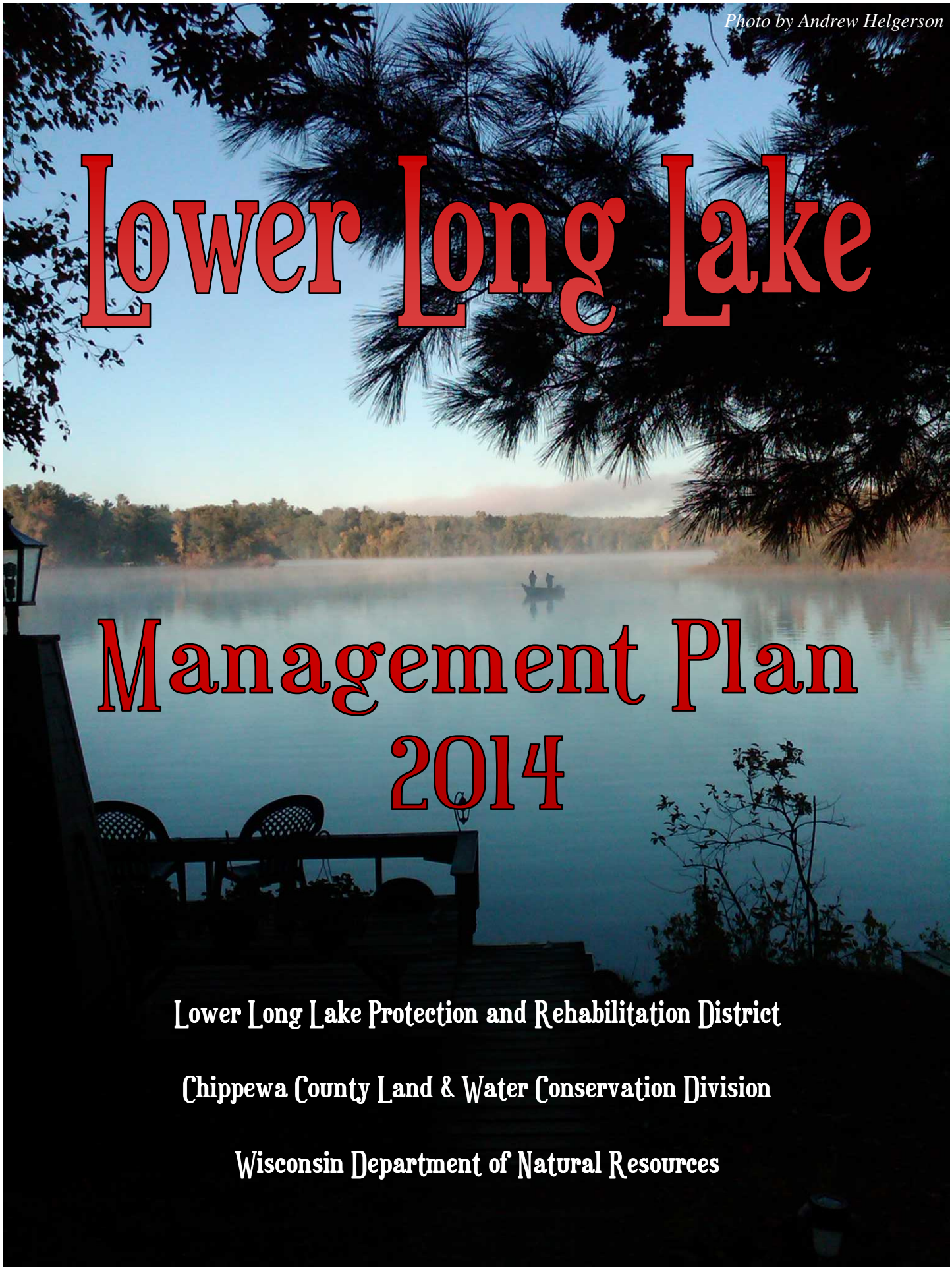


Lower Long Lake

Management Plan 2014

Lower Long Lake Protection and Rehabilitation District

Chippewa County Land & Water Conservation Division

Wisconsin Department of Natural Resources

Contents

Acknowledgements

We would like to thank all of those who were involved in the creation of this document.

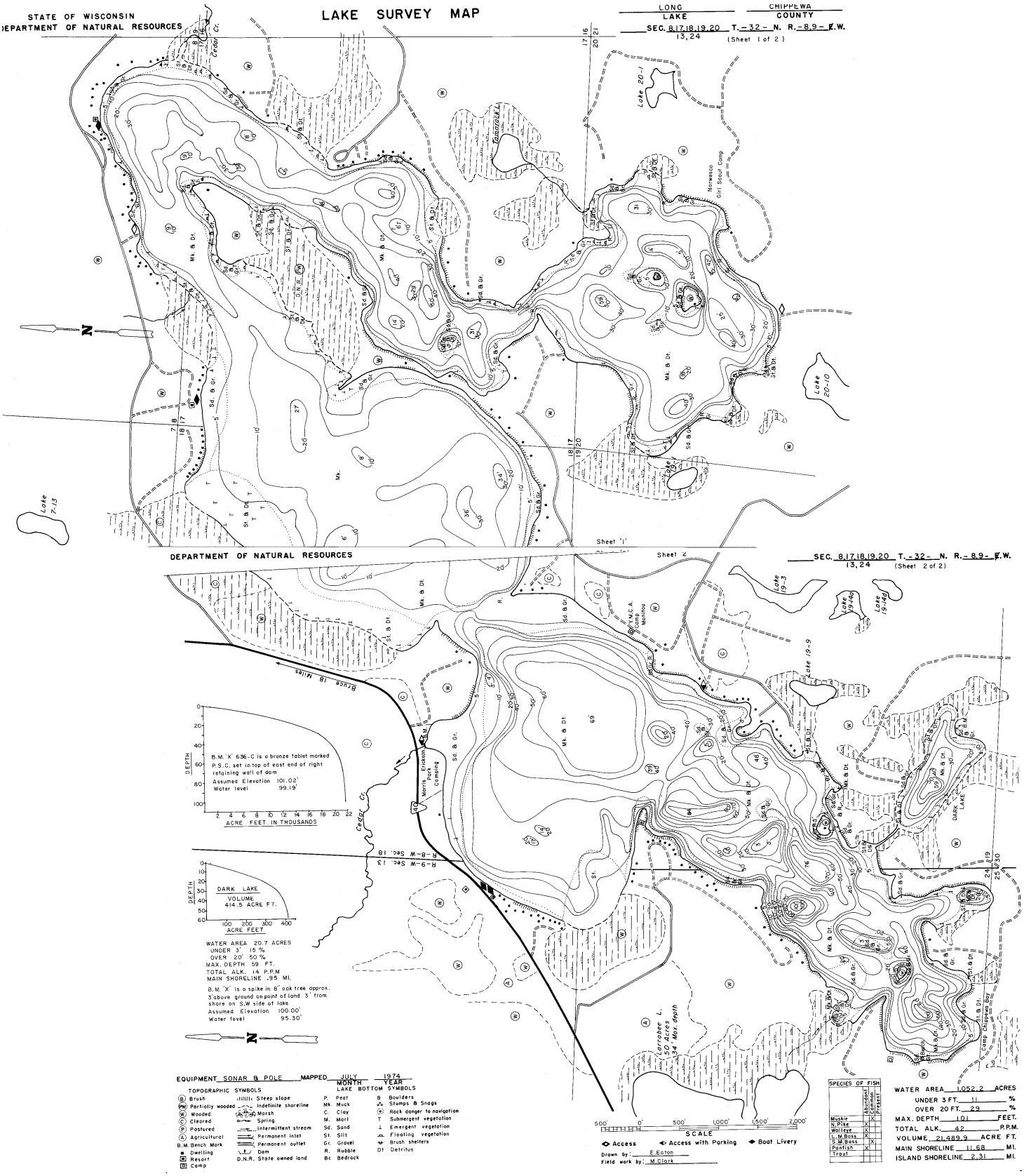
The Lower Long Lake Protection and Rehabilitation District Commissioners: Kathy Kelly (2013), Gale Haas (2011), Jenny Larson (2013), Bill Stimeling (2014), & Samantha Butterfield (2014) – with contributions form District member Diane Dahl, former Vice Chair (2007-2011) & Chair (2011-2013).

Chippewa County Land & Water Conversation Division: Dan Masterpole, County Conservationist. The Wisconsin Department of Natural Resources: Patrick 'Buzz' Sorge, Lake Management Planner; Jodi Lepsch, Water Resources Specialist; and Heath Benike, Fisheries Biologist. The Green Frog Company: Amanda Kostner, Shoreland Specialist.

Thanks to those who took the stunning photos in and around our lake and allowed us to share them.

And finally, thanks to the property owners and patrons of Lower Long Lake. Your continuous efforts to help the growth, stability, and future prosperity of our lake have helped to set a great example for our posterity.

The Lake District: Lower Long, Herde, & Dark Lakes



Source: Wisconsin Department of Natural Resources 608-266-2621
Long Lake – Chippewa County, Wisconsin DNR Lake Map
Date – Jul 1974 - Historical Lake Map - Not for Navigation

Introduction

Long Lake has been a premier lake that is valued by those who live around and recreate on it throughout the history of Chippewa County, Wisconsin. It is valued for good water quality, natural beauty, peace and tranquility, sense of place, high quality fishing and recreational opportunities by the families who use and enjoy the lake.

The Lower Long Lake Protection & Rehabilitation District (LLLPRD) has always been concerned with protecting the quality of Long Lake. It was the main reason for forming the Lake District in 1975. LLLPRD conducted a diagnostic and feasibility study in 1977 which lead to the development of a lake management plan in 1984.

In 2007, LLLPRD coordinated the development of a new lake management plan. The purpose was to develop goals to protect the attributes of the lake and implement activities which will protect and improve Long Lake for future generations. The planning team included the LLLPRD board, a Town of Sampson board member, Chippewa County Land and Water Conservation Department staff, and WDNR Lake Management and Fisheries staff. The goals in that plan were guided by a survey given to Long Lake property owners to identify which lake issues are most important to them.

Every five years, the District updates the lake management plan to record what goals have been met, update information, and create new goals as appropriate. This updated plan is the result of information and comments taken from a few different sources. A survey was given to Long Lake property owners in 2011, to gather information concerning the on-going preservation activities and the conditions considered desirable to be better stewards of the lake. A planning workshop was also held in 2012, led by the Chippewa County Conservationist and WDNR Lake Manager. Twenty LLLPRD members attended the workshop to make their voices heard. Others that have had a hand in the updated plan are WDNR Fisheries and the LLLPRD Board.

Many lake studies have been conducted in the past three decades beginning in the mid 1980's. The purpose of the studies has been to provide insights as to how Long Lake is changing over time and describe the current ecological health of the lake. Studies have been conducted to assess water quality, shoreland habitats, fisheries, aquatic plants, crayfish populations, watershed land use conditions and mathematical modeling to predict present and future water quality conditions in the lake. The results of these studies provide critical information used collaboratively to develop lake management goals for Long Lake.

The lake management goals describe a desired state of conditions for water quality, shoreland habitat, fisheries, and the aquatic plant community, the control of crayfish and invasive and exotic species and multi-faceted recreational opportunities. These goals have been based on science and the values expressed by property owners of Long Lake.

