2014 Project Abstract
For the Period Ending June 30, 2017

PROJECT TITLE: Reducing lake quality impairments through citizen action
PROJECT MANAGER: Jen Kader
AFFILIATION: Freshwater Society
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2014, Chp. 226, Sec. 2, Subd. 03k

APPROPRIATION AMOUNT: $59,000
AMOUNT SPENT: $59,000
AMOUNT REMAINING: $0

Overall Project Outcomes and Results

Since 2000, more than 400 lake associations have participated in the Healthy Lakes and Rivers Partnership (HLRP) program founded by Don Hickman of the Initiative Foundation and now run by Freshwater Society. HLRP is a program designed to help lake associations across the state identify and work towards the priorities they have for their water body, one county at a time. The round of HLRP funded through LCCMR allowed for collaboration with Otter Tail Soil and Water Conservation District, with specific attention focused on helping to align lake plans with County Water Plans so that local efforts could help to achieve county water quality goals.

In the last year and a half, four lake associations from Otter Tail County participated in a 2-day training covering the importance of lake planning, engaged in a Freshwater Society-led participatory planning process to define lake-specific and community-identified goals and strategies, drafted and finalized a Lake Management Plan specific to their lake (copies included in report), and began implementing those plans. These groups now have in their hands documents which detail specific stresses, threats, and opportunities for their lakes generated by RMB Laboratories, a clear indication of the shared vision of the community, and a 2-5 year action plan with steps they identified to help them realize these goals. Additionally, each group understands the resources that are out there to help them along the way, and has received $5,000 of seed funds to get them started from West Central Initiative.

The four participatory planning sessions engaged a total of 184 lake residents from the county, and countless volunteer hours from the boards of the four lake associations to produce their own lake management plan for lakes representing hundreds of Minnesotans who have clear, community-identified goals and action plans to improve the health of their lakes.

Project Results Use and Dissemination

As a requirement for the final distribution of funds from West Central Initiative, all groups needed to send their final Lake Management Plans to East Otter Tail Soil and Water Conservation District. The groups are also planning to distribute the final versions to their member residents and local elected officials in one way or another. This may include a mailing of a portion of the plan, loading the final copy to the website, or providing a small supply to volunteer leaders within the association. Additionally, the Project Manager sent final plans to West Central Initiative so they could see how the funding was going to be used. Freshwater Society will also keep copies of the plan on file to be given to other interested persons upon request.

A blog post describing the project and outcomes will be published by Freshwater Society in coming months, and the project website will be updated to reflect the closure of the project and goals identified by the groups. Each

lake association has been asked to check in with updates so that we may share how LCCMR funding has contributed to the success of community-led efforts to improve local water resources.

Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2014 Work Plan

Date of Report: August 11, 2017

Date of Next Status Update Report: N/A

Date of Work Plan Approval: June 4, 2014

Project Completion Date: June 30, 2017

Does this submission include an amendment request? _Yes_

PROJECT TITLE: Reducing lake quality impairments through citizen action

Project Manager: Jen Kader

Organization: Freshwater Society

Mailing Address: 2424 Territorial Rd. Suite B

City/State/Zip Code: St. Paul, MN 55114

Telephone Number: (651) 313-5807

Email Address: jkader@freshwater.org

Web Address: www.freshwater.org

Location: Otter Tail, Douglas, Becker and Grant counties

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$59,000**
	Amount Spent:	**$59,000**
	Balance:	**$0**

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 03k

Appropriation Language:
$59,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the Freshwater Society to train lake associations and other stakeholder groups to develop lake management plans and to implement science-based, citizen-led water quality improvement projects on impaired lakes in west central Minnesota. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Reducing lake quality impairments through citizen actions

II. PROJECT STATEMENT:

Millions of dollars are being spent to assess the water quality of thousands of lakes in Minnesota. EPA's 2012 Assessed Watersheds list is sobering—over 16 watersheds are listed as impaired predominately for aquatic recreation and aquatic life as the result of nonpoint source pollution. These impairments can be addressed head-on by citizens who have vested interests in the water quality of the lakes they live by and have organized lake associations around those lakes. Concerned citizens recognize the negative impacts on lake health that issues from septic system maintenance to aquatic invasive species have, but often lack the knowledge and resources to act.

This program will train participants from up to eight lake associations in lake ecology, lake assessment, communications, and plan implementation so that they can utilize the latest scientific information on their water body, combine it with participatory input from the broader community and turn it into an actionable lake management plan that results in on-the-ground project implementation. As a result of this program each participating group will implement at least one lake health improvement project that may include but is not limited to: septic system upgrades, lakeshore restoration, aquatic invasive species prevention, fisheries enhancement and updated local ordinances.

Working with local government and agency partners, up to eight groups will be chosen to send 5-8 representatives to two days of training covering lake ecology, reading lake assessments, how to effectively communicate, and how to develop a lake management plan. Each group will receive an assessment on their water body that includes all relevant data on water parameters, land use and other ecological factors that impact the health of that water body. With ongoing assistance and guidance each group will host a community wide input session to gather insights and interest from neighbors and other lake users. They will then distill this information, along with the lake assessment data, into an action plan that delineates the most critical project needed, and a detailed plan for getting it done.

These citizens groups represent an additional and often untapped asset for those agencies and organizations responsible for managing water resources. The strengthened partnerships that this program creates, along with the on-the-ground-projects that are leveraged through funding from our partner at West Central Initiative, create ongoing impacts and the capacity for more in the future.

III. PROJECT STATUS UPDATES:

Project Status as of January 1, 2015: To assist in selecting and recruiting participants, relationships were established with multiple local partners including Ottertail County Soil and Water District, the West Central Initiative, The Ottertail Coalition of Lake Associations, and University of Minnesota Extension. Communications were established with 14 lake groups and to date, three have committed to participating in the program. While this is short of the overall goal of 8 groups, the initial groundwork should result in more groups committing to the program during spring of 2015.

Project Status as of July 1, 2015: The recruitment activities and goals outlined in the January 2015 update did not yield the expected response and to date there is still insufficient participation to implement the whole project. As a result, the geographic scope of the program has been widened and conversations have begun with additional potential partners.

Project Status January 1, 2016: Of the three who committed to the process by January 1, 2015, one is no longer able to participate. However, a total of four groups have now committed to participate in the program, which is

sufficient for initiating the planning process for holding trainings this spring. The four lakes are Wall Lake, Lake Lida, Lake Six, and Big McDonald Lake. Scheduling requests to project partners and the participating groups have gone out, and planning has begun. As there is room for as many as eight groups to participate, we are still recruiting for groups. We are on track to hold the trainings this spring and continue to meet stated project deadlines.

Amendment Request 1/28/16: We have found that recruitment of lake associations to participate in the HLRP has required more time than originally anticipated. As noted in the last status update, the critical mass necessary to implement the full program (6-8 lake associations) through the recruitment efforts previously outlined did not result in the additional groups from Ottertail County that were sought during winter and spring of 2015. Because the initial assessment conducted prior to July 2014 that indicated that there would be sufficient interest within Ottertail did not yield the necessary results, the geographic scope of the program has been widened to include Becker County and conversations have begun with watershed organizations there. While this is somewhat concerning given the initial indications from outreach efforts done prior to implementation of the present grant were very positive, there does currently seem to be potential interest in the expanded areas. This has meant that more budget dollars is needed for Activity 1, Outcome 2. Along with that, there was $5,000 earmarked in Activity 1, Outcome 3 to hire RMB Laboratories to complete Lake Assessments for each of the targeted lakes. We have found that the assessment documents are already done and we did not need to contract with RMB to do this, and will not need the $5,000 of expense for this purpose. Due to the additional recruitment efforts and time spent on recruitment, along with not needing to contract with RMB Laboratories, we are requesting a shift of the $5,000 from Activity 1, Outcome 3 to Activity 1, Outcome 2.
Amendment Approved: February 23, 2016.

Project Status as of July 1 2016: Considerable effort was put into recruiting participants in Otter Tail county, but we were unable to secure participants beyond the four identified in the January update. Template lake management plans were drafted by Freshwater Society for all participating groups. This April, 25 people representing four lake associations (Wall Lake, Big McDonald Lake, Lake Six, and Lake Lida) from Otter Tail County participated in the 2-day training in Pelican Rapids that covered the importance of planning, the resources available to help groups succeed in their plans, and preparation for the Community Visioning Sessions. The 2-day training was attended by representatives from the East Otter Tail Soil and Water Conservation District who shared about the county water plan as well as resources the SWCD provides. They also talked with attendees about their initial ideas and answered many technical questions. In June, three of the four Community Visioning Sessions took place and were facilitated by the Project Manager, and summaries of those sessions also prepared by the Project Manager were distributed to the appropriate groups. The project manager is now working with those three groups to draft the “Action Plan” components of their final Lake Management Plan. The fourth one (Big McDonald) has been delayed to August due to surgeries and other health needs of members of the group’s leadership team. However, the Project Manager did attend and present at the group’s annual meeting in June. With the exception of Big McDonald, which will likely be unable to complete the final draft of the Lake Management Plan by the deadline established in Activity II, all other groups are on track to complete their plans this summer.

Project Status as of January 1, 2017: All four groups have completed their Community Visioning Sessions. Following the sessions, the Project Manager analyzed the community input and provided a summary to each group from which the groups were able to draft action plans designed to help the groups implement their Lake Management Plans. This summer and fall, the Project Manager reviewed drafts of plans submitted and shared those with several others to verify applicability and completeness as well as provide comment or suggestions (more detail on who participated in review is provided under Activity 2). All four groups are at different stages in updating their first drafts, indicative of the varying level of existing capacity in each group. One is making final edits to the full plan, another about to receive feedback on the first draft of their action plan, and the other two on the spectrum in between. Despite their different levels of completeness, it is anticipated that all four will

complete the project in the set timeframe for this grant. In addition, all groups will have started implementing their action plans by the end of the grant period so as to ensure they receive the full match from West Central Initiative. Two of the groups have already been able to begin implementing at least one of their identified strategies, and the Project Manager will work with the other two to identify opportunities to begin implementation before the end of June.

Amendment Request 8/11/17: We have found that the time required to complete the project activities by the end of the grant timeline was more than anticipated. We also found that the amount of travel required was less than anticipated in the final year with the growing acceptance of remote collaboration. As such, we were able to complete the project and work with lake associations via phone and email rather than needing to travel. As a result, we are requesting a shift of $1,952 out of the travel line item to the personnel line item.

Overall Project Outcomes and Results:
Since 2000, more than 400 lake associations have participated in the Healthy Lakes and Rivers Partnership (HLRP) program founded by Don Hickman of the Initiative Foundation and now run by Freshwater Society. HLRP is a program designed to help lake associations across the state identify and work towards the priorities they have for their water body, one county at a time. The round of HLRP funded through LCCMR allowed for collaboration with Otter Tail Soil and Water Conservation District, with specific attention focused on helping to align lake plans with County Water Plans so that local efforts could help to achieve county water quality goals.

In the last year and a half, four lake associations from Otter Tail County participated in a 2-day training covering the importance of lake planning, engaged in a Freshwater Society-led participatory planning process to define lake-specific and community-identified goals and strategies, drafted and finalized a Lake Management Plan specific to their lake (copies included in report), and began implementing those plans. These groups now have in their hands documents which detail specific stresses, threats, and opportunities for their lakes generated by RMB Laboratories, a clear indication of the shared vision of the community, and a 2-5 year action plan with steps they identified to help them realize these goals. Additionally, each group understands the resources that are out there to help them along the way, and has received $5,000 of seed funds to get them started from West Central Initiative.

The four participatory planning sessions engaged a total of 184 lake residents from the county, and countless volunteer hours from the boards of the four lake associations to produce their own lake management plan for lakes representing hundreds of Minnesotans who have clear, community-identified goals and action plans to improve the health of their lakes.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Group selection and lake assessment procurement

Description: Working closely with the West Central Initiative and county partners in the program area, and utilizing the EPA's 2012 assessed watershed list as a reference, a list of associations will be identified for participation in the program. Through input from partners as well as subsequent contact and communications with members of the groups, each association's capacity for undertaking the lake management plan program will be assessed and a larger pool of candidates will be filtered down to a maximum of eight. In addition at this time, attention will be given to finding agricultural partners who would make good candidates for participation in the program, either as a representative to the group in the overall program or later in the community input process. Again, local partner knowledge of the community will be relied on here.

Once the participating groups have been selected, invited, and have accepted, lake assessments for each of the participating water bodies will be procured through RMB laboratories. RMB has already created many

assessments for lakes in the area that are being put to use by county partners. Where no assessment is available, RMB will be hired to complete one.

Summary Budget Information for Activity 1:

ENRTF Budget: $10,000
Amount Spent: $10,000
Balance: $0

Activity Completion Date: 12/1/15

Outcome	Completion Date	Budget
1. Utilize EPA's Assessed Watershed list and work with local partners to identify a list of targeted lakes	9/1/14	$ 1,500
2. Secure the participation of up to 8 participating groups that have the highest potential for completing the program and implementing projects and identify possible agricultural partners.	5/31/16	$8,500
3. Working with RMB Laboratories, secure a completed Lake Assessment or hire them to complete one for each of the targeted lakes	12/1/15	$0

Activity Status as of January 1, 2015: Targeted lakes were identified in partnership with the Ottertail SWCD office. Parameters for selection include lakes that had a minimum level of citizen interest and involvement, lakes with needs that fit within the local water plan and lakes identified through the EPA's Assessed Watershed list as being priority. The program was outlined at two public meetings held by the Ottertail SWCD and the Ottertail Coalition of Lake Associations to inform the public about the program and recruit participants. In addition, two news releases were written and published in the area newspaper, partnering with the West Central Initiative. An application for potential participants was developed by the Program Manager and made available at all meetings as well as online. Due to the large amount of lakes in the Ottertail County area and the benefits of working within one county, recruitment has so far focused on Ottertail County. While the number of participating groups is short of the targeted number of eight groups, follow up communications with potential groups has yielded three confirmed for participation in the program with more expected by the spring of 2015.

Activity Status as of July 1, 2015: The critical mass necessary to implement the full program (6-8 lake associations) through the recruitment efforts previously outlined did not result in the additional groups from Ottertail County that were sought during winter and spring of 2015. Because the initial assessment conducted prior to July 2014 that indicated that there would be sufficient interest within Ottertail did not yield the necessary results, the geographic scope of the program has been widened to include Becker County and conversations have begun with watershed organizations there. While this is somewhat concerning given the initial indications from outreach efforts done prior to implementation of the present grant were very positive, there does currently seem to be potential interest in the expanded areas.

Activity Status as of January 1, 2016: The final groups who signed on to the program were identified with assistance from East Otter Tail SWCD, Otter Tail County COLA, and RMB Laboratories. Lake Assessments for all four participating groups have been completed by RMB Laboratories. The assessments show that the lakes represented by the participating groups vary in their quality and issues, ranging from lakes of higher quality that need to be protected to lakes with serious internal loading and compounding issues.

Activity Status as of July 1 2016: The Project Manager continued efforts to try and recruit more lake associations. Despite many attempts and much effort to get more lake associations involved in the program, the Project Manager was not able to recruit any other participants by the time of the training.

Activity Status as of January 1, 2017: Activity 1 is complete. There was no further work in Activity 1 during this time period.

Final Report Summary: Recruitment for the Healthy Lakes and Rivers Partnership program targeted lakes in Otter Tail County based on the level of citizen interest and involvement in protecting the lake, the lake's needs and connection to the county water plan, and whether or not the lake was deemed a priority through the EPA's Assessed Watershed list. Outreach for recruitment was done in partnership with Otter Tail SWCD, RMB Laboratories, and West Central Initiative and included two public meetings, two news releases, and considerable personal outreach to local communities. This outreach resulted in four lake associations signing up for the program, representing Wall Lake, Lake Lida, Big McDonald Lake, and Lake Six. Lake Assessments for all four participating groups were been completed by RMB Laboratories. The assessments show that the lakes represented by the participating groups vary in their quality and issues, ranging from lakes of higher quality that need to be protected to lakes with serious internal loading and compounding issues.

ACTIVITY 2: Implement program for all participating groups

Description: Working with groups and local partners, a two-day training will be organized and held that focuses on citizen engagement, translating science into action and creating and implementing a lake management plan. Representatives from all relevant local and state agencies (county boards, MN DNR, U of M Extension etc.) will be invited to present on the work that they do. The focus of the training will be to ensure that the leadership group representing each water body has the important relevant information on their lake, knowledge of and access to resource experts in the area, and a framework for prioritizing action through building a formal lake management plan.

After the training, all groups will work closely with the project manager to organize and facilitate a community input session. This meeting will gather as many individuals as possible from around the community to participate in a two-hour session that provides an opportunity for everyone to contribute input to the plan and distills their ideas into 2-3 top priorities for action. As a result of this meeting, each group will choose at least one priority item for action based both on the information from the lake assessment and the feedback received through the community input session.

The project manager will provide ongoing support to each group to assist in consolidating information into a clear plan and implementing the top-most priority. At each of four project milestones, each group will receive $600 as it completes each those milestones, for a total of $2400. An additional $2,600 will be made available for the implementation of a priority that addresses the root cause of a water quality challenge, and not just a symptom (for example, shoreland restoration would be eligible because it reduces run-off, aquatic plant harvesting would not, because it is mainly done to improve recreation on a temporary basis). The project manager will work in tandem with a representative of West Central Initiative to determine which groups meet that criterion. **This $5,000 made available to each group is a match provided by the West Central initiative and not from the LCCMR grant.**

Summary Budget Information for Activity 2:

ENRTF Budget: $49,000
Amount Spent: $49,000
Balance: $0

Activity Completion Date: 6/15/17

Outcome	Completion Date	Budget
1. Organize training logistics and prepare all necessary materials	1/15/16	$10,000
2. Using the Lake Assessments as the focus, conduct two days of leadership training for all lake associations, including citizen engagement, translating science into action and creating and implementing a Lake Management Plan	3/15/16	$10,022
3. Facilitate a visioning community meeting for each association to identify concerns, opportunities, assets, priorities and project timelines	6/15/16	$15,189

4. All groups complete a first draft of their lake management plan	9/16/16	$4,974
5. All groups have started implementation of one priority item	6/15/17	$8,815

Activity Status as of January 1, 2015: This activity has not yet begun.

Activity Status as of July 1, 2015: This activity has not yet begun.

Activity Status as of January 1, 2016: With the necessary number of lake groups secured, planning for the 2-day training in Otter Tail County began in December of 2015, and is on track to be fully organized by the 1/15/16 completion date. Given the schedules of the participating groups, and when lake group leadership is expected to be available in Otter Tail County, the trainings will take place later in the spring that March 15. However, both the two-day training and community visioning session will be completed by or around June 15.

Activity Status as of July 1, 2016: In coordination with Don Hickman of the Initiative Foundation, the project manager organized logistics and prepared all necessary materials—including tailored template management plans for each group—for the two-day training, which was held April 7-8 in Pelican Rapids and was co-facilitated by Don Hickman. Following the training, the project manager coordinated with groups to schedule and promote their Community Visioning Sessions. Lake Six held their session June 3 with 43 in attendance; Lake Lida on June 10 with 42; and Wall Lake on June 11 with 49. The Project Manager facilitated each of those sessions, transcribed the input given, analyzed it, and prepared summaries that were shared with each group to use in crafting the action plans within their management plan. The Project Manager has already begun reviewing drafts of components of the plans, and these three groups are expected to finish in the given timeframe. The Project Manager is currently coordinating with the leadership of Big McDonald to plan for their Community Visioning Session scheduled August 13, and this group is not expected to meet the September 16 deadline. However, they are expected to finish before the end of the LCCMR grant.

Activity Status as of January 1, 2017: All four groups have now completed the Community Visioning sessions, and the Project Manager has received first drafts of all the action plan components of all four lake management plans. Prior to the August 13 session with Big McDonald Lake Improvement District, the Project Manager held in-person office hours with the other three groups to supplement the otherwise electronic and over-the-phone communication. Drafts or any information pulled together by that time was reviewed, as was the remainder of the project timeline. Drafts were also shared with Don Hickman of the Initiative Foundation, the East Otter Tail Soil and Water Conservation District, and other relevant professional staff to ensure that best practices were being followed and that the plans developed by the groups were in line with the County Water Plan. Delivery of drafts to the Project Manager was delayed from a couple of groups, which has delayed the return of their plans with edits and comments. At this time, two of the groups have received responses on their drafts, and the other two will be receiving those comments in the first quarter of 2017. All groups are still expected to be on time in completing their Lake Management Plans by the end of the grant period. The two groups who have already submitted drafts and received comments back have also already begun implementation of their plans based on high local interest and momentum. The Project Manager plans to work with the other two groups to identify projects to prioritize for implementation this spring and early summer in order to remain compliant with funding guidelines for the in-kind match from West Central Initiative.

Summary of the meetings and issues identified for each in the first drafts:

- **Lake Six:** The community visioning session was held on Friday June 3rd at Lake Five Resort just outside of Frazee. 43 were in attendance, and represented a mix of lakeshore homeowners (40% of whom consider themselves year-round residents), DNR staff, and SWCD staff, and homeowners from in the lakeshed and other nearby lakesheds. Their main goals at this time are:
    - Shoreline Stabilization
    - Strong Lake Association
    - Water Quality and Clarity

    - Aquatic weed management
    - Aquatic invasive species
    - Public Access and Use of Lake
    - Wildlife Habitat and Preservation of Natural Spaces
- **Lake Lida**: The community visioning session was help on Friday, June 10th at Lida Greens Golf Course in Pelican Rapids. 42 were in attendance, and represented a mix of lakeshore and lakeshed homeowners and SWCD staff. Their main goals at this time are:
    - Improve water quality of North and South Lida Lakes through education, decrease of runoff, wetland restorations, compliant ISTS, and more visible vegetation along the shoreline.
    - Enhance sense of community among property owners within the lakeshed of North and South Lida Lakes. Increase engagement of property owners in Association and implementation of this Plan.
    - Educate lake property owners and general public regarding recreational use of lake/rules and regulations, and investigate pros and cons of advocating to change the slot limit and viability of implementing change.
- **Wall Lake:** The community visioning session was held at Elks Point in Fergus Falls on Saturday, June 11. 49 were in attendance and largely represented homeowners and the sporting clubs as well as staff from EOTSWCD. Their main goals at this time are:
    - To preserve and protect the water quality of Wall Lake for current and future generations
    - To promote and educate Wall Lake users (residents and visitors) with water and boating safety on the lake
    - To preserve and protect the wildlife for all to enjoy for current and future generations
    - Work towards a membership goal of at least 75% of residents and active involvement within the lake association.
- **Big McDonald Lake:** The community visioning session was held at the Community Center in Dent on August 13. Around 50 participated from the community, including many on the lake as well as in the lakeshed and a few business owners. Their main goals at this time are:
    - To preserve and protect the water quality of Big McDonald Lake and its aquatic ecosystem for current and future generations.
    - To promote appropriate or safe recreational activities on or around Big McDonald Lake.

Final Report Summary: All four groups completed their Lake Management Plans and have begun implementation of at least one of the action strategies. All have received their $5,000 in seed funds from West Central Initiative as well, which required that they initiated one of the action strategies and shared their final plan with East Otter Tail Soil and Water Conservation District. Since the total number of groups was half of the available capacity, the Project Manager was able to spend more individualized time with each group and provide much more detailed support and guidance in responding to multiple draft iterations and helping to finish the plans. Additionally, since all groups were behind on the project timeline, more work was needed in the final grant reporting period to get all groups to the point of being able to submit final plans by the close of the grant period.

V. DISSEMINATION:

Description: Upon approval of each participating group's final lake management plan by the project manager and local partner, copies will be distributed to all interested entities (lake association members, county managers, extension personnel etc.)

As groups implement a priority lake management action item, status of the projects will be featured in Freshwater Society's electronic communications and local partners will be encouraged to do the same.

Status as of January 1, 2015: This activity has not yet begun.

Status as of July 1, 2015: This activity has not yet begun.

Status as of January 1, 2016: This activity has not yet begun.

Status as of July 1 2016: This activity has not yet begun.

Status as of January 1, 2017: While the plans are not final, drafts of what the groups have completed to date have been given to several for review. This includes Don Hickman of the Initiative Foundation (relying on his countless years of experience working with lake groups to make sure that goals are realistic and that groups have all the resources they need to be successful, as well as the connection to the West Central Initiative Foundation for funding of lake groups at completion of the plan), East Otter Tail SWCD staff (for their technical expertise and possibility of resource provision, as well as to ensure that the plans are lining up with the County Water Plan), and Steve Woods of Freshwater Society (for quality control and suggestions, based on his extensive experience in writing water plans and unique knowledge of SWCDs).

Final Report Summary: As a requirement for the final distribution of funds from West Central Initiative, all groups needed to send their final Lake Management Plans to East Otter Tail Soil and Water Conservation District. The groups are also planning to distribute the final versions to their member residents and local elected officials in one way or another. This may include a mailing of a portion of the plan, loading the final copy to the website, or providing a small supply to volunteer leaders within the association. Additionally, the Project Manager sent final plans to West Central Initiative so they could see how the funding was going to be used. Freshwater Society will also keep copies of the plan on file to be given to other interested persons upon request.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Explanation
Personnel:	~~$43,265~~ $45,051	1 project Manager at .2 FTE for 3 years Management, training, facilitation, plan review and BMP implementation assistance.
Professional/Technical/Service Contracts:	$9,500	1 contract with the Initiative Foundation for training and management support and management plan review.
Equipment/Tools/Supplies:	$ 400	CD ROMs, training workbooks, , name tags, pens, flip chart paper and markers
Printing:	$ 1,200	Lake management plan drafts and final copies
Travel Expenses in MN:	~~$ 4,635~~ $ 2,849	Mileage, Lodging and meals
TOTAL ENRTF BUDGET:	**$ 59,000**	

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than $5,000: N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 0.6 FTE

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 0.04 FTE

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
West Central Initiative (Cash support)	$ 40,000	$0	Lake project implementation
Lake Association match	$ 40,000	$0	Lake project implementation; cash and in-kind support
Freshwater Society (In kind support)	$ 5,440	$0	Additional project management and communications
West Central Initiative (In kind support)	$ 5,600	$0	Meeting space, project support
RMB Laboratories (In kind support)	$ 960	$0	Consulting an existing lake assessments
TOTAL OTHER FUNDS:	**$ 92,000**	**$**	

VII. PROJECT STRATEGY:

A. Project Partners:

Project Partners Not Receiving Funds:

- Lake Associations: Providing volunteer support and matching funds for lake project implementation.
- West Central Initiative: Providing $40,000 in matching funds for lake project implementation and $5,600 for in-kind support.

Project Partners Receiving Funds:

- Initiative Foundation: $9500 for training, management support and lake management plan review.
- RMB Laboratories: $5,000 for new lake assessments.

B. Project Impact and Long-term Strategy: These citizens groups represent an additional and often untapped asset for agencies and organizations responsible for managing water resources. The strengthened partnerships that this program creates, along with the on-the-ground-projects that are leveraged through funding from our partner at West Central Initiative, increase water quality protection and build community capacity to implement additional protections.

Specifically, by helping to create or further develop mutually beneficial relationships between citizen organizations and the local officials who oversee water resource management, both groups get access to resources that they might not otherwise have had access to. Citzens get the resource expertise along with an elevated credibility with local government and agencies, and those same local officials get access to volunteer efforts that help them accomplish objectives that limited resources might have other wise put out of their reach.

Through strategic targeting of groups, it is also possible to build a larger unified effort through several groups working together on common interests, as through a COLA, or Coalition of Lake Associations. This brings a more unified constituency to local officials and helps more efficiently leverage resources, including funding.

C. Spending History:

Funding Source	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13	M.L. 2013 or FY14
Freshwater Society (In-kind)					$4,080

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. VISUAL ELEMENT or MAP(S): See attached word cloud

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than January 1, 2015; July 1, 2015; January 1, 2016; July 1, 2016; and January 1, 2017. A final report and associated products will be submitted between June 30 and August 15, 2017.

Environment and Natural Resources Trust Fund
M.L. 2014 Project Budget
Project Title: Reducing Lake Quality Impairents Through Citizen Action
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 03k
Project Manager: Jen Kader
Organization: Freshwater Society
M.L. 2014 ENRTF Appropriation: $59,000
Project Length and Completion Date: 3 Years, June 30 2017
Date of Report: August 11, 2017

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Revised Activity 1 Budget 1/28/16	Amount Spent	Activity 1 Balance	Activity 2 Budget	Revised Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	**Group selection and lake assessment procurement**			**Implement program for all participating groups**					
Personnel (Wages and Benefits)									
Jen Kader, Project Manager, 14% benefits 86% salary .2 FTE for 3 years	$8,500	$8,500	$0	~~$34,599~~	$36,551	$36,551	$0	$45,051	$0
Professional/Technical/Service Contracts									
Initiative Foundation. Consultant, Don Hickman. Training, management support and lake management plan review.				$9,500	$9,500	$9,500	$0	$9,500	$0
RMB Environmental Laboratories, Inc.: Lake assesment documents	$0	$0	$0					$0	$0
Equipment/Tools/Supplies									
CD ROMs, name tags, pens, flip chart paper and markers				$400	$400	$400	$0	$400	$0
Printing									
training workbooks, lake management plan drafts and final copies,				$1,200	$1,200	$1,200	$0	$1,200	$0
Travel expenses in Minnesota									
Mileage, lodging, meals for travel to and between participating groups	$1,500	$1,500	$0	~~$3,301~~	$1,349	$1,349	$0	$2,849	$0
COLUMN TOTAL	**$10,000**	**$10,000**	**$0**	**$49,000**	**$49,000**	**$49,000**	**$0**	**$59,000**	**$0**


recreational
wall
fergus
vegetation
implementation
wetland
aquatic
represented
viability
lakeshore
education
compliant
community
lake
generations
water
wildlife
greens
shoreline
including
membership
year
big
goals
enhance
boating
sporting
pros
dnr
weed
visitors
swcd
preservation
lida
quality
educate
engagement
access
involvement
management
lakesheds
attendance
ists
safe
residents
session
homeowners
plan
june
active
center
ecosystem
users
lakes
sense
preserve
rapids
elks
investigate
current
change
south
regulations
improve
participated
species
goal
invasive
slot
held
point
staff
lakeshed
frazee
public
golf
spaces
dent
falls
increase
friday
mix
clubs
business
cons
visible
north
clarity
promote
round
main
time
nearby
august
enjoy
largely
visioning
saturday
mcdonald
association
owners
work
future
property
restorations
pelican
natural
eotswcd
safety
limit
decrease
activities
resort
protect
runoff
habitat
rules
advocating
stabilization
implementing
strong

Lake Management Plan

For

Big McDonald Lake

Restoration of a Buffer Zone Using Native Plants

Photo by the Minnesota DNR

Big McDonald Lake Improvement District 2017

TABLE OF CONTENTS

Section 1: Overview

Aerial Photo of Big McDonald Lake Taken by Rob Campbell with his Drone

A. Letter from BMLID President regarding the Lake Management Planning Process

In late 2015, the Big McDonald Lake Association was invited to participate in the Initiative Foundation's Healthy Lakes and Rivers Partnership Program along with three other lake associations in Otter Tail County. Under the coordination of Jen Kader of the Freshwater Society, with strong support from Darrin Newman of East Otter Tail Soil and Water Conservation District, representatives attended a day of training on lake ecology, strategic planning, and communications.

Representatives of many state and local agencies, as well as nonprofit organizations, attended the training sessions in order to offer their assistance to each group in developing their strategic Lake Management Plans. The Big McDonald Lake Association was represented at the Healthy Lakes and Rivers Partnership training sessions by Craig Johnson and Tim Spiess.

Following the training sessions, each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Big McDonald Lake Association held this planning session on August 13, 2016, facilitated by Jen Kader. Approximately 50 people were in attendance, with about 15% of the participants describing themselves as year-round residents. Details of the public input received at this session are provided within this plan.

This document is intended to create a record of historic and existing conditions and influences on Big McDonald Lake and to identify the goals of the surrounding community. Ultimately it is meant to help prioritize goals and guide citizen action and engagement in the priority action areas. While state agencies and local units of government have a vital role and responsibility in managing surface waters and other natural resources, this Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

This Lake Management Plan is also intended to be a "living document," updated as new or better information becomes available. As we accomplish our goals or discover that alternative strategies are needed, it is our intent to update this plan so that it continues to serve as a useful guide to future leaders.

In discussing lake management issues it is impossible to avoid all scientific or technical terms. We have tried to express our goals, measures of success, and other themes as simply and clearly as possible, but we have included a glossary of common limnological terms at the end of the plan to assist the reader. Limnology is the state of lake conditions and behavior.

Finally, we would like to thank the Legislative-Citizen Commission on Minnesota Resources who, through the Environment and Natural Resources Trust Fund, made this round of the program possible.

Donald Beck

Chairman of the Big McDonald Lake Improvement District (BMLID)

B. Plan Structure

The purpose of this Lake Management Plan is to provide an agreed upon set of strategies and actions BMLID can take to address issues relating to Big McDonald Lake, and secure its future as an amenity for the community. The plan, included in full detail in the following section, is broken out into several areas. These sections are explained below.

Section 1: Overview

This section, which you are currently in, is designed to be a stand-alone plan, laying out the overarching issues Big McDonald Lake and the BMLID face, what are the implications of these issues for the lake and group, and what the next steps are. The details as they relate to each section are included in full detail in the next section, but the summaries in Section 1 can be referenced by the group, shared with decision-makers, and be used as a readily-understandable guide to inform the work of BMLID and against which progress can be measured.

Section 2: Plan Detail

This is the longest section of the plan, detailing the following:

- History of the BMLID;
- RMB Environmental Laboratories' Report of the lake, including in-lake and lakeshed characteristics;
- Maps and other data reflecting the historical, existing, and projected (as applicable) conditions for the following focus areas:
    - Aquatic Vegetation;
    - Wildlife;
    - Exotic Species;
    - Land Use and Zoning;
    - Public Water Access; and
    - Organizational Development and Communication;
- Notes from the Community Visioning Process;
- Detailed Action Plans, laying out individual steps as well as overarching goals, and identifying key players both in and outside the BMLID that will be relied on to complete the actions;
- Approach for revisiting and refreshing the plan, so that it may be a living document that adapts and evolves over time as issues and knowledge of solutions change.

