	0%
80-89%	65	12%	62	11%	1	0%	31	6%	31	6%	7	1%
90-100%	163	30%	226	41%	1	0%	25	5%	58	11%	3	1%

Figure 3 – Riparian Zone Percent Cover Graph

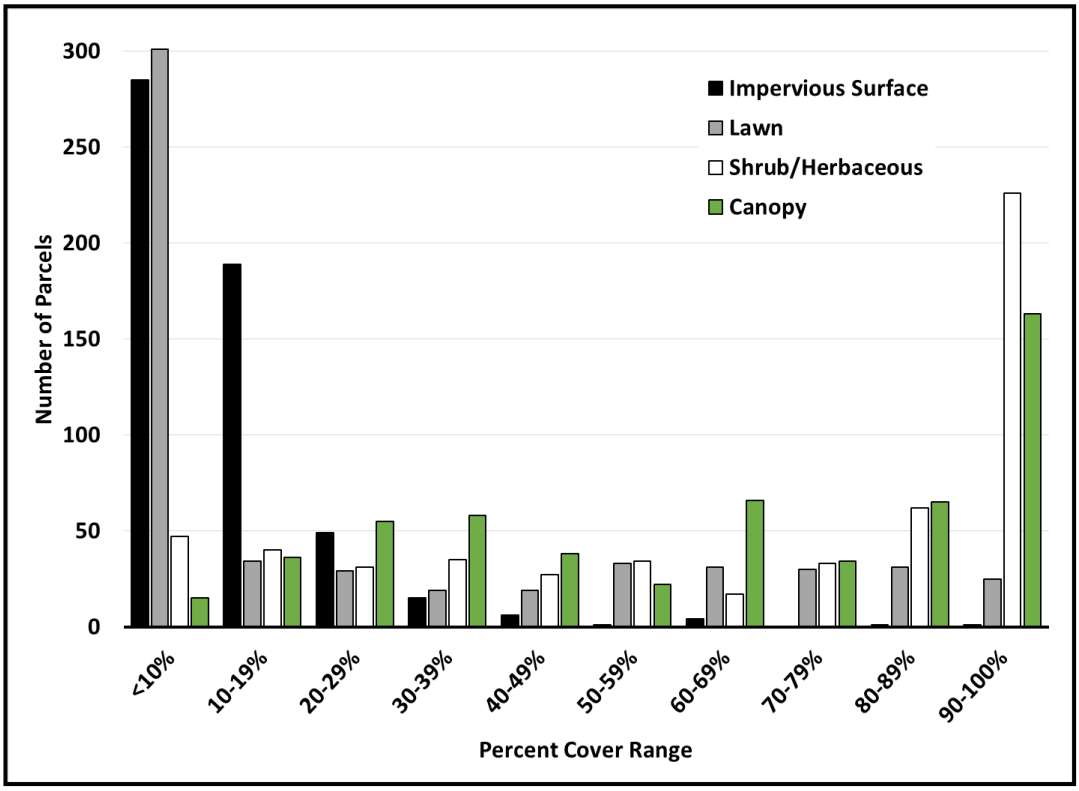


Figure 4 – Estimated Percent Cover for the Riparian Zone of Round Lake

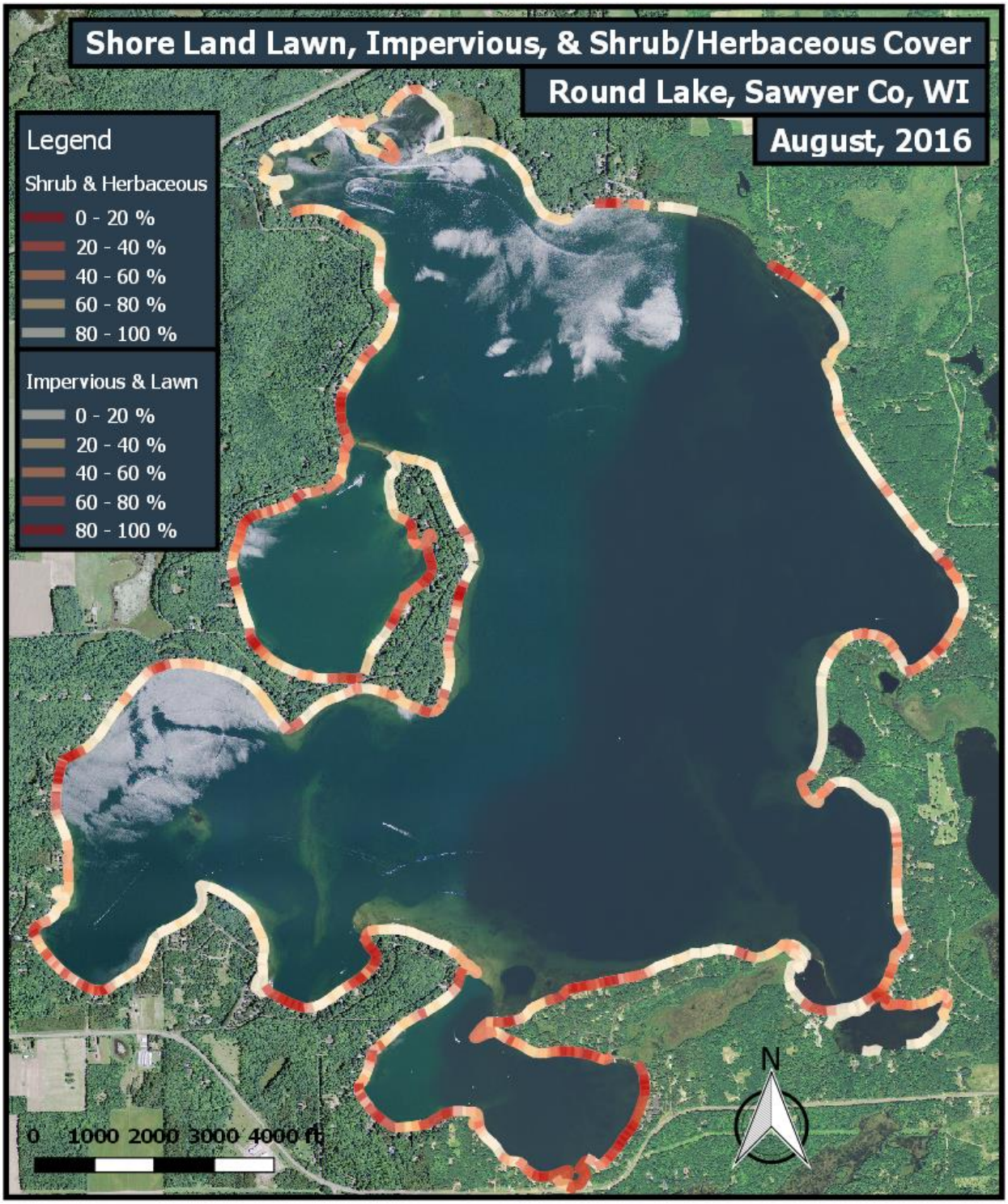