Renee Schulenberg

Background

Erickson Point – 1920's (currently Scheppke property)

Long Lake is a drainage lake located in the Town of Sampson in northwestern Chippewa County. It measures 1052 acres and 101 feet deep. Long Lake has long been valued as a high quality recreational resource. Long Lake was first developed during the late 1800's by families from Eau Claire associated with the logging boom of the Chippewa Valley. It is reported that the initial homes and resorts as well as the shoreland forest were destroyed by wildfires in 1893-1894 (Laine, unpublished manuscript). Long Lake has 11.68 (15.8) miles of shoreline and an additional 2.31 miles of island shoreline. 6.91 miles of shoreline have been developed into seasonal and permanent residences.

The protection of social values, water quality, fisheries, aquatic life and natural beauty of Long Lake is dependent upon the continued stewardship of the members of the Long Lake Protection and Rehabilitation District. The development of riparian *(adjacent to a body of water)* property increases water runoff and nutrient inputs to Wisconsin's lakes (US Geological Survey 2003). Runoff studies conducted on several northern Wisconsin lakes found that phosphorus inputs to lakes from developed lots where 8 times higher than phosphorus inputs from adjacent undeveloped forested lands. No data is available comparing artificially raised lakes.

Phosphorus is the nutrient responsible for stimulating algae growth in Long Lake and most other lakes in Wisconsin. The major sources of phosphorus to northern Wisconsin lakes are lawn fertilizers, and increased runoff from roof tops, roadways and other impervious surfaces associated with developed lake lots. Decreasing phosphorus inputs to Long Lake will protect water quality conditions for future generations.

High quality shoreland habitats are critical to the protection and production of fisheries and aquatic life. Over 90 percent of the aquatic life that lives in Long Lake is dependent upon the near shore shallow water habitat for some or all life stages. This fact demonstrates why it is critical to protect and improve shoreland habitats of Long Lake. Several studies of Wisconsin lakes (Christensen 1996, Schindler 2000, Jennings et al 2003, Woodford and Meyer 2003, Lindsay et al 2002, Garrison et al 2005, and Garrison and Wakeman 2000) have documented that current and

historical development practices have been detrimental to Wisconsin lake ecosystems. Water quality, fish populations, woodland bird populations, frog populations, aquatic insects, and aquatic plants and near shore habitat have all been significantly degraded in Wisconsin lakes. The protection and restoration of lake shorelines can restore many critical habitat features.


Mary Karker

Several studies have been conducted on Long Lake to assess the health, condition and protection and restoration potential of the lake. Fisheries surveys have been conducted from 1967 through present assessing the status of the fishery. An assessment of the rusty crayfish populations was conducted in 1974 through 1978 (Lorman 1980). The Long Lake Management Plan (1984) was completed by WDNR for LLLPRD compiling studies conducted by LLLPRD in the late 1970's. Trends monitoring for water quality, shorelands, fisheries and aquatic plants to characterize changes has been conducted by the Wisconsin Department of Natural Resources since 1986 to present. A paleolimnological *(the study of lakes from their sediments and fossils)* assessment of lake sediments was conducted to assess water quality changes from pre-settlement conditions through history to present day (Garrison 1994). The LLLPRD conducted a watershed land use study in 2001 to characterize potential sources of controllable phosphorus inputs from the various land uses in the Long Lake watershed (Applied Data Consultants, Inc. 2001). A Sensitive Area designation study completed in 2002, mapped areas of aquatic vegetation identified by the WDNR as critical or unique fish and wildlife habitat areas or beneficial to water quality or erosion control (WDNR). The lake property owner survey conducted by the LLLPRD Board in 2004 provided critical insights as to how the residents of Long Lake value the lake. Another property owner survey conducted by the LLLPRD Board in 2011 showed how the conservation activities of the current Shoreland Restoration Project were progressing and were perceived by the property owners. The Lower Long Lake Shoreline Assessment in 2013 gauged the current level of development and amount of vegetation on the shoreline (WDNR).

Long Lake is now on the 2014 Impaired Waters List for Wisconsin which has been submitted to EPA for approval. Long Lake is classified as a two-story fishery seepage lake which is the highest classification for Wisconsin Lakes. The phosphorus water quality standard for Long Lake is 15 ug/l. The average summer phosphorus for Long Lake is about 18 ug/l, exceeding the lake's current water quality standard. Long Lake currently has water quality conditions which limits the lakes ability to support a cool water fishery in the hypolimnion (summer bottom waters) of the lake. It is important that we all work to achieve water quality standards for Long Lake which is achievable with implementing stormwater reduction strategies on all lake shore development.


Amanda Kostner

Lake Management Goals and Objectives

Goal I: Water Quality

Protect water clarity, prevent the occurrence of algae blooms and reduce nutrient levels in Long Lake.


Renee Schulenberg

Objectives and Activities 2014-2019

1. ***Maintain current shoreland restoration and stormwater management education and technical assistance. (Ongoing. WDNR, Chippewa County LCD, LLLPRD)***
   - Apply for additional State or Federal grants where appropriate. (LLLPRD)
   - Fund certain projects/services through the LLLPRD budget at the Board's discretion. (LLLPRD)

2. ***Apply new ways to promote implementation of Shoreland Protection Plans.***
   - Apply for new WDNR Lake Health Grants to fund recommended buffers, rain gardens, and rock infiltration pits that have been included in Shoreland Protection Plans, but not yet implemented. (LLLPRD)
   - Provide recognition for participants (such as signage at properties) that complete the recommendations given in their Shoreland Protection Plans. (LLLPRD)

3. ***Use new stormwater management technologies and designs to accommodate small and non-conforming lots.***
   - Employ new strategies for runoff such as pervious pavements and engineered bioretention. (LLLPRD, WDNR, Chippewa County LCD)
   - Install a demonstration site on Long Lake (LLLPRD, WDNR, Chippewa County LCD)

4. ***Decrease nutrient levels from developed lots.***
   - Capture 90% of stormwater runoff from the impervious surfaces of each property and infiltrate it into the ground using Best Management Practices. (2015. LLLPRD)
     - "Retaining the first inch of precipitation captures about 90 percent of all rainfall events. Sizing a BMP to capture water beyond these amounts becomes more expensive with less return in terms of treatment.." *from the Minnesota Stormwater Manual; Minnesota Pollution Control Agency*

5. ***Apply for WDNR Lake Protection Grant to fund stormwater runoff projects listed in Objectives 3 and 4. (2015. LLLPRD)***

6. ***Encourage conservation easements for future protection of private natural shorelands. (Ongoing. LLLPRD)***
   - Owners of large tracts of shoreland
   - Groups of owners of smaller connected natural shores or buffers.

7. ***Continue current water quality monitoring in Long Term Trends and Volunteer Monitoring programs. (Ongoing. WDNR, LLLPRD)***

Previous Objectives and Activities 2007-2013

Apply for Lake Planning Grant in January 2007 to fund staffing for inventory conduction, planning, and design for stormwater runoff and shoreland restorations.

- Applied for and received WDNR grant LPL-1160-07 for $10,000. Hired a private contractor to provide technical support through shoreland evaluations and Shoreland Protection Plans for voluntary riparian owners. (2007. LLLPRD/contractor, Chippewa Co. LCD, WDNR)
- Installed four demonstration sites to promote shoreland conservation practices. Proehl – rain garden; Babbitt – rain garden; Enders – shoreline buffer enhancement; County Park – shoreline buffer restoration. (2007. LLLPRD/Contractor, Chippewa Co. LCD)

Conduct a two-year pilot project for up to 30 riparian properties which will control: stormwater runoff and restore natural shoreland buffers. These restorations will serve as demonstrations at multiple sites around the lake.

- Conducted a one-year pilot project through this grant that provided 20 riparian owners with a Shoreland Protection Plan to help increase natural shoreline vegetation, and control storm water runoff and shoreline erosion. (2007. LLLPRD/Contractor, Chippewa Co. LCD, WDNR)

Apply for Lake Protection Grant in 2008 to implement up to 30 storm water plans and shoreland restorations.

- Applied first for a small Lake Planning Grant in January 2008, and received grant LPL-1216-08 for $10,000. This funded a shoreline buffer and rain garden training workshop for riparian owners and landscapers and planning for how structure the shoreland projects implementation phase for the next grant. (2008. LLLPRD/Contractor)
- Applied for Lake Protection Grant in April 2008, and received grant LPT-333-09 for $100,000. This is the grant that we are currently working under until July 2014. To date, 57 riparian owners in the LLLPRD have requested and received a custom Shoreland Protection Plan for their property. A little over half of those are implementing their plans. This grant also funds the coordination of the tree/shrub program and group native plant orders. At this point the contractor also took the role of shoreland educator by coordinating riparian owner workshops, project tours, a lake education fair, and educational materials such as the Lake Family Fun Kits (fish, insect and shoreline wildlife exploration), the Shoreland Protection Information Packets, and writing the annual Shoreline Project newsletter. (2008-2013. LLLPRD/Contractor)

Apply for Lake Planning Grant to provide technical support and oversight for staff conducting stormwater and shoreland restoration inventories (Chippewa County).

- This was not needed. Chippewa County Land Conservation donated some time for this at the beginning of the project (2007 and 2008). Further direct oversight was not needed. However, they are always available to occasionally answer questions and give guidance.

Apply for Lake Planning Grant in 2008 to conduct community based social marketing assessment. This assessment will be used to determine the most effective strategies to obtain 60-80 percent participation from riparian property owners for installation of stormwater management practices and shoreland buffer restorations.

- We did not need to apply for a new grant for this activity. The Lower Long Lake Property Owners Survey took place in 2011. Funding for planning, printing, and mailing it came from the existing Lake Protection Grant. A great deal of volunteer time from the Lake District Board was also put into it. (2011. LLLPRD/Contractor, WDNR)

Participate in Town of Sampson comprehensive planning processes to include lake protection and improvement activities.

- Town of Sampson opted out of Comprehensive Land Use Planning. Nothing was done on their part, so our lake district could not participate.

Continue current water quality monitoring in Long Term Trends and Volunteer Monitoring programs.

- The WDNR continues to monitor fish populations and water quality. A volunteer also takes Secchi disk measurements for water quality and monthly water samples for chemistry studies. This is part of the Wisconsin Citizen Lake Monitoring Network. (LLLPRD, WDNR)

Goal II: Shoreland Habitat

Protect and restore healthy shoreland habitats.

Objectives and Activities 2014-2019

1. ***Follow shoreline restoration objectives in Goal I. These benefit shoreland habitat as well.***

2. ***Help identify shoreline areas where rip rap or a bioengineered product is the appropriate method of erosion control/protection and promote installation with assistance from WDNR grants. (LLLPRD, WDNR)***
   – The high waters of 2014 eroded and exposed portions of the shoreline. This would help repair and protect the shoreline.

3. ***Explore and address the effects of large boat wakes on shoreline erosion and fish & wildlife habitat.***
   - In 2013, WDNR inspected the County-owned dam and downstream culverts located at the County boat landing and park because of reports they were not working properly. WDNR determined the downstream culverts were deficient and requested Chippewa County replace those culverts. LLLPRD requires that Chippewa County make said repairs to lessen impacts of wind and boat wake erosion, property damage, and flooding, and maintain the dam at design capacity.

4. ***Continue to offer educational programs and workshops about shoreland wildlife. (Ongoing. LLLPRD)***

5. ***Install two proposed Fish Stick shoreline habitat restorations with the help of a federal grant and the WDNR. See map. (2014. LLLPRD, WDNR)***
   – Wisconsin DNR, in partnership with LLLPRD, proposes to install 30 coarse large woody debris structures (fish sticks) in the littoral zone on two treatment areas in Long Lake. They will look as if they have naturally fallen in the water. LWHA 1, a 15 fish stick cluster (or 45 trees) will be placed along a 1350-foot section of State land shoreline located on the eastern shore of Long Lake. LWHA 2, a 15 fish stick cluster (or 45 trees) will be placed along a 1260-foot section of Chippewa Bay on the property of Steve Kristo on the south end shore of Long Lake.