While Section 1 will include summaries of all of this information, the data and information from Section 2 is needed to provide clarification and further information when called for by partners, members, decision-makers, or others, especially as time passes.

Section 3: Appendix

This section contains a glossary of terms, list of common biological or chemical abbreviations, guide to common acronyms, and supporting documents.

C. Executive Summary

Introduction

Big McDonald Lake is located in Otter Tail County near Dent, MN. The initial organization that oversaw lake issues was the Big McDonald Lake Association. It was established by Keith and Lynne Brokke in 1996 for the purposes of lake management.

The Big McDonald Lake Association was comprised of 120 lakeshore property owners (dues were $30/year). Events organized included an annual summer get together, fish stocking, water testing through COLA, and 4th of July boat parade.

The association transitioned to the Big McDonald Lake Improvement District (BMLID)under the direction of the then lake association president Roger Fenstad. The BMLID was officially established under Minnesota Statute 103B.501, approved by the Board of Otter Tail County Commissioners, and adopted on November 6, 2012. Currently the BMLID is organized as a taxing entity and has over 140 lakeshore property owners with an annual budget of $18,000 in 2017. We believe that we have put together a lake management plan that can be implemented and actively managed by all lake residents to conserve the lake resource for future generations.

Section 2: Plan Detail

A. History and Purpose of Big McDonald Lake Association and The Big McDonald Lake Improvement District

Big McDonald Lake Association

Keith Brokke was approached by Big Pine Lake and Paul Lake Association presidents to attend a COLA meeting in April 1996. At the meeting he learned that Big McDonald residents needed to form a lake association to qualify for annual water testing through COLA. Keith and his wife, Lynne, sent flyers to residents on Big McDonald and had a preliminary meeting at their home on Memorial Day 1996 to discuss the benefits of lake monitoring and to establish a lake association.

The first year the Big McDonald Lake Association meeting was held on a late afternoon. The association found that very few people wanted to attend a late afternoon meeting. Since then meetings were held at 9:00 am, giving door prizes along with coffee and pastries, which attracted people to the Big McDonald Lake Association meetings. Average attendance now is approximately 50% of lakeshore property owners.

Representatives from East Otter Tail Soil & Water Conservation District (EOT-SWCD), MN DNR, MN Fisheries, Otter Tail County Sheriff's Department, Perham Ambulance, Fresh Water Society, and others have spoken at Big McDonald Lake Association meetings.

The Big McDonald Lake Association was successful in bringing residents together to discuss community issues and to socialize once a year for 20 years. The Big McDonald Lake Improvement District (BMLID) was the next necessary step forward to address emerging lake issues. The BMLID gives the group taxing authority, which can provide financial resources to address needs as they arise.

The Bylaws for the Big McDonald Lake Association are as follows:

BYLAWS of Big McDonald Lake Association

ARTICLE I: NAME

Section I: The name of this organization shall be the **Big McDonald Lake Association.**

ARTICLE II: PURPOSE

Section I: The Association shall monitor and promote the maintenance and protection of the environment, economic and recreational properties of Big McDonald Lake and vicinity.

Section II: The Association shall work in conjunction with federal, state and local agencies, public and private, to maintain the quality of the lake.

Section III: The Association shall develop a program for the promotion of stocking Big McDonald Lake.

Section IV: The Association shall provide educational resources relating to the protection and quality of Big McDonald Lake area and its wildlife.

Section V: The Association shall inform the general membership of civil concerns relating to the purposes of the Association.

Section VI: The Association shall be a nonprofit, non-stock organization.

ARTICLE III: MEMBERSHIP

Section I: Membership shall be open to all interested parties who own property on, or a back lot to, Big McDonald Lake and who share a concern for the purposes of the Association.

Section II: Associate Membership shall be open to any interested parties who share a concern for the purposes of the Association; however, voting privileges will not be extended to Associate Members. Dues for Associate Members will be the same as for the general membership.

ARTICLE IV: DUES

Section I: Initial membership fee shall be $10 for general membership.

Section II: Annual dues shall be $20 for general membership. Annual dues shall be payable no later than July 31st of the current fiscal year to remain a voting member in good standing with the Association.

ARTICLE V: OFFICERS

Section I: The officers of the Association shall be President, Vice President, Secretary and Treasurer. There will also be 9 Directors from various areas around the lake with one Director appointed "At Large."

Section II: The immediate Past President shall serve on the Board of Directors as a voting member and to advise the Board for one year after his/her term as President expires.

Section III: Duties:

A: The President shall preside at all annual, board and special meetings of the Association and shall represent the Association at all official functions.

B. The Vice President shall, in the absence of the President, fulfill the duties of the President. Further, the Vice President shall fulfill other duties as designated by the President, the Board, or the general membership.

C. The Secretary shall record and maintain the minutes of all annual, board, and special meetings of the Association and shall manage all routine correspondence of the Association.

D. The Treasurer shall maintain all revenues of the Association and shall dispense expenditures as designated by the Board or the general membership.

1) The Treasurer shall be bonded at the expense of the Association (only if deemed necessary).

2) The Treasurer shall present a yearly report of income and expenditures at the annual meeting of the Association.

E. Board members shall fulfill all duties as directed by the President, Board of Directors, or the general membership.

Section IV: Term of Office:

A: Officers (President, Vice President, Secretary and Treasurer) shall serve a term of two years and shall be elected at the annual meeting by a simple majority.

B. Directors shall serve a three-year term and shall be elected at the annual meeting by a simple majority or may be appointed by the President.

C. An individual may not serve more than two consecutive terms in the same office.

D. The terms of Officers will be staggered so that every other year, one-half of the Officers will be replaced or re-elected to a second term.

E. The terms of Directors will be staggered so that 3 of the 9 Directors are replaced or re-elected each year.

ARTICLE VI: MEETINGS

Section I: The Association general membership shall meet annually on the second Saturday in June. The actual date and location will be posted by Directors for the area they represent.

Section II: The Board of Directors shall meet at least two weeks prior to the annual meeting to set the agenda for the annual meeting. The Board will meet again in the fall each year.

Section III: Special meetings may be called at the discretion of the Board of Directors or the request of the general membership.

ARTICLE VII: ADDRESS

Section I: The Association shall maintain a post office box in Dent, MN 56528.

ARTICLE VIII: VOTING AND QUORUM

Section I: Each paid membership is entitled to one (1) vote.

Section II: Proxy votes, in writing or preauthorized, shall be allowed.

Section III: A quorum shall consist of twenty-five percent (25%) of the general membership in attendance and voting, including allowable proxy votes.

Section IV: For the purposes of Board meetings, a quorum shall consist of seven (7) of the thirteen (13) Board members in attendance and voting, including allowable proxy votes.

ARTICLE IX: PARLIAMENTARY PROCEDURE

Section I: All meetings of the Association and the Board of Directors shall be conducted with *Robert's Rules of Order*, unless otherwise specified by these bylaws.

ARTICLE X: SUSPENSION OF THE BYLAWS

Section I: These bylaws may be suspended by a two-thirds vote of the majority of the general membership and two-thirds of the Board of Directors, present and voting for emergency situations only.

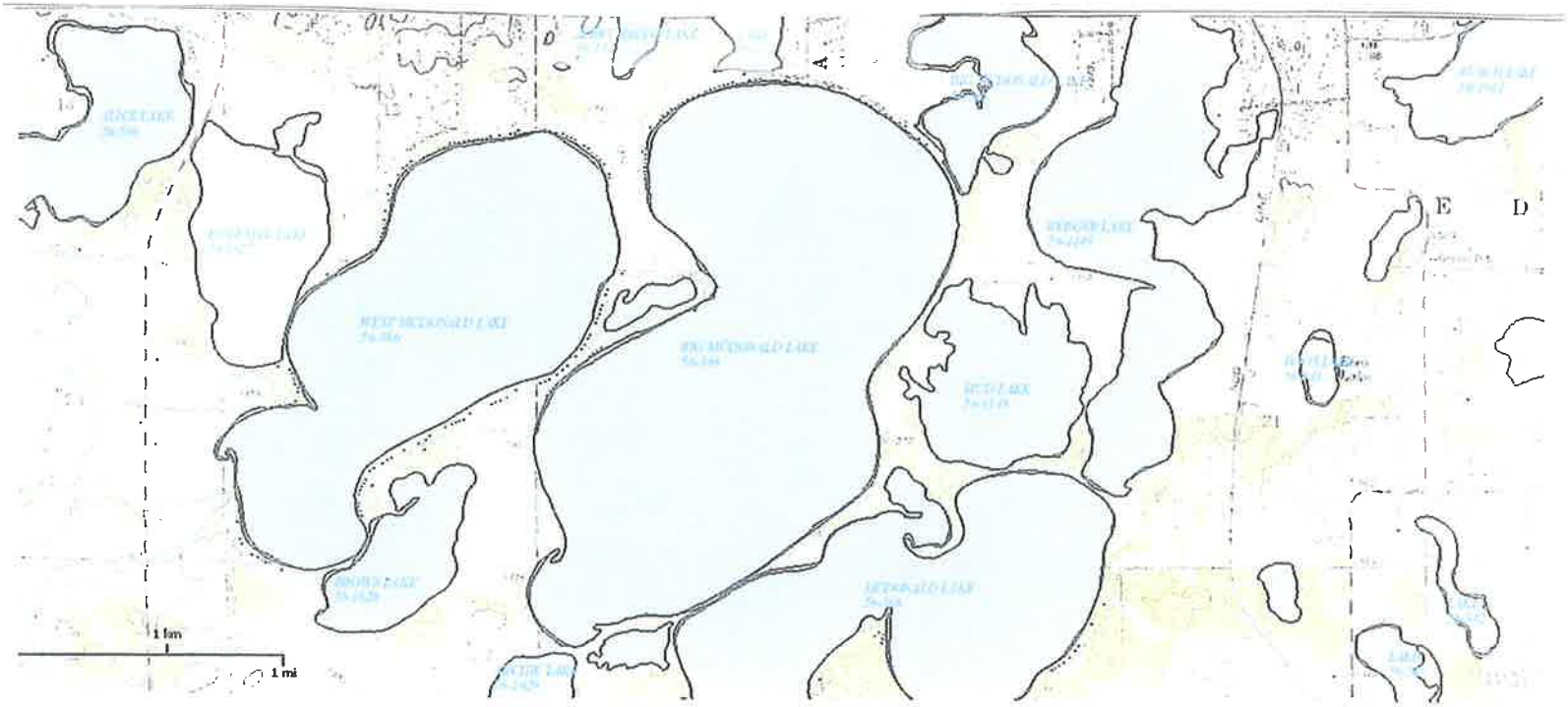
The Big McDonald Lake Association, at the time of this Lake Management Plan, is no longer active. Its purposes and responsibilities were assumed by the Big McDonald Lake Improvement District (BMLID) when it was established in 2012.

Big McDonald Lake Improvement District (BMLID)

The BMLID was discussed for several years. At the request of a large majority of the property owners of Big McDonald Lake, the Otter Tail County Board of County Commissioners established the BMLID on November 6, 2012. The BMLID is a nonprofit organization subject to county, state, and federal laws.

The first BMLID Board of Directors was appointed by the Otter Tail County Commission in July 2013. On July 14, 2013, the Board had its first organizational meeting. The first annual meeting for the BMLID was held on Saturday, August 10, 2013. At that meeting the by-laws were approved along with the first budget. A copy of the by-laws is attached.

The purpose of the BMLID is to protect and preserve the lake, and to increase and enhance the use and enjoyment of the lake. It is in the public interest that a lake improvement program is established to preserve the natural character of the lake and the shoreland environment, fish and wildlife populations, and where feasible and practical, to improve the quality of the water in the lake, to help maintain a reasonable water level in the lake, and to help protect the lake from detrimental effects of human activities and certain natural processes. The BMLID represents 100% of the shoreland around the lake.



GIS Map of Big McDonald Lake and Immediate Environs with Shoreline Highlighted by Otter Tail County

BYLAWS of the Big McDonald Lake Improvement District

ARTICLE 1: ESTABLISHMENT

Establishment under Minnesota Statute Section 103B.501 by the Ottertail County Board of County Commissioners Resolution No. 2012-47 and its order establishing the Ottertail County Big McDonald Lake Improvement District, adopted November 6, 2012, and filed with the Minnesota Office of the Secretary of State, Minnesota Pollution Control Agency, and the Minnesota Department of Natural Resources.

ARTICLE 2: NAME OF DISTRICT

The name of the organization is Big McDonald Lake Improvement District, herein after referred to as the BMLID.

ARTICLE 3: DEFINITION OF THE BIG MCDONALD LAKE IMPROVEMENT DISTRICT (BMLID)

The BMLID is a nonprofit organization subject to county, state, and federal laws.

ARTICLE 4: PURPOSE

The purpose of the BMLID is to protect and preserve the lake, and to increase and enhance the use and enjoyment of the lake. It is in the public interest that a lake improvement program is established to preserve the natural character of the lake and the shore land environment, fish and wildlife populations, and, where feasible and practical, to improve the quality of water in the lake, to help maintain a reasonable water level in the lake, and to help protect the lake from detrimental effects of human activities and certain natural processes.

The following water-related land and resource management programs and services may be undertaken by the BMLID:

a. Develop and implement a comprehensive plan to improve water quality;

b. Apply for private and public grants or enter into contracts with federal or state agencies for the study and treatment of pollution problems and related programs;

c. Enter into contracts with private contractors for the above;

d. Undertake research to determine the condition and development of the body of water included within the LID and to transmit the studies to the DNR, MPCA and other interested authorities;

e. Make cooperative agreements with federal, state, county or city to effectuate water and related land resource programs;

f. Conduct programs of water improvement and conservation;

g. Serve as local sponsor for state and federal projects or grants;

h. Regulate water surface elevation as deemed necessary and reasonable;

i. Implement a water monitoring system; or

j. Such other programs, studies, developments or implementations as are allowed or permitted by law and approved by the County Board from time to time.

ARTICLE 5: MEMBERSHIP

Section 1. Membership Qualification

Owners of properties located within boundaries stated below are members. The boundaries of the LID shall include parcels that have lake frontage on Big McDonald Lake or otherwise have riparian rights, but shall exclude agricultural land.

Section 2. Voting Rights

Each owner of one or more parcels of real estate, regardless of size with lake frontage is a member entitled to one vote at the annual membership meeting or any special BMLID meetings, however only one vote is allowed if ownership is joint, or any other type of multiple ownership. If multiple parcels are owned the member is entitled to one single vote. "Owner" means all individual natural persons who are identified on the deed or other instrument of conveyance, and who have reached the age of majority.

Section 3. Votes

Votes at all membership meetings shall be cast in person.

Section 4. Transfer of Membership

When a parcel of land is sold, BMLID membership is transferred to the new owner. When a parcel is sold on contract for deed, membership is transferred from the contract seller to the contract purchaser. When a parcel is leased, membership shall remain with the landlord.

ARTICLE 6: FUNDING

Section 1. Initial Funding

The initial first year funding of the BMLID shall be raised by the Big McDonald Lake Association and any personal donations received.

Section 2. Subsequent Funding and Special Projects

A. BMLID activities may be funded by the levying of ad valorum tax solely on property within the district. No establishment or increase in the ad valorum property tax will be allowed if it affects the county levy subject to state-imposed levy limits.

B. BMLID activities may also be funded by imposition of service charges on users of BMLID services within the district (Minnesota Statutes Section 428A.05).

C. BMLID activities may also be funded by assessment of costs of projects upon the benefited property within the district in the manor provided under Chapter 429 of the Minnesota Statutes.

D. BMLID may also finance projects and services of the District by issuing obligations (Minnesota Statutes Section 429.091).

ARTICLE 7: BOARD OF DIRECTORS

Section 1. Initial Board of Directors

The initial board of directors shall be appointed by the Otter Tail County Commissioners. There shall be 7 members, 3 persons appointed to 3 year terms, 2 persons appointed to 2 year terms, and 2 persons appointed to 1 year terms.

Section 2. Terms

After their initial term expires, each board of director member may be elected to an additional three-year term. No director may serve more than 2 successive complete terms.

Section 3. Nominating Committee

The nominating committee shall consist of any retiring board members and the chairperson and vice chairperson. The slate of nominees shall be submitted to the Board one month prior to the annual membership meeting. Effort by the committee should be given to see that the 5 beaches of Big McDonald Lake have representation on the board, insofar as there are qualified members willing to serve.

Section 4. Election of Directors

Nominees shall be elected by majority vote of the members at the annual membership meeting. Property owners not present at the meeting may participate in the election by absentee ballot. If more than one person is nominated for any office, elections shall be by secret ballot. Nominees must be present at the annual meeting or submit a letter of acceptance to be accepted for office.

Section 6. Vacancies

Vacancies on the board of directors may be filled by a majority vote of the remaining Directors, subject to approval by majority vote at the next annual meeting. A director elected to fill a vacancy shall serve the unexpired term.

Section 7. Removal of Directors

Directors may be removed by a 5/7 vote of the remaining board members, or by a majority of the property owners at the annual meeting.

ARTICLE 8: BOARD OF DIRECTORS OFFICERS

Section 1. Officers

All officers of the BMLID shall be directors.

Section 2. Officer Positions

The officers shall consist of Chair, Vice Chair, and Secretary-Treasurer. These officers are the Executive Committee. The Executive Committee may meet from time to time without notice to other board members for planning purposes and to facilitate the activities of the board.

Section 3. Election of Officers

Officers shall be elected by the Board of Directors from their numbers at the first board meeting after the annual meeting at which new directors were elected. Elections will be by secret ballot if more than one person is nominated for any office.

Section 4. Duties of Officers

A. The Chair shall preside over all board meetings and the annual membership meeting.

B. The Vice Chair shall preside in the absence of the Chair.

C. The Secretary-Treasurer shall keep accurate records of all meetings, regularly submit minutes to the Board of Directors, present a financial statement at each meeting, and perform all other duties normally associated with his office. Two signatures shall be required on all BMLID checks.

ARTICLE 9: DIRECTORS' MEETINGS

Section 1. Meetings

Directors are to meet when necessary, in addition to the annual membership meeting and shall be scheduled by the Chair, or in the Chair's absence, by a majority of the remaining members of the Executive Committee. Special meetings may be called by the Chair, or Vice Chair as directed by the Chair, or by four members of the Board of Directors, that are required or necessary to carry out the activities of the board.

Section 2. Notice of Meetings

There shall be at least 10 days' notice in writing or email to each director for any regularly scheduled meeting. In case of special meetings, written or electronic notice shall be given to the directors not less than three days before meetings. In any case, any director may waive such notice by written or electronic notice to the Secretary.

Section 3. Quorum

A majority of the Board of Directors duly serving shall constitute the necessary quorum for the transaction of business.

ARTICLE 10: COMMITTEES

Section 1. Appointment and Records

The Chair, with the approval of a majority of the Board of Directors at any regular or special meeting, may create and appoint such additional committees as deemed necessary. The chair of each such committee, upon its organization, shall be designated by the appointing authority, and each such committee chair shall report to the Board of Directors their committee's progress.

Section 2. Funds

Should any committee require funds for the purpose of its work, the committee shall make a request to the Board of Directors in writing with a full statement of the funds required and the purpose for which such funds are to be expended. Upon request to the Board of Directors, the committee shall meet with the board at any regular or special meeting thereafter to review the request and secure approval of the same. No committee shall expend any funds without the approval of the Board of Directors of the BMLID. All funds secured by any formed committee shall be turned over to the Board of Directors. All disbursement of funds, for any committee, shall be disbursed by the Secretary-Treasurer only after such approval is given by the Board of Directors.

ARTICLE 11: ANNUAL MEETING

Section 1. Time

The annual meeting of the membership of the BMLID shall be held on the second Saturday in June, preferably coinciding with the annual meeting of the Big McDonald Lake Association, unless changed by vote at a previous annual meeting.

Section 2. Notice

The annual meeting shall be preceded by a minimum of at least 2 weeks published notice in the *Perham Focus* and by written notice mailed at least 10 days in advance of the meeting to all property owners in the BMLID as well as to the county board or joint county board or joint county authority , town boards, and statutory and home rule charter cities wholly or partially in the district, the Minnesota Pollution Control Agency, and Commissioner of Natural Resources; and if there is a project of the district having a cost of greater than $5,000, 30 days written notice shall be given to all property owners within the assessment district.

Section 3. Agenda

At the annual meeting, the members shall:

A. Elect one or more members to fill vacancies to the board of directors;

B. Approve a budget for the fiscal year;

C. Approve or disapprove projects by the district having a proposed cost in excess of $5,000;

D. Take up and consider other business that comes before them;

E. Approve taxes and assessments to satisfy budget requirements.

Section 4. Annual Report

Each year the Board of Directors shall prepare and file a report of the financial condition of the district, status of all projects in the district, the business transacted by the district, other matters affecting the interest of the district, and discussion of the directors' intentions for the succeeding years. Copies of the report shall be transmitted to the county board or joint county authority, town boards and city councils of statutory and home rule charter cities wholly or partially within the district, the Commissioner of Natural Resources and the Minnesota Pollution Control Agency within four months after the annual meeting.

ARTICLE 12: SPECIAL MEETINGS

Special meetings of the BMLID may be called to discuss pending matters with the same notice required for the annual meeting, with the exception of written notice to property owners being two weeks.

ARTICLE 13: FISCAL YEAR

The district fiscal year shall be the calendar year starting January 1 and ending December 31.

ARTICLE 14: EXPENDITURE OF BMLID FUNDS

Section 1. Approval

All projects and expenditures must be submitted to the Board of Directors. All expenditures must be approved by a majority vote of the Board of Directors.

Section 2. Projects in Excess of $5,000

All projects in excess of $5,000 must be approved first by the Board of Directors, and secondly, by a majority vote of the membership at the district's annual meeting or a special meeting of the district.

Section 3. Audit

There shall be an independent audit of the financial records, submitted to the Chair, prior to the annual district meeting.

ARTICLE 15: AMENDMENT OF BYLAWS

These bylaws may be amended at any annual or special meeting for which due notice has been given and when such amendment has been approved by a majority of the Board and by a majority vote of the members at any annual or special meeting.

ARTICLE 16: RULES OF ORDER

The rules contained in the current edition of *Robert's Rules of Order* shall govern the convention in all cases to which they are applicable and which are not governed by the bylaws of the BMLID.

B. Hydrology and Geology

Location Data

MN Lake ID:	56-0386
County:	Otter Tail
Eco Region:	North Central Hardwood Forests
Major Drainage Basin:	Red River Basin
Latitude / Longitude:	46.579, -95.767
Invasive Species:	None as of 2013

Physical Characteristics

Surface area (acres):	992
Littoral area (acres):	368
% Littoral area:	37
Max depth (ft), (m):	46, 14
Inlets:	0
Outlets:	0
Public Accesses:	1

Lake Map

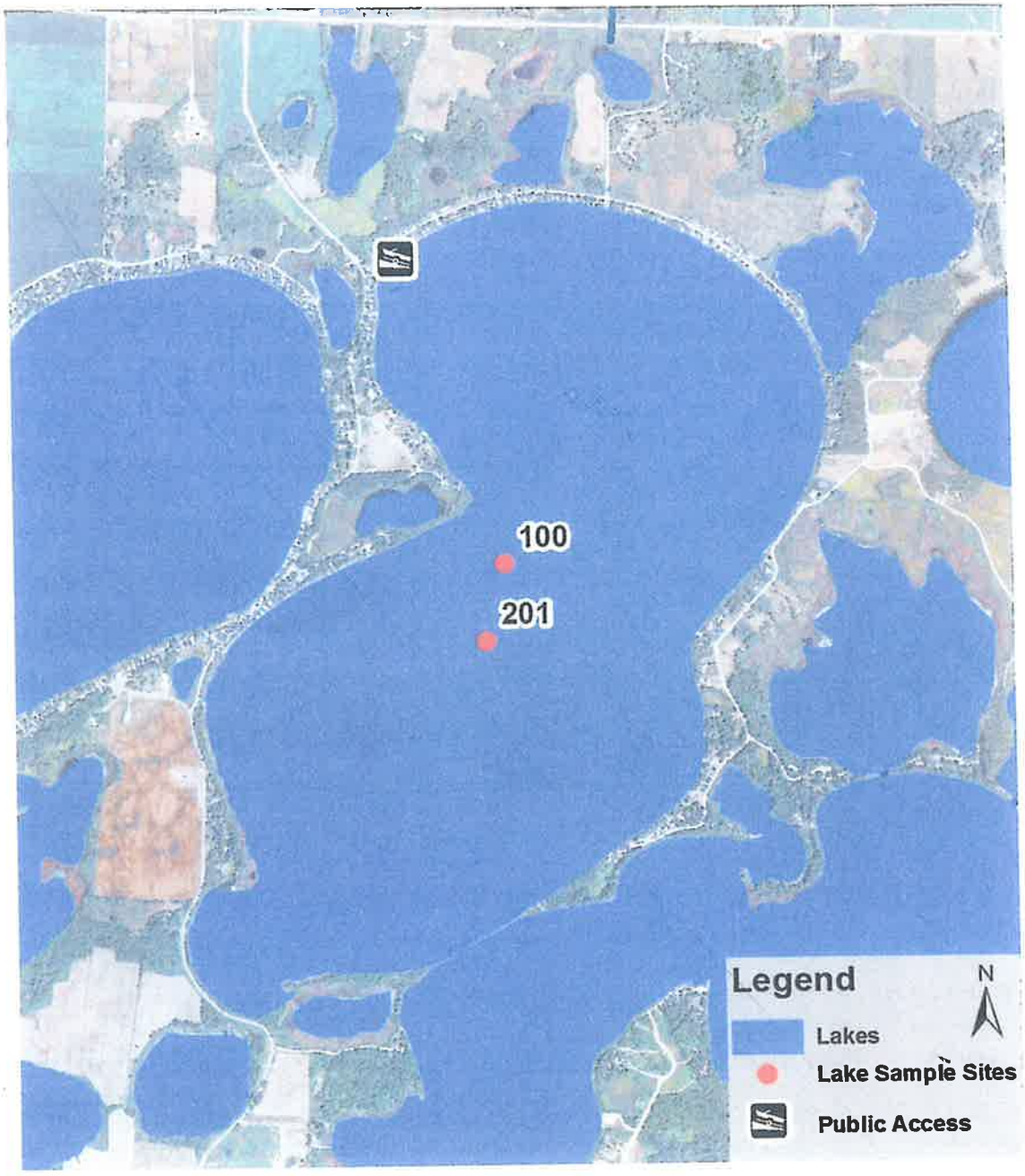


Figure 1. Map of Big McDonald Lake with 2010 aerial imagery, sample site locations, inlets and outlets, and public access points. There is no bathymetry data available electronically for this lake.

C. Historical and Existing Conditions

1. RMB Environmental Laboratories' Report

Water Quality Characteristics - Historical Means and Ranges

Table 4. Water quality means and ranges for primary sites.

Parameters	Primary Site 201
Total Phosphorus Mean (ug/L):	**14.6**
Total Phosphorus Min:	5.0
Total Phosphorus Max:	37.0
Number of Observations:	121
Chlorophyll *a* Mean (ug/L):	**4**
Chlorophyll-a Min:	1
Chlorophyll-a Max:	11
Number of Observations:	122
Secchi Depth Mean (ft):	**16.4**
Secchi Depth Min:	9.0
Secchi Depth Max:	38.0
Number of Observations:	116

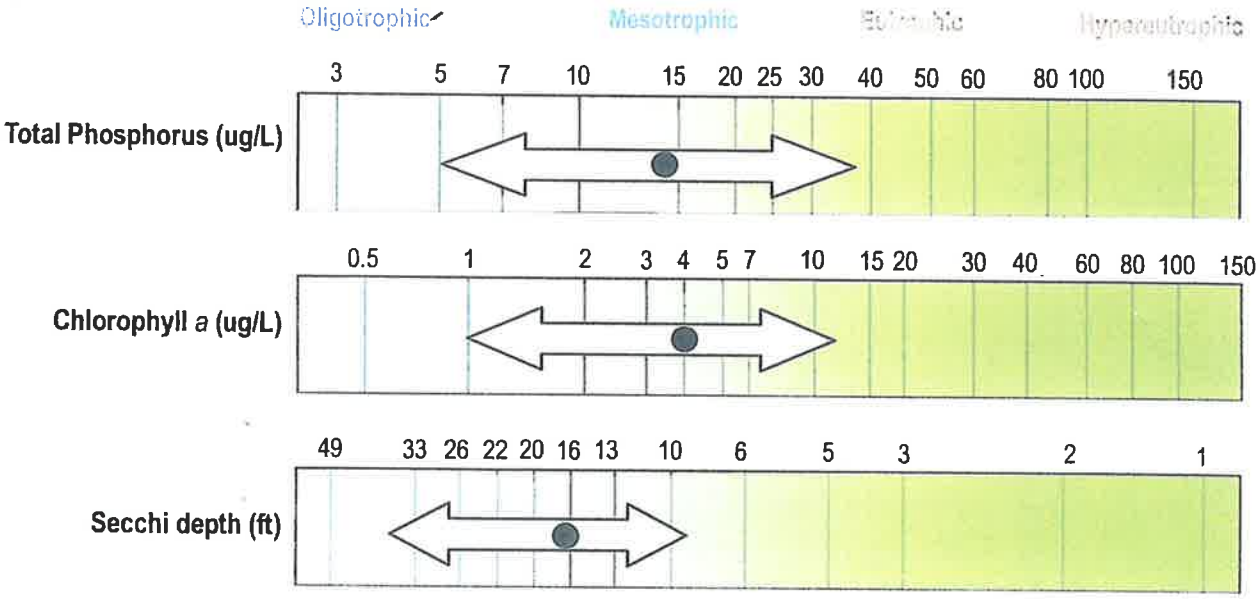


Figure 2. Big McDonald Lake total phosphorus, chlorophyll a and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 201). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, so they are only able to grow in areas of lakes where the sun penetrates. Water transparency depends on the amount of particles in the water. An increase in particulates results in a decrease in transparency. The transparency varies year to year due to changes in weather, precipitation, lake use, flooding, temperature, lake levels, etc.

The annual mean transparency in Big McDonald Lake ranges from 13.2 to 20.4 feet (Figure 3). The transparency at site 201 appears to be relatively consistent with an average Secchi reading of 16.4 feet between 1991 and 1996- 2012. Transparency monitoring should be continued every year at site 201 in order to track future changes in water quality.

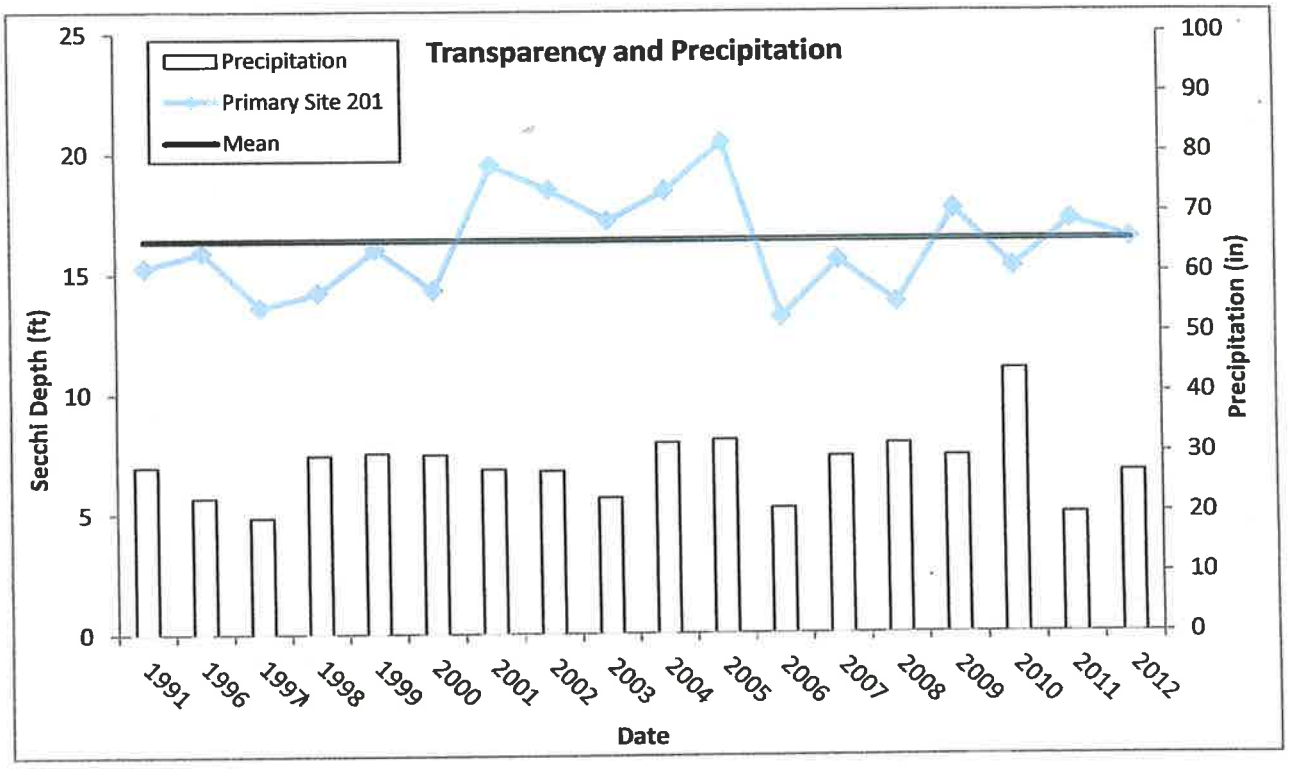


Figure 3. Annual mean transparency compared to long-term mean transparency.

Big McDonald Lake transparency ranges from 9.0 to 38 ft at the primary site (Table 4). Figure 4 shows the seasonal transparency dynamics. The maximum Secchi reading is usually obtained in early summer. Big McDonald Lake transparency is high in May and June, and then declines through August. The transparency then rebounds in late September after fall turnover. This transparency dynamic is typical of a Minnesota lake. The dynamics have to do with algae and zooplankton population dynamics, and lake turnover.