Figure 5 – Impervious Surface Cover for the Riparian Zone of Round Lake

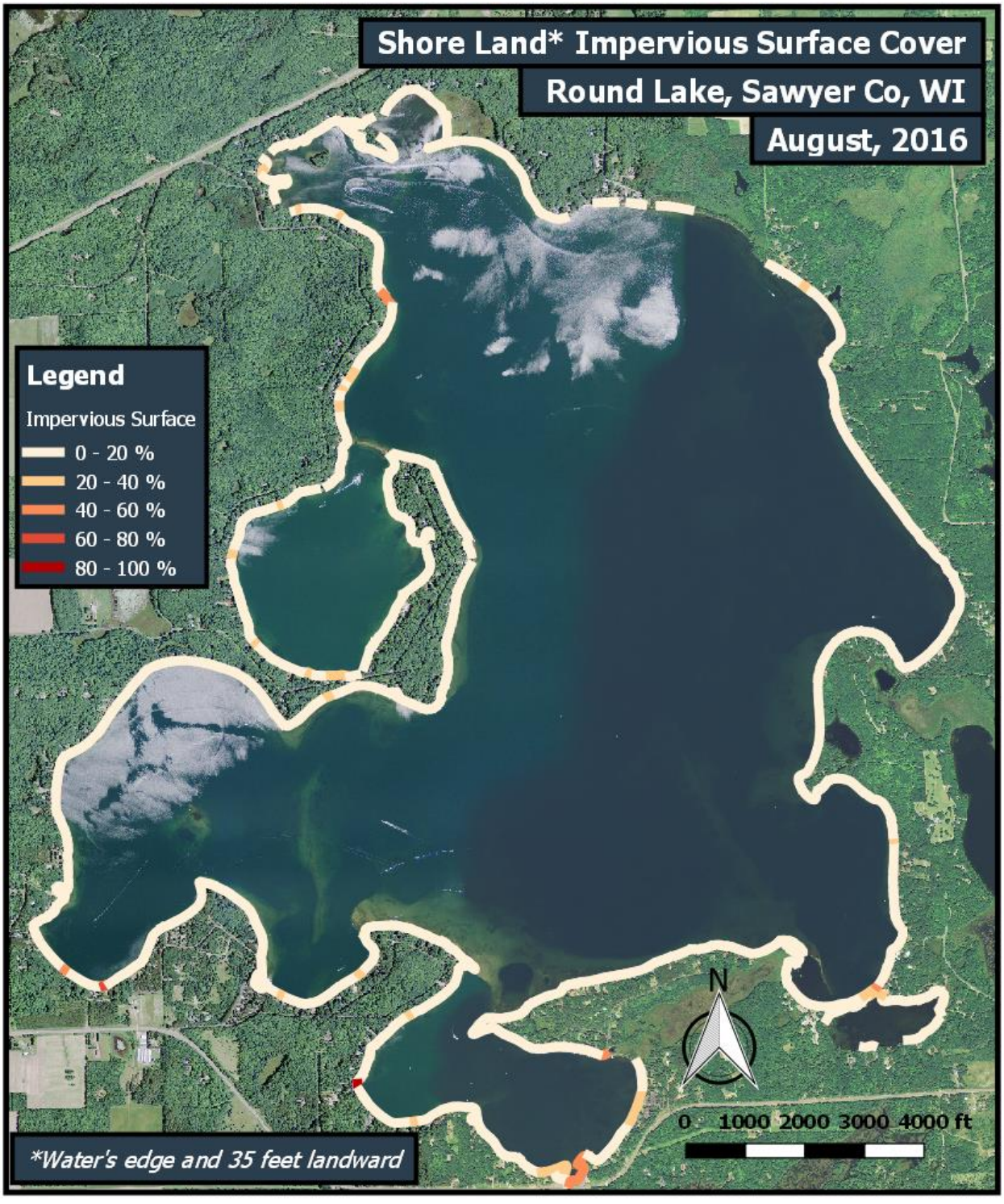


Figure 6 – Lawn Cover for the Riparian