– This work will be done in the winters of 2013-2015 so trees can be hauled across the ice and placed at the shoreline without eroding soil or damaging vegetation along the shore. A grant from Midwest Glacial Lakes Partnership will fund the projects if funds are allocated to the partnership by the U.S. Fish & Wildlife Service this year. WI Department of Natural Resources fisheries staff will oversee installation.

Fallen trees are vital to lives of fish and wildlife. Young fish get their start by eating the microscopic food that underwater woody habitat provides and it is a place for small fish to escape predators. Smart anglers know in-water wood is a place to find big predators like bass, northern, walleye and musky. Above-water wood provides refuge for turtles, ducks, and other shore-loving wildlife.

Previous Objectives and Activities 2007-2013

Request Chippewa County to update shoreland zoning ordinance to include shoreland buffer restorations and stormwater management activities as requirements for riparian properties which are being redeveloped on Long Lake. (LLLPRD)

- Revisions were made to the Chippewa County Shoreland Ordinance in 2010. They allowed at-grade stairways and walkways to the water instead of the previously-required elevated stairways and walkways.
- Shoreland buffers and/or shoreland vegetation are required from Chippewa County Zoning Department for mitigation of non-compliance.

Work in partnership with Chippewa County to clearly define shoreland buffer protection and stormwater management needs for new development on Long Lake. (LLLPRD, Chippewa County, WDNR)

- The Consultant produced a handout in 2013 called *Resources for your Waterfront Property Questions*. This brochure includes text and a map of the shoreland cover and viewing corridor standards for Chippewa County, local contacts for State and County permits and shoreland regulations, and information about buffers.

County Shoreland Zoning Permits and WDNR Permits need to include environmental protection activities to insure the protection of sensitive areas within Long Lake. (LLLPRD, Chippewa County, WDNR)

Identify and map undeveloped shorelands and critical watershed areas for lake protection and future conservation easements. (Ongoing. LLLPRD, LLL Foundation, West Wisconsin Land Trust)

- In 2001, WDNR identified and mapped 11 ecologically sensitive areas in the Lake District.
- In 2004, a lake volunteer made and disseminated a water trail map highlighting these sensitive areas.
- In 2011, WDNR inventoried and mapped all the shoreline within the Lake District to show amount of vegetation cover due to shoreline development. The inventory showed that 55% of the shoreline is 100% Wild; 20.5% of the shore was more than 70% Wild and Human Natural; 14.9% of the shore was 30-70% Wild or Human Natural; and 9.6% of the shore was more than 70% Disturbed. *See Appendix.*

Goal III: Aquatic Life

Protect and improve the diverse aquatic life of Long Lake; including a self-sustaining fishery and diverse aquatic plant community.


Ty Bernicke

Objectives and Activities 2014-2019

1. ***Take actions to help restore the declining walleye fishery. (WDNR, LLLPRD)***
   - Change the fishing regulations to enable anglers to harvest more largemouth bass. The elevated largemouth bass numbers negatively affect walleye and other native species. This process takes *at least* three years. (WDNR)
   - Control the largemouth bass population through relocation. (WDNR, LLLPRD)
     - LLLPRD Fish Committee paid the DNR $3,000 in 2012 and 2013 to relocate Lower Long Lake largemouth bass to area lakes that have experienced freeze-out. This process needs to be repeated for a few years until a change in fishing regulations can help control the largemouth bass population.
       - (Summer, 2013) The WDNR spent five days on the lake with two boats most days. They removed 1,029 largemouth bass in total from Long Lake, of which 535 were greater than 8 inches. (Target was 500 over 8 inches, which was met.) Those fish were stocked into South Shattuck and Firth Lakes in Chippewa County.
   - Aid walleye spawning with the "walleye wagon." (WDNR, LLLPRD)
     - The walleye wagon enables volunteers to capture Lower Long Lake walleyes, strain their milt and eggs, release the walleyes back in the lake, and then raise the fertilized eggs in oxygenated water inside the walleye wagon. Once the fertilized eggs grow to an appropriate size they are released back into the lake. This process increases the survival rate of walleyes.
       - In spring 2013, Lower Long Lake walleyes spawned while there was still ice on the lake. This prevented volunteers from capturing walleyes, thereby, negating this year's walleye wagon benefits. Nothing was done in spring 2014 as well.
   - Stock extended growth walleye in Lower Long Lake from WDNR hatcheries. (WDNR; funded by the Wisconsin Walleye Initiative)

Previous Objectives and Activities 2007-2013

Develop educational materials for lake stewardship. Include values and management of aquatic plants, coarse woody habitat, and shoreland vegetation. Provide a list of shoreland and riparian zone activities which require county, state, and federal permits. (LLLPRD, WDNR, Chippewa County, UWEX)

- A brochure titled Contacts for your Waterfront Property Questions was produced for LLPRD and will be printed and distributed in 2013. (2012. LLLPRD/contractor)
- Existing UWEX and WDNR educational materials regarding aquatic plant management, coarse woody habitat, shoreland vegetation, and other lake stewardship topics have been distributed to the 54 property owners who received a Shoreland Protection Plan and Shoreland Protection

Information Packet. The materials are also made available on the LLLPRD website and at the annual LLLPRD general meeting. (Ongoing. LLLPRD/contractor)

Review shoreland zoning and WDNR permits to insure water quality, habitat, and natural beauty protection for Long Lake. (LLLPRD)

Continue long term trends monitoring for aquatic plants, shoreland habitat, and fisheries on present schedule. (Ongoing. WDNR)

- The WDNR selected Long Lake to be included in the Long Term Trends Monitoring Program in 1986 and has monitored water quality since. See Appendix.

Evaluate Long Lake for potential native aquatic vegetation restoration sites. (WDNR)

County Shoreland Zoning permits and WDNR permits need to include environmental protection activities to insure the protection of sensitive areas within Long Lake. (LLLPRD, WDNR, Chippewa County)

Goal IV: Invasive Species

Prevent the expansion and new infestations of invasive and exotic species.

Objectives and Activities 2014-2019

1. ***Develop AIS Emergency Response Plan. (LLLPRD, WDNR)***

2. ***Develop, publish, and implement a free standing AIS monitoring plan. (LLLPRD, WDNR)***
   - Inventory all activities and priorities
   - Develop budget/grant strategy
   - Plan how to implement a sustainable program

3. ***Mitigate risks of invasive species introduction due to fishing tournaments. (LLLPRD)***
   - Boat washing/inspection stations

4. ***Maintain Clean Boats Clean Water program at boat landings. (LLLPRD)***
   - Evaluate use of paid monitor.
     - Expand responsibility to include other monitoring tasks (using AIS monitoring protocol): zebra mussels or others; invasive plant locations at landings
   - Expand monitoring (paid or volunteer) to all landings or points of entry.
     - Evaluate use at the two main landings (County landing on Hwy 40 and Town landing on Basswood Rd.)
     - Evaluate existing signage at other points of entry.

5. ***Continue rusty crayfish monitoring (LLLPRD)***

Previous Objectives and Activities 2007-2013

Develop and implement Clean Boats Clean Waters Program for the prevention of infestations of invasive species. (LLLPRD)

- Volunteer boat landing monitors talked to boaters about preventing AIS during peak use days during the summers 2007-2012.
- A paid boat landing monitor was employed the summer months of 2012 and 2013 through a WDNR Aquatic Invasive Species (AIS) Grant. See Appendix.

Design and implement long term monitoring for Rusty Crayfish population. (LLLPRD, WDNR)

a. Confirm and publish monitoring protocol
  - Currently, three baited traps are set at seven sites around the lake during the middle two weeks of July each year to capture and count rusty crayfish. The total is reported to the Board Chair of LLLPRD, who then passes the information along to the DNR.

b. Compile/update data and maps

c. Create a GPS record for traps

d. Maintain long-term monitoring record. See Appendix.

Design and implement Invasive Species Monitoring and Infestation Response Program. (LLLPRD, Beaver Creek Citizen Science Center, UWEX)

- Volunteer monitors survey the shoreline at least once a month in boats looking for evidence of invasive weeds transported to our lake from surrounding lakes. The lake is divided up into sections with monitors for each section. There has been up to 11 volunteers, with currently only 9. The one area needing monitoring is the northwest side of the lake in the bog area. Requests for any new volunteers have been unsuccessful.
- In 2012, an AIS Grant from WDNR helped fund the purchase of an I-LIDS (Internet Landing Installed Device Sensor) from Environmental Sentry Protection, LLC. It is an un-manned camera system to monitor boat landing activities, capture video events, and make this information for available for review. It is an onsite solution to ensure compliance with the Aquatic Invasive Species clean-off laws so lakes can be protected from the extensive impact of new exotic species. (www.environmentalsentry.com) Our unit was installed at the Morris-Erickson County Park boat landing in August 2012. It is in use annually, April-November, when most boat traffic is present.

Continue the fishing regulations which are thought to be critical in decreasing Rusty Crayfish populations. (Ongoing. WDNR)

- DNR is currently proposing to liberalize bass regulations on Long Lake. The proposed regulation would allow harvest of smaller and more abundant largemouth bass, but still protect and maintain the high quality smallmouth bass fishery which is needed to maintain rusty crayfish numbers at low levels.

Goal V: Hydrology

Establish long-term lake monitoring to track climate trends and changes in lake hydrology.

Objectives and Activities 2014-2019

1. ***Establish methods for ongoing lake level monitoring/tracking.*** *(LLLPRD, WDNR)*
   - Install automatic lake level sensors
     - Funded by *WDNR Lake Protection Grant for stormwater runoff project*

2. ***Record and monitor annual weather.***
   - Monitor a weather station *(YMCA Camp Manitou, LLLPRD)*
   - Record ice-on and ice-off dates (LLLPRD)

3. ***Document historic lake levels and previous hydrological study of Long Lake.*** *(LLLPRD, WDNR)*
   - Research and document original Federal Government surveys for pre-dam lake levels, since Long Lake is currently an artificially-raised lake.

Goal VI: Recreation

Provide safe, lake-friendly, multifaceted recreational opportunities.

Objectives and Activities 2014-2019

1. ***Maintain slow/no-wake restrictions in areas of hazard to assure safe passage.***
   - Locate major hazards (such as Herde Lake passage)
   - Acquire Town ordinance to legally allow LLLPRD management of sand bar buoys

2. ***Provide educational resources for watercraft safety concerns.*** *(LLLPRD)*
   - Boats passing too closely to shore and other boats
   - Personal watercraft operating unsafely within 200 ft of shore
   - How to ensure compliance by way of better enforcement
   - Ways to educate boaters

3. ***Evaluate State purchase of land on Long and Dark Lakes.*** *(LLLPRD)*
   - Learn how the new public land (and water) will be used and how that will affect the lakes
   - Become a stakeholder in planning process

4. ***Explore concerns regarding tourism promotion and expanded public use.*** *(LLLPRD)*
   - Evaluate campground expansion in adjacent LLL watershed as added pressure and invasive species risk to LLL

Previous Objectives and Activities 2007-2013

Conduct an assessment to identify potential slow, now-wake areas for the protection of water quality, habitat and public safety. (LLLPRD, Town of Sampson, WDNR)

Coordinate annual or biannual boating safety course. (LLLPRD)

Provide appropriate public lake access. (Ongoing. LLLPRD, Town of Sampson, WDNR)

- Public access to the lake is provided by Chippewa County at the Morris-Erickson County Park, Town of Sampson at their boat landing on Basswood Road and carry-in access on Breezy Point Road (Long Lake Estates), and the State at the former camp on Dark and Long Lakes, carry-in only. Also an undeveloped public access point is located on Basswood Road (Basswood Estates) but has been largely unknown and inaccessible because it runs through a wet area.