It is important for lake residents to understand the seasonal transparency dynamics in their lake so that they are not worried about why their transparency is lower in August than it is in June. It is typical for a lake to vary in transparency throughout the summer.

a. Lake Water Quality

EAST OTTER TAIL SOIL AND WATER CONSERVATION DISTRICT

East Otter Tail County Water Quality Factsheet

Total Phosphorus

Big McDonald Lake is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus. Total phosphorus was evaluated in Big McDonald Lake in 1996-2012. The data show that phosphorus increases slightly as the beginning to the end of summer.

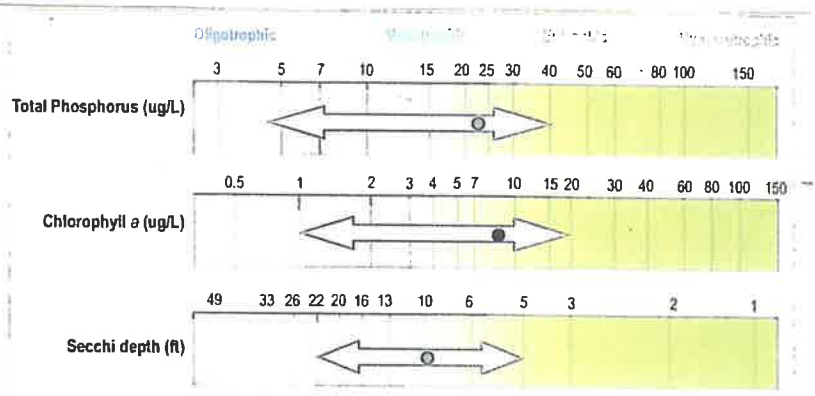


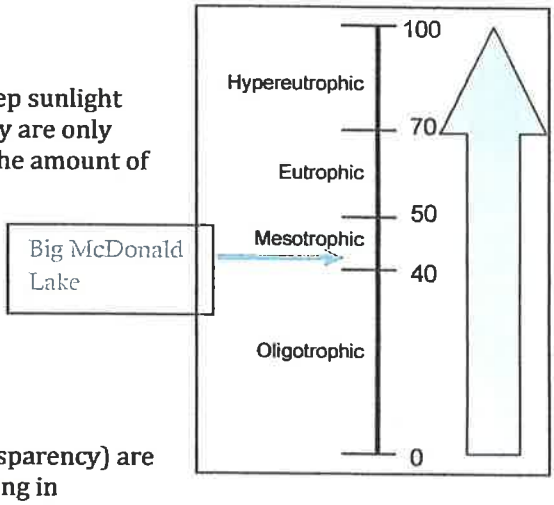
Figure 1. Big McDonald Lake total phosphorus, chlorophyll a and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 201). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Chlorophyll *a*

Chlorophyll *a* is the pigment that makes plants and algae green. It is tested in lakes to determine the algae concentration or how green the water is. Chlorophyll *a* concentrations greater than 10 ug/L are perceived as a mild algae bloom, while concentrations greater than 20 ug/L are perceived as a nuisance. Chlorophyll *a* was evaluated in Big McDonald Lake in 1996–2012. Concentrations remained below 10 ug/L on all sample dates except for two, indicating clear water most of the summer. Throughout the years of sampling, chlorophyll *a* increases every year in late summer and early fall.

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, therefore they are only found in areas of lakes where the sun penetrates. Water transparency depends on the amount of particles in the water. An increase in particulates results in a decrease in transparency. The annual mean transparency in Big McDonald Lake ranges from 13.2 to 20.4 feet. The transparency at site 201 appears to be relatively consistent with an average Secchi reading of 16.4 feet between 1991 and 1996-2012. Transparency monitoring should be continued every year at site 201 in order to track future changes in water quality.



Trophic State Index (TSI)

Phosphorus (nutrients), chlorophyll *a* (algae concentration), and Secchi depth (transparency) are interrelated. As phosphorus increases, there is more food available for algae, resulting in increased algal concentrations. When algal concentrations increase, the water becomes less transparent and the Secchi depth decreases. The results from these three measurements cover different units and ranges and thus cannot be directly compared or averaged. In order to standardize these measurements to make them directly comparable, we convert them to a tropic state index (TSI). The mean TSI for Big McDonald Lake is 41, and falls within the mesotrophic range. Mesotrophic lakes (TSI 40-50) are characterized by moderately clear water most of the summer. "Meso" means middle and the root "trophy" means nutrients, therefore, mesotrophic literally means a medium amount of productivity. These lakes are commonly found in Central Minnesota and have clear water with algal blooms late in the summer. They are also good walleye fishing.

Local association information: Otter Tail County Lakes Assoc.

b. Lakeshed Data and Interpretations

Land Cover / Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed. The basic purpose of land use planning is to ensure that each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.

Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the land's ability to absorb and store water rather than cause it to flow overland allowing nutrients and sediment to move towards the lowest point, typically the lake. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed (Figure 17). Even though the entire lakeshed has the potential to drain towards the lake, the land use occurring directly around the lakeshore will most likely have the greatest impact to the lake.

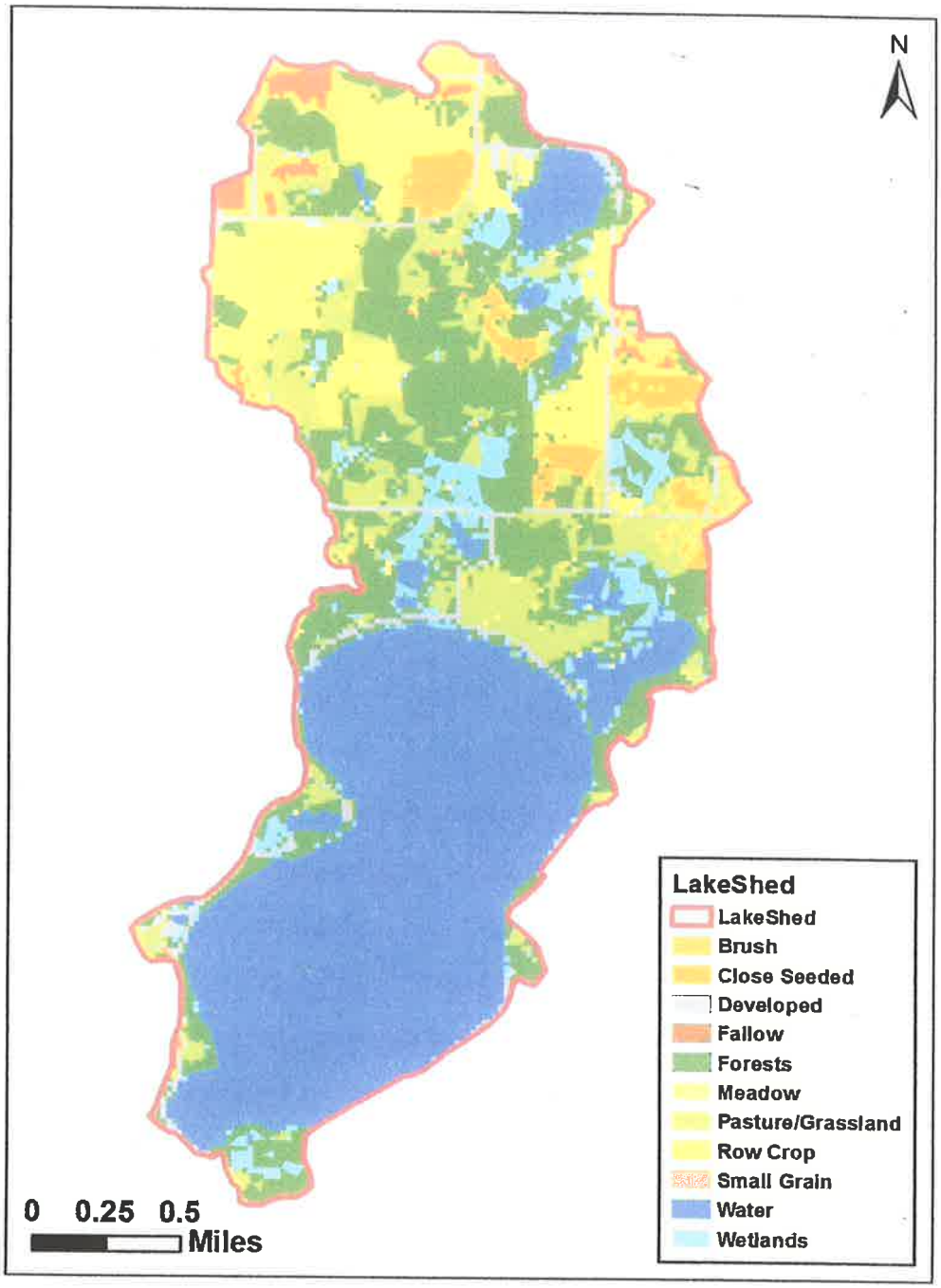


Figure 17. Big McDonald lakeshed (5603104) land cover (NASS, 2012).

Developed land cover mostly describes impervious surface. In impervious areas, such as roads and houses, the land is unable to absorb water and it runs off the landscape carrying with it any nutrients or sediment in its path. The higher the impervious intensity the more area that water cannot penetrate in to the soils. Impervious areas can contribute 0.45 – 1.5 pounds of phosphorus per year in runoff. Big McDonald Lake has 4% of its lakeshed classified as developed (Table 9). This doesn't sound like much area, but if it is mainly concentrated on the lakeshore, the runoff from impervious areas can run directly into the lake.

Table 9. Land cover in the Big McDonald lakeshed.

Runoff Potential	Category	Specific Landcover	Acres	Percent
High	Agriculture	**Row Crop**	248.1	8.3%
High	Urban	**Developed**	119.2	4.0%
High	Agriculture	**Close Seeded**	103.4	3.5%
High	Agriculture	**Small Grain**	49.4	1.6%
High	Agriculture	**Fallow**	0.5	0.0%
Low	Forest	**Woods**	749.3	25.0%
Low	Water	**Water**	1098.9	36.7%
Low	Agriculture	**Pasture/Grassland**	454.2	15.2%
Low	Wetlands	**Wetlands**	161.0	5.4%
Low	Agriculture	**Meadow**	11.7	0.4%
Low	Grass/Shrub	**Brush**	0.8	0.0%
Total area with low runoff potential			2475.9	82.6%
Total area with high runoff potential			520.7	17.4%
Total			2996.6	100.0%

Agricultural land use has the potential to contribute nutrients to a lake through runoff, but the amount of phosphorus runoff depends on the type of agricultural land use. Generally, the highest concentration of agricultural nutrient runoff comes from animal feedlots. There is one animal feedlot in the Big McDonald Lake lakeshed (Table 8). The second highest agricultural runoff generally comes from row crops. There are some row crops within the northern portion of the lakeshed but some of the nutrients may be buffered out before reaching the lake (Figure 17). Buffer areas composed of wetlands or forest are important for filtering the runoff and helping it infiltrate into the ground. Pasture land has less nutrient runoff, and most likely doesn't impact the lake as much as other agricultural uses. Therefore, the statistics in Table 9 are valuable for evaluating runoff in the lakeshed. Overall, 83% of the Big McDonald Lake lakeshed is classified as having low nutrient runoff land uses (Table 9).

The University of Minnesota has online records of land cover statistics from years 1990 and 2000 (http://land.umn.edu). Although this data is 12 years old, it is the only data set that is comparable over a decade's time. In addition, a lot of lake development occurred from 1990 to 2000 when the US economy was booming. Table 10 describes Big McDonald's lakeshed land cover statistics related to development and percent change from 1990 to 2000. Due to the many factors that influence demographics, one cannot determine with certainty the projected statistics over the next 10, 20, 30+ years, but one can see the impervious area has increased, which has implications for storm water runoff into the lake. The increase in impervious area is consistent with the increase in urban acreage.

Table 10. Big McDonald Lake's lakeshed land cover statistics and % change from 1990 to 2000 (http://land.umn.edu).

Land Cover	1990 Acres	Percent	2000 Acres	Percent	Comments
Urban	101	3.4 %	139	4.6 %	Increase of 38 acres
Total Impervious Area*	19 acres	1.0 %	39 acres	2.1 %	Increase of 20 acres

*Percent Impervious Area Excludes Water Area

c. Key Findings and Recommendations

Monitoring Recommendations

Transparency monitoring at site 201 should be continued annually. It is important to continue transparency monitoring weekly or at least bimonthly every year to enable year-to-year comparisons and trend analyses. Total phosphorus and chlorophyll monitoring should continue at site 201, as the budget allows, to track trends in water quality.

Overall Summary

Big McDonald Lake is a mesotrophic lake (TSI = 41) with no evidence of a trend in water quality. The total phosphorus, chlorophyll and transparency ranges are better than the ecoregion ranges.

Thirty-two percent (32%) of the lake shed is disturbed by development and agriculture. The threshold of disturbance where water quality tends to decline is 25%. Big McDonald is over this threshold; however, most of the agricultural land is in pasture, which has much less runoff potential than row crops. A more accurate estimate of disturbed land is 17%, which is below the 25% threshold.

Big McDonald Lake has the advantage of a very small watershed. The lake does not have any major inlets or outlets, which means that it probably has a high residence time. Therefore, nutrients in the lake tend to stay there instead of getting flushed out. The oldest septic systems around the lake were re-checked by the county in 2010, so the septic systems around the lake should be in good working order. The land practices around the lake and the runoff from them are the main impacts to the lake.

A map showing the surface runoff potential from the different catchments around the lake show that there is a potential area for soil erosion on the southwest corner of the lake (Figure 21). This area needs to be visually inspected for high elevation and potential runoff. If this type of scenario is occurring there, shoreline restoration, rain gardens, grassed waterways, filter strips, and other best management practices could be applied to address overland flow and erosion.

Priority Impacts to the Lake

The priority impact to Big McDonald Lake is expansion of residential housing development in the lakeshed and second tier development along the lakeshore. The runoff from this development (impervious surface) delivers nutrients to the lake. The majority of first tier shoreline parcels have been developed. From 1990 to 2000 the urban area around the lake increased by 38 acres. In addition, the conversion of seasonal cottages to year-round homes increases the impervious area of the home.

The reason the lakeshed is rated as "full restoration" is surrounding agriculture. Agriculture is the dominant land use type on private lands (27.8%) within the lakeshed, but most of it is located north of the lake instead of around the lakeshore. Surface runoff mapping shows that this farmland north of the lake is likely not running directly off into the lake (Figure 21). However, the recent "cleaning" of Ditch 25 for the first time in over 100 years heightened the

probability of increased sediment and nutrient loading in the lake in the future. An initial flush of sediments was photographically documented shortly after the ditch was "cleaned" and drained through the inlet.

Best Management Practices Recommendations

The management focus for Big McDonald Lake should be to protect the current water quality and restore the lakeshed. This can be done by focusing on managing and/or decreasing the impact caused by additional development, including second tier development, and impervious surface area. Project ideas include protecting land with conservation easements, enforcing county shoreline ordinances, smart development, shoreline restoration, rain gardens, and septic system maintenance.

Partnering with farmers in the lakeshed to implement conservation farming practices, increase shoreline buffers, restore wetlands, or place priority parcels into land retirement programs will help decrease the impacts of agriculture in the lakeshed.

Project Implementation

The best management practices above can be implemented by a variety of entities. Some possibilities are listed below.

Individual property owners

- Shoreline restoration
- Rain gardens
- Aquatic plant bed protection (only remove a small area for swimming)
- Conservation easements

Lake Associations

- Lake condition monitoring
- Ground truthing – visual inspection upstream on stream inlets
- Watershed mapping by a consultant
- Shoreline inventory study by a consultant
- Conservation easements

Soil and Water Conservation District (SWCD) and Natural Resources Conservation Service (NRCS)

- Shoreline restoration
- Stream buffers
- Wetland restoration
- Work with farmers to
    - Restore wetlands
    - Implement conservation farming practices
    - Land retirement programs such as Conservation Reserve Program

d. Suggested Approaches for Watershed Protection and Restoration of DNR-Managed Fish Lakes in Minnesota

Watershed Disturbance (%)	Watershed Protected (%)	Management Type	Comments
< 25%	> 75%	Vigilance	Sufficiently protected -- Water quality supports healthy and diverse native fish communities. Keep public lands protected.
	< 75%	Protection	Excellent candidates for protection -- Water quality can be maintained in a range that supports healthy and diverse native fish communities. Disturbed lands should be limited to less than 25%.
25-60%	n/a	Full Restoration	Realistic chance for full restoration of water quality and improve quality of fish communities. Disturbed land percentage should be reduced and BMPs implemented.
> 60%	n/a	Partial Restoration	Restoration will be very expensive and probably will not achieve water quality conditions necessary to sustain healthy fish communities. Restoration opportunities must be critically evaluated to assure feasible positive outcomes.

Big McDonald Lake's lakeshed is classified with having 41.3% of the watershed protected and 32.4% of the watershed disturbed (Figure 19). Therefore, this lakeshed should have a full restoration focus. This lake is just over the 25% disturbed threshold. Goals for the lake should be to limit any increase in disturbed land use. Figure 20 displays the upstream lakesheds that contribute water to the lakeshed of interest. All of the land and water area in this figure has the potential to contribute water to Big McDonald Lake, whether through direct overland flow or through a creek or river. There are three lakesheds upstream of the Big McDonald Lake lakeshed.

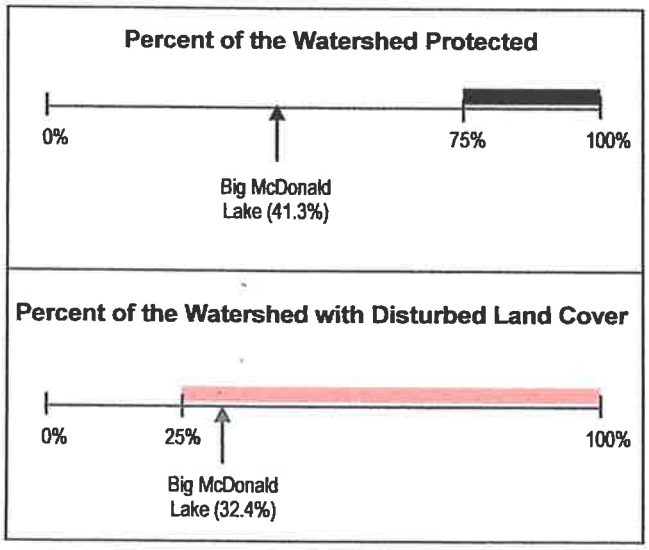


Figure 19. Big McDonald Lake's lakeshed percentage of watershed protected and disturbed.

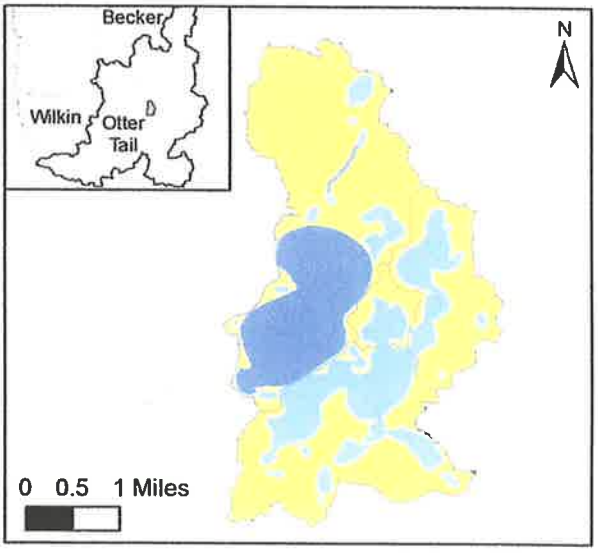


Figure 20. Upstream lakesheds that contribute water to the Big McDonald Lake lakeshed. Color-coded based on management focus (Table 12).

Surface Runoff Analysis (East Otter Tail SWCD)

The map below (Figures 21) shows the different catchments that drain into Lake Lida. These catchments are delineated by land elevation, as everything drains downhill. Each catchment was evaluated for potential surface erosion. Catchments that are colored red have a relatively high potential for surface erosion and soil loss and catchments that are colored dark green have a relatively low potential for soil loss. Shoreline in red areas would be good candidates for shoreline restoration, rain gardens, grassed waterways, filter strips and other best management practices addressing overland flow and erosion. Contact the Otter Tail SWCD for help with these areas.

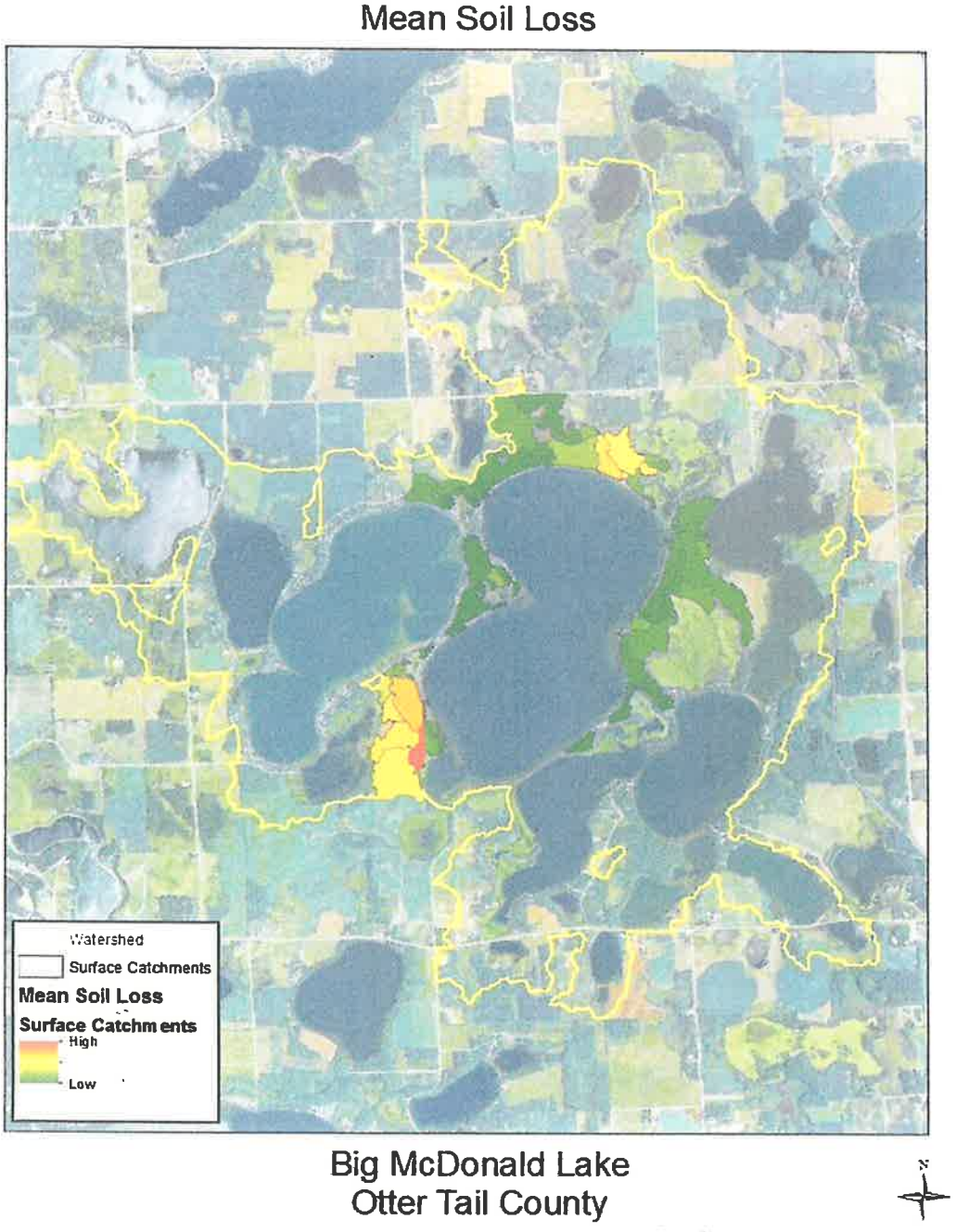


Figure 21. Potential for erosion in the surface catchments for Big McDonald Lake.

e. Organizational Contacts and Reference Sites

Big McDonald Lake Improvement District

bmlid.org

DNR Fisheries Office

1509 1st Avenue North, Fergus Falls, MN 56537
218-739-7576

fergusfalls.fisheries@state.mn.us

http://www.dnr.state.mn.us/areas/fisheries/fergusfalls/index.html

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Regional Minnesota Pollution Control Agency Office

714 Lake Ave., Suite 220, Detroit Lakes, MN 56501

218-847-1519, 1-800-657-3864

http://www.pca.state.mn.us/yhiz3e0

East Otter Tail Soil and Water Conservation District

801 Jenny Avenue SW, Suite 2, Perham, MN 56573

218-346-4260, ext. 3

http://www.eotswcd.org/

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2. Aquatic Vegetation

We are unaware of any scientific surveys that identify existing aquatic species, estimate the quantity of existing aquatic species, or assess the quality of the aquatic plant community. The aquatic plant community is not actively managed as habitat for fish, wildlife, or beneficial aquatic insects.

Some protection is afforded beneficial aquatic plants by MN DNR and Otter Tail County shoreline regulations. Despite these regulations, beneficial plants, bulrush in particular, have periodically been removed over the past ten years, as evidenced by large windrows of freshly cut stems washed ashore.

The following aquatic vegetation observations were compiled by a retired professor of landscape architecture and wildlife biologist, who is a year-round resident of Big McDonald Lake. Additional data was compiled by RMB Laboratories and included in the Big McDonald Lake status report. The RMB lake status report notes that 37% of the lake is classified as being littoral, "less than 15 feet in depth – usually dominated by aquatic plants." The littoral zone is critical habitat for panfish, bass, and northern pike. It is equally important for many resident species of amphibians, toads, and migratory birds that feed on insects produced in the littoral zone. The shoreline edges between the littoral zone and uplands are home to nesting birds, mink, muskrats, and other species. Research suggests 75% – 80% of all vertebrates in the watershed live in the shoreline edge zone during their life cycle.

Other lakeland interface characteristics include the following:

- Shoreline: 5.8 miles;
- Riprap: ≥1.25 miles (estimate);
- Bulrush: 2 miles (estimate) 10 feet to ≥300 feet stand widths (estimate); bulrush stands have thinned in stem density over the last 20 years, likely caused by high water levels during that period.
- Hybrid and Native Cattails: ≤1 mile;
- Submergent Vegetation: 400 acres;
- Emergent Vegetation: Much of the remaining shoreline edge is manicured turf or ornamental landscaping. Remnant natural landscapes can be found along the south shore, Skunk Bay, southwest shoreline, and south shoreline of Lundstrom Point. The most common emergent aquatic species in order of abundance include bulrush, reed canary grass (also occupies upland shore edges), cattail, water lilies, phragmites, and sedges.
- Key Emergent: Hard stem bulrush is the key species for many reasons. It is critical spawning habitat for pan fish and largemouth bass. Loons, grebes, and other waterfowl nest in bulrush patches. Bulrush seed is an important fall food source for waterfowl, and stems are eaten by muskrats. Bulrush patches also dampen wave action, thus reducing shoreline erosion. Except for boat access and space for swimming, bulrush removal should comply with MN DNR regulations, 50 lineal feet maximum. Less is better.

- Water Lilies: Water lilies are beneficial. They are important protective cover habitat for young fish of all species. Like bulrush, water lilies dampen wave action and reduce shore erosion.
- Cattails, Hybrid Cattails, Reed Canary Grass, and Phragmites: These species are discussed in the exotic species section.
- Submergent Vegetation: Little is known about the species composition of the submergent aquatic plant community in Big McDonald Lake. However, observations suggest that Chara (Carpetweed) appear to be covering more shallow water areas. Chara has one positive effect: it grows into fine sediments fixing them in place. The negative impacts are not well understood. Observations indicate that Chara over-grows traditional pan fish spawning beds and covers habitat for native clams. It also negatively affects the swimming experience for some residents.

More needs to be known about Chara. There is one lake lot demonstration site (private) on the north shore of Big McDonald Lake. The Pelican Lake Garden Club and numerous Big McDonald Lake residents have toured the property over the past ten years. Design features include:

- 100 feet of restored shoreline using native trees, shrubs, and sedges; matting and stakes used came from East Otter Tail Soil and Water Conservation District (EOT SWCD).
- 100 feet by 20 feet of sand prairie buffer strip planting;
- 60 feet of grass bioswale;
- Rain garden;
- Restored oak woodland understory planting of native plants.

In addition to the demonstration site, there is a narrow strip of relatively undisturbed native vegetation acting as a buffer at the MN DNR access site. There are also numerous native lakeshore plant communities (good reference sites) around the lake at the:

- Northeast corner;
- Skunk Bay and points on either side of the sand bar;
- Southwest highlands shoreline;
- South side shoreline of Lundstrom Point.

These native plant communities have persisted for decades and protected the shoreline. All of these sites are privately owned. Observing them, even from a distance off shore, can be educational in regard to plant community structure and species composition.

Two University of Minnesota Master Gardeners, one a retired professor of Landscape Architecture, reside on Big McDonald Lake. They have taught, and continue to teach, courses on landscaping and gardening for wildlife at East Otter Tail Horticultural Days, COLA meetings, and the Prairie Wetland Center in Fergus Falls. They are willing to do the same for the BMLID.

Several property owners on Big McDonald Lake have partnered with EOT SWCD on shoreline restoration projects. EOT SWCD is an excellent resource for technical advice, materials, and funding. Much more could be done by continued partnering with EOT SWCD to encourage "lake friendly" shoreline restoration projects and buffer strips, as noted in the recommendation section.

Fresh Water Society Draft Lake Management Report: The following landscape design elements and management techniques have significant positive impacts, such as protecting and enhancing water quality, aquatic ecology, and wildlife habitat:

- Shoreline restoration;
- Buffer strips;
- Reduced turf areas;
- Minimum or no mow zones; and
- Reduced or integrated riprap (rock and shrubs).

The University of Minnesota Cooperative Extension Service, Otter Tail County Extension Office, and the County Agent are also valuable sources of information and advice. Education courses on Aquatic Invasive Species (AIS) identification and their control are available through the Extension Service, US Fish and Wildlife Service, Otter Tail County Coalition of Lake Associations, and others. Trained observers living on the lake are key to early detection of AIS, and early detection followed immediately by an appropriate response is key to controlling the problem.

3. Wildlife

The "Blue Book," *Developing a Lake Management Plan* notes that:

"Minnesota's lakes are home to many species of wildlife. From our famous loons and bald eagles to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife.

The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and wild rice along the shoreline provide both feeding and nesting areas for wildlife. Loons, black terns, and red-necked grebes are important Minnesota birds that are particularly affected by destruction of this vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young."

The MN DNR also recognizes the unique importance of shallow lakes:

"Minnesota's diverse wildlife populations are influenced in large part by our state's abundant water resources. While all lakes support wildlife needs, it is the shallow water zone, characterized by aquatic plants and generally less than 15 feet deep, that provides the most important wildlife habitat."

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section.

Many residents around Big McDonald Lake are birders, most casual, some ardent. The spring waterfowl and warbler migrations are much anticipated events. Loons, trumpeter swans, bald eagles, sand hill cranes, and terns are species of special interest; all nest in the watershed. Sadly, the long-occupied eagle nest near the sandbar was destroyed in 2015. Eagles, however, constructed a new nest nearby in 2016. Species typically attracted to feeders put out by lake residents include warblers, finches, hummingbirds, orioles, cardinals, blue jays, chic-a-dees, and nut hatches. Nest boxes attract bluebirds, wrens, swallows, wood ducks, and hooded merganzers.

There are no apparent trends in most wildlife species or populations that are resident or migrate through the Big McDonald Lake watershed. Observations around Big McDonald Lake, however, as well as adjacent lakes and uplands, suggest:

- Incremental development of approved platted subdivisions;
- Continued removal of desirable shoreline vegetation;
- Clearing of native wooded upland and understory vegetation in the watershed;
- Increased acreage devoted to manicured turf;
- Expanding populations of invasive species; and
- Increase in shoreline riprap could significantly reduce the quantity and quality of habitat for wildlife in the watershed. A long term trend for declining local populations of some species is likely.

Regional populations of species already in decline include: monarch butterflies, European honey bees, and various native bee species, and warbler species that require healthy riparian habitat or large patches of ungrazed woodland with undisturbed native species. Wildlife species around the lake considered to be a "nuisance" by many include: Canadian geese (numbers are increasing), raccoons, skunks, moles, voles, cottontail rabbits, and whitetail deer. Geese, cottontail rabbits, and whitetail deer are classified as game species; taking of these species is regulated. If issues with any of these species arise on your property, contact the MN DNR.

Beavers are an ongoing problem at the inlet and outlet from Big McDonald Lake. Dams at the Ditch 25 inlet cause flooding of back lots on the north shore. Dams on the outlet ditch raise the lake water level, causing wave-induced beach erosion in the spring and ice damage to shorelines in the winter.

A contracted trapper with the necessary permits has been helpful in controlling beaver population. For the outlet, however, trapping is a short- term fix. The Big McDonald Lake community still awaits the construction of a new outlet channel, which was approved by the

Otter Tail County Commission in 2015. (Note: on wildlife habitat the "lake friendly" landscape practices and maintenance suggestions described in the Aquatic Vegetation section directly benefit wildlife and should be considered when developing landscape plans for lakeshore properties.)

4. Exotic Species

Background

"Exotic" species -- organisms introduced into habitats where they are not native -- are severe world-wide agents of habitat alteration and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian Watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes, primarily by boats and also by waterbirds, it reached Midwestern states between the 1950's and 1980's.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well-established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Purple loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals and are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Reed Canary Grass (*Phalaris arundinacea)* is considered a major threat to natural wetlands as it out competes most native species and presents a major challenge in wetland mitigation efforts.