Zone of Round Lake

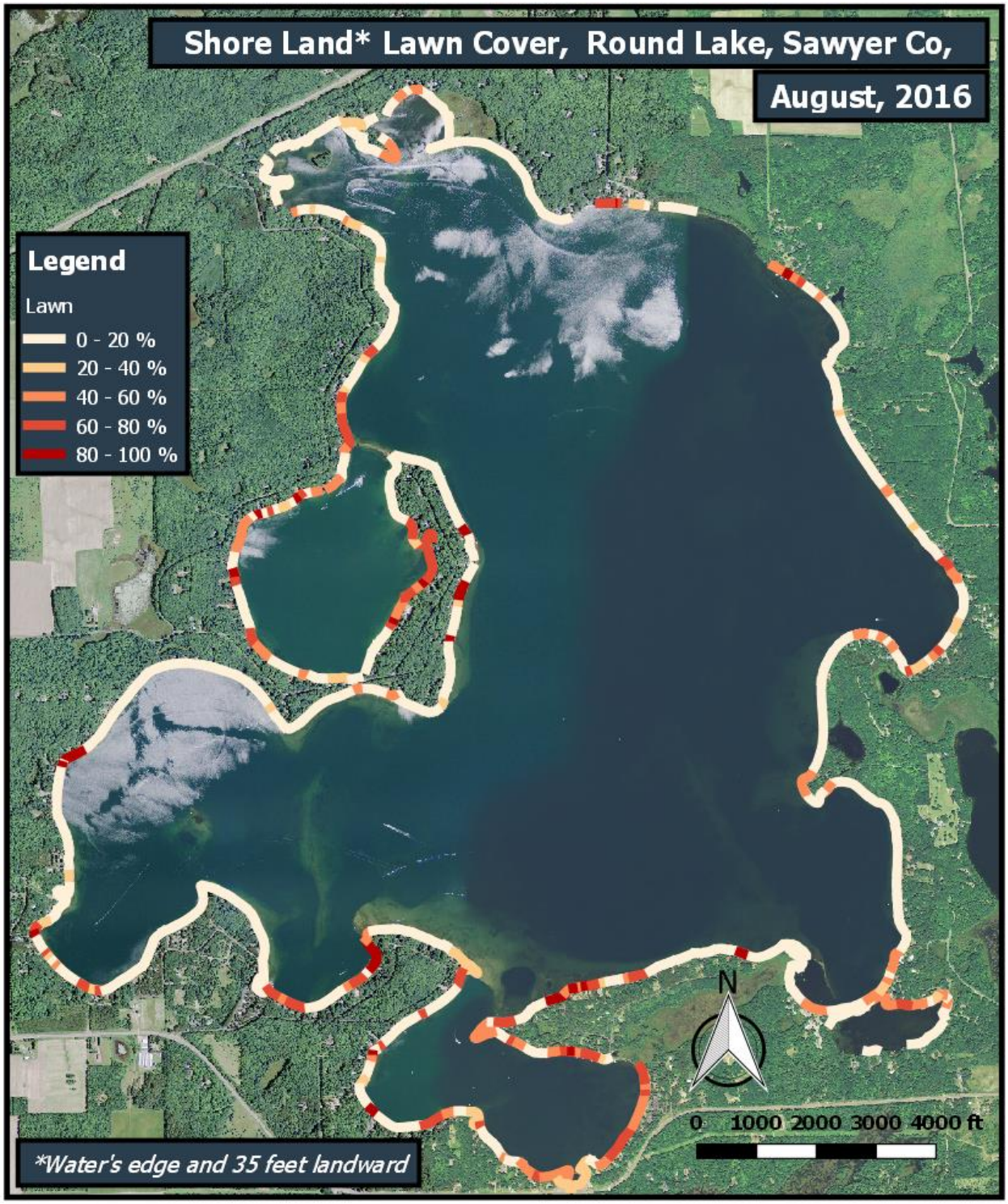


Figure 7 – Shrub and Herbaceous Percent Cover for the Riparian Zone of Round Lake