Goal VII: Lake Stewardship

Maintain a sustainable public information/education program to encourage lake stewardship and support lake management efforts.


Amanda Kostner

Objectives and Activities 2014-2019

1. ***Update and maintain website.*** *(LLLPRD)*

2. ***Develop District information/education plan.*** *(LLLPRD)*
   - Identify messages, activities, and target audiences
   - Hire consultant when needed

Goal VIII: Administration

Maintain and improve organizational ability.

Objectives and Activities 2014-2019

1. ***Review and evaluate committee framework and administration.*** *(LLLPRD)*

2. ***Develop specific charge for each committee.*** *(LLLPRD)*

3. ***Consider mechanisms for transferring skills/knowledge.*** *(LLLPRD)*

Appendix

(In chronological order)

Long Lake Rusty Crayfish Count (1974-Present)

The rusty crayfish *(Orconectes rusticus)*, a native to Illinois, Indiana, Ohio, Kentucky and Tennessee, is an exotic species in Wisconsin. This species of crayfish was likely introduced through its use as fishing bait (Lorman 1980). Plant material makes up a major portion of the rusty crayfish diet (Magnuson, et. al. 1975). Since it has a higher metabolic rate than other species of crayfish, it can eat twice as much plant biomass as some of the native crayfish (Gunderson 1995).

In 1974, a study was sponsored by the National Science Foundation and the Wisconsin Department of Natural Resources to assess the role of crayfish in the decline of aquatic plants. The crayfish study in Long Lake (Magnuson et. al. 1975) indicated:

1) Rusty crayfish density in Long Lake was high, compared to other lakes with rusty crayfish populations.
2) The mean density of rusty crayfish in Long Lake was 51 crayfish per meter^2 on rock substrate and 4 crayfish per meter^2 on sand substrate. (Rusty crayfish in Long Lake would need to be in the size range of only 2.7-35 grams each to completely eliminate all vegetation in the area in which they occurred.)
3) There was an inverse relationship between crayfish abundance and aquatic plant density. Sites in Long Lake with high crayfish densities lacked plants. Areas of the lake in which crayfish were less abundant supported more vegetation (Magnuson et. al. 1975).
4) The rusty crayfish dominated the crayfish community in Long Lake, almost to the total exclusion of native crayfish. The 1974-78 crayfish population in Long Lake was estimated at 5.2 million crayfish, with a yearly production of 6700 kg of crayfish tissue per year (dry weight) (Magnuson et. al. 1975).

LLLPRD Crayfish Count History

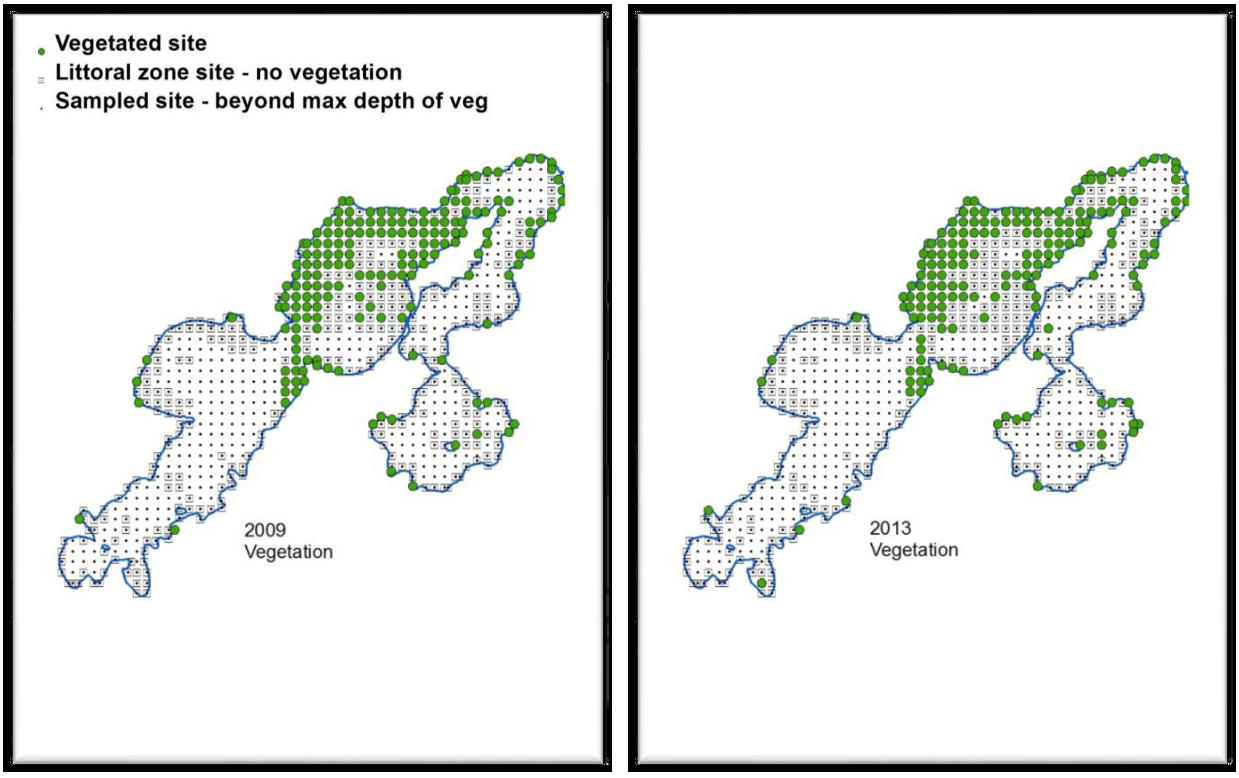
- 1980's (G. Berres) 1,313-2,136 (mostly rusty) crayfish were caught annually in 21 traps.
- 2007 (Beaver Creek Reserve) 94 crayfish
- 2008 (C. Haller) 139 rusty crayfish, 1 native crayfish
- July 29, 2010 (C. Haller) Site #1 (Herde Lake): 15 rusty. Site #2: (Clark's): 0 crayfish. Site #3 (Dahl's grassy island): 36 rusty. Site #4 (Erickson): 10 rusty, 1 northern blue. Site #5 (Pat Kelly): 31 rusty. Site #6 (Chippewa Bay East): 19 rusty. Site #7 (Chippewa Bay West): 26 rusty crayfish. Totals: 137 rusty crayfish and 1 blue crayfish.
- July 14, 2013 (J. Bearson) 49 rusty crayfish and 102 blue crayfish, a total of 151 crayfish. The blue were found on the south end of the lake and the rusty were found on the opposite end.

Aquatic Plant Assessments (1986-Present)

The aquatic plant population of Long Lake is a highly valuable component of the lake ecosystem. The aquatic plants are valuable fish and aquatic life habitat, protect shorelines from erosion, protect the lake from the invasion of exotic aquatic plants and assist in protecting water quality. The colonization of Long Lake by rusty crayfish (Orconectes rustics) in the 1960's severely decreased the amount of aquatic plants present in the lake.

The changes and condition of the aquatic plant population have been monitored from 1986 to present. As part of the Wisconsin Department of Natural Resources Long Term Trend Monitoring program, an Aquatic Plant Survey was conducted on Long Lake in August 2009 and August 2013 by water resources staff at the Wisconsin Department of Natural Resources. Aquatic plant surveys have also been conducted in 1986, 1989, 1992, 1995, 1998, 2001, and 2005, however, these past surveys were conducted using methods different from those used in the current surveys so results are not directly compared.

During the most recent WDNR plant study, completed in 2013 (Lepsch 2014), forty-six species were found in Long Lake from 2009 to 2013. Nine species considered sensitive to disturbance were found. These sensitive species accounted for 36.6% of all species occurrences in 2009 and 45.21% in 2013. One invasive species, curly-leaf pondweed (*Potamogeton crispus)*, was found in 2009 and accounted for 0.25% of all species occurrences. It was not found in 2013. Flat-stem pondweed *(Potamogeton zosteriformis)* was the dominant species in 2013.



The plant community does appear to be spatially limited as all large plant beds are limited to the center of the northern shoreline. Sandy shorelines have some vegetation but most of the vegetation located farther away from the shore is limited to muck sediments. The southwest area of the lake has very little vegetation. This area of the lake is dominated by steep sand/rock shorelines. However, there are small pockets of shallow muck areas that are also devoid of vegetation.

Long Lake is characterized by steeply sloping shorelines with the exception of the center of the northern shoreline. The majority of sites sampled were greater than 20 feet. The maximum depth of vegetation was 20 feet in 2009 and 19 feet in 2013. When considering all sites sampled, 23% to 24% of the lake had vegetation. When considering only sites less than 20 feet (littoral zone), 37% of sites had vegetation during both survey years.

A dramatic increase in the amount of vegetation was seen between 1998 and 2001. This coincides with a change in fishing regulations that has resulted in a decrease in rusty crayfish, a destructive herbivore. That trend has continued to date. Every metric has shown an increase from 1986 to 2013.

Long Lake is an oligotrophic to mesotrophic lake with very good to excellent water quality and clarity. Chlorophyll levels have decreased slightly over time and Secchi disc depths are increasing. Phosphorus values, however, have been increasing slightly over time. (Lepsch 2014)

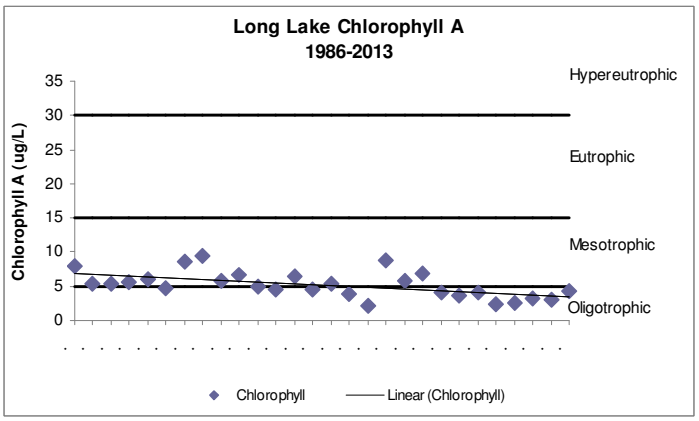
Previous plant studies found that the aquatic plant population was significantly improving from 1986. In 2005, the number of species increased from 8 to 25, the maximum rooting depth increased from 3.0 feet in 1986 to 13.0 feet in 2005, and the amount of the shallow water (littoral zone) colonized by plants increased from 6.5% to 26.7%. Aquatic plants provided 170 acres of critical habitat in Long Lake at that time. (Konkel 2006)

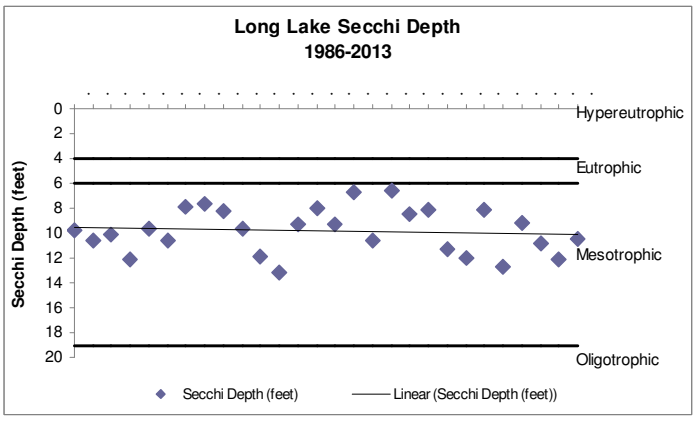
A component of the 2005 plant study included an assessment of shoreland habitat. This assessment documented an alarming loss of shoreland habitat in the decade (1995 – 2005). Natural shoreline cover decreased from 87% cover to 74% cover in 2005. Conversely, shoreline disturbed by shoreland development increased since 1995 from 13% coverage to 25% coverage in 2005. This was near a 100% increase in shoreland habitat loss in one decade.