Planted throughout the U.S. for forage and erosion control since the 1800s, it forms large, single-species stands, with which other species cannot compete. Invasion is associated with disturbances, such as ditch building, stream channeling sedimentation and intentional planting and if cut during the growing season a second growth spurt occurs in the fall.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

Starry Stonewort (*Nitellopsis obtuse*) is a grass-like form of algae that are not native to North America. The plant was first confirmed in Minnesota in Lake Koronis in late August of 2015. Plant fragments were probably brought into the state on a trailered watercraft from infested waters in another state.

It is similar in appearance to native grass-like algae such as other stoneworts and musk-grass. Native stoneworts and musk-grass are both commonly found in Minnesota waters. Starry stonewort can be distinguished from other grass-like algae by the presence of star-shaped bulbils.

Starry stonewort can interfere with recreational and other uses of lakes where it can produce dense mats at the water's surface. These mats are similar to, but can be more extensive then, those produced by native vegetation. Dense starry stonewort mats may displace native aquatic plants.

Like all plants, starry stonewort may grow differently in different lakes, depending on many factors. At this time, we cannot predict how it might grow in any one Minnesota lake. It is believed to be spread from one body of water to another by the unintentional transfer of

bulbils, the star-like structures produced by the plant. These fragments are most likely attached to trailered boats, personal watercraft, docks, boat lifts, anchors or any other water-related equipment that was not properly cleaned.

Zebra Mussels (*Dreissena polymorpha*) Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized animals that attach to solid surfaces in water. They can cause problems for lakeshore residents and recreationists and present a threat to the ecological integrity of lakes a rivers by potentially disrupting food chains and crowding out native species.

Zebra mussels can be a costly problem for cities and power plants when they clog water intakes. Zebra mussels also cause problems for lakeshore residents and recreationists. They can attach to boat motors and boat hulls, reducing performance and efficiency; attach to rocks, swim rafts and ladders where swimmers can cut their feet on the mussel shells; and clog irrigation intakes and other pipes.

Zebra mussels also can impact the environment of lakes and rivers where they live. They eat tiny food particles that they filter out of the water, which can reduce available food for larval fish and other animals, and cause aquatic vegetation to grow as a result of increased water clarity. Zebra mussels can also attach to and smother native mussels.

No survey nor scientific study of exotic species in Big McDonald Lake has been conducted. Exotic species in the immediate area and known to exist include:

- Zebra Mussels: have been found in neighboring lakes, including Little McDonald, Paul, Krebs, and Reush. None of these lakes are in the Big McDonald watershed. Researchers continue to seek an effective treatment for Zebra Mussels.
- Chinese Mystery Snails: Mystery snails exist in Big McDonald Lake. Observations by lake residents suggest that population is increasing. Although this species is not currently considered a threat to lake ecology, it is perceived by residents as a nuisance.
- Vegetation Hybrid Cattails: Hybrid cattails are more aggressive than the native species. Patches of hybrid cattails dominate the shoreline around Skunk Bay. Smaller patches exist in the northeast corner of the lake and along the south shore of Lundstrom Point. Hybrid cattails also encircle most wetlands in the watershed. Cattails temporarily stabilize lake shorelines and provide habitat for some wildlife species. They out-compete more desirable native species, however, such as wild rice, sedges, and bulrush. These native species are effective shoreline stabilizing plants and provide quality wildlife and fish habitat.
- Phragmites: Small patches of phragmites exist in the northeast corner of Big McDonald Lake. They are more abundant on the south shoreline of Skunk Bay. This species has little habitat value, is very aggressive, and expands rapidly into newly exposed beach areas when water levels recede. It is very difficult to eradicate.
- Reed Canary Grass: is very common around the lake. It has little or no habitat value. The dense rooting structure of this species, however, has effectively stabilized shorelines in several locations. Removing canary grass and replacing it with higher

habitat value shoreline stabilizing shrubs and sedges is difficult. Consult with EOT SWCD or contact a private restoration specialist before undertaking removal of large patches of this species.

- Buckthorn: Common and Glossy Leaf Buckthorn are common in some wooded lake and woodlands in the watershed. These species are spread by birds. Birds eat the fruit, fly away, and defecate the seed in a new location. If left unchecked, Buckthorn will dominate the woodland understory, eliminating all desirable native plant species. This change in plant community structure causes rain-induced flushing of fine sediments and debris, which is transported by runoff and washed into the lake.
- Fish: European Carp are present in Big McDonald Lake. Population levels are unknown. Also unknown are preferred carp spawning areas (most likely Skunk Bay) and the reproductive success of lake spawning carp. In the past, lake residents have observed carp spawning in wetlands to the north of Big McDonald Lake linked to the lake by Ditch 25. In 2010 a carp barrier was installed north of Big McDonald Lake. Its intent was to prohibit carp access to upstream spawning habitat. Carp have been observed in these wetlands uprooting beds of wild rice and other desirable aquatic species. Further, carp foraging activity floats detrital material up into the wetland water column. From there it is transported by wave action and water currents through the outlet and into the lake. In 2011 the barrier was vandalized. An estimated 20 to 30 very large carp entered the wetlands, and to the best of our knowledge, have not returned to the lake. Each year the resident carp population is supplemented by fish migrating upstream from Round Lake and other downstream lakes linked by Ditch 25. An outlet carp barrier is needed! MN DNR specifications would apply, and their approval is needed.

5. Land Use and Zoning

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. Otter Tail County Soil and Water Conservation District recognizes the multiple areas that impact water health including residential development, agriculture and shoreline management. The Otter Tail County Local Water Plan was created by the SWCD to evaluate the multiple sources of decreasing water quality and propose programs to address those challenges. The priorities listed in the plan include:

Surface Water Quality

- To improve the water quality of surface waters in East Otter Tail County by reducing or minimizing the amount and extent of contaminants entering surface waters.
- Example Action Items : Provide technical assistance to shore land owners on water quality projects. Assist with feedlot runoff projects providing technical assistance and financial assistance when available to projects that meet criteria.

- Ground Water Quality and Quantity
  To improve and protect the quality and quantity of groundwater resources in East Otter Tail County by minimizing or reducing the amount and extent of contaminants entering the groundwater resources, and ensuring that there will be a stable and adequate source of useable water for municipal, industrial and agricultural purposes.

- Development Pressure
  To protect the natural resources of Otter Tail County by reducing or minimizing the impacts of ongoing and future development within the county.

- Soil Erosion
  Promote best management practices that reduce soil losses through wind and water erosion to below 2T (T is a technical abbreviation for tolerable soil loss).

- Wildlife Habitat
  To protect and preserve wildlife habitat and wetlands from conversion to cropland and urban development, and promote the re-establishment of wildlife habitat.

- Sustainable Agriculture
  To assist agricultural producers in maintaining productivity through the use of conservation practices that protect and preserve our natural resources and maintain a sustainable agricultural base in the county.

- Education Promotion
  Promote soil and water conservation through an effective information and education program to the residents, seasonal property owners, schools, and elected officials in Otter Tail County.

- Funding/Partnering/Administration
  Provide assistance to the public through the most efficient use of public funds and administration of programs, and maintain and develop a strong working relationship with other resource agencies.

The specific impacts to a lake from various land uses vary as a function of local soils, topography, vegetation, precipitation and other factors. However, one of the most important ways that citizens can work to positively impact their local waters is through ensuring that prudent local zoning ordinances are in place.

Many zoning regulations are based upon the Shoreland Management Act and/or the Minnesota Department of Natural Resources (DNR) classification of a given lake. The DNR has classified all lakes within Minnesota as General Development (GD), Recreational Development (RD), or Natural Environmental (NE) lakes, and assigned a unique identification number to the lake for ease of reference. Counties in turn have used these classifications as a tool to establish minimum lot area (width and setbacks) that is intended to protect and preserve the character reflected in the classification. It should be noted that counties will often make local ordinances more strict than the minimum standards set by the DNR.

On any shoreland the permissible density and setbacks for virtually all new uses are determined by the lake or river classification standards established by the Department of Natural Resources. Otter Tail County has three categories for defining development around area lakes: Natural Environment, General Development, and Recreational Development. Big McDonald Lake is classified by Otter Tail County as a Recreational Development Lake.

Natural environment lakes are generally small, often shallow lakes with limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock, and unsuitable soils. These lakes, particularly in rural areas, usually do not have much existing development or recreational use.

Recreational development lakes are generally medium-sized lakes of varying depths and shapes with a variety of landform, soil, and ground water situations on the lands around them. They often are characterized by moderate levels of recreational use and existing development. Development consists mainly of seasonal and year-round residences and recreationally-oriented commercial uses. Many of these lakes have capacities for accommodating additional development and use.

General development lakes are generally large, deep lakes or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation and, except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use.

Below are zoning standards associated with each of you lakes. Please note that this chart does not represent all the zoning requirements that are involved with land use and property development. You will want to contact the Otter Tail County Zoning staff to determine the zoning district and the specific regulations that apply to your property.

	General Development (Lake Lida, Wall Lake)	Recreational Development (Big McDonald, Lake Six)
Structure Setback from OHWL	75 ft	100 ft
Water Frontage/Lot Width	100 ft	150 ft
Lot Area*	20,000 ft^2	40,000 ft^2
Buildable Area	8,400 ft^2	8,400 ft^2
Sewage Treatment Area	2,500 ft^2	2,500 ft^2

**Setbacks are measured from the Ordinary High Water Level (OHWL)*
***excluding public road right-of-ways, bluffs, wetlands, and land below the OHWL of public waters*

Please Note: Otter Tail County is in the process of revising their shoreland ordinance. As you make plans, be sure to check in with the Otter Tail County Land and Resource Management Department for any updates.

Many lakes have numerous properties that are considered to have "vested rights" or were developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment, or are destroyed by natural, accidental causes, or in association with significant renovation.

Questions may be directed to:

Bill Kalar, Land & Resource Management Director
Phone: 218-998-8095
Email: bkalar@co.ottertail.mn.us
Location: 540 Fir Ave. W, Fergus Falls, MN 56537

6. Public Water Access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80% of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources (MN DNR), Trails and Waterways Unit. They are responsible for the acquisition, development, and management of public water access sites. The MN DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government, such as townships and

municipalities. The MN DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written MN DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

According to the MN DNR Fisheries Survey, there is one public access on Big McDonald Lake. The public access on Big McDonald Lake includes the following facilities:

- Launch ramp and docking;
- Parking for 6 to 8 vehicles with trailers (there are seldom more than 3 parked at the access at any one time);
- Standard signage on AIS, boat / trailer cleaning; and
- Nesting loon habitat advisory.

MN DNR manages the access site. The access receives constant but relatively low levels of use. Busier periods include:

- Memorial Day and Labor Day holidays;
- Mondays when resort patrons arrive and Fridays when resort patrons depart;
- Occasional fishing derbies.

The MN DNR is responsible for access upkeep. North shore residents pick up incidental litter, as needed. In general, the access site is well-kept and maintained. MN DNR staff periodically inspects boats for AIS. Opportunities for a graphic display of AIS species and boater information regarding Big McDonald Lake, which would help protect water quality and fish and wildlife habitat, would require coordination with MN DNR.

D. Notes and Outcomes of the Visioning Process

Big McDonald Lake Improvement District

Healthy Lakes and Rivers Partnership
Community Visioning Session Summary
Prepared by Jen Kader of the Freshwater Society
August 2016

Nearly 250 comments were received by participants in the Community Visioning Session on August 6, 2016. While several categories were identified by attendees during the session so as to facilitate conversation, further review of the comments across categories has demonstrated that three major categories actually exist. Those categories, and the themes in each, are detailed below.

Strong Lake Improvement District

Comments in this category generally focused on two major themes: increasing the LIDs engagement with the community, and coordinating with local government. Both are needed to increase the participation of the local community in behaviors and activities that can promote a healthier Big McDonald now and into the future.

- Sub-themes
    - Community engagement:
        - Education and communication
        - Active Membership
    - Governmental engagement
        - Lobbying and follow-through
        - Coordinated lake management
        - Partnership
- Who should be at the table (no suggestions were identified by the group, so some suggestions to start with are included below in italics)
    - *Lake residents*
    - *Local government*
        - *Towns*
        - *County*
    - *Local businesses*
    - *DNR*
    - *MPCA*
    - *East Otter Tail SWCD*
    - *Neighboring lakes*
- Next 30/60/90 days
    - (30) Flyer and home visits
    - (30) Volunteer groups for compliance and education about benefits
    - (30) Set meeting between LID and county: find out what the plan isn't being implemented or get an update on the proposed implementation timeline.
    - (30) Review Jen's summary report
    - (30) Form committee to put together education and communication plan (Rob Campbell nominated to participate)
    - (30) Complete management plan *(I would recommend 90 days here)*
    - (60) Education and Communication Plan (Glen Swanton nominated to participate
    - (90) Have a firm action plan
    - (90) Send out beginning of education and plea for cooperation

WATER QUALITY

By far, the largest number of comments from the session dealt in some way with the topic of water quality. There is a shared understanding of the need to better understand what is happening in the water and why, and then share that information with neighbors. There is also wide recognition of the impact runoff is having on the quality of the water and stability of the shoreline. As you seek answers to the problems you are facing, it will be important to work with the SWCD to identify the proper course(s) of action. In the meantime, there is a lot that can be done to encourage shoreline property owners to install shoreline and rain gardens, mow less (less area and less frequency), and otherwise adopt practices that can improve water quality. While there are a large number of sub-themes, there is a lot of overlap between them. As you write out your plan for how to address issues in this category, look for opportunities to support multiple sub-themes at the same time.

- Sub-themes
    - Shoreline management
        - Shoreline stabilization
        - Shoreline gardens and buffer strips
    - In-lake and on-shore habitat and wildlife protection
    - Runoff reduction
    - Reduction of the amount of phosphorus and nitrogen in the water
    - Ditches
    - Septic tanks
- Who should be at the table (no suggestions were identified by the group, so some suggestions to start with are included below in italics)
    - *Lake residents*
    - *DNR*
    - *East Otter Tail SWCD*
    - *Farmers*
    - *County*
    - *University of Minnesota Extension*
    - *Angling clubs*
- Next 30/60/90 days
    - (30) Contact Craig Johnson about showing us his place and what he did to his shore
    - (30) Establish a filter through the DNR
    - (60) Approach EOTSWCD about having a seminar to educate us on shoreline restoration
    - (60) Resolution around Ditch 25

Use of Lake Six

Comments in this category range from management of lake level to etiquette for lake use. All are geared towards preserving and enhancing the enjoyment of the lake by various users.

- Sub-themes
  - Surrounding area
    - Road traffic speeds
    - Campground atmosphere
    - Property values
  - Aquatic Invasive Species
    - Awareness
    - Research and monitoring
  - Managing water quantity/lake level
  - Lake etiquette/competing lake use
- Who should be at the table
  - Volunteers
  - Sheriff's department
  - DNR
- Next 30/60/90 days
  - (30) Look for AIS regulations
  - (30) Identify damage caused by Chinese mystery snails
  - (30) Write up generic lake use etiquette
  - (90) Meetings and discussion about lake use

Other – Regulation & Education

Pervasive throughout each of the themes were two additional themes that merit their own section in this summary: regulation and education. They are included together here as they fall along a spectrum that relates to level of authority and control, in that as legal authority to regulate an act decreases, education (and incentives) are needed to create behavior change.

- Sub-themes
  - Water quantity and quality
  - Aquatic Invasive Species
  - Zoning
    - Current and future land use
    - Overlays
- Who should be at the table
  - NRCS and UFWS
  - *DNR and MPCA*
  - *County and Town*
  - *University of Minnesota Extension*
  - *East Otter Tail SWCD*

E. Detailed Action Plans

Prioritized Goals and Action Plans

The final chapter of our Lake Management Plan summarizes the conclusions and priority actions we have chosen to work on at this time. Below we will identify our top priorities, what our goals for each priority are, and how, who, and when we will implement action for each of these priorities.

Goal Area: #1- Preserve and protect, and where practical, enhance the water quality of Big McDonald Lake and its aquatic ecosystem for current and future generations

Discussion Recorder: Jon Lundby

Discussion Reporter: Jon Lundby

Outcome: Our desired outcome is to maintain or improve the water quality and healthy aquatic vegetation that we have enjoyed.

Obstacles:

a. **Obstacle**: Ditch 25 maintenance and drainage into Big McDonald Lake
Overcome by: Inventory, analyze, assess, and monitor water quality inflow from Ditch 25 (RMB Lab)

b. **Obstacle**: Lack of resources
Overcome by: Recruitment of participants, grants (grant for aquatic vegetation survey), and volunteers to sample water quality)

c. **Obstacle**: Lack of septic monitoring by County
Overcome by: Coordinating with Otter Tail County

d. **Obstacle**: Lack of information on aquatic vegetation in the lake
Overcome by: Get general information from the residents; conduct a survey, mapping, and assessment of aquatic vegetation; do sampling and ongoing monitoring

e. **Obstacle**: Lack of resident knowledge about aquatic invasive species
Overcome by: Distribution of AIS information to lake residents

Measuring Success: What are the two most important and measurable "indicators of success" for an activity associated with this goal area? How will you know you achieved the desired outcome?

a. Water test results
b. Health of the lake aquatic ecosystem

These indicators of success should be evident by improved water quality; the results of periodic aquatic vegetation sampling and DNR Fisheries surveys; and property owners' survey results.

1. **Activities / Programs:** Educate residents at the annual meeting, through newsletters, distribution of AIS literature, and by the website postings, about the importance of preventing runoff into the lake and stabilizing their shoreline through the use of rain gardens, rain barrels, and native buffers. Include information about cost-sharing options for installation of these practices through Eastern Otter Tail Soil and Water Conservation District (EOT-SWCD). An on-site tour of a restored shoreline, buffer strip, and rain garden on Big McDonald Lake will be offered to Big McDonald residents.

Who's Leading: Craig Johnson with assistance from EOT-SWCD

Resources Needed: Information about technical assistance and funding for projects

***Activity Timeline**: Summer 2017

Result: Increased awareness and motivation to act; evidence of shoreline and buffer projects; and other practices noted above.

*The 2017 tour was canceled due to significant storm damage to the tour site. It will be rescheduled for June 2018.

2. **Activity / Program:** Water quality testing and monitoring

Who's Leading: Rob Campbell, Craig Johnson, and Don Beck

Resources Needed: Testing equipment from RMB Labs; volunteers

Activity Timeline: 4 times per summer

Result: Ongoing data to track trends in Ditch 25 water quality entering the lake. If issues arise seek funding.

3. **Activity / Program:** Provide all BMLID members and lakeshore property owners with *F.W.S. Guide to Lake Protection and Management*

Who's Leading: Cyndy Wedrick

Resources Needed: Guides from F.W.S.

Activity Timeline: Annual Meeting of BMLID

Result: Education; motivation; resources available on BMLID website; Resident survey presented at the BMLID annual meeting

4. **Activity / Program:** Continued annual monitoring of Big McDonald Lake water quality

Who's Leading: Steve and Junelle Christiansen, Steve and Suzanne Wilson

Resources Needed: BMLID support

Activity Timeline: May – September annually; annual report presented at the BMLID annual meeting

5. **Activity / Program:** Encourage best management practices on lakeshore properties; Reduce nutrient flow into Big McDonald Lake by promoting and coordinating with EOT-SWCD to provide cost-sharing for property owners to install rain gardens, rain barrels, and/or native buffers.

Who's Leading: BMLID Board

Resources Needed: EOT-SWCD; technical experts

Activity Timeline: Annual BMLID meetings

Result: Increased awareness of conservation practices and opportunities to implement them; resources available on BMLID website; reference map of website

6. **Activity / Program:** Septic inspection – check with septic inspectors about the cost of conducting septic system inspections on Big McDonald Lake. Consider a cost-sharing program with residents.

Who's Leading: Rob Campbell

Resources Needed: County cost-sharing

Activity Timeline: Ongoing

Result: Removal and replacement of faulty systems (over time)

Goal Area: #2- To promote appropriate or safe recreational activities on or around Big McDonald Lake

Discussion Recorder: Jon Lundby

Discussion Reporter: Jon Lundby

Obstacles: What barriers/ obstacles could prevent making the above changes? How can they be addressed or overcome?

a. **Obstacle**: Lack of public awareness
Overcome by: Education; information distributed at public access and resort; reminder and discussion at annual meeting

b. **Obstacle**: BM Lake residents do not always practice safe boating practices
Overcome by: Distribution of DNR's *Safe Boating Guide;* reminder and discussion at annual meeting

c. **Obstacle**: Occasional disrespect of anglers' fishing space
Overcome by: Education at annual meeting

Goal Area #3: To preserve and enhance habitat for fish and wildlife in the Big McDonald Lake watershed

Discussion Recorder: John Lundby

Discussion Reporter: John Lundby

a. **Obstacle:** Lack of public awareness
Overcome by: Education by distribution of information regarding wildlife habitat and native plants; habitat site visit

b. **Obstacle:** Funding for project implementation
Overcome by: Encouraging lake residents to attend COLA Annual Lakescaping Workshop and EOT-SWCD funding presentation

c. **Obstacle:** Technical assistance
Overcome by: EOT-SWCD, Master Gardeners, DNR USFWS

1. **Activity / Program:** Educate residents about safe boating practices and on the water etiquette

   Who's Leading: Jon Lundby

   Resources Needed: DNR's *Safe Boating Guide*

   Activity Timeline: Annual meeting and on BMLID website

   Result: Increase awareness of safe boating practices and courtesy; respect for anglers' fishing space; respect by anglers of shoreland property owners

2. **Activity / Program:** Educate residents about damage caused by wakes and activities too close to the shoreline

   Who's Leading: Rob Campbell

   Resources Needed: Information dispenser at the public access

   Activity Timeline: Annual meeting of BMLID

   Result: Wildlife, fish, and their habitats in and around Big McDonald Lake are protected

3. **Activities / Programs:** Educate residents about the importance of lakeshore habitat to a diverse community of wildlife species and the role pollenators play in sustaining a healthy environment. In regard to wildlife habitat, provide information about the importance of pollinators (bees and butterflies) at the annual meeting of BMLID, through site visits, newsletters, and the BMLID website. Encourage residents to plant native plants to provide habitat for insect pollinators, birds, and other wildlife species and to minimize the use of pesticides and herbicides.

   Who's Leading: Craig Johnson

   Resources Needed: Information on lakeshore habitat, pollinators, protection of existing quality habitat; an increase in wildlife-friendly plantings on lakeshore properties; and opportunities for other habitat improvements, including bird nesting boxes.

   Activity Timeline: Annual meeting

Result: Increased awareness of pollinators' plight and appropriate plantings on lakeshore properties.

4. **Activity / Program:** Identify and control wild noxious and invasive shoreline and terrestrial plant species.

   Who's Leading: Craig Johnson

   Resources Needed: Information and funding for website manager

   Activity Timeline: Distribute noxious and invasive weed identification; site visit; and information posted on BMLID website

   Result: Evidence of noxious and invasive plant species declines

5. **Activity / Program:** Educate residents about the loons' life cycle and the importance of staying away from them while boating on the lake. Identification of existing loon nesting sites (if any) and potential new locations outside present home ranges.

   Who's Leading: Don and Lori Beck

   Resources Needed: location of existing loon nesting sites; Information about making nesting sites for loons and materials; assistance from DNR biologist and knowledgeable residents

   Activity Timeline: Spring 2018

   Result: To protect existing loon nesting sites, if any, and to attract loons to Big McDonald Lake and provide nesting structures in suitable locations; loon nesting update posted on BMLID website and DNR contact information should issues arise

Future Activities / Programs: To achieve the desired outcomes for this priority focus area, we need the following people or organizations to get involved:

F. Approach for Revisiting and Refreshing this Plan

This plan is designed to be relevant for only three to five years. In fact, at least every five years, we should plan to engage in an update process. Issues change, people change, and resources change, so this plan should change, too! Though it was developed through the Lakes and Rivers Partnership Program, we do not need to go through the program again to get an updated plan. If we've been effective in building and maintaining relationships with our local resource experts, all we will really need to do to update this plan is the following:

1. Review our plan
    a. Make sure our membership and leadership remember the purpose of the plan (especially useful for new members).
    b. What has changed in the lake and lakeshed based on new data?
        i. Contact our resource experts for updated data if we do not have it
        ii. Review new data for changes in status or trends
    c. What is the status of the action plans?
        i. Are the action plans still relevant?
        ii. If we were not successful, why? (These can help us as we identify obstacles in the new action plans.)
2. Identify our new action plans
    a. Hold a community visioning session
    b. Identify our new priority issues or opportunities our group wants to work on
    c. Research new funding opportunities
    d. Draft our new action plans
3. Update the full document, and approve it at an upcoming meeting!

That's it! A lot of this can be done working collaboratively with EOT- SWCD and the different staff listed in the agency roster—we do not have to worry about updating all the data alone. Other than that, it's just bringing people together in the same way we did during the initial drafting of this plan. Of course, as we work on this, we are encouraged to reach out to the HLRP facilitators with any questions or concerns.

G. Summary and Conclusions

The modest goals outlined in this initial Lake Management Plan are important. Once completed they become the first blocks in building a community culture committed to lake stewardship. Future plan updates should emphasize on-the-ground projects around the lake. This will continue progress toward: preserving, protecting, and enhancing water quality, fish and wildlife habitat, and the lake recreation experience.

Section 3: Appendix

GLOSSARY

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bioaccumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll *a*: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevents groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and non-point source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

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COMMON BIOLOGICAL OR CHEMICAL ABBREVIATIONS

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

GUIDE TO COMMON ACRONYMS

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

110B	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five "Injection" well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Recreational Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code

Draft Lake Management Plan

for

Lake Lida

Lake Lida Property Owners Association, August 2016

TABLE OF CONTENTS

Section 1: Overview

LETTER FROM ORGANIZATION PRESIDENT:

In late 2015, the Lake Lida Property Owners Association was invited to participate in the Initiative Foundation's Healthy Lakes and Rivers Partnership program along with three other Lake Associations in Otter Tail County. Under the coordination of Jen Kader (Freshwater Society) and with strong support from Darrin Newville (East Otter Tail Soil and Water Conservation District) representatives attended a day of training on lake ecology, strategic planning and communications.

Representatives of many state and local agencies, as well as nonprofit organizations also attended the training sessions in order to offer their assistance to each group in developing a strategic Lake Management Plan.

Following the training sessions, each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. Details of the public input received at this session are provided within this plan.

This document is intended to create a record of historic and existing conditions and influences on Lake Lida, and to identify the goals of the surrounding community. Ultimately it is meant to help prioritize goals, and guide citizen action and engagement in the priority action areas. While state agencies and local units of government have a vital role and responsibility in managing surface waters and other natural resources, this Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

This Lake Management Plan is also intended to be a "living document;" as new or better information becomes available. As we accomplish our goals or discover that alternative strategies are needed, it is our intent to update this plan so that it continues to serve as a useful guide to future leaders.

In discussing lake management issues it is impossible to avoid all scientific or technical terms. We have tried to express our goals, measures of success, and other themes as simply and clearly as possible, but have included a glossary of common limnological terms at the end of the plan to assist the reader. Limnology is the state of lake conditions and behavior.

Finally, we would like to recognize the Legislative-Citizen Commission on Minnesota Resources who, through the Environment and Natural Resources Trust Fund, made this round of the program possible.

Plan Structure

The purpose of this Lake Management Plan is to provide an agreed upon set of strategies and actions Lake Lida Property Owners Association can take to address issues relating to Lake Lida, and secure its future as an amenity for the community. The plan, included in full detail in the following section, is broken out into several areas. These sections are explained below.

Section 1: Overview

This section, which you are currently in, is designed to be a stand-alone document, laying out the overarching issues Lake Lida and the POA face, the implications of these issues for the lake and group, and our next steps. The details as they relate to each section are included in full detail in the next section, but the summaries in Section 1 can be referenced by the group, shared with decision-makers, and be used as a readily-understandable guide to inform the work of Lake Lida Lake Association and against which progress can be measured.

Section 2: Plan Detail

This is the longest section of the plan, detailing the following:

- History of the group
- RMB Laboratories Report of the lake, including in-lake and lakeshed characteristics
- Maps and other data reflecting the historical, existing, and projected (as applicable) conditions for the focus areas:
    - Aquatic Vegetation
    - Wildlife
    - Exotic Species
    - Land Use and Zoning
    - Public Water Access
    - Organizational Development and Communication
- Notes from the Community Visioning Process
- Detailed Action Plans, laying out individual steps as well as overarching goals, and identifying key players both in and outside the group that will be relied on to complete the actions
- Approach for revisiting and refreshing the plan, so that it may be a living document that adapts and evolves over time as issues and knowledge of solutions change.

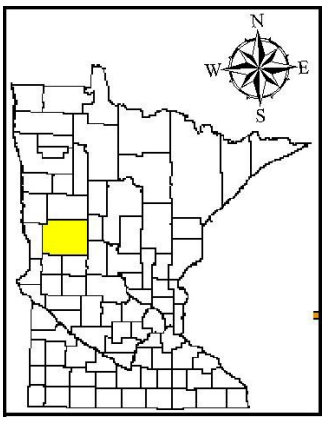
While Section 1 will include summaries of all of this information, the data and information from Section 2 is needed to provide clarification and further information when called for by partners, members, decision-makers, or others, especially as time passes.

Section 3: Appendices

This section contains any reference documents that help to further clarify any of the information in Section 2, including things like relevant articles and studies. It also contains a glossary of terms, as throughout this plan there will be a frequent use of acronyms and scientific terms that may not be familiar to all readers.

Introduction

The lakes addressed in this plan – North and South Lida and Venstrom – are located among the over 1,000 lakes in Otter Tail County. These lakes are part of the Otter Tail River Watershed, located in the Red River Basin. Glacial outwash plain provides the sandy/gravel mix of the lake basins and surrounding shorelines. Steep slopes and bluff areas are located along the eastern shoreline of both Lida Lakes, and along the west shoreline of South Lida. The watershed is predominantly made up of cultivated agriculture land with large patches of deciduous forest.



Homes are clustered around the shorelines of these lakes as seen in ***Figure One***.

These three lakes together total nearly 6500 acres. North Lida Lake, the largest of the three, is located south of Otter Tail County Highway 4 and north of State Highway 108. North Lida is connected to South Lida by a navigable culvert under Highway 108 and is also connected to Lizzie Lake by an unnavigable culvert under County Road 4. There is also a public access to the lake off of this road.

South Lake Lida is located North of County Highway 3 and South of State Highway 108. It is connected to North Lida as mentioned above as well as to Venstrom Lake by small channel (navigable only by small water craft). Almost the entire east side of the lake borders Maplewood State Park, protecting it from development and vegetation loss.

Venstrom**,** by far the smallest of the three lakes is only accessible from South Lida. Paddleboats and canoes frequent it.

Lida Lake dwellings & Park Boundary

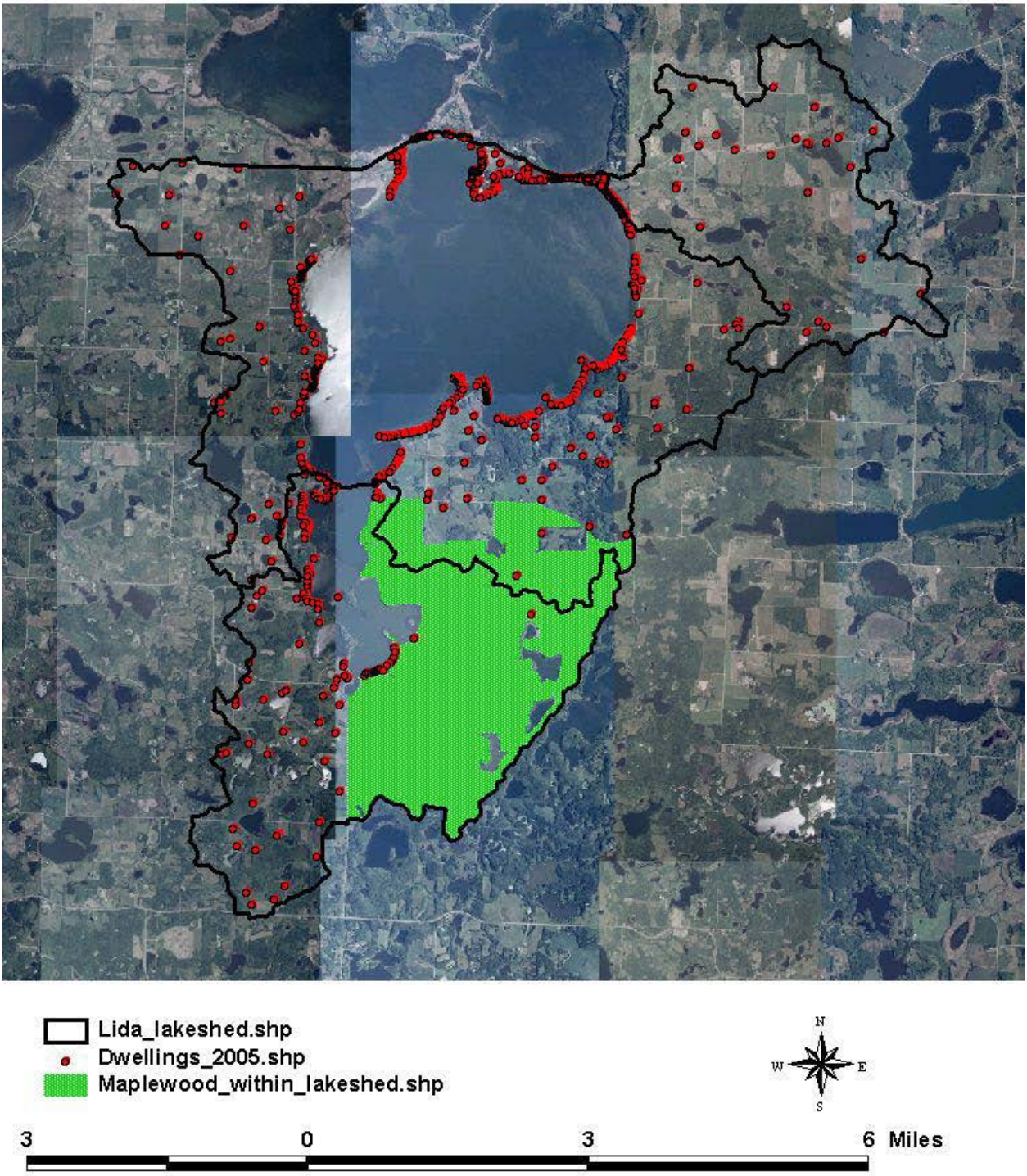


Figure 1

Priority Concerns

The LLPOA identified three priority concerns through a visioning session in August of 2004. The session was offered to the full membership and surrounding community leaders. Local and state agency staff were invited to participate in the visioning session. As a result of these inquiries, the following priorities were set: Water Quality, Land Use and Zoning, and Community. From these concerns, specific goals and actions are identified and targeted for implementation.