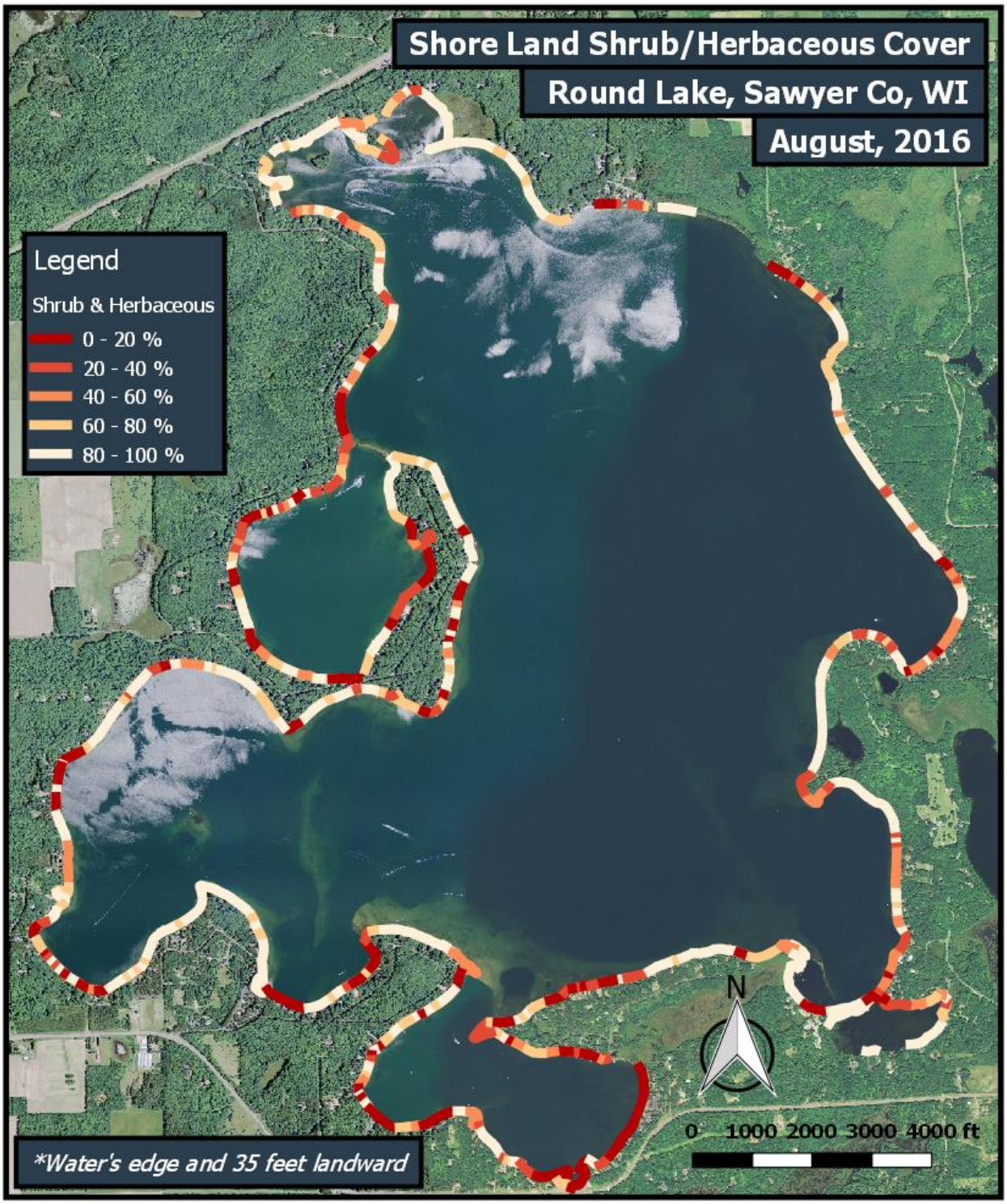


Figure 8 - Canopy Cover for the Riparian Zone of Round Lake

Runoff Concerns in Riparian

The presence and absence of runoff concerns listed in Table 1 were document at each of the 552 parcels. The most common runoff concern was stairs, trails, or roads leading to the lake at 224 parcels. Lawn or soil sloping to the lake was the next most common runoff concern at 203 parcels. The remaining runoff concerns documented were uncommon (Table 3).

Table 3 – Riparian Runoff Concerns

Runoff Concern	Number of Parcels Where Present	
Point source	1	0%
Channel water flow or gully	6	1%
Stair, trail, or road to lake	224	41%
Lawn or soil sloping to lake	203	37%
Bare soil	57	10%
Sand or silt deposits	17	3%
Other	8	1%

Bank Zone Human Modifications

The presence and estimated length of bank zone human modifications listed in Table 1 were also document at each of the 552 parcels. The most common modification was rip rap at 138 parcels. The rip rap was estimated to be 50 feet or more at 94 of the parcels and 100 feet or more at 24 of those parcels. The remaining modifications found at the bank zone were uncommon (Table 4).

Table 4 – Bank Zone Human Modifications

Bank Zone Human Modification	Number of Parcels Where Present	
Sea wall	20	4%
Rip rap	138	25%
Other erosion control	15	3%
Artificial beach	29	5%
Bank erosion >1 foot face	22	4%
Bank erosion <1 foot face	6	1%

DISCUSSION AND MANAGEMENT RECOMMENDATIONS

Information provided in the background section reveals that land use and water quality are closely linked. Proximity of a land use change to a lake is also important, which is why riparian owners are called upon to serve as stewards to the lake's water quality. Stewardship can happen in the form of less manicured lawn, minimizing impervious surfaces, and more shrub and herbaceous cover, especially as a buffer at the lake's edge. The areas identified in this report show where there is low shrub/herbaceous cover acting as a buffer between land and water and also reveal where there is high percentage of impervious surface and lawn. Some areas may not be easily changed, such as the marina and boat launch area in the far south of Richardon's Bay just before entering Little Round Lake. Focus should be on areas where land owners are willing to make modifications. One possibility for a next phase would be to identify landowners where land use change would be beneficial and begin with a letter of introduction and survey to gauge their willingness to modify their yards to better protect water quality. A letter with a follow-up phone call may also serve this same purpose.

New development and changes in land ownership mean that appealing to riparian landowners to act as stewards of water quality is an ongoing task. Annual appeals in newsletters and special announcements on the website are recommended.