In 2005, a comparison of the aquatic plant communities adjacent to natural shorelands with aquatic plant communities adjacent to shorelands disturbed by development was also conducted. There was a difference in plant communities at the natural shoreline sites and the disturbed shoreline sites. All parameters used to measure the condition of the aquatic plant community indicated a more degraded aquatic plant community associated with developed shorelands (Konkel 2006).

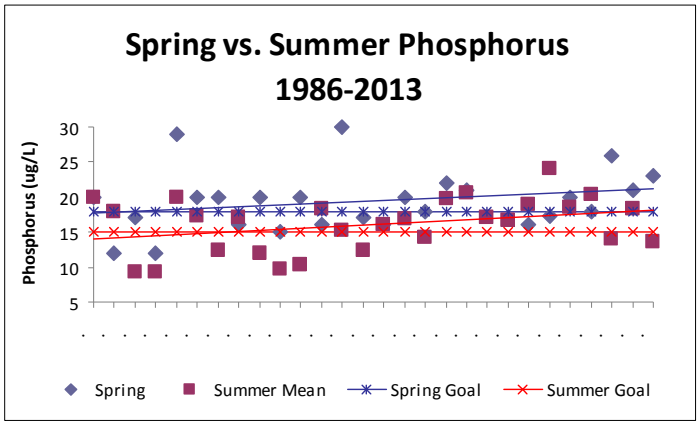
Water Quality Monitoring (1986-Present)

The health or condition of the Long Lake ecosystem has been a concern of the LLLPRD and WDNR since the Lake District was formed in the mid 1970's. Water quality monitoring is a tool to assess the health of the lake. Lake ecosystem health is routinely assessed by measuring water clarity (Secchi

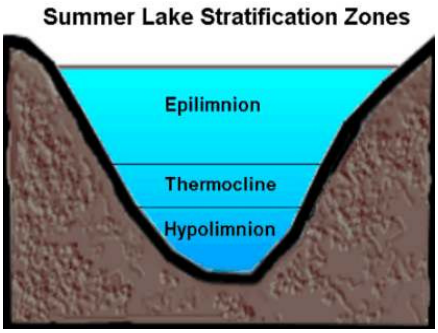




depth), nutrient enrichment (phosphorus concentration) and algae abundance (chlorophyll concentration). The WDNR selected Long Lake to be included in the Long Term Trends Monitoring Program in 1986 and has monitored water quality the past two decades. Water quality has also been monitored by a volunteer monitor from LLLPRD through the WDNR Self-Help Monitoring Program.



The most concerning information from the water quality monitoring is the lake phosphorus concentration. Phosphorus is the major controllable factor controlling the amount of algae which will grow in Long Lake. The phosphorus concentration in Long Lake is approaching the threshold value of 20 ug/l (micrograms per liter) where if the average spring turnover and summer phosphorus concentration increases to or above this level more frequent algae blooms will occur and water clarity will decrease. Spring turnover phosphorus concentrations in Long Lake range from 12 to 30 ug/l with a 20 year average of 18.44 ug/l. The variation in the phosphorus concentration is largely due to the amount of snowfall and rainfall in a given year. Current algae concentrations in Long Lake are moderate at a 20 year summer average of 5.92 ug/l with a range of 2 to 9.5 ug/l. The two decade average summer Secchi depth is 2.9 meters (9.5 feet) and has ranged from 2.0 meters (6.56 feet) to 4.15 meters (13.61 feet). The values for phosphorus, algae and water clarity are indicative of a moderately (mesotrophic) enriched Wisconsin lake.



Each year as the waters of Long Lake warm in late spring and early summer the lake stratifies or layers into 3 distinct layers by water density. The colder bottom layer (hypolimnion) of the lake is separated by a mid layer (metalimnion) from the warmer surface layer (epilimnion). These layers remain stratified into three distinct layer until late fall when the lake mixes top to bottom. The bottom layer of Long Lake is oxygenated by spring mixing (spring overturn). The rapid loss of oxygen from the bottom layer by bacterial decomposition of the deep sediments is an indication of declining water quality. The loss of

oxygen is caused by the bottom sediments of the lake being enriched with increasing amounts of decomposing algae. An assessment of oxygen levels in the bottom layer of Long Lake from 1974 to 2000 indicates declining water quality (McGinley and Turyk 2002). The bottom waters (hypolimnion) of Long Lake become anoxic by mid summer and can not support fish.

The water quality of Long Lake is considered good when compared with other Wisconsin lakes. Current phosphorus concentrations indicate the lake is approaching a threshold where algae blooms will occur and water clarity will decrease. The assessment of oxygen levels in the bottom layer of the lake during the summer indicate water quality is declining. The loss of oxygen from the bottom waters during the summer is an irreversible decline in water quality. The protection or modest improvement of surface water quality can occur by developing lake management goals and implementing management activities to achieve those goals.

Water Quality Modeling

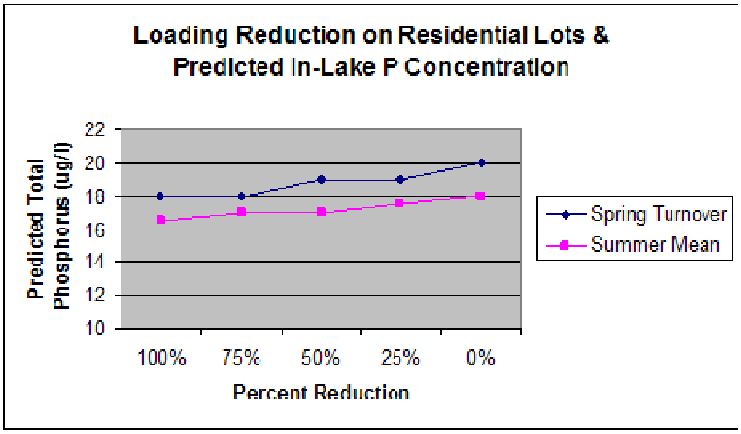
Water quality models are computer based mathematical models which simulate lake water quality and watershed runoff conditions. The models are based on the mathematical representation of lake functions which determine lake water quality. The model is a tool which assists in predicting changes in water quality when watershed management activities are simulated. The model can answer the question of what is the estimated water quality improvement when watershed sources of phosphorus inputs are reduced. It must be acknowledged that models predict a relative and not an exact environmental response.

A key component of the water quality model is the phosphorus budget. The phosphorus budget is the estimated amount of phosphorus delivered to the lake from each land use type annually. The phosphorus budget can be thought of as the fuel which drives the algae population in Long Lake. The only current controllable sources of phosphorus are the phosphorus in the stormwater runoff from shoreland development (High Density and Medium Density Urban).

Long Lake Land Use Nutrient Loads

Land Use	Acres	Kg/Yr	Lbs/Yr
High Density Urban	17.3	11	24.3
Med. Density Urban	125.7	25	55.1
Rural Residential	101.2	4	8.8
Pasture/Grass	218.7	27	59.5
Wetlands	1144.7	46	101.4
Forest	2089.4	76	167.6
Atmosphere	1052	128	282.2
Septics		6.25	13.8
Total		323.25	712.7

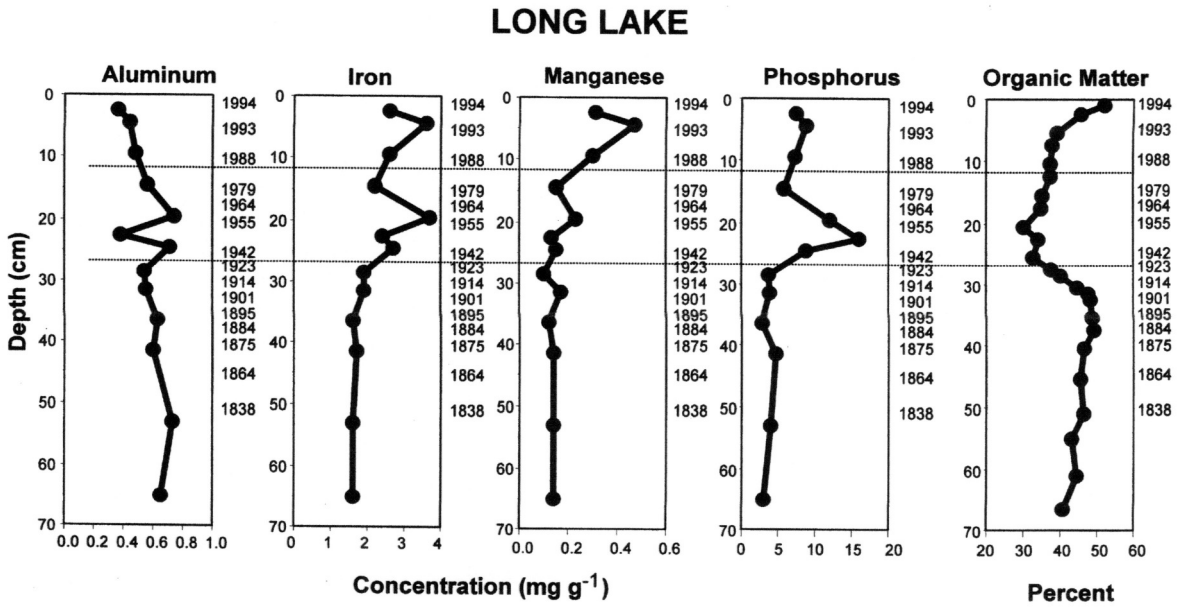
The model was used to evaluate a series of phosphorus input reduction scenarios. The modeling scenarios represent a 25%, 50%, 75%, and 100% reduction in phosphorus inputs in stormwater runoff from shoreland development. The model predicted (graph below) that reducing phosphorus inputs from shoreland development will improve and protect Long Lake water quality by reducing the current phosphorus levels by 1-2ug/l.



The modeling study results clarify the importance of reducing existing controllable phosphorus inputs to improve and protect Long Lake. It also must be recognized that future sources of phosphorus must be minimized if water quality is to be protected for the enjoyment of future generations. The development and implementation of lake management goals by the residents of Long Lake and its watershed will be the core tools which protect Long Lake.