Education is the main component of implementation on all three Priority Concerns. The citizens participating felt presenting information to property owners would go a long way toward changing behavior. It was felt if people knew not only what the rules are, but why and how they affect the quality of the lake, they would tend to be more compliant.

Becoming more active in the county regulatory process and voicing concerns about decisions regarding these lakes was another need that became clear through this process.

The Plan was updated in 2014 and since the plan was adopted by the LLPOA in 2005, implementation was the focus of the board and members. Some of the accomplishments since adoption are as follows:

- About every 5 years a new LLPOA lake directory is published and presented free to members of the Association.
- Inlets have been surveyed to determine what materials are entering the lake that could cause pollution or other kinds of problems.
- The outlet channel has been monitored and appropriate measures to keep it open have been recommended to the DNR, and in some cases funded by LLPOA.
- LLPOA has worked with the Minnesota Pollution Control Agency to eliminate or minimize feedlot flow to the lake.
- Shoreline stabilization has been initiated and in part funded to eliminate erosion on a number of Lida properties, including the major project completed on the North Clay Bank area.
- Enhance Bass habitat through various efforts in cooperation with the DNR.
- Purchase and release many thousands of walleye fingerlings (up to 10 inches) into the lake. Currently walleye stocking takes place on years with poor natural walleye hatches.
- Funded a lakes ecology unit for 5th grade students (Books and curriculum).
- Water quality monitoring has been maintained by LLPOA volunteers each summer with samples taken monthly from May-September. Sample testing has been paid for by LLPOA.
- The Association developed the official Lake Lida Management Plan in 2003, paid for by a grant from Minnesota Waters and matched by LLPOA dues.
- Official web page for LLPOA. It is: http://poa.lakelida.com. This website had complete update in 2008 and includes the 2013 Lake Study and 2013 LLPOA Directory.
- Support the funding for a professional consultant who meets with land owners and discusses the “best” changes for their property. Also will consult and contribute time to develop and write grants for LLPOA property owner’s shoreline improvement.
- Numerous property owners secured grants from East Otter Tail to improve lakeshore through specific plantings of vegetation required by those grants. It is my recollection that total grants amounted to over $25,000.00 in the years of 2008-2009. Steve Henry was the East Otter Tail contact for helping to write and implement those grants.
- Requested Lida Township to implement a Township Storm Water Permitting Program (this is in township legal counsel)

- Obtained a permit to widen/open the clogged outlet, under County HWY4 to 10 feet wide. Water is flowing out, at a slow rate - movement will slow the spread of AIS.
- Develop a plan to help educate boaters, fisherman, and lake users to the AIS and to monitor lake access points. Monitors will be volunteer or paid, starting near opening fishing. We will be applying for grants if available.
- Continue to work on the Star Lake Classification
- Funded trash pick-up every other year for major clean-up around the lake.
- Supplied fishing rulers and refrigerator magnets to all property owners.
- Paid dues to be an official member of Ottertail COLA and Minnesota Waters.

Fast Forward to 2016: Lake Lida did accomplish Star Lake status. Much of the same issues are still identified in the Planning Session conducted as a part of the 2016 Healthy Lakes and Rivers Partnership process

- Organizational Growth;
- Water Quality;
- Lake Use; &
- Water Supply.

Organizational Growth: The group would like to see enhanced communication with (and within) the community around the lake, and increased capacity to take on the projects that will be written into the lake management plan. This can include social opportunities that can be used to promote the activities and accomplishments of the Lake Association to garner support. Improving communication will also assist in the engagement of membership and in the successful implementation of this plan.

The group also suggested enhanced communication to educate property owners of best practices for improving and sustaining the water quality of the lake.

Increased communication can also benefit our relationships with government bodies, the coordination of committees pursuing action plan items and our progress to becoming a LID (Lake Improvement District).

It may seem odd to put garbage service under organizational growth, but many feel that the Lake Association should provide this service periodically to clean up the properties and refuse to join the LLPOA unless they decide to fund it.

Water quality: This was the lengthiest category, and has a good deal of variation. While we have good data, there is a good understanding that there is a need for continued research to really understand what is going on.

Weeds is a major concern and an example of the need for further information before we can address the issue. While there is an immediate desire to address the weeds in the lake, those weeds are likely there due at least in part to an excess of nutrients. A management plan that only addresses the weeds will lead to even higher nutrient levels, and the problem will never go away (or, it could create an environment where an invasive aquatic plant could dominate). Education will be instrumental in developing an action plan for the weed situation.

Also, since fishing is an important asset to the community, we need to ensure that the management of aquatic plants doesn't cause issues for fish habitat. It is important to work with the SWCD and DNR to identify the proper course of action regarding in-lake plant control.

What we do know is that installing shoreline and rain gardens and mowing less (less area and less frequency) can improve water quality, so this is something that can be implemented in the form of education and communication to the shoreline property owners.

While we determine the impact of the livestock and farmland in close proximity to the lakes, we can begin forging relationships with the farmers in the watershed.

Other action items discussed were educating and encouraging buffers, erosion and shoreline stabilization, runoff from watershed, the culvert over the state highway, nutrient levels and the water level.

There has also been expressed a desire to address the zebra mussels infestation, though many feel that since they are already in Lake Lida, there's not much we can do. Keeping up to date with the latest research and property owner education could have a positive impact on the situation.

Lake Use: Several of the identified themes from the visioning session can be combined to reflect a larger area of work that still has manageable work areas and tangible outcomes. The action plan in this category will likely focus on identifying maintenance and management solutions, as well as communicating with lake users information on everything from water quality to aquatic invasive species to rules around jet skis and speed boats. In addition, those who work on this category will want to pass on information about shorelines being impacted by waves, and the importance of minding your wake.

Access maintenance was also discussed as a need to improve and increase lake use as well as education at access (ranging from slot limit to wake impact to laws and common courtesies when using jet skis and speed boats).

Management of the lake for sustainable fishing was identified as a priority. In regard to the slot limit, there was lots of discrepancy about what should be done ranging from finding out what can be done to eliminate it, to changing it to keeping it as is. Working with the DNR to chart out a best course of action will be an important first step.

Water Supply: While this issue wasn't a top priority, there does appear to be a strong desire to look into the option of rural water, or investigate rural water as opposed to well water.

In order to respond to the priorities listed above, the lake association needs to increase involvement of property owners, work with the proper organizations and agencies and increase education and communication to and with the shoreline lake owners.

At this time, funding is not a concern, the Lake Association is healthy financially, but increasing membership and explicitly, increasing the contact information of the membership will be key in accomplishing the issues identified.

Section 2: Plan Detail

History and purpose of Lake Lida Property Owners Association

History

Lake Lida Property Owners Association (LLPOA) was formed in the mid 1990's. The concerns that brought about the formation of the association were similar to the concerns voiced today: changes in the quality of the water from in-flows and land uses. Some of the first projects included:

- Prevent erosion off the clay banks when the water was high – work with the DNR to place rock riprap.
- Influence on non-compatible developments such as a turkey growing operation on the shoreline.
- Decrease high water problems by opening the lake outlet by creating a channel.
- Start a water quality-monitoring program that is still being done today.
- Identify the drainage basin (lakeshed) of the three lakes.
- Work with the DNR to create bass habitat.

In recent years membership has ranged from 300-420 paid members. We had 360 paid members in 2015.There is a potential of 664 members (property owners).

Recent accomplishments include:

- Grants are currently being offered to members for shoreline projects improving water quality. (2016)
- LLPOA lake directory has been published in 2009 and 2013 and presented free to members of the Association. 2017 Directory currently in production.
- Shoreline stabilization has been initiated and in part funded to eliminate erosion on a number of Lida properties, including the major project completed on the North Clay Bank area.
- Water quality monitoring has been maintained by LLPOA volunteers each summer with samples taken monthly from May-September. Sample testing has been paid for by LLPOA.
- The Association developed the official Lake Lida Management Plan in 2003, paid for by a grant from Minnesota Waters and matched by LLPOA dues. Plan was updated in 2010 and a copy is posted on the website.
- Hosted a Lake Lida Healthy Lakes Community Meeting June 10, 2016 at Lida Greens to help identify priority focus areas to improve the water quality and health of the Lake Lida community.
- Assisting with and supporting 4th of July band on the lake as an opportunity to build community within Lake Lida.
- Hosted Movie night in August, 2015- an outdoor movie at Lake Lida Township building. Family movie, starts just before dusk, free popcorn.

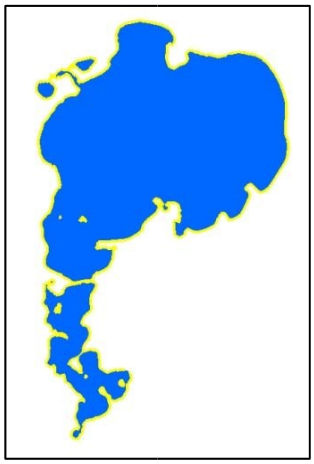
Purpose

The purpose of LLPOA and the Lake Management Plan is to identify existing problems and opportunities for protection and management. LLPOA intends to use this document as work-plan guidance for the next five years- setting priority strategies and projects for implementation.

Lida Lakes 56-0747-01 & 56-0747-02 OTTER TAIL COUNTY

Lake Water Quality

Summary



Lake Lida is located 5 miles east of Pelican Rapids, MN in Otter Tail County. It is a long lake with a large northern bay and a smaller southern bay covering 6,288 acres (Table 1).

Lake Lida has three inlets and one outlet, which classify it as a drainage lake. Water enters Lake Lida from small creeks to the east and south. Water exits Lake Lida at the north and flows into Lake Lizzie, which joins the Pelican River.

Water quality data have been collected on Lake Lida since 1975 (Tables 2 & 3). These data show that North Lida is mesotrophic (TSI = 46) and South Lida is Eutrophic (TSI = 52).

The Lake Lida Property Owners Association (LLPOA) was formed in the

mid 1990's. The concerns that brought about the formation of the association were similar to the concerns voiced today: changes in the quality of the water from in-flows and land uses. The Association is involved in many activities including water quality monitoring, website maintenance, education, and is a member of the Otter Tail County Coalition of Lake Associations (COLA).

Table 1. Lake Lida location and key physical characteristics.

Location Data		Physical Characteristics		
	North Lida: 56-0747-01	Surface area (acres):	North: 5513	South: 775
MN Lake ID:	South Lida: 56-0747-02	Littoral area (acres):	North: 2380	South: 356
County:	Otter Tail	% Littoral area:	North: 43	South: 46
Ecoregion: North Central Hardwood Forests		Max depth (ft):	North: 58	South: 48
		Inlets: North: 3	South: 1	
Major Drainage Basin:	Red River	Outlets: North: 1	South: 1	
Latitude/Longitude: North: 46.5865, -95.9672				
	South: 46.5284, -95.986	Public Accesses:	North: 1	South: 1
Invasive Species: Zebra mussels, curly-leaf pondweed				

Table 2. Availability of primary data types for Lake Lida.

Data Availability

Transparency data Excellent data		source from 1975-1976, 1995-2012.
Chemical data Excellent data		source from 1998-2012.
Inlet/Outlet data Not available.		

Lake Map

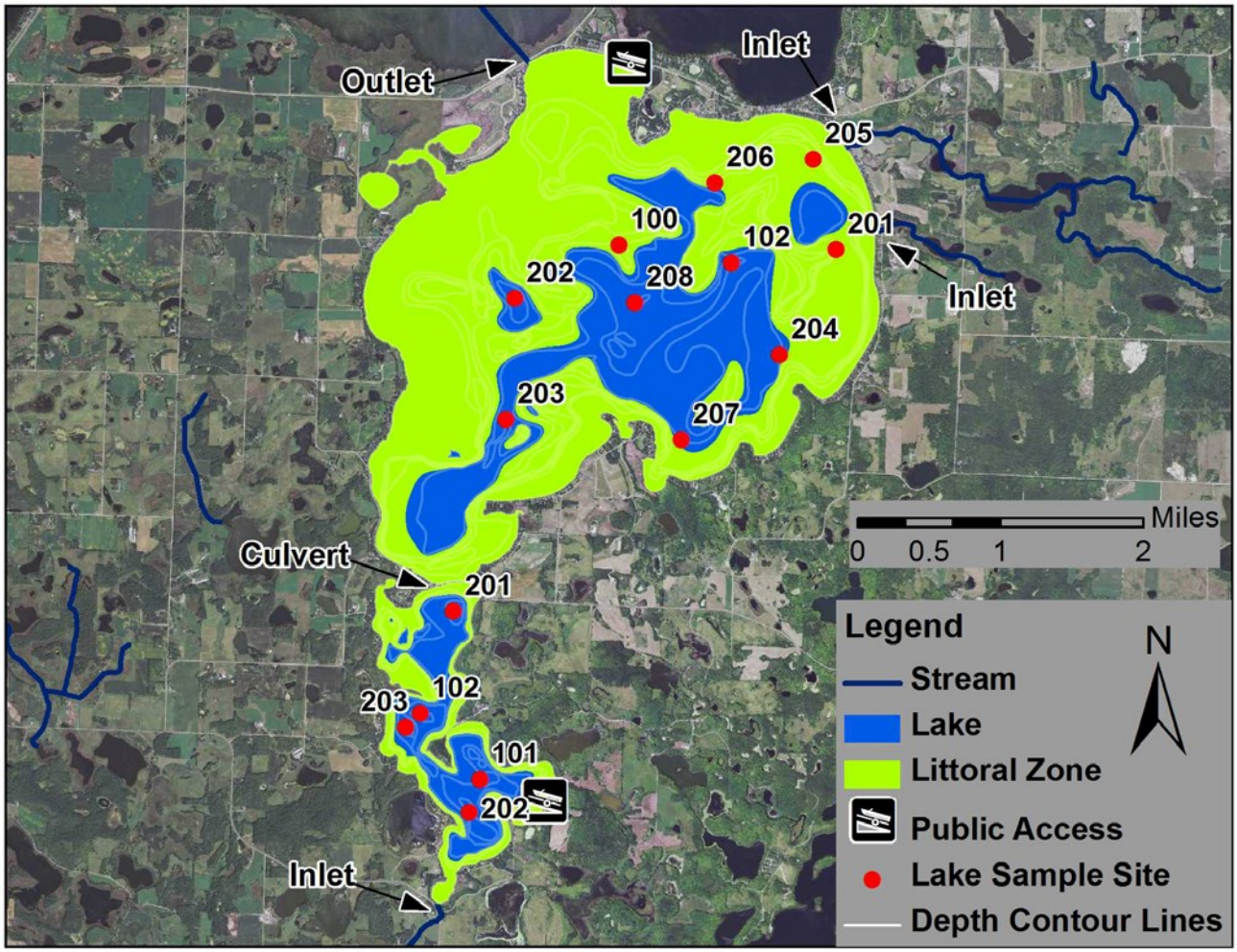


Figure 1. Map of Lake Lida with 2010 aerial imagery and illustrations of lake depth contour lines, sample site locations, inlets and outlets, and public access points. The light green areas in the lake illustrate the littoral zone, where the sunlight can usually reach the lake bottom, allowing aquatic plants to grow.

Table 3. Monitoring programs and associated monitoring sites. Monitoring programs include the Minnesota Pollution Control Agency Lake Monitoring Program (MPCA), Citizen Lake Monitoring Program (CLMP) and RMB Environmental Laboratories Lakes Program (RMBEL).

Basin	Lake Site	Depth (ft)	Monitoring Programs
North	102	40	MPCA: 2000
North	201	30	CLMP: 1975-1976, 1992, 1995-1997
North	202	40	CLMP: 1995-1996, 2000, 2009-2010
North	203	30	CLMP: 1995
North	204	20	CLMP: 1995-2012
North	205	20	CLMP: 1995-1997
North	206	20	CLMP: 1995-1997
North	207	20	CLMP: 1995-2007
North	208*	40	CLMP: 1998-2012; RMBEL: 1998-2012
South	101	40	MPCA: 2000
South	102	40	MPCA: 2000
South	201	30	CLMP: 1995-2012
South	202*	40	CLMP: 1995-2012; RMBEL: 1998-2012
South	203	45	CLMP: 1995-1996

*primary sites

Average Water Quality Statistics

The information below describes available chemical data for Lake Lida through 2012 (Table 4). Data for total phosphorus, chlorophyll *a*, and Secchi depth are from the primary sites 208 (North) and 202 (South). All additional chemical data is from site 202 (North) and 101 (South) and reflects mean values from 2000.

Minnesota is divided into 7 ecoregions based on land use, vegetation, precipitation and geology. The MPCA has developed a way to determine the "average range" of water quality expected for lakes in each ecoregion. For more information on ecoregions and expected water quality ranges, see page 11.

Table 4. Water quality means compared to ecoregion ranges and impaired waters standard.

Parameter	North Lida Mean	South Lida Mean	Ecoregion Range[1]	Impaired Waters Standard[2]	Interpretation
Total phosphorus (ug/L)	20	32	23 – 50	> 40	Results are within the expected range for the ecoregion and below the impaired waters standard.
[3] Chlorophyll *a* (ug/L)	6	14	5 – 22	> 14	
Chlorophyll *a* max (ug/L)	21	33	7 – 37		
Secchi depth (ft)	12.0	9.9	4.9 – 10.5	< 4.6	

Dissolved oxygen	Dimictic *see page 9*	Dimictic *see page 9*		Dissolved oxygen depth profiles show that the deep areas of the lake are anoxic in late summer.
Total Kjeldahl Nitrogen (mg/L)	0.73	0.89	<0.60 – 1.2	Indicates insufficient nitrogen to support summer nitrogen-induced algae blooms.
Alkalinity (mg/L)	210	196	75 – 150	Indicates a low sensitivity to acid rain and a good buffering capacity.
Color (Pt-Co Units)	10	10	10 – 20	Indicates clear water with little to no tannins (brown stain).
pH	NA	NA	8.6 – 8.8	Data not available
Chloride (mg/L)	6	5.4	4 – 10	Within the expected range for the ecoregion.
Total Suspended Solids (mg/L)	3	5	2 – 6	Within the expected range for the ecoregion. Indicates low suspended solids and clear water.
Conductivity (umhos/cm)	NA	NA	300 – 400	Data not available
Total Nitrogen : Total Phosphorus	36:1	28:1	25:1 – 35:1	Indicates the lake is phosphorus limited, which means that algae growth is limited by the amount of phosphorus in the lake.

[1]The ecoregion range is the 25th-75th percentile of summer means from ecoregion reference lakes

[2]For further information regarding the Impaired Waters Assessment program, refer to http://www.pca.state.mn.us/water/tmdl/index.html [3]Chlorophyll *a* measurements have been corrected for pheophytin Units: 1 mg/L (ppm) = 1,000 ug/L (ppb)

Water Quality Characteristics - Historical Means and Ranges

Table 5. Water quality means and ranges for primary sites.

Parameters	North Primary Site 208	North Site 204	South Primary Site 202	South Site 201
Total Phosphorus Mean (ug/L):	**20.1**		**32.7**	
Total Phosphorus Min:	7		8	
Total Phosphorus Max:	31		56	
Number of Observations:	74		74	
Chlorophyll *a* Mean (ug/L):	**6.2**		**14**	
Chlorophyll-a Min:	1		1	
Chlorophyll-a Max:	21		33	
Number of Observations:	71		72	
Secchi Depth Mean (ft):	**12.0**	**10.7**	**9.9**	**10.5**
Secchi Depth Min:	4.0	3.9	4.5	4.5

Secchi Depth Max:	26.0	26.0	28.0	32.0
Number of Observations:	209	190	353	288

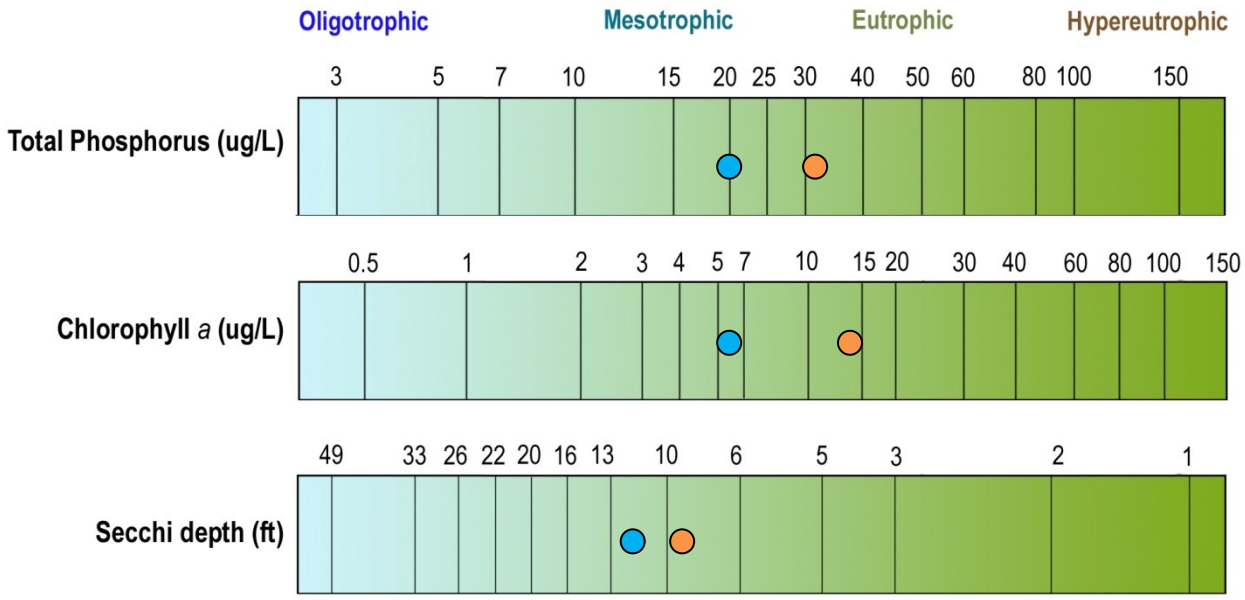


Figure 2. Lake Lida total phosphorus, chlorophyll a and transparency historical ranges. The dots Figure 2. Lake "insert" total phosphorus, chlorophyll *a* and transparency historical ranges. The arrow represent historical means for each basin. represents the range and the black dot represents the historical mean (Primary Site xxx). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Figure adapted

Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002) after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, so they are only able to grow in areas of lakes where the sun penetrates. Water transparency depends on the amount of particles in the water. An increase in particulates results in a decrease in transparency. The transparency varies year to year due to changes in weather, precipitation, lake use, flooding, temperature, lake levels, etc.

The mean transparency in Lake Lida ranges from 9.0 to 15.0 feet (Figure 3). The transparency in North Lida is better on average than the transparency in South Lida. This is most likely due to the fact that North Lida is larger and deeper than South Lida.

The transparency is somewhat affected by annual precipitation. In 2010, precipitation was the highest since 1998 and the transparency in both North and South Lida was lower (Figure 3). Transparency monitoring should be continued annually at site 208 in North Lida and 202 in South Lida in order to track water quality changes.

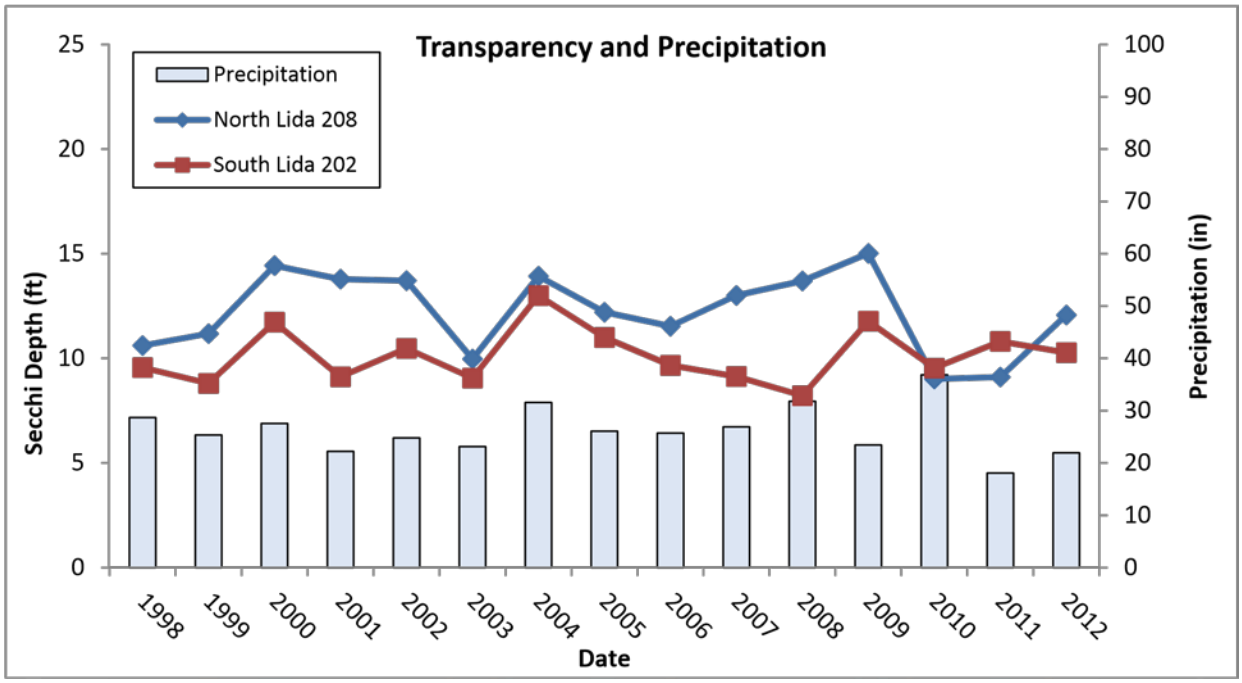


Figure 3. Annual mean transparency compared to long-term mean transparency.

Lake Lida transparency ranges from 4 to 26 ft at the primary site in North Lida (208). Figure 4 shows the seasonal transparency dynamics. The maximum Secchi reading is usually obtained in early summer. Lake Lida transparency is high in May and June, and then declines through August. The transparency then rebounds in October after fall turnover. This transparency dynamic is typical of a Minnesota lake. The dynamics have to do with algae and zooplankton population dynamics, and lake turnover.

It is important for lake residents to understand the seasonal transparency dynamics in their lake so that they are not worried about why their transparency is lower in August than it is in June. It is typical for a lake to vary in transparency throughout the summer.

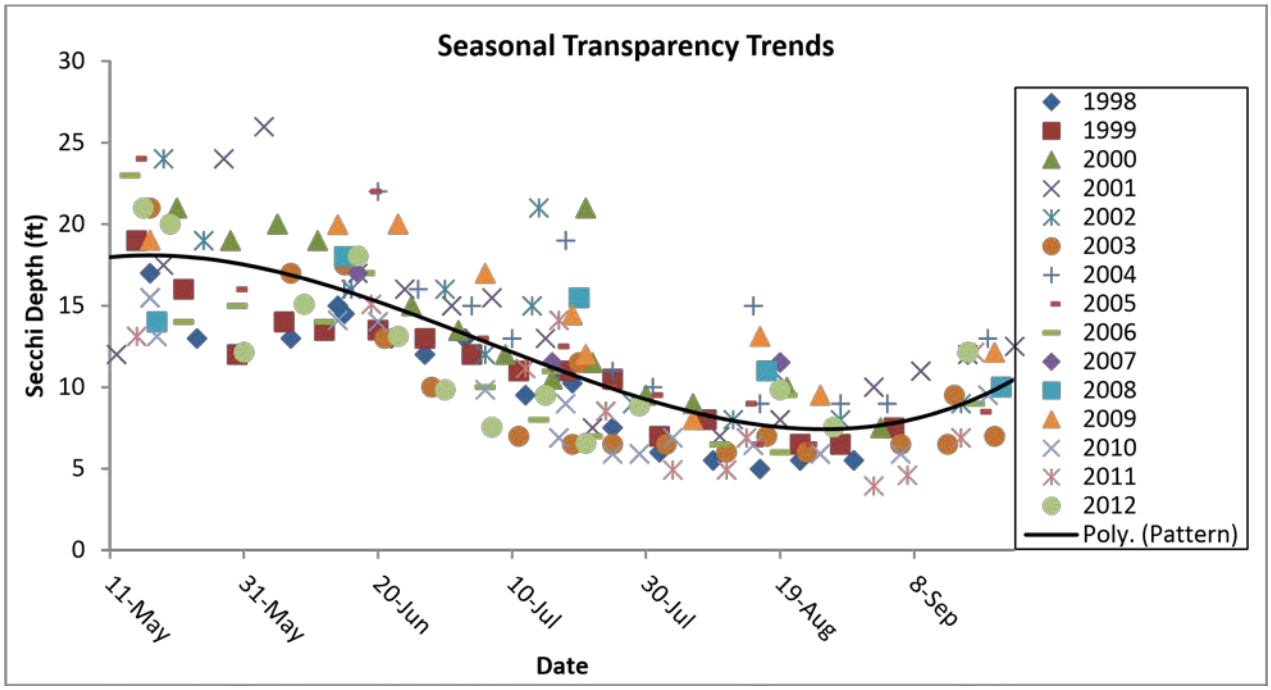


Figure 4. Seasonal transparency dynamics and year to year comparison (Primary Site 208). The black line represents the pattern in the data.

User Perceptions

When volunteers collect Secchi depth readings, they record their perceptions of the water based on the physical appearance and the recreational suitability. These perceptions can be compared to water quality parameters to see how the lake "user" would experience the lake at that time. Looking at transparency data, as the Secchi depth decreases the perception of the lake's physical appearance rating decreases. Lake Lida was rated as being either crystal clear or not quite crystal clear most of the time by samplers in 1998-2012 (Figure 5).

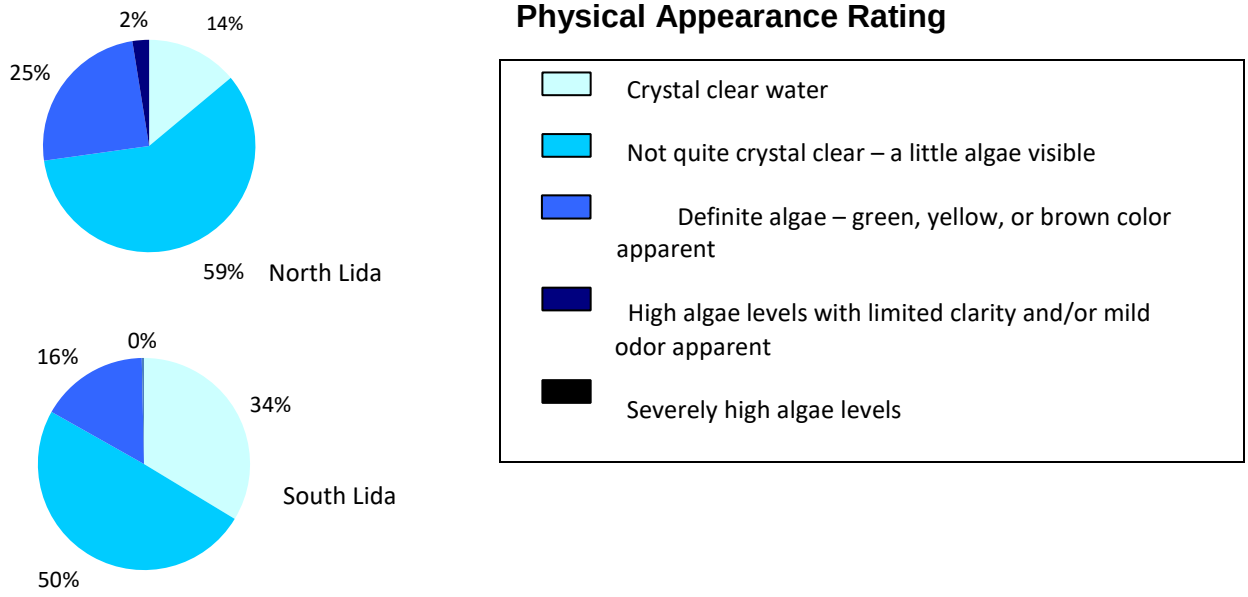


Figure 5. Lake Lida physical appearance ratings by samplers.

As the Secchi depth decreases, the perception of recreational suitability of the lake decreases. Lake Lida was rated as being "beautiful" or having just minor aesthetic problems in 1998-2012 (Figure 6).