The charge to protect water quality in the riparian corridor is more challenging since the reduced zoning restrictions that passed in the Wisconsin State Budget in 2015. Counties were once able to develop shoreland zoning that had stricter standards than the state, but now the state standards are the strictest that are allowed. That means it is even more important for riparian owners to understand the links between land use and water quality and charge themselves with the responsibility of protecting water quality with healthy riparian land use practices.

Water quality can also be linked to property values. A study that assessed over 1,000 waterfront properties in Minnesota found that properties on lakes with clearer water commanded significantly higher prices (Krysel et. al. 2003). Another study in Maine found decreases in water clarity of three feet could change lakefront property values by $200 per frontage foot (Michael et. al. 1996). This means a three-foot increase in water quality could increase property value for a lot with 100 frontage feet by $20,000. Conversely, a three-foot decrease in water quality could reduce the same property by $20,000. This provides financial incentive for all lake property owners to work together and protect their investment.

Once shoreland development has occurred and water quality is diminished, actions *can* reduce the impacts of impervious surfaces and compacted soils (e.g., lawns). Those mitigating actions are often expensive and difficult to implement and maintain (Markham, 2003). Keeping riparian areas in a more natural state, even within developed parcels, is a more pragmatic approach. Reaching out to landowners of sites planned for development may help reduce the impacts of construction and help those landowners understand the benefits of shoreland buffers, less impervious surface, and less lawn cover.

Table 5 - Management Recommendations Summary

1. Identify areas where improved riparian cover is a realistic possibility. Reach out to those landowners with a letter, survey, phone call, personal visit, or combination of these techniques to gauge their interest in changing riparian cover to protect water quality.
2. Include regular appeals (possibly annually) in newsletters and the website that call shoreland property owners to stewardship of water quality. An annual article in the newsletter on the connections between development and water quality and educations links on the website are recommended.
3. Help and encourage landowners of newly developed sites to keep shoreland buffers and minimize impervious surface and lawn cover.

REFERENCES

Galli, J. 1988. A Limnological Study of an Urban Stormwater Management Pond and Stream Ecosystem. M.S. Thesis. George Mason University.

Graczyk, D.J., R.J. Hunt, S.R. Greb, C.A. Buchwald and J.T. Krohelski. Hydrology, Nutrient Concentrations, and Nutrient Yields in Nearshore Areas of Four Lakes in Northern Wisconsin, 1999-2001. US Geological Survey Water Resources Investigations Report 03-4144. 73pp.

Hatleli, S. 2015. Aquatic Plant Management Plan for Round and Little Round Lakes 2015-2019. Aquatic Plant and Habitat Services LLC. 74pp.

Jeffrey, D. 1985. Phosphorus Export from a Low Density Residential Watershed and an Adjacent Forested Watershed. Proceedings of the 5th Annual Conference, North American Lake Management Society, Lake Geneva, Wisconsin. Pp. 401-407.

Krysel, C., E. M. Boyer, C. Parson, and P. Welle. 2003. Lakeshore property values and water quality: evidence from property sales in the Mississippi Headwaters region. Mississippi Headwaters Board & Bemidji State University. 30 November, 2016. www.friendscvsf.org/bsu_study.pdf

Markham, L. 2003. Shoreland Development Density and Impervious Surfaces: How do they affect water resources? How much is too much for our lakes and streams? Center for Land Use Education, University of Wisconsin - Stevens Point.

Michael, H., K. Boyle, and R. Bouchard. 1996. Water quality affects property prices: a case study of selected Maine lakes. Maine Agricultural and Forest Experiment Station. University of Maine. Miscellaneous Report 398. 30 November, 2016. www.umaine.edu/mafes/elec_pubs/ miscrepts/mr398.pdf

Panuska, J. and R. Lillie. 1995. Phosphorus Loading from Wisconsin Watersheds: Recommended Phosphorus Export Coefficients for Agriculture and Forested Watersheds. Research Management Findings, #38. Bureau of Research, WDNR, 8pp.

QGIS Development Team, 2016. QGIS Geographic Information System. Open Source Geospatial Foundation Project. http://qgis.osgeo.org.

Shaw, B., C. Mechenich, L. Klessig. 2004. Understanding Lake Data. UW-Extension Publication G3582.

WDNR. 2015. Wisconsin Department of Natural Resources. 21 December 2015, http://dnr.wi.gov/lakes/lakepages/.