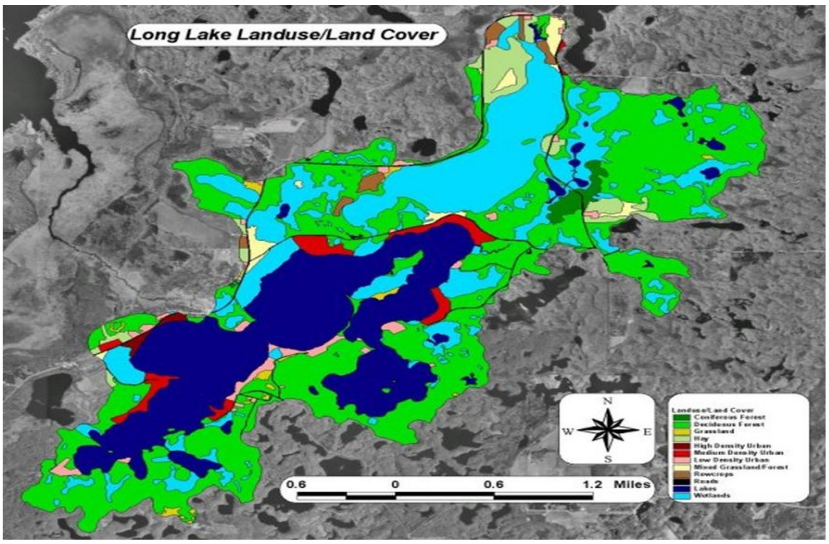
Paleolimnological Assessment (1998)

Paleolimnology is the study of lake sediments to recreate the water quality history of a lake. A paleolimnological assessment was done to reconstruct the changes in water quality in Long Lake from the early 1800's to present day. Each year Long Lake receives a fresh layer of sediment and within this layer of sediments is stored the water quality characteristics of the lake for that year. This annual layering of sediment is similar to a tree receiving a growth ring each year. The sediments are sampled by taking a vertical core down through the annual layers of sediment and the individual layers of sediment are sectioned, dated and analyzed to recreate the water quality history of the lake.
A sediment core was taken from the 72 foot deep area west of Camp Manitou in October of 1994. It was evaluated to assess the degree that shore land development and watershed land use have changed the water quality of Long Lake. The sediment core assessment has shown that the current level of



shore land and watershed development has increased the phosphorus concentration of Long Lake by 50 percent. The predevelopment (early 1800's to 1940) phosphorus concentration of Long Lake was 12 ug/l (micrograms per liter); the present day phosphorus concentration is 18 ug/l. Phosphorus concentrations in Long Lake ranged from 12 – 14 ug/l from the early 1800's until 1940. As the lake shore lands were developed after 1940, phosphorus levels increased to present day levels. The increase in phosphorus levels is due to the increase in storm water runoff and nutrient delivery to the lake from shore land and watershed development. The current phosphorus levels in Long Lake are increasing to a critical level which could stimulate the growth of higher levels of algae in the lake.

Watershed Land Use Assessment (2001)

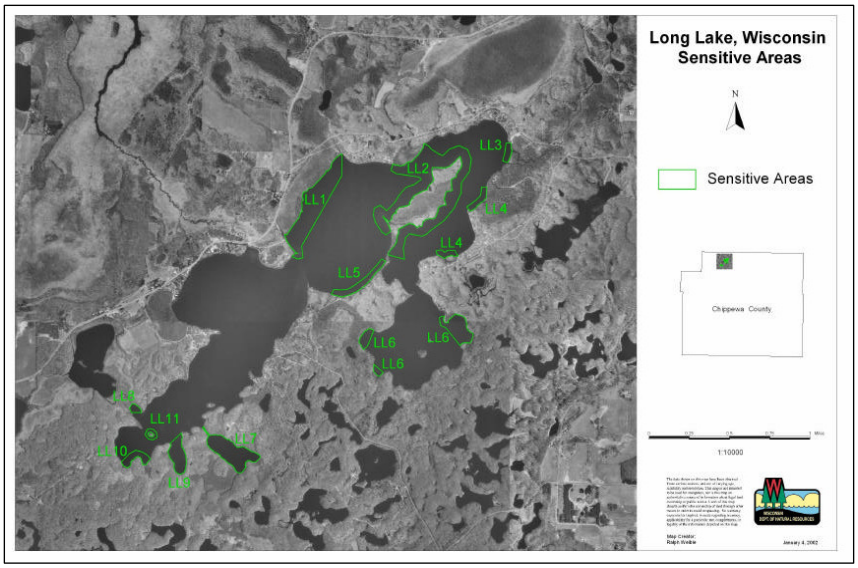


A watershed land use assessment was conducted for the Long Lake watershed in 2001. The study included a comparison of the land uses in 1938 to present. The most significant land use change from 1938 to present is the increase in the amount of residential development from 44 acres to 188 acres with the majority of this development occurring on the shore lands of Long Lake. The significance of the increased shore land development is that storm water runoff and nutrient inputs were increased causing a decrease in water quality. The land use information collected in 2001 was used in the lake water quality modeling study to predict existing and potential water quality characteristics in Long Lake.

Land Use Assessments

There is a common phrase among lake managers - "Lakes are products of their watersheds." Most often the land use of the lands within a watershed will influence the water quality characteristics of the lake. Natural land uses such as forest, grasslands and wetlands deliver natural amounts of storm water runoff and nutrients to lakes. The development of land for residential, commercial, or agricultural purpose significantly increases the amount of storm water runoff and nutrients delivered to lakes. Development increases the amount of storm water runoff by adding *impervious surfaces* (rooftops, sidewalks, and roadways), decreasing the soils ability to infiltrate storm water by compacting soils during construction activity and changing natural drainage by patterns by construction grading or drainage activity. The concentration of nutrients in storm water runoff is increased by increasing the source of nutrients by adding excessive amounts of yard fertilizers, animal manure, agricultural fertilizer, the washing off atmospheric deposition on impervious surfaces, and increased soil erosion from soil disturbance activities.

Sensitive Areas Designation (2002)



Sensitive areas are areas of aquatic vegetation identified by the WI Department of Natural Resources as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water. The Sensitive Area Designation was completed for Long Lake in 2002 by the WDNR. The

purpose of identifying and mapping sensitive areas is to preserve and protect the most sensitive areas within Long Lake.

Eleven sensitive areas were identified in Long Lake. These sensitive areas identify high quality aquatic and riparian terrestrial plant communities, critical fish and wildlife habitats, shorelands critical for protecting water quality and areas of exceptional natural beauty. Portions or all of sensitive areas 1, 2, 4, 6, 7, 8, 9, 10, and 11 have been protected by generous donations from families on Long Lake to the Long Lake Foundation and conservation easements held by land trusts. The vision of the people of Long Lake will protect these critical habitats in perpetuity.

Recommendations included within Designation *of Sensitive Areas Long Lake, Chippewa County* (WDNR 2002) will assist in developing management decisions and activities to protect critical habitats. The report can assist the Lake District for planning and decision making for lake management or protection projects. The report can also be used to spur lake stewardship activities and provide a wealth of educational information about important habitats in Long Lake.

LLLPRD Property Owners' Surveys

2004 Survey

The LLLPRD surveyed every property owner on the lake (about 170) and received 79 responses. The survey was conducted in 2004 and asked several questions regarding why people chose to own property on Long Lake, how people use the lake, what was the persons perception of the quality of the lake and a variety of additional questions related to owning property on the lake and recreating on the lake. The majority of property owners chose to own property on Long Lake because of its superior quality, proximity to home and family tradition, but the lake is enjoyed most for its peace and tranquility. Many also enjoy entertaining and relaxing with family on the lake.

- Shoreland property owners mostly use the lake in the summer months with very few people listing winter activities. Many enjoy boating, bird watching, swimming, canoeing and fishing, and the spring, summer and autumn weekends see the most use of the lake, although people did report that they use the lake year round.
- People report that they are very happy with the quality and clarity of the lake. Sixty-nine percent of the people that responded to the survey feel that the lake quality has remained the same or has only slightly degraded since they have been on the lake.
  Boat traffic does not seem to be an issue with our responders. Eighty-one percent of the respondents report that "it is easy to share the lake" and that watercraft traffic is moderate and "not enough to bother my use."
- Regarding access to the lake, 52 of 60 responders say that they feel the access points are adequate for the size of our lake. Comments were made about improving the Morris Erickson landing and the North End Landing.
- The survey found that continued water chemistry study, riparian property owner education and fishery improvements are the issues that matter most to property owners. A number of property owners are interested in having the district test and monitor septic systems near the lake.
- A majority feels that the LLLPRD should manage the lake and finance that management, but many also think that the Town of Sampson or the State of Wisconsin should be involved.
  People have many positive comments about the LLLPRD. The respondents encourage education and want to see positive enforcement of regulations. There were positive comments about land trusts activities.

2011 Survey

Because of the Shoreland Restoration and Runoff Protection Project (2008-2014), funded by a WDNR Lake Protection Grant, LLLPRD surveyed property owners again in 2011. This survey gathered information concerning the on-going activities and the conditions considered desirable to be better stewards of the lake. The Board sent 150 surveys and received 59 responses. It was divided into two sections to learn about two top priority issues at the time – Shoreland Restoration/Runoff Protection and Aquatic Invasive Species.

Shoreland Restoration and Runoff Protection

- 46% of the survey respondents had participated in the Shoreland Project and had been given a shoreland plan by the private consultant (Amanda Kostner, Green Frog Company). This was about half of the 52 total participants at that time.
- 85% of those with shoreland plans had been working on them, even if they had not been completed. Although, a large majority intended to work on their shoreland plan, with two considering it, and two not planning to. The overwhelming response was that people were completing their plans a little at a time – mostly because of lack of time to work on them.
- Participants' reasons for not taking any action on their shoreland plan: Cost, time, resistant to change, unwanted maintenance, messy appearance, and lack of belief that it will benefit the lake. Only 4 people answered this question this way, so these are not the beliefs of the majority of survey respondents with shoreland plans.
- Most respondents would not consider cost-sharing from the WDNR for a buffer or rain garden project because of a deed restriction attached to it.
- Summarizing the survey respondents' lake-friendly practices, the majority of them: direct their downspouts away from the driveway and lake (64%); maintain aquatic vegetation and fallen trees for fish/wildlife habitat (62%); use a mulching lawnmower (57%); and maintain a shoreline buffer – maybe not 35 feet but according to them, doing what they can (56%). Practices in the minority include rain gardens (38%) and rain barrels (29%).
- Strategies that would encourage property owners to allow a portion of their shoreland area to return to a more natural state: 87% for *Advice from the Long Lake Shoreland Consultant*, 84% for *Free shrubs/trees,* 82% for *Workshop*, 80% for *Help to plant shrubs/trees*, 64% for *Hands-on assistance from other property owners*.