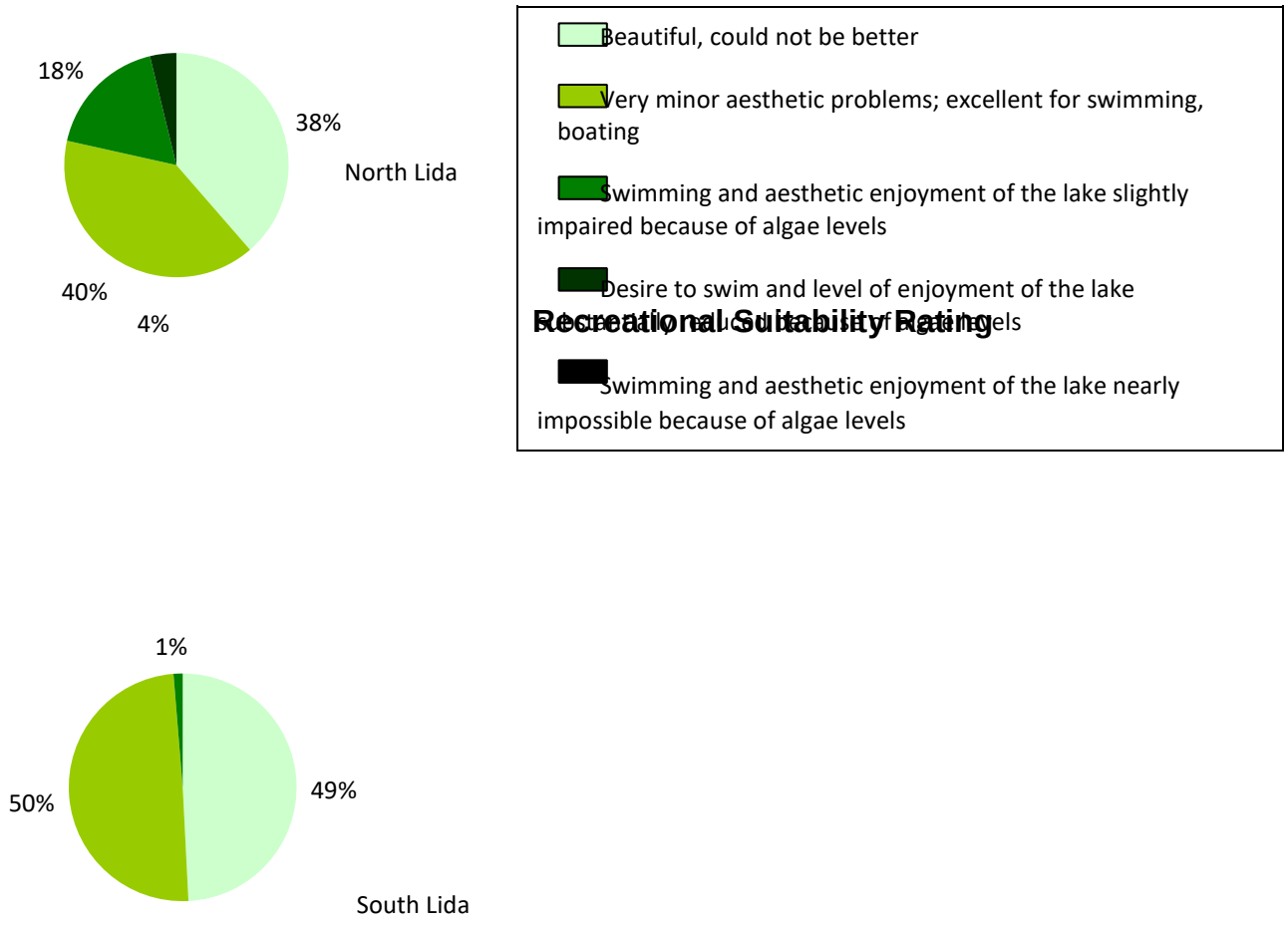


Figure 6. Recreational suitability rating, as rated by the volunteer monitor.

Total Phosphorus

Lake Lida is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus.

Total phosphorus was evaluated in both North Lida and South Lida in 1998-2012.

In North Lida the majority of the data points fall into the mesotrophic range (Figure 7). There is not much of a seasonal pattern in phosphorus in North Lida.

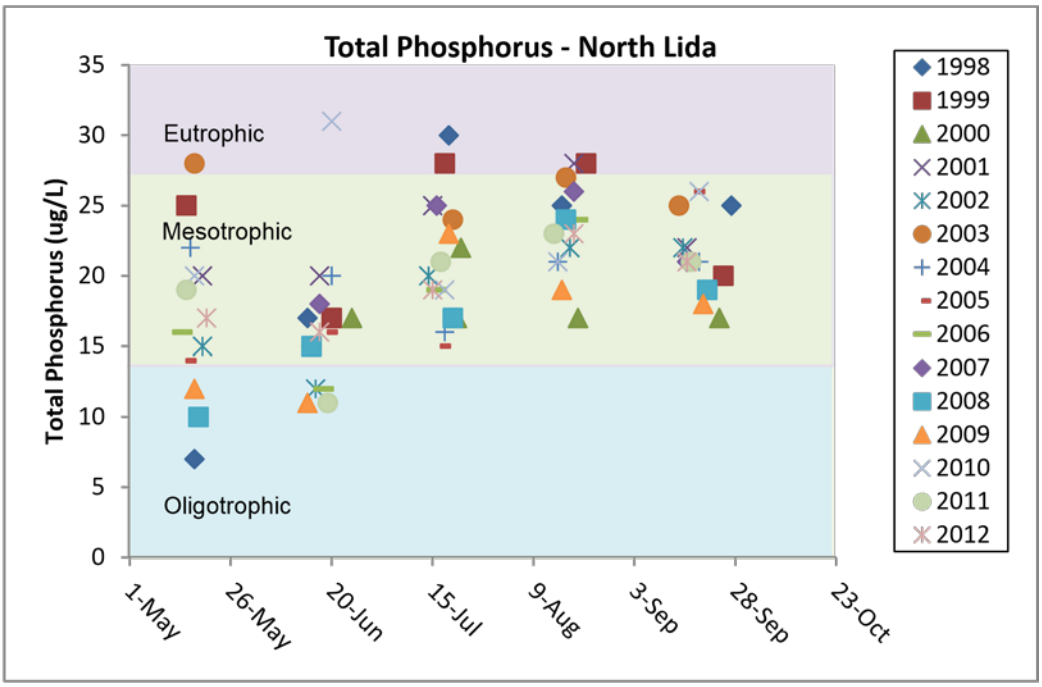


Figure 7. Historical total phosphorus concentrations (ug/L) for North Lida site 208.

In South Lida, the majority of the data points fall into the eutrophic range (Figure 8). The eutrophic nature of South Lida is most likely due to its shallow depth. The phosphorus in South Lida tends to be higher in spring and fall, which is most likely due to turnover.

Phosphorus should continue to be monitored to track any future changes in water quality.

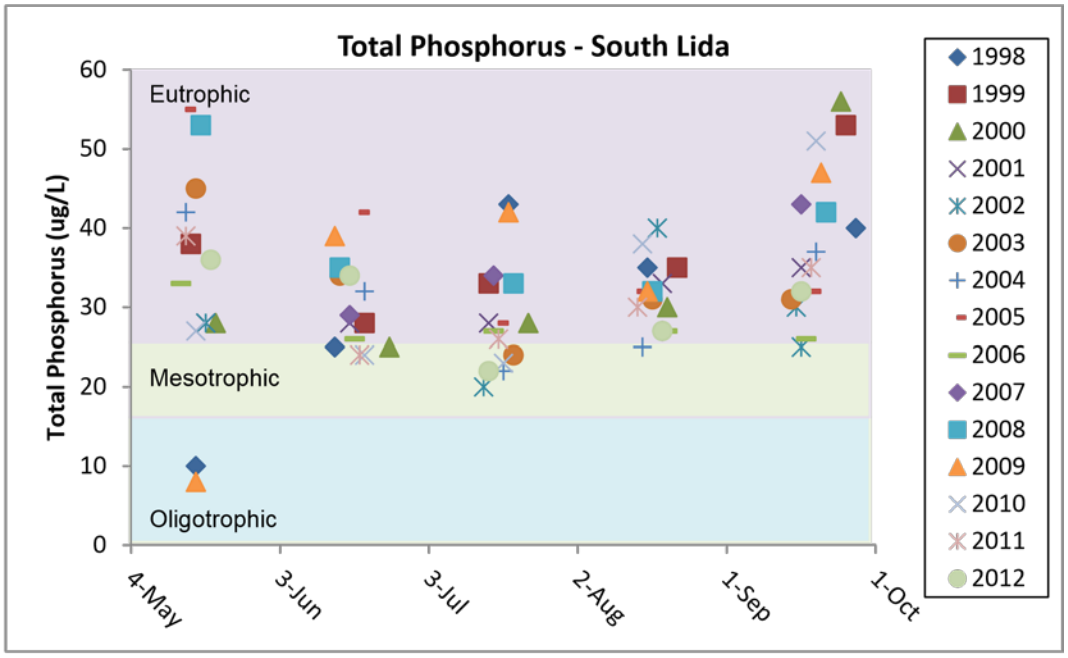


Figure 8. Historical total phosphorus concentrations (ug/L) for South Lida site 202.

Chlorophyll *a*

Chlorophyll *a* is the pigment that makes plants and algae green. Chlorophyll *a* is tested in lakes to deter mine the algae concentration or how "green" the water is.

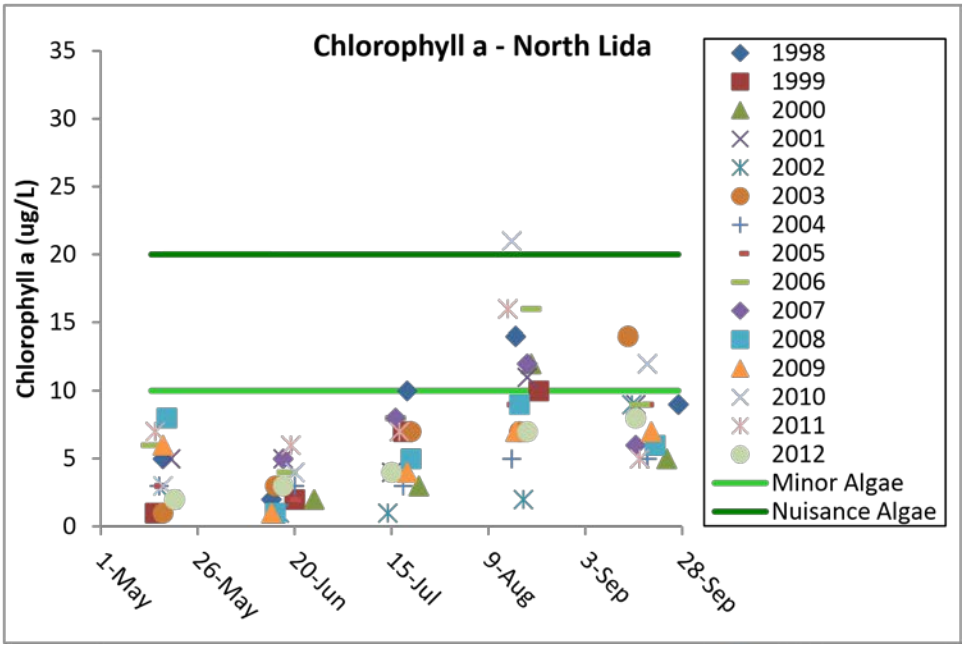


Figure 9. Chlorophyll *a* concentrations (ug/L) for North Lida at site 208.

Chlorophyll *a* concentrations greater than 10 ug/L are perceived as a mild algae bloom, while concentrations greater than 20 ug/L are perceived as a nuisance.

Chlorophyll *a* was evaluated in Lake Lida from 1998-2012 (Figures 9-10). In North Lida, chlorophyll *a* concentrations are low in early summer and increase towards the end of summer (Figure 9). This pattern matches the transparency dynamics (Figure 4).

Chlorophyll *a* concentrations reached 10 ug/L most summers in North Lida, indicating minor algae blooms (Figure 9). In South Lida, chlorophyll a concentrations exceeded 20 ug/L in most summers, indicating nuisance algae blooms (Figure 10).

The higher algae concentration in South Lida is due to the higher phosphorus concentration (Figure 8).

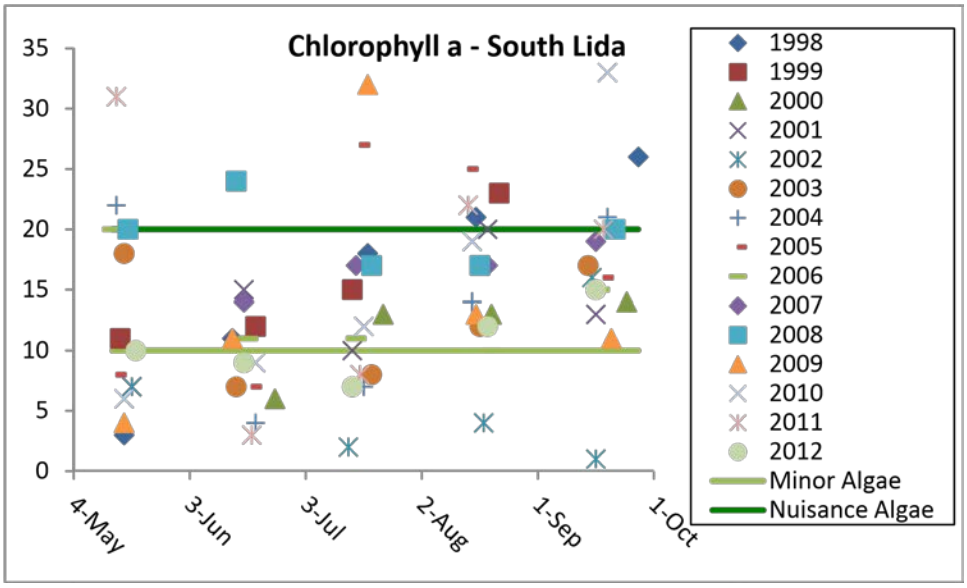
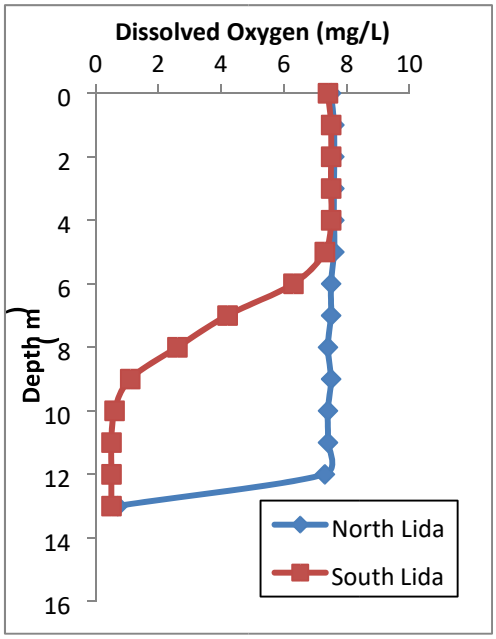


Figure 10. Chlorophyll a concentrations (ug/L) for South Lida at site 202.

Dissolved Oxygen



Dissolved Oxygen (DO) is the amount of oxygen dissolved in lake water. Oxygen is necessary for all living organisms to survive except for some bacteria. Living organisms breathe in oxygen that is dissolved in the water. Dissolved oxygen levels of <5 mg/L are typically avoided by game fisheries.

Lake Lida is a moderately deep lake, with a maximum depth of 58 feet in North Lida and a maximum depth of 46 feet in South Lida. Dissolved oxygen profiles from data collected on 6/12/2000 show stratification developing in South Lida, but not yet in North Lida. This is most likely because the data was collected in early summer before North Lida stratified. One would expect that North Lida stratifies as well in mid-summer. The thermocline in South Lida occurs at approximately 7 meters (23 feet), which means that gamefish will be scarce below this depth. Figure 11 is a representative dissolved oxygen profile for Lake Lida and it illustrates stratification in the summer of 2000.

Figure 11. Dissolved oxygen profile for Lake Lida.

Trophic State Index (TSI)

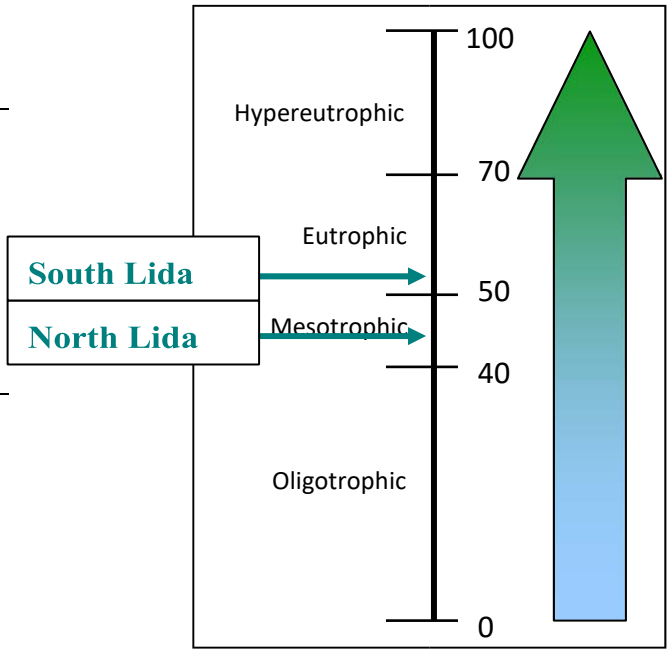
TSI is a standard measure or means for calculating the trophic status or productivity of a lake. More specifically, it is the total weight of living algae (algae biomass) in a waterbody at a specific location and time. Three variables, chlorophyll a, Secchi depth, and total phosphorus, independently estimate algal biomass.

Phosphorus (nutrients), chlorophyll *a* (algae

Table 6. Trophic State Index for Lake Lida.

Trophic State Index	North Lida	South Lida
TSI Total Phosphorus	47	54
TSI Chlorophyll-a	48	56
TSI Secchi	41	44
TSI Mean	46	52
Trophic State:	Mesotrophic	Eutrophic

Numbers represent the mean TSI for each parameter.



concentration) and Secchi depth

(transparency) are related. As phosphorus increases, there is more food available for algae, resulting in increased algal concentrations. When algal concentrations increase, the water becomes less transparent and the Secchi depth decreases. If all three TSI numbers are within a few points of each other, they are strongly related. If they are different, there are other dynamics influencing the lake's productivity, and TSI mean should not be reported for the lake.

The mean TSI falls into the mesotrophic range for North Lida and the eutrophic range for South Lida (Figure 12). In both bays the transparency TSI is lower than the phosphorus and chlorophyll a (Table 6). This could be due to larger algae cells dominating the algal community, selective grazing of smaller algal cells by zooplankton, or loss of rooted vegetation.

Figure 12. Trophic state index chart with corresponding trophic status.

Table 7. Trophic state index attributes and their corresponding fisheries and recreation characteristics.

TSI	Attributes	Fisheries & Recreation
<30	Oligotrophy: Clear water, oxygen throughout the year at the bottom of the lake, very deep cold water.	Trout fisheries dominate
30-40	Bottom of shallower lakes may become anoxic (no oxygen).	Trout fisheries in deep lakes only. Walleye, Cisco present.
40-50	Mesotrophy: Water moderately clear most of the summer. May be "greener" in late summer.	No oxygen at the bottom of the lake results in loss of trout. Walleye may predominate.
50-60	Eutrophy: Algae and aquatic plant problems possible. "Green" water most of the year.	Warm-water fisheries only. Bass may dominate.
60-70	Blue-green algae dominate, algal scums and aquatic plant problems.	Dense algae and aquatic plants. Low water clarity may discourage swimming and boating.
70-80	Hypereutrophy: Dense algae and aquatic plants.	Water is not suitable for recreation.
>80	Algal scums, few aquatic plants	Rough fish (carp) dominate; summer fish kills possible

Source: Carlson, R.E. 1997. A trophic state index for lakes. *Limnology and Oceanography*. 22:361-369.

Trend Analysis

For detecting trends, a minimum of 8-10 years of data with 4 or more readings per season are recommended. Minimum confidence accepted by the MPCA is 90%. This means that there is a 90% chance that the data are showing a true trend and a 10% chance that the trend is a random result of the data. Only short-term trends can be determined with just a few years of data, because there can be different wet years and dry years, water levels, weather, etc, that affect the water quality naturally.

Lake Lida had enough data to perform a trend analysis on all three parameters (Table 8). The data was analyzed using the Mann Kendall Trend Analysis.

Table 8. Trend analysis Lake Lida.

Lake Site	Parameter	Date Range	Trend
208 – North Lida	Total Phosphorus	1998-2012	No trend
208 – North Lida	Chlorophyll *a*	1998-2012	No trend
208 – North Lida	Transparency	1998-2012	No trend
202 – South Lida	Total Phosphorus	1998-2012	No trend
202 – South Lida	Chlorophyll *a*	1998-2012	No trend
202 – South Lida	Transparency	1998-2012	No trend

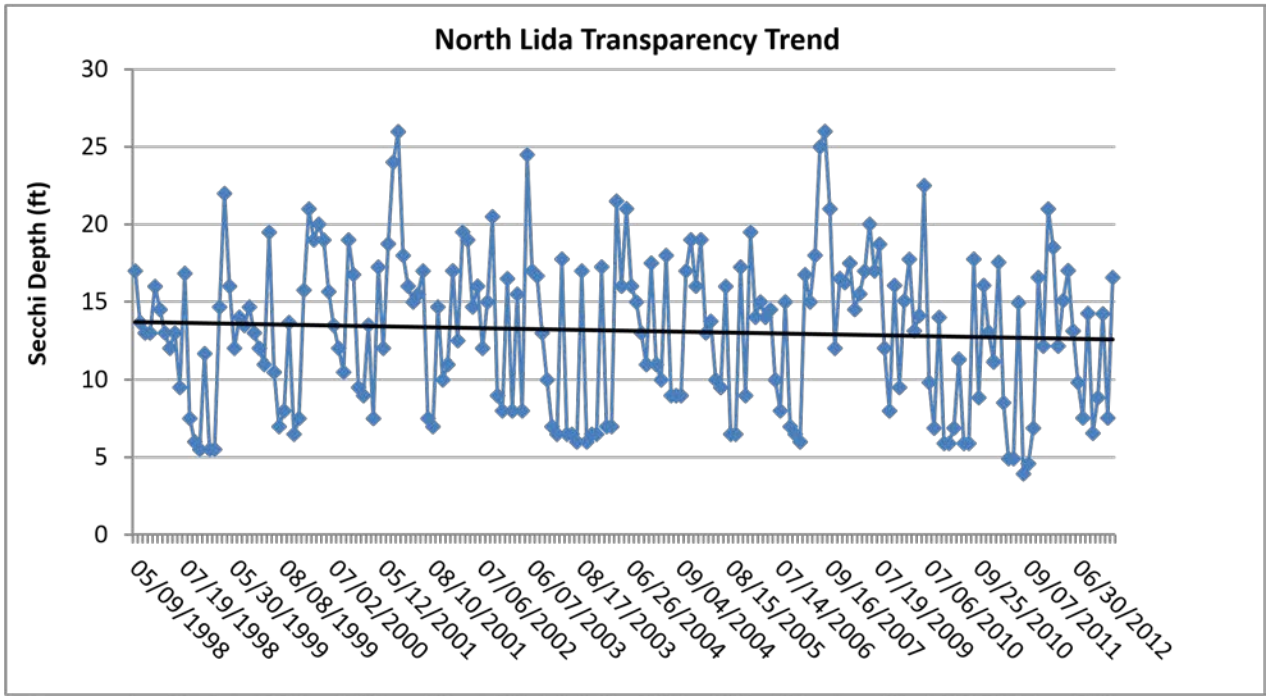


Figure 13. Transparency (feet) trend for site 208 from 1998-2012.

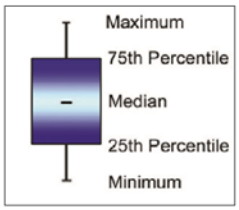
Lake Lida shows no evidence of water quality trends (Figure 13). That means that the water quality is stable. Transparency monitoring should continue so that this trend can be tracked in future years.

Ecoregion Comparisons

Minnesota is divided into 7 ecoregions based on land use, vegetation, precipitation and geology (Figure 14). The MPCA has developed a way to determine the "average range" of water quality expected for lakes in each ecoregion. From 1985-1988, the MPCA evaluated the lake water quality for reference lakes. These reference lakes are not considered pristine, but are considered to have little human impact and therefore are representative of the typical lakes within the ecoregion. The "average range" refers to the 25th

For the purpose of this graphical representation, the means of the reference lake data sets were used.

- 75th percentile range for data within each ecoregion.



Lake Lida is in the Northern Lakes and Forest Ecoregion. The mean total phosphorus, chlorophyll *a* and transparency (Secchi depth) for Lake Lida are within the ecoregion ranges (Figure 13).

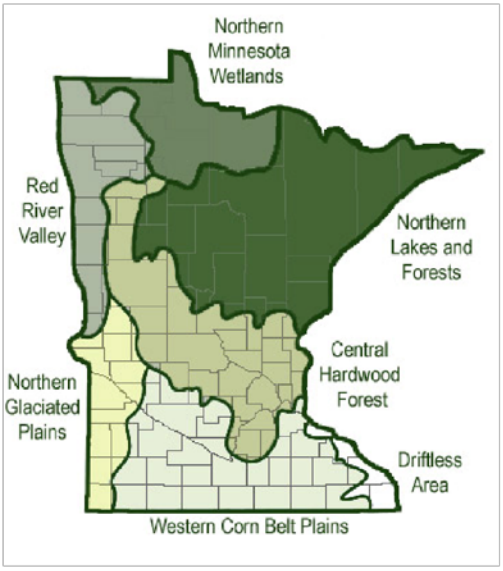


Figure 14. Minnesota Ecoregions.

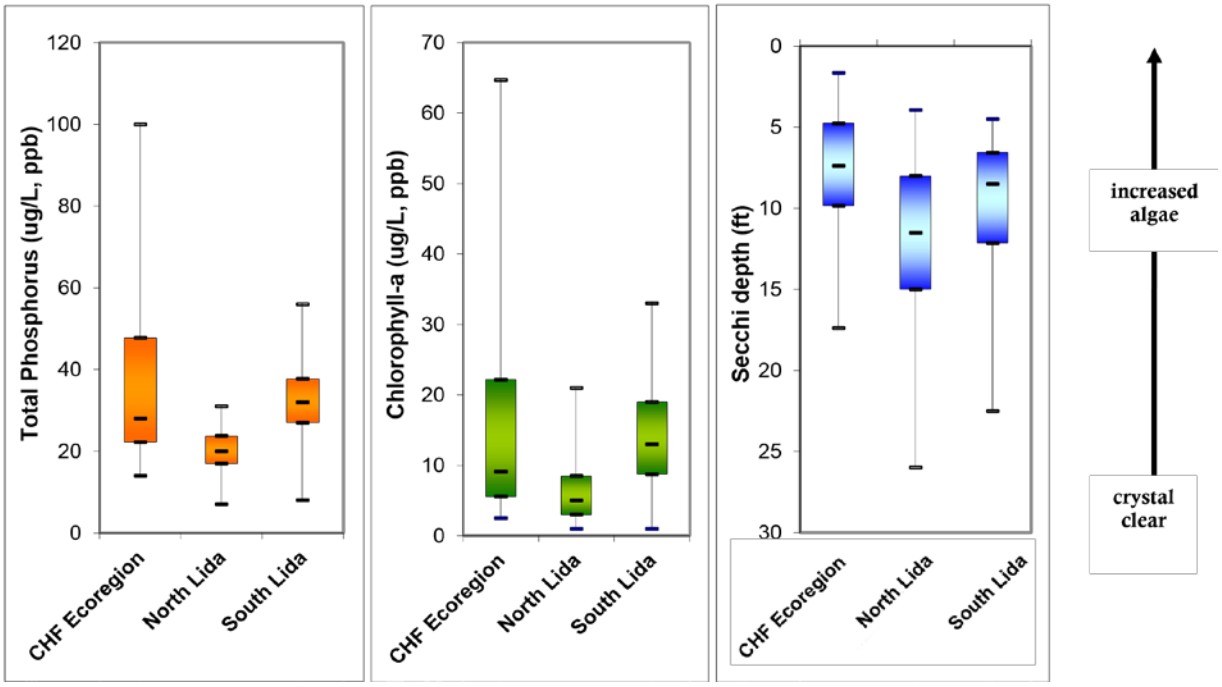


Figure 15. Lake Lida ranges compared to Northern Lakes and Forest Ecoregion ranges. The Lake Lida total phosphorus are from 74 data points while the chlorophyll *a* ranges are from 71 data points, both collected in May-September of 1998-2012. The Lake Lida Secchi depth range is from 198 data points collected in May-September of 1998-2012.

Lakeshed Data and Interpretations

Lakeshed

Understanding a lakeshed requires an understanding of basic hydrology. A watershed is defined as all land and water surface area that contribute excess water to a defined point. The MN DNR has delineated three basic scales of watersheds (from large to small): 1) basins, 2) major watersheds, and 3) minor watersheds.

The Otter Tail River Major Watershed is one of the watersheds that make up the Red River Basin, which drains north to Lake Winnipeg (Figure 16). This major watershed is made up of 106 minor watersheds. Lake Lida is located in minor watershed 56029 (Figure 17).

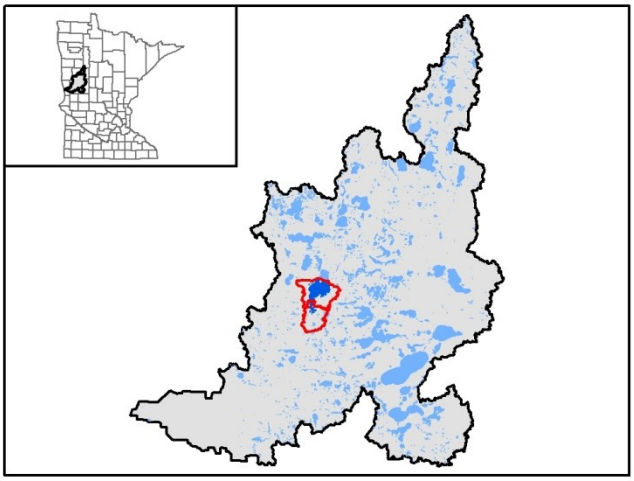


Figure 16. Otter Tail River Watershed.

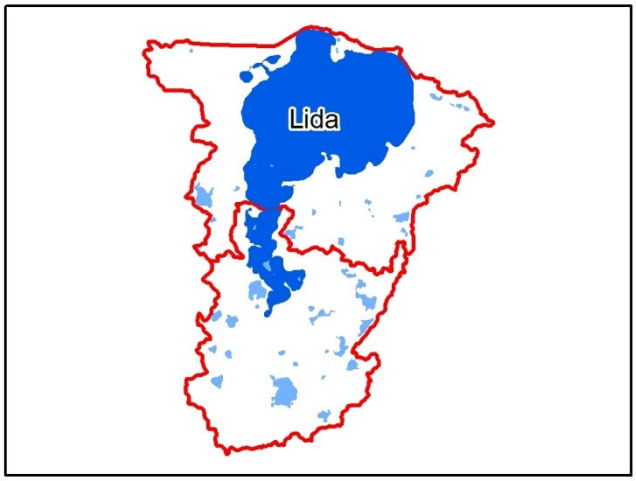


Figure 17. Minor Watershed 56029.

The MN DNR also has evaluated catchments for each individual lake with greater than 100 acres surface area. These lakesheds (catchments) are the "building blocks" for the larger scale watersheds. Lake Lida falls within lakeshed 5602900 & 5603000 (Figure 18). Though very useful for displaying the land and water that contribute directly to a lake, lakesheds are not always true watersheds because they may not show the water flowing into a lake from upstream streams or rivers. While some lakes may have only one or two upstream lakesheds draining into them, others may be connected to a large number of lakesheds, reflecting a larger drainage area via stream or river networks. For further discussion of Lake Lida's watershed, containing all the lakesheds upstream of the Lake Lida lakeshed, see page 19. The data interpretation of the Lake Lida lakeshed includes only the immediate lakeshed as this area is the land surface that flows directly into Lake Lida.

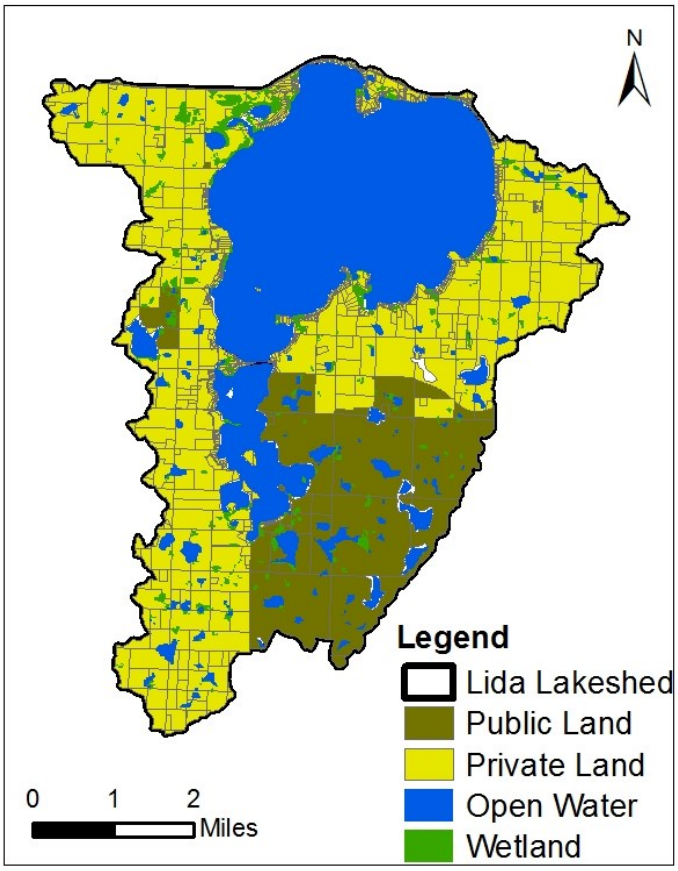


Figure 18. Lida lakesheds (5602900 & 5603000) with land ownership, lakes, wetlands, and rivers illustrated.

The lakeshed vitals table (next page) identifies where to focus organizational and management efforts for each lake (Table 9). Criteria were developed using limnological concepts to determine the effect to lake water quality.

KEY

Possibly detrimental to the lake

Warrants attention

Beneficial to the lake

Table 9. Lake Lida lakeshed vitals table.

Lakeshed Vitals			Rating
Lake Area (acres)	North: 5513	South: 775	descriptive
Littoral Zone Area (acres)	North: 2380	South: 356	descriptive
Lake Max Depth (feet)	North: 58	South: 48	descriptive
Lake Mean Depth (feet)	North: 18	South: 18	
Water Residence Time (years)	North: 12.5	South: 4.5	
Miles of Stream	North: 0.5	South: 2.4	descriptive
Inlets	North: 3	South: 1	
Outlets	North: 1	South: 1	
Major Watershed	56 – Otter Tail River		descriptive
Minor Watershed	North: 56029	South: 56030	descriptive
Lakeshed	North: 5602900	South: 5603000	descriptive
Ecoregion	North Central Hardwood Forests		descriptive
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	North – 2:1	South – 9:1	
Standard Watershed to Lake Basin Ratio (standard watershed includes lake areas)	North – 4:1	South – 12:1	
Wetland Coverage (NWI)	North: 13%	South: 17%	
Aquatic Invasive Species	Zebra mussels, curly-leaf pondweed		
Public Drainage Ditches	None		
Public Lake Accesses	North: 1	South: 1	
Miles of Shoreline	North: 19	South: 9.3	descriptive
Shoreline Development Index	North: 1.8	South: 2.4	
Public Land to Private Land Ratio	North – 0.2:1	South – 1.1:1	
Development Classification	General Development		
Miles of Road	North: 42	South: 24	descriptive
Municipalities in lakeshed	None		
Forestry Practices	None		
Feedlots	North: 3	South: 3	
Sewage Management	Individual Subsurface Sewage Treatment Systems (The county last inspected the entire lake in 1984, however in 2011 & 2012 they did rechecks of septic systems that were 20+ years old)		
Lake Management Plan	Last updated in 2005		
Lake Vegetation Survey/Plan	DNR, 2003 & 2005		

Land Cover / Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed. The basic purpose of land use planning is to ensure that each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.

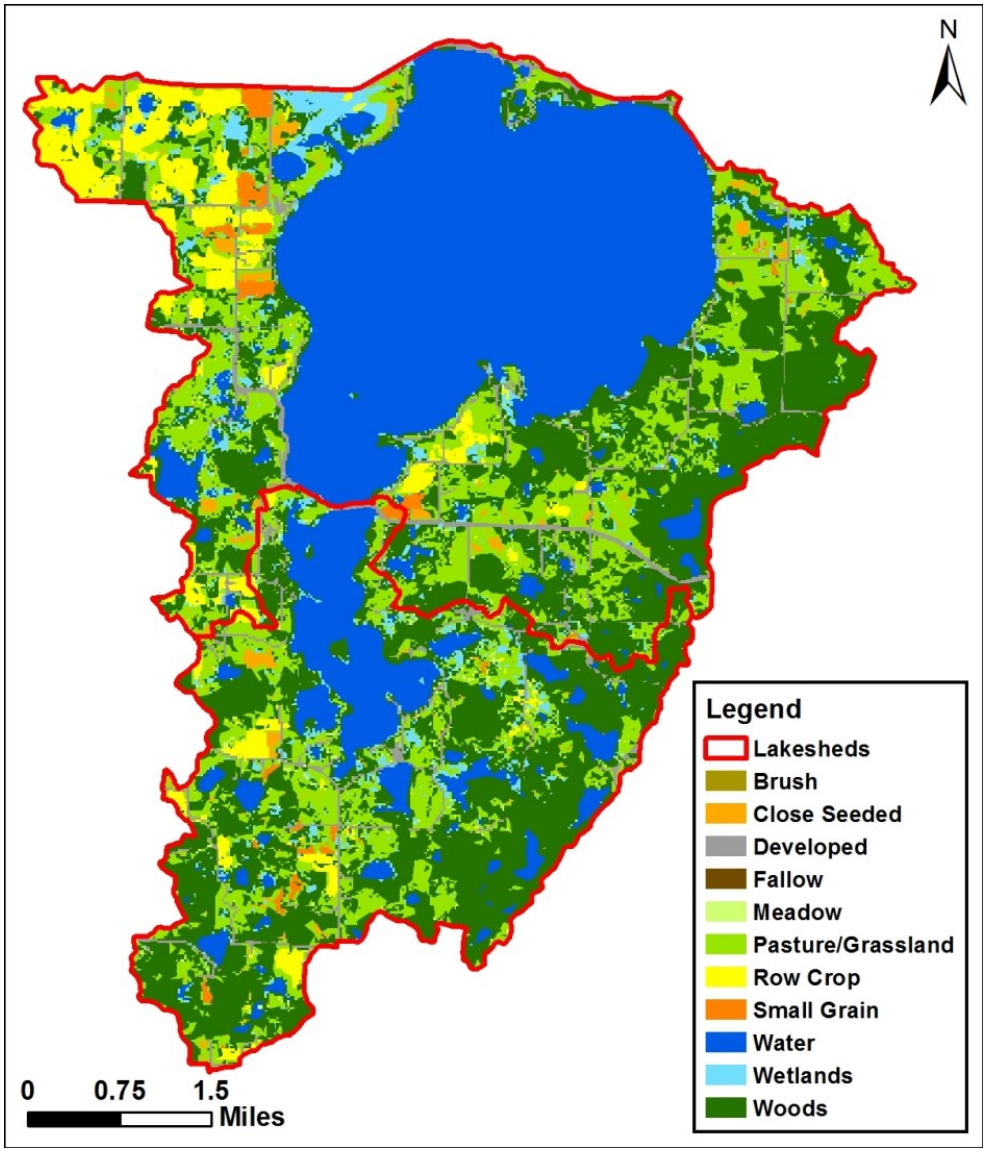


Figure 19. Lida lakeshed (5602900 & 5603000) land cover (NASS, 2012).

Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the land's ability to absorb and store water rather than cause it to flow overland allowing nutrients and sediment to move towards the lowest point, typically the lake. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed (Figure 17). Even though the entire lakeshed has the potential to drain towards the lake, the land use occurring directly around the lakeshore will most likely have the greatest impact to the lake.

Developed land cover (Table 10) mostly describes impervious surface. In impervious areas, such as roads and houses, the land is unable to absorb water and it runs off the landscape carrying with it any nutrients or sediment in its path. The higher the impervious intensity the more area that water cannot penetrate in to the soils. Impervious areas can contribute 0.45 – 1.5 pounds of phosphorus per year in runoff. North Lida Lake has 3.85% of its lakeshed classified as developed, and South Lida has 4.23% of its lakeshed classified as developed (Tables 10-11). This doesn't sound like much area, but if it is mainly concentrated on the lakeshore, the runoff from impervious areas can run directly into the lake. Table 10. Land cover in the North Lida lakeshed

Potential Category		Specific Landcover	Acres	Percent
High	Agriculture	**Row Crop**	863.26	6.08%
High	Urban	**Developed**	545.92	3.85%
High	Agriculture	**Close Seeded**	136.58	0.96%
High	Agriculture	**Small Grain**	141.69	1.00%
High	Agriculture	**Fallow**	0.60	0.00%
Low	Forest	**Woods**	3600.42	25.38%
Low	Water	**Water**	5851.13	41.24%
Low	Agriculture	**Pasture/Grassland**	2468.31	17.40%
Low	Wetlands	**Wetlands**	504.64	3.56%
Low	Agriculture	**Meadow**	70.67	0.50%
Low	Grass/Shrub	**Brush**	4.41	0.03%
Total area with low runoff potential			12499.58	88.11%
Total area with high runoff potential			1688.05	11.89%
Total			14187.63	100.00%

Table 11. Land cover in the South Lida lakeshed.

Potential Category		Specific Landcover	Acres	Percent
High	Agriculture	**Row Crop**	201.07	2.82%
High	Urban	**Developed**	301.56	4.23%
High	Agriculture	**Close Seeded**	58.35	0.82%
High	Agriculture	**Small Grain**	58.65	0.82%
High	Agriculture	**Fallow**	0.82	0.00%
Low	Forest	**Woods**	3452.69	48.47%
Low	Water	**Water**	1296.71	18.20%
Low	Agriculture	**Pasture/Grassland**	1440.80	20.23%
Low	Wetlands	**Wetlands**	238.78	3.35%
Low	Agriculture	**Meadow**	69.04	0.97%
Low	Grass/Shrub	**Brush**	4.37	0.06%
Total area with low runoff potential			6502.38	91.28%
Total area with high runoff potential			620.45	8.70%
Total			7122.84	100.00%

Runoff

Agricultural land use has the potential to contribute nutrients to a lake through runoff, but the amount of phosphorus runoff depends on the type of agricultural land use. Generally, the highest concentration of agricultural nutrient runoff comes from animal feedlots. There are three animal feedlots in the North Lida lakeshed and three in the South Lida lakeshed (Table 9). The second highest agricultural runoff generally comes from row crops. There are some row crops along the northwest and southeast shore of North Lida, although it looks like there is some forested buffer and wetlands between the row crops and the lake (Figure 19). This buffer is important for filtering the runoff and helping it infiltrate into the ground. Pasture land has less nutrient runoff, and most likely doesn't impact the lake as much as other agricultural uses. Therefore, the statistics in Table 10 are valuable for evaluating runoff in the lakeshed. Overall, 88% of the North Lida lakeshed and 91% of the South Lida lakeshed is classified in low nutrient runoff land uses (Tables 10-11).

The University of Minnesota has online records of land cover statistics from years 1990 and 2000 (http://land.umn.edu). Although this data is 12 years old, it is the only data set that is comparable over a decade's time. In addition, a lot of lake development occurred from 1990 to 2000 when the US economy was booming. Tables 12-13 describes Lida's lakeshed land cover statistics related to development and percent change from 1990 to 2000. Due to the many factors that influence demographics, one cannot determine with certainty the projected statistics over the next 10, 20, 30+ years, but one can see the impervious area has increased, which has implications for storm water runoff into the lake. The increase in impervious area is consistent with the increase in urban acreage.

Table 12. North Lida lakeshed land cover statistics and % change from 1990 to 2000 (http://land.umn.edu).

	1990		2000		
Land Cover	**Acres**	**Percent**	**Acres**	**Percent**	**Comments**
Urban	482	3.4%	598	4.2%	Increase of 116 acres
Total Impervious Area*	88	1.05%	129	1.55%	Increase of 41 acres

*Percent Impervious Area Excludes Water Area

Table 13. South Lida lakeshed land cover s :atistics and › change from 1 990 to 2000 (ıttp://land.umn.edu).

	1990		2000		
Land Cover	**Acres**	**Percent**	**Acres**	**Percent**	**Comments**
Urban	238	3.34%	314	4.41%	Increase of 76 acres
Total Impervious Area*	29	0.49%	57	0.98%	Increase of 28 acres

*Percent Impervious Area Excludes Water Area

Demographics

Lake Lida is classified as a general development lake. General development lakes usually have more than 225 acres of water per mile of shoreline, 25 dwellings per mile of shoreline, and are more than 15 feet deep.

The Minnesota Department of Administration Geographic and Demographic Analysis Division extrapolated future population in 5year increments out to 2035. Compared to Otter Tail County as a whole, Lida and Maplewood Townships have a higher growth projection (Figures 20, 21).

(source:http://www.demography.state.mn.us/resource.html?Id=19332)

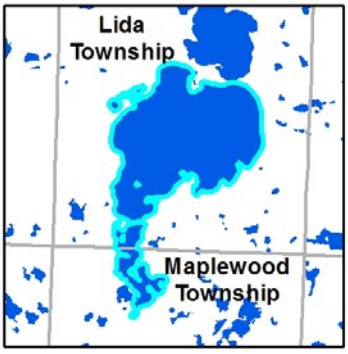


Figure 20. Lake Lida showing adjacent township boundaries.

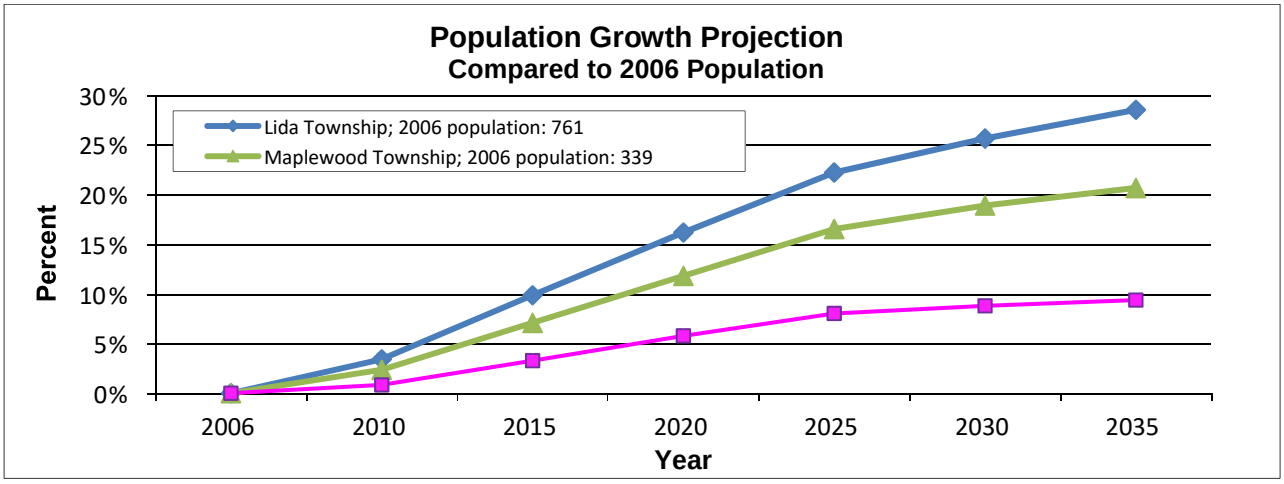


Figure 21. Population growth projection for Lida Township, Maplewood Township and Otter Tail County.

Lakeshed Water Quality Protection Strategy

Each lakeshed has a different makeup of public and private lands. Looking in more detail at the makeup of these lands can give insight on where to focus protection efforts. The protected lands (easements, wetlands, public land) are the future water quality infrastructure for the lake. Developed land and agriculture have the highest phosphorus runoff coefficients, so this land should be minimized for water quality protection.

The majority of the land within Lake Lida's lakeshed is privately owned and used for agricultural production (Tables 14-15). This land can be the focus of development and protection efforts in the lakeshed.

Table 14. North Lida Land ownership, land use/land cover, estimated phosphorus loading, and ideas for protection and restoration in the lakeshed (Sources: Otter Tail County parcel data, 2006 National Land Cover Dataset).

	Private (51%)					41%	Public (8%)		
	Developed	Agriculture	Forested Uplands	Other	Wetlands	Open Water	County	State	Federa
Land Use (%)	3.2	23	18.1	3.7	3	41	0.7	6.3	1
Runoff Coefficient Lbs of phosphorus/acre/year	0.45 – 1.5	0.26 – 0.9	0.09		0.09		0.09	0.09	0.09
Estimated Phosphorus Loading Acreage x runoff coefficient	204–680	849–2940	231		36		9	81	14
Description	Focused on Shoreland	Cropland	Focus of develop-ment and protection efforts	Open, pasture, grassland, shrubland	Protected				
Potential Phase 3 Discussion Items	Shoreline restoration	Restore wetlands; CRP	Forest stewardship planning, 3rd party certifica-tion, SFIA, local woodland cooperatives		Protected by Wetland Conservation Act		County Tax Forfeit Lands	State Forest	National Forest

Table 15. South Lida Land ownership, land use/land cover, estimated phosphorus loading, and ideas for protection and restoration in the lakeshed (Sources: Otter Tail County parcel data, 2006 National Land Cover Dataset).

	Private (40%)					16%	Public (44%)		
	Developed	Agriculture	Forested Uplands	Other	Wetlands	Open Water	County	State	Federa
Land Use (%)	2.3	13.4	18	5	1.3	16	0.3	43.7	0
Runoff Coefficient Lbs of phosphorus/acre/year	0.45 – 1.5	0.26 – 0.9	0.09		0.09		0.09	0.09	0.09
Estimated Phosphorus Loading Acreage x runoff coefficient	74–247	247–856	115		9		2	289	0
Description	Focused on Shoreland	Cropland	Focus of develop-ment and protection efforts	Open, pasture, grassland, shrubland	Protected				
Potential Phase 3 Discussion Items	Shoreline restoration	Restore wetlands; CRP	Forest stewardship planning, 3rd party certification, SFIA, local woodland cooperative s		Protected by Wetland Conservation Act		County Tax Forfeit Lands	State Forest	National Forest

DNR Fisheries approach for lake protection and restoration

Credit: Peter Jacobson and Michael Duval, Minnesota DNR Fisheries

In an effort to prioritize protection and restoration efforts of fishery lakes, the MN DNR has developed a ranking system by separating lakes into two categories, those needing protection and those needing restoration. Modeling by the DNR Fisheries Research Unit suggests that total phosphorus concentrations increase significantly over natural concentrations in lakes that have watershed with disturbance greater than 25%. Therefore, lakes with watersheds that have less than 25% disturbance need protection and lakes with more than 25% disturbance need restoration (Table 16). Watershed disturbance was defined as having urban, agricultural and mining land uses. Watershed protection is defined as publicly owned land or conservation easement.

Table 16. Suggested approaches for watershed protection and restoration of DNR-managed fish lakes in Minnesota.

Watershed Disturbance (%)	Watershed
< 25%	
25-60%	
> 60%	

The next step was to prioritize lakes within each of these management categories. DNR Fisheries identified high value fishery lakes, such as cisco refuge lakes. Ciscos (*Coregonus artedi)* can be an early indicator of eutrophication in a lake because they require cold hypolimnetic temperatures and high dissolved oxygen levels. These watersheds with low disturbance and high value fishery lakes are excellent candidates for priority protection measures, especially those that are related to forestry and minimizing the effects of landscape disturbance. Forest stewardship planning, harvest coordination to reduce hydrology impacts and forest conservation easements are some potential tools that can protect these high value resources for the long term.

Lake Lida's lakeshed is classified with having 52.1% of the lakeshed protected and 32.8% of the lakeshed disturbed (Figure 22). Therefore, this lakeshed should have a full restoration focus. This lake is just over the 25% disturbed threshold. Goals for the lake should be to limit any increase in disturbed land use.

Figure 23 displays the upstream lakesheds that contribute water to the lakeshed of interest. All of the land and water area in this figure has the potential to contribute water to Lake Lida, whether through direct overland flow or through a creek or river. There are 2 lakesheds upstream of the Lake Lida lakeshed.

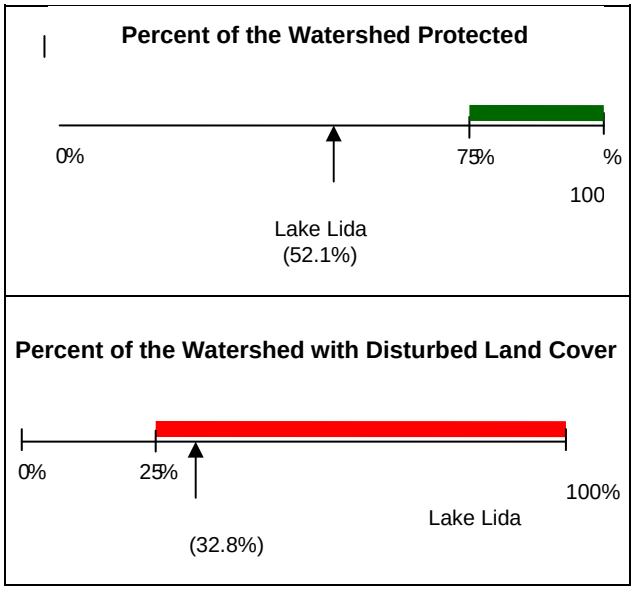


Figure 22. Lake Lida's lakeshed percentage of watershed protected and disturbed.

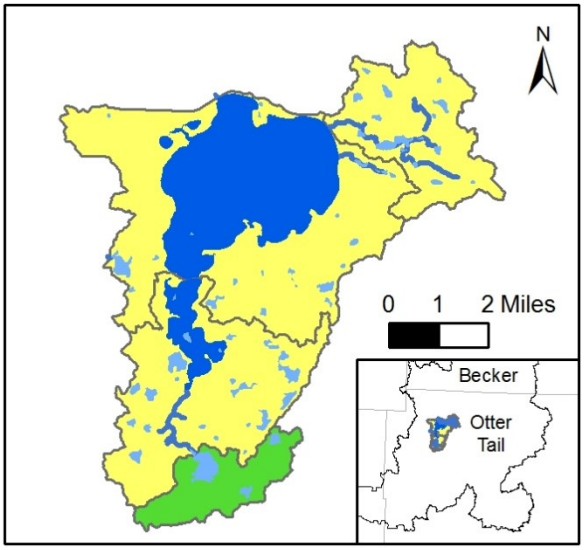


Figure 23. Upstream lakesheds that contribute water to the Lake Lida lakeshed. Color-coded based on management focus (Table 16).

Surface Runoff Analysis (East Otter Tail SWCD)

The maps below (Figures 24-27) show the different catchments that drain into Lake Lida. These catchments are delineated by land elevation, as everything drains downhill. Each catchment was evaluated for potential surface erosion. Catchments that are colored red have a relatively high potential for surface erosion and soil loss and catchments that are colored dark green have a relatively low potential for soil loss. Shoreline in red areas would be good candidates for shoreline restoration, rain gardens, grassed waterways, filter strips and other best management practices addressing overland flow and erosion. Contact the Otter Tail SWCD for help with these areas.

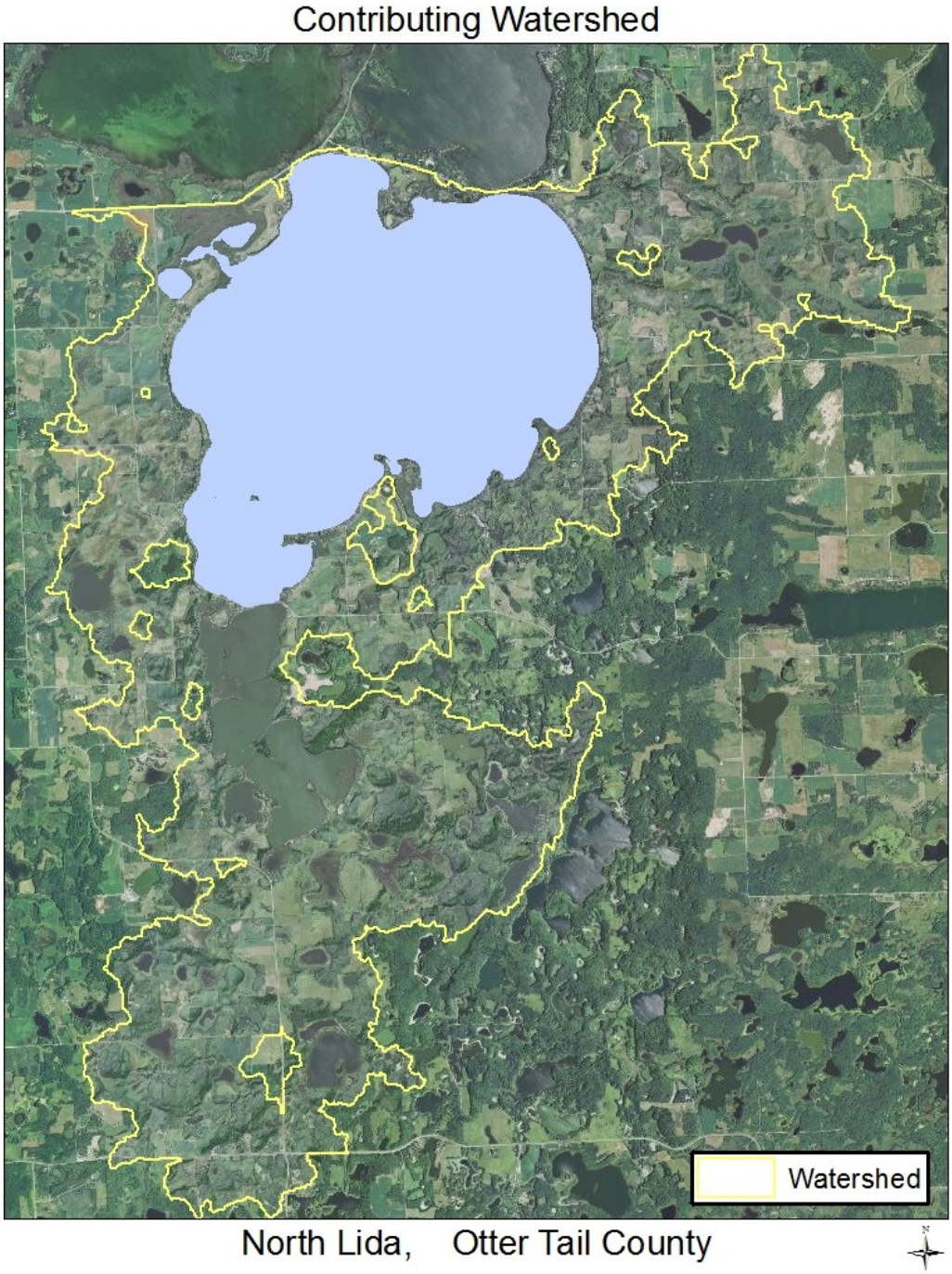


Figure 24. Contributing watershed to Lida Lake. The area inside the yellow box is all the land area that drains into North Lida Lake.

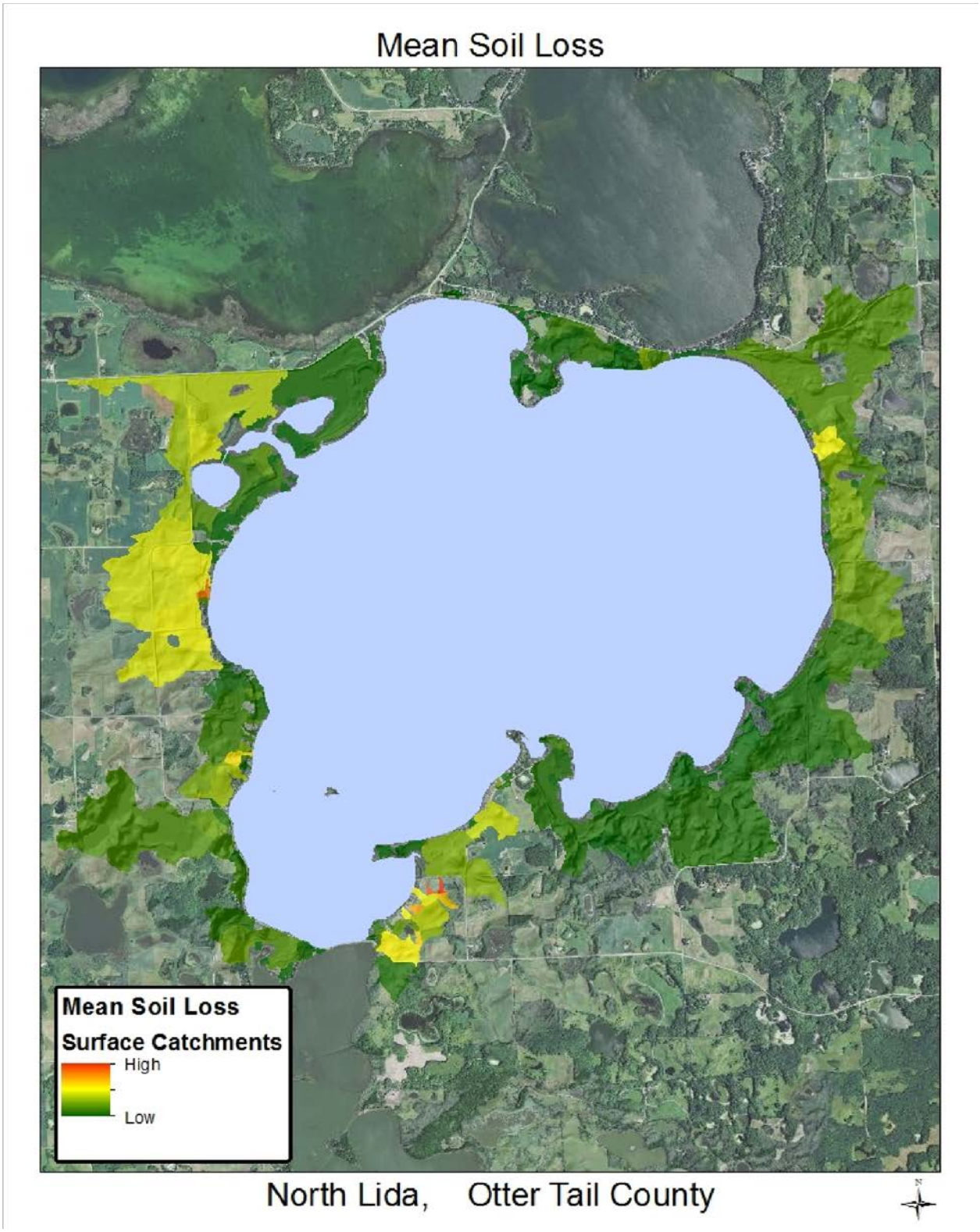


Figure 25. Potential for erosion in the surface catchments for North Lida Lake.

Figure 26. Contributing watershed for South Lida Lake. Inside the yellow box is all the land area that drains to South Lida Lake.

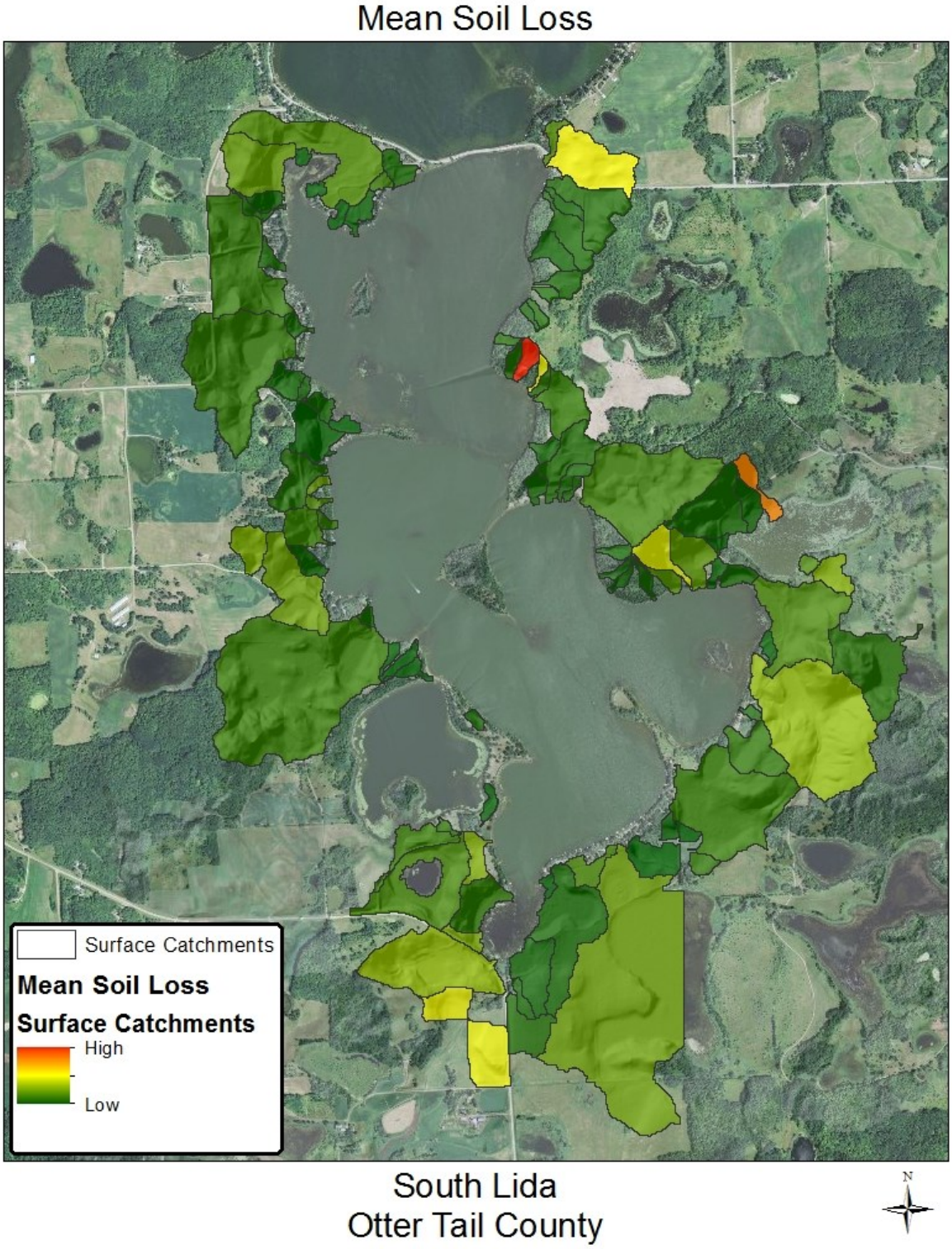


Figure 27. Potential for erosion in the surface catchments for South Lida Lake.

Status of the Fishery

North Lida, (DNR, 08/06/2009)

North Lida Lake is a 5,564-acre mesotrophic (moderately fertile) lake located in northwestern Otter

Tail County approximately five miles east of Pelican Rapids, MN. North Lida Lake is connected to

South Lida Lake by a navigable culvert under State Highway 108 along the south shoreline. North Lida Lake is also connected to Lizzie Lake via a non-navigable culvert under County Road 4. The immediate watershed is composed primarily of agricultural land interspersed with hardwood woodlots. The maximum depth is 58 feet; however, 43% of the lake is 15 feet or less in depth. The secchi disk reading during the 2012 lake survey was 6.5 feet. Previous secchi disk readings have ranged from 6.0 to 9.5 feet.

A majority of the shoreline on North Lida Lake has been developed. Homes, cottages, and resorts compose the development. A DNR owned concrete public water access is located off of County Road 4 along the north shoreline.

Large stands of hardstem bulrush are scattered throughout the lake. Emergent aquatic plants such as bulrush provide valuable fish and wildlife habitat, and are critical for maintaining good water quality. They protect shorelines and lake bottoms, and can actually absorb and break down polluting chemicals. Emergent plants provide spawning areas for fish such as northern pike, largemouth bass, and panfish. They also serve as important nursery areas for all species of fish. Because of their ecological value, emergent plants may not be removed without a DNR permit.

North Lida Lake is one of the best all-around angling lakes in Otter Tail County. Walleye, northern pike, smallmouth bass, black crappie, and bluegill are the dominant gamefish species. Data from recent lake surveys indicate that these species are abundant and have good size distributions as well.