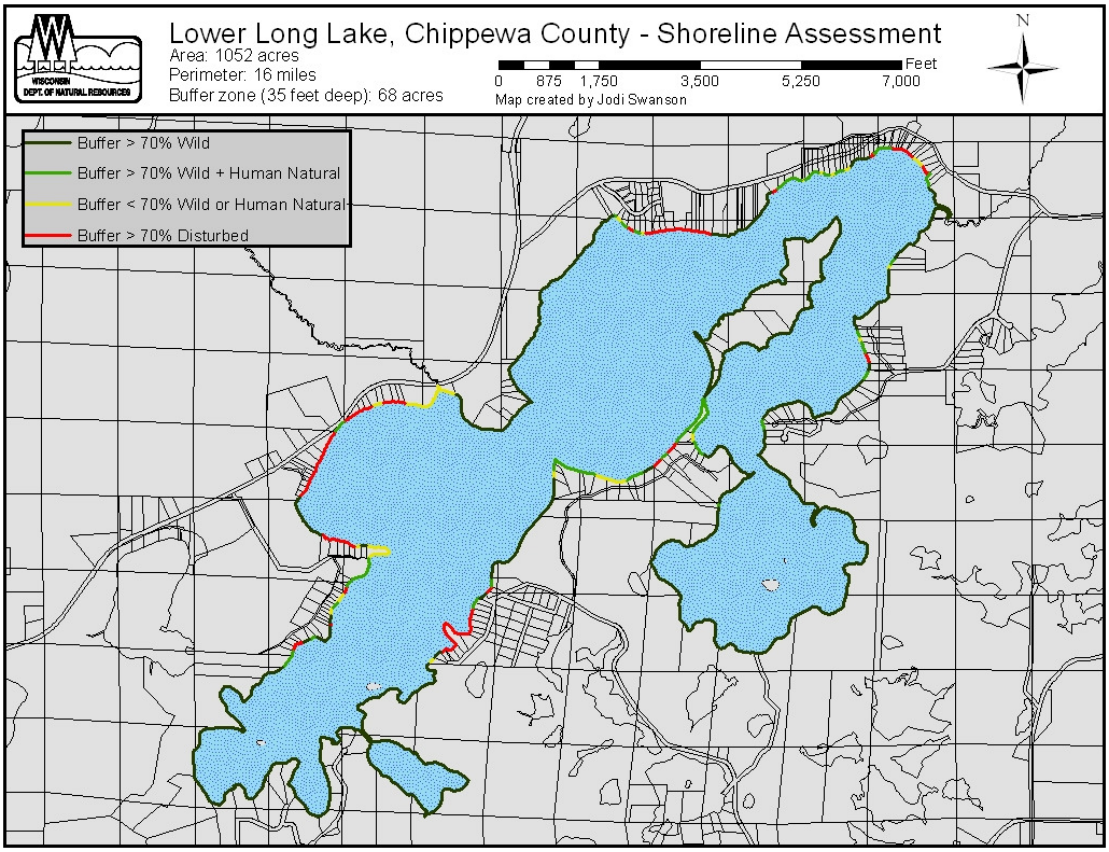
Aquatic Invasive Species (AIS)

- 33% said they could identify rusty crayfish, Eurasion water milfoil, curly-leaf pond weed and zebra mussels. The others said they could not or were unsure.
- 75% responded they would like to learn more about AIS.
- 55% would like training to identify AIS.
- 93% thought the District should monitor watercraft for AIS at the boat landing by both volunteers and paid individuals. Although 58% said they would not do the monitoring. 12 % were unsure.
- 15 people said they would be interested in becoming a citizen lake monitor for AIS.
- 72% would support a security camera paid for by District funds to monitor the boat landing for those disregarding the invasive species law.
- If new aquatic invasive species were found in Long Lake, the majority wanted the LLLPRD Board to act in the best interest of the District if timing is crucial, almost the same amount wanted the Board to seek input from property owners at a special meeting. Some said they would want the Board to act based on majority vote at the annual meeting.
- If new AIS were found, the amount respondents were willing to allow the LLLPRD Board to spend without District approval was as follows: 37% were unsure; 20% said less than $10,000; 20% said $10,000-$19,999; 7% said $20,000-$29,999; 7% said $50,000 or more; 7% said $0; 2% said $40,000-$49,999.

Lower Long Lake Shoreline Assessment (2011)

A shoreline assessment was conducted by the WDNR on Lower Long Lake in 2011. It evaluated the shoreland habitat health of the vegetative buffer zone surrounding the lake, classified each property based on its level of development and identified properties that do not meet minimum state shoreline habitat standards. The following is just some of that report. The full report can be found online at *www.lowerlonglake.org*.

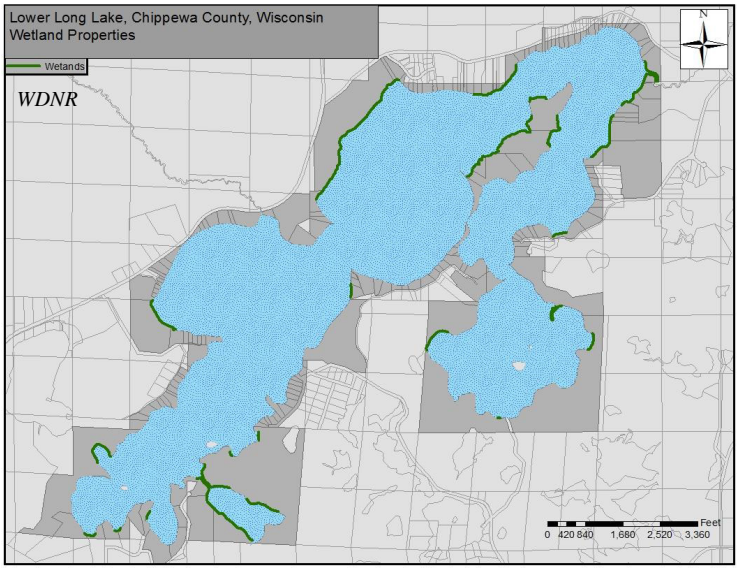
Results. A total of 202 shoreline properties were identified. The perimeter of Lower Long Lake (including Herde and Dark Lakes) measures 83,619 feet (15.8 miles). If you consider a 35-foot buffer extending inland from the waterline all around the lake, there are 67.02 acres of land in the buffer zone. Of the total acreage that occurs in the 35-foot buffer zone, 73.4% is classified as *Natural* (green), which retains its natural state with no human influence. Forests and wetlands are the main sources of these areas on Long Lake. Areas impacted by human activities account for 26.6% of the buffer zone. Of that percentage, 11.4% is classified as *Human-Natural* (lime), which consists of native vegetation, but not necessarily in a completely natural condition. Native shrubs and herbaceous vegetation scattered around cultivated lawns are examples of this. 15.2% of the buffer zone is classified as *Human-Disturbed* (yellow & red), which consist of cultivated lawns or man-made structures such as boat houses, decks and stairs. The canopy, created by large trees, covers 87.2% of the buffer zone leaving 12.8% exposed to direct impact from precipitation.



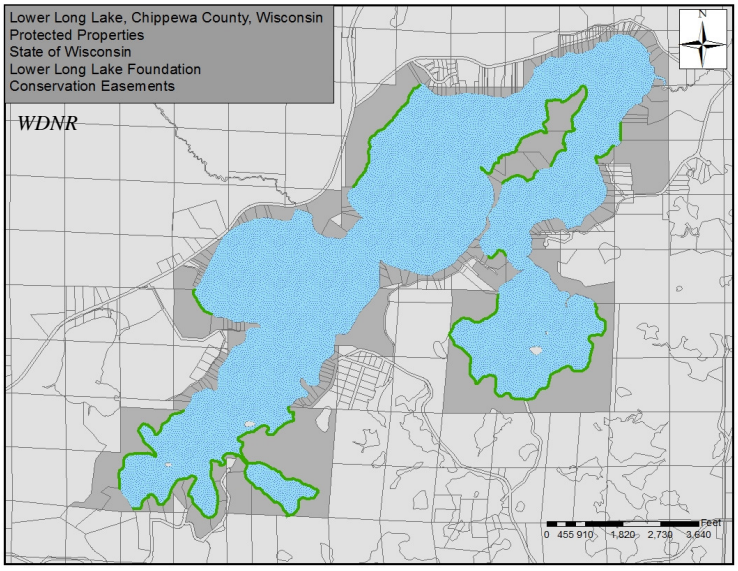
Summary. The majority of the shoreline of Lower Long Lake is high quality and provides protection to the lake. State of Wisconsin and Lower Long Lake Foundation-owned properties in conjunction with conservation easements provide protection in perpetuity. Along with protected areas, there are several examples of privately-owned properties that are developed to allow access and enjoyment of the lake while minimizing human impact. On these properties, houses are set back while maintaining

native vegetation in the buffer zone or in some cases, maintaining the buffer zone in a natural condition. On these properties, the view and access corridor, if developed, does not exceed 30% of the total frontage.

There are also several areas of the shoreline that are considered by the WDNR as wetlands. (Surface Water Data Viewer, www.dnr.wi.gov/topic/surfacewater/swdv/) Wetlands provide protection to the water body by acting as a filtering system, stabilizing the shoreline and providing flood protection. Slightly more than half of these wetland areas are government-owned or occur in conservation easements giving them permanent protection.



There are a small percentage of properties that do not conform to minimum zoning standards. These properties often have cultivated grass extending up to or near the Ordinary High Water Mark and/or have structures such as boat houses or impervious patios near the water. There are also examples of shoreline buffer zones that direct storm water run-off to the lake. Although these properties are often small (average frontage length of 206 feet for yellow properties and 147 feet for red properties), they exist in concentrated clusters which intensify the effect of each individual property. Reducing the negative impacts of these properties by infiltrating shoreland run-off and restoring shoreland vegetative buffers will improve natural beauty, lake fisheries, wildlife and aquatic life habitats, and water quality.

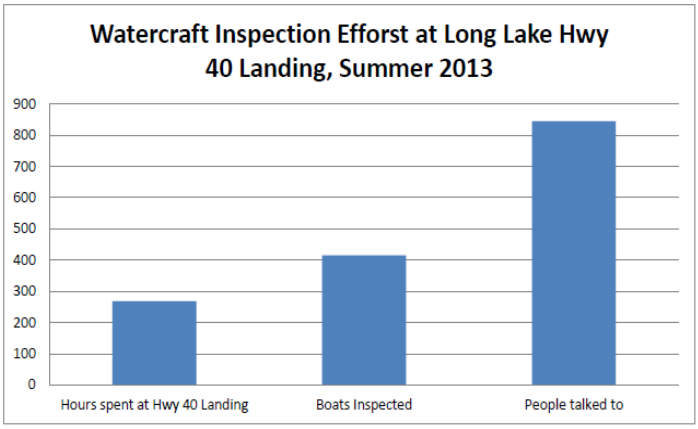


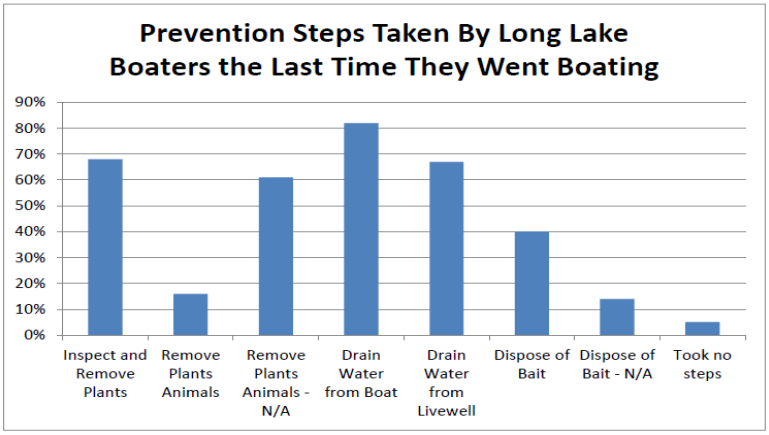
Shorelands protect critical ecosystems and cultural values of lakes. Lake shorelands provide critical habitat for water-dependent wildlife, preserve natural beauty, protect water quality and near-shore shallow water habitat for fisheries and aquatic life. Native vegetation growing at the interface between the water's edge and inland areas acts to stabilize soil and infiltrate stormwater run-off, preventing erosion and protecting water quality. Root systems of native vegetation act as a filtration system to prevent excess nutrients and soil from entering the water body. Native shoreline vegetation is also necessary to provide habitat and traveling corridors for wildlife. Tree canopy coverage is also an important component of a healthy shoreline as it intercepts and softens rainfall, thereby lessening storm water run-off and erosion. Sustainable shoreline practices contribute to healthy aquatic plant and wildlife communities, water quality and clarity. Installing shoreland vegetative buffers and infiltration practices are important to insure the long-term protection of critical habitats and lake water quality.

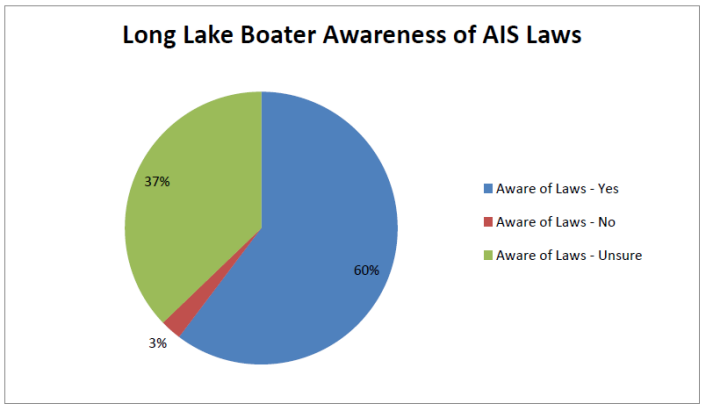
Long Lake Watercraft Inspection Efforts (2013)

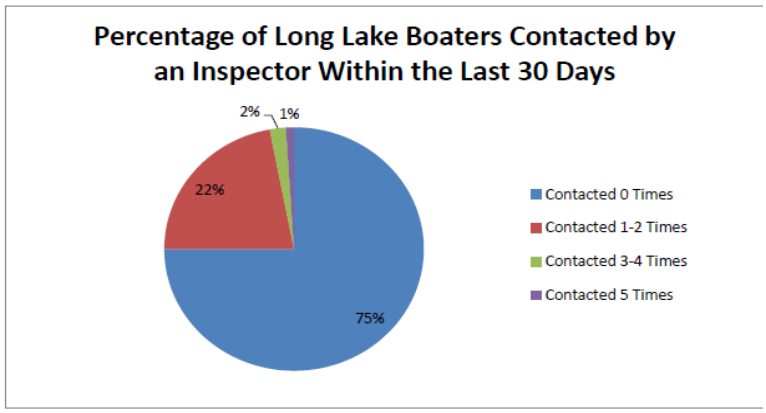
Clean Boats Clean Waters Program, Beaver Creek Reserve Citizen Science Center

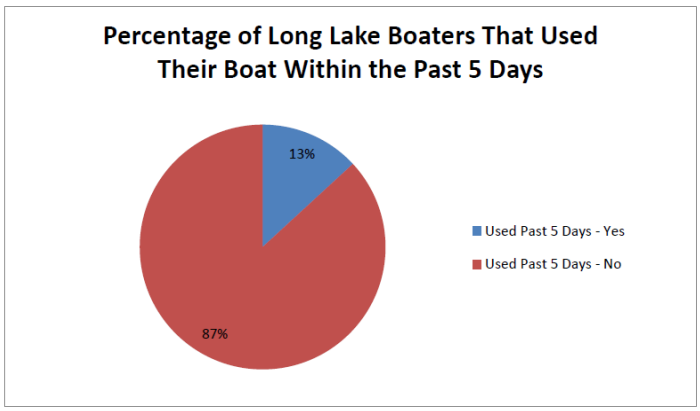
During the summer of 2013, Long Lake in Chippewa County was part of a regional watercraft (aquatic invasive species) inspection effort. The Lower Long Lake Protection and Rehabilitation District financially supported 200 hours of inspection time at the landing and Beaver Creek Reserve summer staff supplemented uncovered hours. The data shown below is a combination of these efforts. The Long Lake watercraft inspector was trained on how to properly inspect boats (for aquatic species), fill out data sheets, and identify invasive species and how to look for them in the lake. The Long Lake inspector was checked up on by BCR staff and LLLPRD at various times throughout the summer. Hours were spread out over 45 different days during the summer with a concentration on weekends (Friday-Sunday).

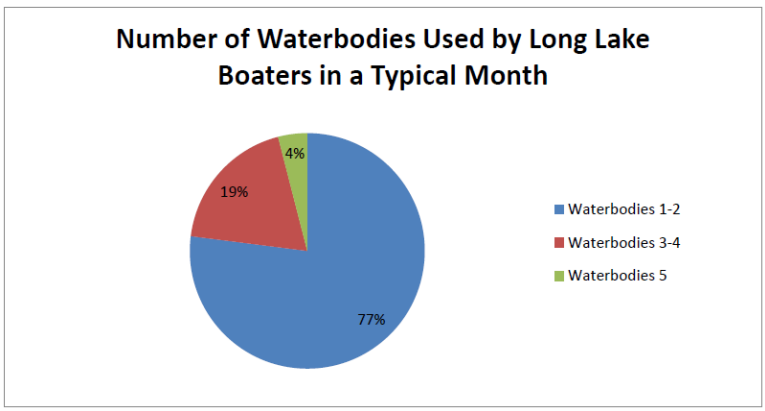












Fisheries Management Update (2014) H. Benike, WDNR

Long Lake harbors one of the top smallmouth bass fisheries for trophy-sized fish. Abundance has remained stable and large fish are present in the population. Similar to many lakes in Northwestern Wisconsin, largemouth bass abundance has been increasing on Long Lake. During this same time period, walleye recruitment and adult abundance has decreased. Whether this is a cause and effect relationship or a relationship driven by other factors is unknown at this time. However, a regulation proposal is currently under review in an effort to liberalize largemouth bass regulations for a variety of reasons. Muskellunge are stocked on an alternate year basis. Muskellunge stocking was reduced from 1.0 to 0.5 fish/acre because muskellunge condition was poor when compared to other muskellunge populations. No other fish stocking occurs. A quality crappie fishery is available with above averaged sized fish in the population and a modest bluegill fishery is present.

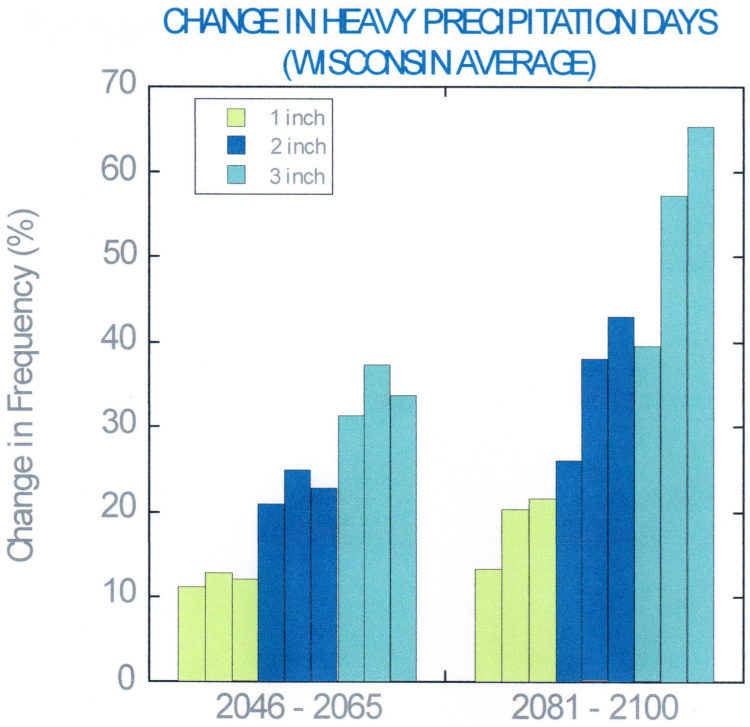
Climate Change and Increasing Intense Precipitation Events

In 2011, the Wisconsin Initiative on Climate Change Impacts (WICCI) released its first comprehensive report, *Wisconsin's Changing Climate: Impacts and Adaptation*, a project of the Nelson Institute for Environmental Studies at the University of Wisconsin-Madison and the Wisconsin Department of Natural Resources. The report serves as a resource for business executives, government, natural resource managers, public health officials and other decision makers as they take strategic steps to preserve jobs, invest resources wisely, build resiliency and protect our built and natural environment in the face of a changing climate. For the full report and details on the methods used by the WICCI Climate Working Group, please visit www.wicci.wisc.edu.

As a lake district, we can look to this to better plan for future runoff and shoreline erosion control problems. Other issues such as projected decreased lake ice and increased water temperatures may play a role in future lake management planning as well.

Summary:
WICCI has undertaken a detailed study of recent historical trends in Wisconsin's climate. WICCI scientists have also developed projections of our state's future climates using some of the world's most advanced computer models. These studies reveal an emerging consensus on the range of possible climate changes that Wisconsin will experience. In particular, these studies find that Wisconsin is likely to become a much warmer state over the next few decades, with average temperatures more like those currently experienced in states hundreds of miles to our south. Our state is also likely to become somewhat wetter, with a modest increase in total precipitation and in the number of intense rainfall events. The amount of climate change varies by season, with winter experiencing the greatest warming and most likely increase in precipitation.

Intense Precipitation Events:
Typically, heavy rainfall events – at least two inches in a 24-hour period – are recorded at rain gauges roughly 12 times per decade in southern Wisconsin and seven times per decade in northern Wisconsin. By the mid-21st century, Wisconsin will likely have two or three more of these intense events per decade, about a 25 percent increase in their frequency (see graph), with these changes concentrated in spring and fall. The heaviest rainfall events will also increase slightly in magnitude, according to the models. For example, averaged over the state, the magnitude of a 100-year storm event (five to seven inches of precipitation in a 24-hour period) is expected to increase by about 10 percent.



Intense precipitation events are more likely in the decades ahead. Each set of bars in each time period represents the expected increase in the frequency of intense rain events under the three greenhouse gas emission scenarios used by the Intergovernmental Panel on Climate Change. The colors represent daily rainfalls of at least one inch (green), two inches (blue), and three inches (teal). Within each trio of same-color bars, the left bar corresponds to the lower emission scenario, which assumes large reductions in emissions after the year 2050, the middle bar corresponds to the scenario used as the basis for this report, and the right bar represents intense rain events under the higher carbon emissions.

The WICCI climate analysis illuminates a growing need for more climate information in the years ahead. Wisconsin's climate monitoring network should be improved and maintained, and the Wisconsin State Climatology Office supported, to provide continued high-quality data to enable both short- and long-term climate impact modeling at a scale appropriate to support decision-makers in both the public and private sectors.

Sources Cited

Christensen D.L., Herwig B.R., Schnindler D.E., & Carpenter S.R. 1996. Impacts of Lakeshore Residential Development on Coarse Woody Debris in North Temperate Lakes. Ecological Applications. 6(4): 1143-1149.

Garrison P.J., Marshall D.W., Stremick-Thompson L., Cicero P.L. and Dearlove P.D. 2005. Effects of Pier Shading on Littoral Zone Habitat and Communities in Lakes Ripley and Rock, Jefferson County, Wisconsin.

Garrison P.J. and R.S. Wakeman. 2000. Use of Paleolimnology to document the effect of lake shoreland development on water quality. Journal of Paleolimnology. 24: 369-393.

Jennings M.J., Emmons E.E., Hatzenbeler G.R., Edwards C. and Bozek M.A. 2003. Is littoral habitat affected by residential development and land use in watersheds of Wisconsin lakes. Lake and Reservoir Management. 19(3): 272-279.

Lorman J. 1980. Ecology and Management of the Crayfish Orconectes rusticus in Long Lake, Chippewa County, Wisconsin. Report prepared for the Long Lake Inland Lake District.

Lindsay A.R., Gillum S.S. and Meyer M.W. 2002. Influence of lakeshore development on breeding bird communities in a mixed northern forest. Biological Conservation. 107: 1-11.

Schindler D.E., Geib S.I. and Williams M.R. 2000. Patterns of Fish Growth along a Residential Development Gradient in North Temperate Lakes. Ecosystems. 3: 229-237.

Wisconsin Department of Natural Resources, Jefferson County Land and Water Resources Department and Lake Ripley Management District. PUB-SS-1006 2005.

Woodford J.E. and Meyer M.W. 2003. Impacts of lakeshore development on green frog abundance. Biological Conservation. 110: 277-284.

Mike Faber