Walleye abundance is the highest recorded for this lake. Walleyes ranged in length from 7.2 to 24.6 inches with an average length and weight of 13.7 inches and 1.2 pounds. Age and catch data indicate that the 2011 year class is very strong and should provide consistently good walleye angling for several years. Walleyes attain an average length of 14.2 inches at four years of age.

Pike abundance has remained at a moderate density and natural reproduction has continued to be consistently good. Pike ranged in length from 15.0 to 27.2 inches with an average length and weight of 20.4 inches and 1.8 pounds. Pike attain an average length of 21.8 inches at four years of age.

Age and catch data indicate that a balanced smallmouth bass population exists. Smallmouth bass ranged in length from 5.8 to 18.1 inches with an average length and weight of 12.6 inches and 1.3 pounds. Age and length data indicate that reproduction is consistently good. Smallmouth bass attain an average length of 13.8 inches at five years of age.

Data from a spring trapnetting assessment indicate that the black crappie population is very abundant and has a good size distribution. Crappies ranged in length from 2.2 to 13.0 inches with an average length of 10.3 inches. Forty-seven percent of the sample was 11.0 inches or greater in length. Crappies attain an average length of 11.4 inches at six years of age.

Age and catch data indicate that the bluegill population is very abundant and that reproduction is consistently good. Twenty-nine percent of the bluegills were 7.0 inches or greater in length. Bluegills attain an average length of 7.9 inches at seven years of age.

The DNR and the Lida Lakes Association have been involved in several cooperative projects designed to improve and protect water quality and fish habitat. In 1998, a shoreline stabilization project was completed. Rock rip-rap was used to stabilize several areas of shoreline that were experiencing varying degrees of erosion. In 1997, 160 smallmouth bass nesting structures were constructed and placed in North Lida Lake. These structures help smallmouth bass reproduce more successfully.

Harvest regulations for walleye and black crappie have been implemented on North Lida Lake. The walleye regulation is a 17.0 to 26.0 inch protected slot limit with one fish over 26.0 inches allowed in possession. The black crappie regulation is an 11-inch minimum length limit. The intent of these regulations is to improve the size structures of these populations. Anglers can also maintain the quality of angling by practicing selective harvest. Selective harvest encourages the release of medium to large size fish while allowing the harvest of more abundant smaller fish for table fare. Releasing the medium to large fish will ensure that the lake will have enough spawning age fish on an annual basis and will provide anglers with more opportunities to catch large fish in the future.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. http://www.dnr.state.mn.us/lakefind/showreport.html?downum=56074701

South Lida, (DNR, 07/02/2012)

South Lida Lake is connected to North Lida Lake by a navigable culvert under State Highway 108 along the north shoreline of the lake. The immediate watershed is composed primarily of hardwood forest. The maximum depth is 48 feet; however, 42% of the lake is 15 feet or less in depth. The secchi disk reading during the 2012 lake survey was 7.0 feet. Previous secchi disk readings have ranged from 4.5 to

9.3 feet. The south and west shorelines of South Lida Lake have been extensively developed with homes and cabins. A majority of the east shoreline is located within the boundaries of Maplewood State Park. A DNR owned public water access is located within the state park along the southeast shoreline and a private access is located along the north shoreline. A public swimming beach and campground are also located along the east shoreline in the state park.

Large stands of hardstem bulrush and common cattail are scattered along the undeveloped sections of shoreline. Emergent aquatic plants such as bulrush and cattail provide valuable fish and wildlife habitat, and are critical for maintaining good water quality. They protect shorelines and lake bottoms, and can actually absorb and break down polluting chemicals. Emergent plants provide spawning areas for fish such as northern pike, largemouth bass, and panfish. They also serve as important nursery areas for all species of fish. Because of their ecological value, emergent plants may not be removed without a DNR permit.

South Lida Lake can be ecologically classified as a walleye-centrarchid type of lake and this is reflected in the assemblage of the fish community. Walleye, northern pike, largemouth bass, black crappie, and bluegill are the dominant gamefish species. Walleyes ranged in length from 7.4 to 28.0 inches with an average length and weight of 18.1 inches and 2.3 pounds. Age data indicate that the 2011 year class is strong and should provide good walleye angling in the future. Walleyes attain an average length of 16.5 inches at five years of age.

The general trend over recent surveys has been an increase in northern pike abundance. Age and length data indicate that pike reproduction is consistently good. Pike ranged in length from 17.5 to 34.6 inches with an average length and weight of 22.1 inches and 2.4 pounds. Pike attain an average length of 22.1 inches at four years of age.

Data from a spring trapnetting assessment indicate that black crappies are abundant and have a good size distribution. Black crappies ranged in length from 6.1 to 13.0 inches with a mean length of 10.2 inches. Thirty-seven percent of the crappies were 11.0 inches or greater in length. Crappies attain an average length of 10.6 inches at five years of age.

The bluegill population is very abundant and has a good size structure. Twenty-six percent of the bluegills were 7.0 inches or greater in length. Bluegills reach an average length of 7.9 inches at age-VI.

Harvest regulations for walleye and black crappie have been implemented on South Lida Lake. The walleye regulation is a 17.0 to 26.0 inch protected slot limit with one over 26.0 inches allowed in possession. The black crappie regulation is an 11-inch minimum length limit. The intent of these regulations is to improve the size structures of these populations. Anglers can also maintain the quality

of angling by practicing selective harvest. Selective harvest encourages the release of medium to large size fish while allowing the harvest of more abundant smaller fish for table fare. Releasing the medium to large fish will ensure that the lake will have enough spawning age fish on an annual basis and will provide anglers with more opportunities to catch large fish in the future.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. http://www.dnr.state.mn.us/lakefind/showreport.html?downum=56074702

Key Findings / Recommendations from the RMB Laboratories Report

Monitoring Recommendations

Transparency monitoring at site 208 in North Lida and 202 in South Lida should be continued annually. It is important to continue transparency monitoring weekly or at least bimonthly every year to enable year-to-year comparisons and trend analyses. Total Phosphorus and chlorophyll *a* monitoring should continue at the same sites, as the budget allows, to track trends in water quality.

Overall Summary

North Lida is a mesotrophic lake (TSI = 46) and South Lida is a eutrophic lake (TSI =52). Both lakes have no evidence of a trend in water quality, meaning the water quality is stable. The total phosphorus, chlorophyll *a* and transparency ranges are within the ecoregion ranges.

For North Lida, only 11.9% of the lakeshed is classified as high runoff land use (Table 10). For South Lida, 44% of the lakeshed is public land, and only 8.7% of the lakeshed is classified as high runoff land use (Table 11). Almost the entire east shoreline of South Lida is bordered by Maplewood State Park, which protects it from development and vegetation loss.

The septic systems around Lake Lida should be in good working order. The county last inspected the entire lake in 1984, however in 2011 & 2012 they did rechecks of septic systems that were 20+ years old and brought them up to compliance.

The potential for erosion and soil loss into the lake appears low from Figures 24-27. There are not many red drainage areas indicated on the maps.

Even though they're in the same geographic location and have similar land use in their lakesheds, North Lida is mesotrophic and South Lida is eutrophic. The main differences between the lakes are the size, volume of water, and size of the lakeshed. North Lida has a volume of 105,716 acrefeet and a

watershed area to lake surface ratio of 3:1. South Lida has a volume of 17,976 acrefeet and a watershed area to lake surface ratio of 11:1. So South Lida has much less volume and a larger watershed than North Lida, therefore there is less water in South Lida to dilute runoff into the lake. In addition, the MPCA LAP study in 2000 concluded that South Lida retains much of the phosphorus from the inlet before it flows into North Lida. As such, the South Lida is expected to have higher concentrations of phosphorus and poorer Secchi disk readings.

Priority Impacts to the Lake

The priority impact to Lake Lida is expansion of residential housing development in the lakeshed and second tier development along the lakeshore. The majority of first tier shoreline parcels have been developed, and the majority of the current residences are seasonal (2005 Lake Management Plan). Conversion of seasonal residences to permanent residences can alter the use of the property and increase the pressure on the water quality of Lake Lida. In addition, a significant portion of properties in the second tier remain in large parcels and have not been subdivided for development; however development pressure is expected for these properties. From 1990-2000, the urban area around the lake increased by 192 acres, and the impervious area increased by 69 acres (Table 11). Second tier development in the future should be done in large lot sizes with minimal impervious surface. Once a lake is developed into the second tier, it can significantly change the drainage to the lake and funnel more nutrients directly.

Best Management Practices Recommendations

The management focus for Lake Lida should be to protect the current water quality and restore the lakeshed. This can be done by managing and/or decreasing the impact caused by additional development, including second tier development, and impervious surface area. Project ideas include protecting land with conservation easements, enforcing county shoreline ordinances, smart development, shoreline restoration, rain gardens, and septic system maintenance.

In addition, partnering with farmers in the lakeshed to implement conservation farming practices, increase shoreline buffers, restore wetlands, or place priority parcels into land retirement programs can decrease the impacts of agriculture in the lakeshed.

Native aquatic plants stabilize the lake's sediments and tie up phosphorus in their tissues. When aquatic plants are uprooted from a lake, the lake bottom is disturbed, and the phosphorus in the water column gets used by algae instead of plants. This contributes to "greener" water and more algae blooms. Protecting native aquatic plant beds will ensure a healthy lake and healthy fishery.

Project Implementation

The best management practices above can be implemented by a variety of entities. Some possibilities are listed below.

Individual property owners

- Shoreline restoration
- Rain gardens
- Aquatic plant bed protection (only remove a small area for swimming)
- Conservation easements

Lake Associations

- Lake condition monitoring
- Ground truthing – visual inspection upstream on stream inlets
- Watershed mapping by a consultant
- Shoreline inventory study by a consultant
- Conservation easements

Soil and Water Conservation District (SWCD) and Natural Resources Conservation Service (NRCS)

- Shoreline restoration
- Stream buffers
- Wetland restoration

- Work with farmers to o
    - o Restore wetlands
    - o Implement conservation farming practices
    - o Land retirement programs such as Conservation Reserve Program

Aquatic Invasive Species

Zebra mussels were found in Lake Lida in 2013. Zebra mussels have the potential to affect water quality by filtering out algae and clearing out the water column. This can result in increased transparency. Increased transparency can allow rooted plants to grow in deeper areas of the lake than previously found. In addition, the removal of plankton in the water column can affect the food chain.

Curly-leaf pondweed was documented in Lake Lida during a 2005 DNR aquatic plant survey. Curly-leaf pondweed is usually the first aquatic plant to get established in the lake in early spring and then it dies off in late June to early July. At its peak growth, curly-leaf pondweed can form mats on the surface that can interfere with boating and other recreational activities. When the plant dies off, it releases phosphorus into the water column. This phosphorus can cause algae blooms. When you see mats of dead curly-leaf pondweed floating on the lakes surface in late June, it is best to remove them from the lake, which will remove some of the phosphorus. Curlyleaf pondweed can be successfully managed by aquatic herbicidal treatment by a hired professional.

Organizational contacts and reference sites

Lake Lida Property Owners Association
http://www.lakelida.com/news/

DNR Fisheries Office	1509 1st Avenue North, Fergus Falls, MN 56537 218-739-7576 fergusfalls.fisheries@state.mn.us http://www.dnr.state.mn.us/areas/fisheries/fergusfalls/index.html
Regional Minnesota Pollution Control Agency Office	714 Lake Ave., Suite 220, Detroit Lakes, MN 56501 218-847-1519, 1-800-657-3864 http://www.pca.state.mn.us/yhiz3e0
East Otter Tail Soil and Water Conservation District	506 Western Ave N, Fergus Falls, MN 56537 218-739-1308 ext.3 http://www.eotswcd.org/

Aquatic Vegetation

Areas of aquatic vegetation have been mapped by Otter Tail County and are shown on ***Figure Thirteen (A and B)***. Due to the shallowness of the bay areas, there is abundant aquatic vegetation located around the shoreline of Lida Lakes. This vegetation acts not only as a buffer for incoming nutrients, it also provides habitat for waterfowl, fish, and small aquatic mammals such as muskrats. Macro invertebrates such as mayflies have a safe place to hatch, providing food for fish, thus providing a "food chain" that exists in a healthy ecosystem. This vegetation includes cattails, hardstem bulrush, arrowhead, and a variety of sedges. This "good" vegetation is crucial to a healthy lake system.

Buffers along the shoreline including upland vegetation are rapidly deteriorating. The upland buffer is as important as the aquatic for habitat, and more important for filtering out nutrients before they enter the lake. It also solidifies the shoreline, decreasing the likelihood of erosion. This is nature's way of stabilizing the banks surrounding the lake.

North Lida dwellings and Emergent Aquatic Vegetation

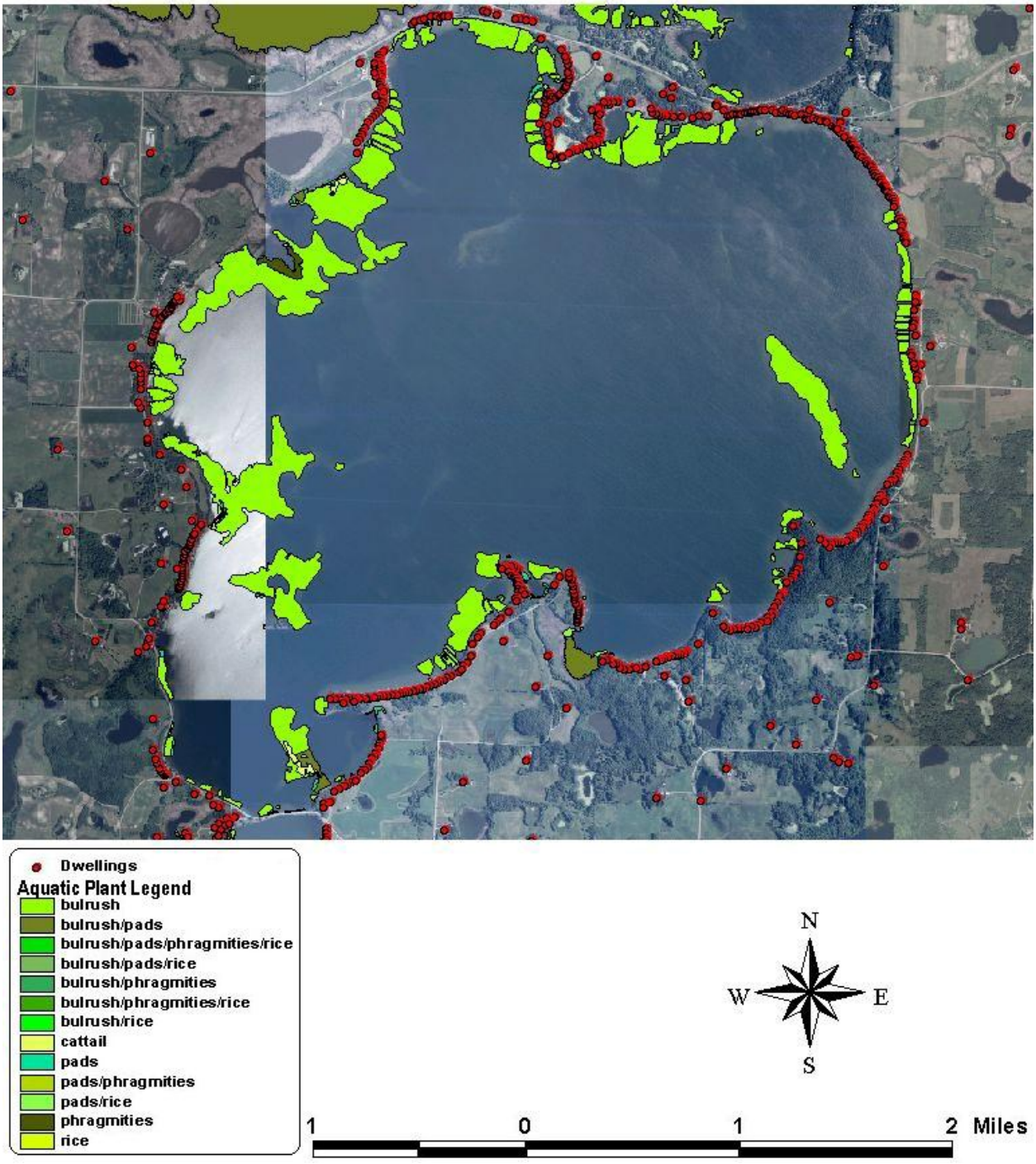


Figure 13A

South Lida Lake dwellings and Emergent Aquatic Vegetation

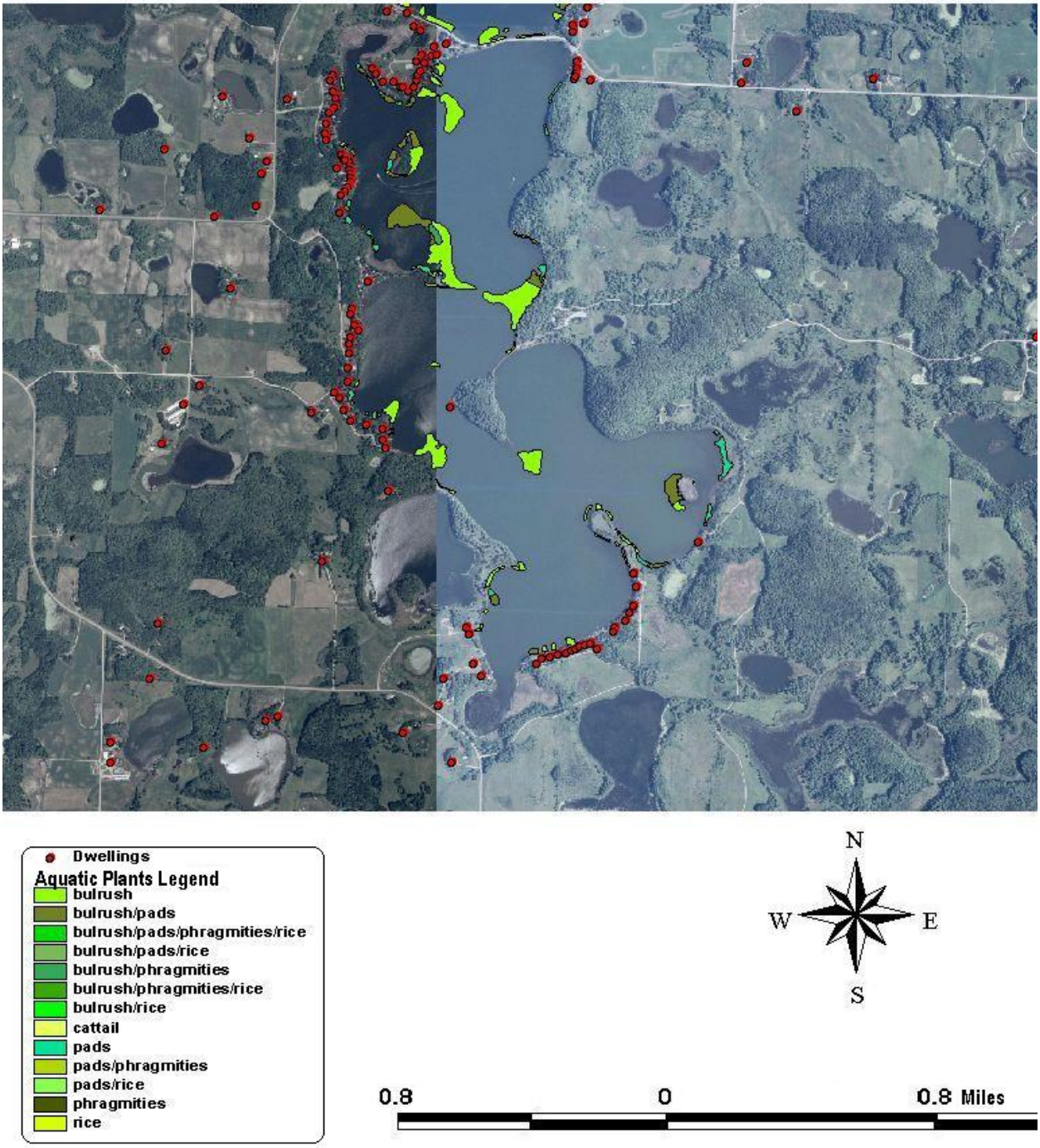


Figure 13B

Exotic Species

Background

"Exotic" species -- organisms introduced into habitats where they are not native -- are severe world-wide agents of habitat alternation and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and also by waterbirds, it reached Midwestern states between the 1950s and 1980s.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well-established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Purple loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals and are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Reed Canary Grass (*Phalaris arundinacea)* is considered a major threat to natural wetlands as it out competes most native species and presents a major challenge in wetland mitigation efforts.

Planted throughout the U.S. for forage and erosion control since the 1800s, it forms large, single-species stands, with which other species cannot compete. Invasion is associated with disturbances, such as ditch building, stream channeling sedimentation and intentional planting and if cut during the growing season a second growth spurt occurs in the fall.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

Starry Stonewort (*Nitellopsis obtuse*) is a grass-like form of algae that are not native to North America. The plant was first confirmed in Minnesota in Lake Koronis in late August of 2015. Plant fragments were probably brought into the state on a trailered watercraft from infested waters in another state.

It is similar in appearance to native grass-like algae such as other stoneworts and musk-grass. Native stoneworts and musk-grass are both commonly found in Minnesota waters. Starry stonewort can be distinguished from other grass-like algae by the presence of star-shaped bulbils.

Starry stonewort can interfere with recreational and other uses of lakes where it can produce dense mats at the water's surface. These mats are similar to, but can be more extensive then, those produced by native vegetation. Dense starry stonewort mats may displace native aquatic plants.

Like all plants, starry stonewort may grow differently in different lakes, depending on many factors. At this time, we cannot predict how it might grow in any one Minnesota lake. It is believed to be spread from one body of water to another by the unintentional transfer of bulbils, the star-like structures produced by the plant. These fragments are most likely attached to trailered boats, personal watercraft, docks, boat lifts, anchors or any other water-related equipment that was not properly cleaned.

Zebra Mussels (*Dreissena polymorpha*) Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized animals that attach to solid surfaces in water. They can cause problems for lakeshore residents and recreationists and present a threat to the ecological integrity of lakes a rivers by potentially disrupting food chains and crowding out native species.

Zebra mussels can be a costly problem for cities and power plants when they clog water intakes. Zebra mussels also cause problems for lakeshore residents and recreationists. They can attach to boat motors and boat hulls, reducing performance and efficiency; attach to rocks, swim rafts and ladders where swimmers can cut their feet on the mussel shells; and clog irrigation intakes and other pipes.

Zebra mussels also can impact the environment of lakes and rivers where they live. They eat tiny food particles that they filter out of the water, which can reduce available food for larval fish and other animals, and cause aquatic vegetation to grow as a result of increased water clarity. Zebra mussels can also attach to and smother native mussels.

Wildlife

The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and sedges along the

shoreline provide both feeding and nesting areas for wildlife. Loons are important Minnesota birds that are particularly affected by destruction of this vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young. There are more than fifteen loon-nesting sites on these lakes.

Various species of Canada geese, egrets, blue herons, green heron, gulls, pelicans and cormorants are common on the lake. Bluebills, Mallard, Wood duck teal golden eye, and wild turkey have also been seen. Bald Eagles are known to nest within the shoreland area. Trumpeter Swans, Golden Eagles and Osprey migrate through the area.

Mammals noted include deer, skunk, raccoon, mink, beaver, and muskrat Black bears, coyotes, fox and a cougar with cubs has been spotted in Maplewood Park. Otters have been seen in the South Lida area. These animals exist where habitat makes it possible.

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section. For Lida Lakes, the Area Wildlife Manager is Don Schultz, 1509 1st Avenue North, in Fergus Falls. Phone: (218) 739-7576. Email: don.schultz@dnr.state.mn.us.

The "Blue Book," *Developing a Lake Management Plan* notes that:

> "Minnesota's lakes are home to many species of wildlife. From our famous loons and bald eagles to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife."

The MN DNR also recognizes the unique importance of shallow lakes:

> "Minnesota's diverse wildlife populations are influenced in large part by our state's abundant water resources. While all lakes support wildlife needs, it is the shallow water zone, characterized by aquatic plants and generally less than 15 feet deep, that provides the most important wildlife habitat."

6. Land Use and zoning

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. Martin County Soil and Water Conservation District recognizes the multiple areas that impact water health including residential development, agriculture and shoreline management. The Martin County Local Water Plan was created by the SWCD in partnership with Martin County Planning and Zoning to evaluate the multiple sources of decreasing water quality and propose programs to address those challenges. The priorities listed in the plan include:

- **Surface Water Quality**
  - To improve the water quality of surface waters in East Otter Tail County by reducing or minimizing the amount and extent of contaminants entering surface waters.
  - Example Action Items : Provide technical assistance to shore land owners on water quality projects. Assist with feedlot runoff projects providing technical assistance and financial assistance when available to projects that meet criteria.

- **Ground Water Quality and Quantity**
  To improve and protect the quality and quantity of groundwater resources in East Otter Tail County by minimizing or reducing the amount and extent of contaminants entering the groundwater resources, and ensuring that there will be a stable and adequate source of useable water for municipal, industrial and agricultural purposes.

- **Development Pressure**
  To protect the natural resources of Otter Tail County by reducing or minimizing the impacts of ongoing and future development within the county.

- **Soil Erosion**
  Promote best management practices that reduce soil losses through wind and water erosion to below 2T (T is a technical abbreviation for tolerable soil loss).

- **Wildlife Habitat**
  To protect and preserve wildlife habitat and wetlands from conversion to cropland and urban development, and promote the re-establishment of wildlife habitat.

- **Sustainable Agriculture**
  To assist agricultural producers in maintaining productivity through the use of conservation practices that protect and preserve our natural resources and maintain a sustainable agricultural base in the county.

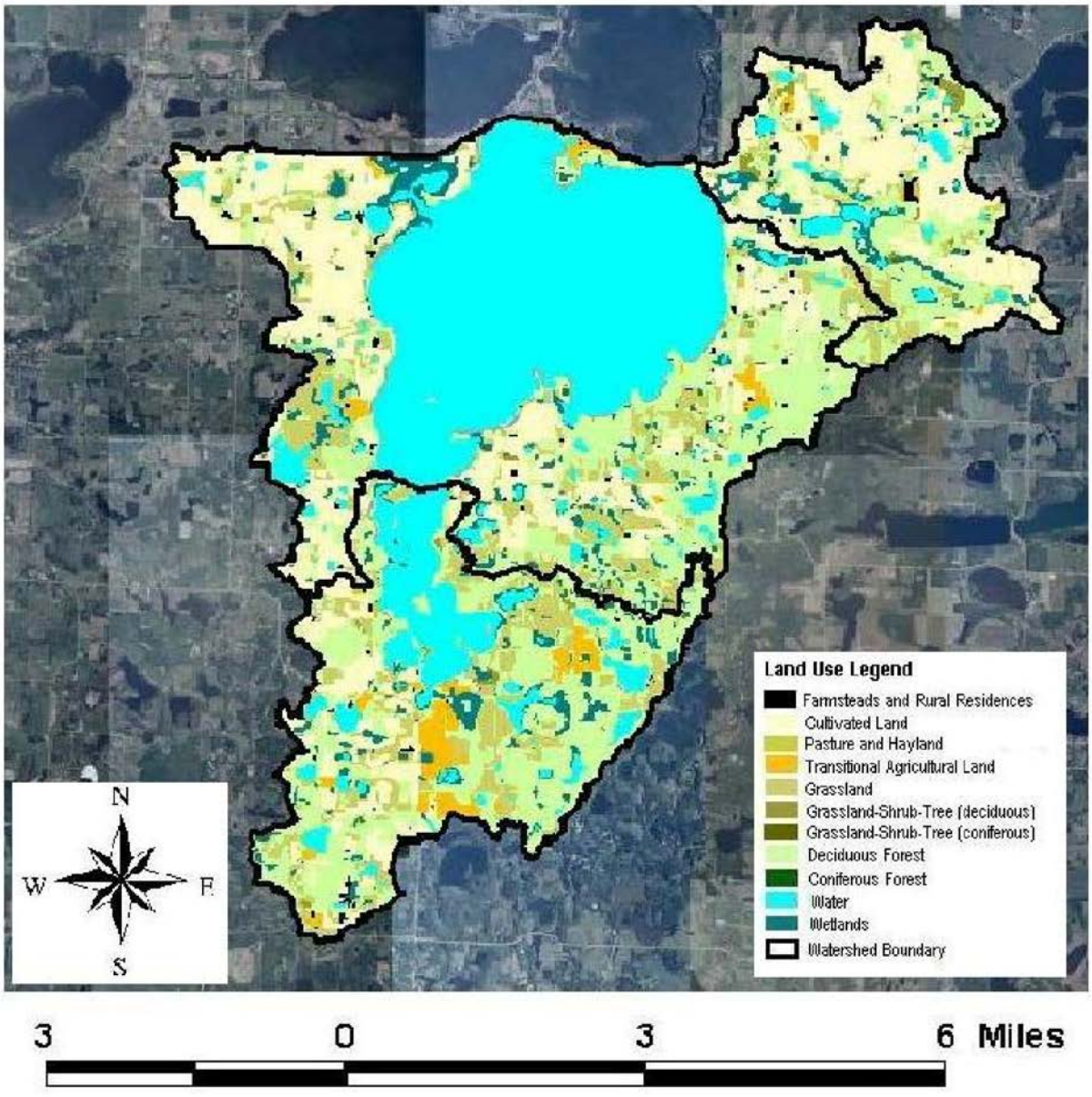
- **Education Promotion**

Promote soil and water conservation through an effective information and education program to the residents, seasonal property owners, schools, and elected officials in Otter Tail County.

- **Funding/Partnering/Administration**
  Provide assistance to the public through the most efficient use of public funds and administration of programs, and maintain and develop a strong working relationship with other resource agencies.

Landuse within the Lakeshed

Lida Lake



Lake Lida is classified by Otter Tail County as a General Development Lake.

General Development lakes are generally large, deep lakes or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation and, except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use.

Below are zoning standards associated with Lake Lida. The Otter Tail County Zoning staff can determine the zoning district and the specific regulations that apply to your property.

	General Development (Lake Lida)
Structure Setback from OHWL	75 ft
Water Frontage/Lot Width	100 ft
Lot Area*	20,000 ft²
Buildable Area	8,400 ft²
Sewage Treatment Area	2,500 ft²

Please Note: Shoreline ordinances are subject to change. The Otter Tail County Land and Resource Management Department can give us updates.

Many lakes have numerous properties that are considered to have "vested rights" or were developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment, or are destroyed by natural, accidental causes or in association with significant renovation.

Additional questions may be directed to:

Bill Kalar, Land & Resource Management Director
Phone: 218-998-8095
Email: bkalar@co.ottertail.mn.us
Location: 540 Fir Ave. W, Fergus Falls, MN 56537

Public water access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80 percent of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources, Trails and Waterways Unit. They are responsible for the acquisition, development and management of public water access sites. The DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government such as townships and municipalities. The DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

According to Minnesota Department of Natural Resources Fisheries Survey, there are two public access points on Lake Lida.

Organizational Development and Communication

NOTES AND OUTCOMES OF THE VISIONING PROCESS

Summary of Visioning/Planning Session

Lake Lida hosted an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Lake Lida Property Owners Association held this planning session on Friday, June 10, facilitated by Jen Kader. Approximately 40 people were in attendance. Details of the public input received at this session are provided within this plan.

The final chapter of our lake management plan summarizes the conclusions and priority action we have chosen to work on at this time. Specifically, for each priority action we have down our best to answer (<u>for each goal presented</u>):

- What are the criteria for measuring success (measured as outcomes, not effort)?
- What is our schedule for implementation (What needs to happen in the next 30 days, 60 days, one-year out)?
- Who is responsible for implementation or measurement (name names!)?
- What is the budget for this action/goal?
- Is this an ongoing action/goal, or a one-time effort? If on-going will we require additional funds for full implementation?

Following this format, the remaining pages identify our top priorities, what our goals for each priority are, and how, who, and when we will implement action for each of these priorities.

Process: The Lake Lida Property Owner's Association Lake Management planning process of addressing priorities has included the following actions based on the issues identified by the attendees of the Visioning session:

- Organizational Growth;
- Water Quality;
- Lake Use; &
- Water Supply.

Organizational Growth: The group would like to see enhanced communication with (and within) the community around the lake, and increased capacity to take on the projects that will be written into the lake management plan. This can include social opportunities that can be used to promote the activities and accomplishments of the Lake Association to garner support. Improving communication will also assist in the engagement of membership and in the successful implementation of this plan.

The group also suggested enhanced communication to educate property owners of best practices for improving and sustaining the water quality of the lake.

Increased communication can also benefit our relationships with government bodies, the coordination of committees pursuing action plan items and our progress to becoming a LID (Lake Improvement District).

It may seem odd to put garbage service under organizational growth, but many feel that the Lake Association should provide this service periodically to clean up the properties and refuse to join the LLPOA unless they decide to fund it.

Water quality: This was the lengthiest category, and has a good deal of variation. While we have good data, there is a good understanding that there is a need for research to really understand what is going on.

Weeds is a major concern and an example of the need for further information before we can address the issue. While there is an immediate desire to address the weeds in the lake, those weeds are likely there due at least in part to an excess of nutrients. A management plan that only addresses the weeds will lead to even higher nutrient levels, and the problem will never go away (or, it could create an environment where an invasive aquatic plant could dominate). Education will be instrumental in developing an action plan for the weed situation.

Also, since fishing is an important asset to the community, we need to ensure that the management of aquatic plants doesn't cause issues for fish habitat. It is important to work with the SWCD to identify the proper course of action regarding in-lake plant control.

What we do know is that installing shoreline and rain gardens and mowing less (less area and less frequency) can improve water quality, so this is something that can be implemented in the form of education and communication to the shoreline property owners.

While we determine the impact of the livestock and farmland in close proximity to the lakes, we can begin forging relationships with the farmers in the watershed.

Other action items discussed were educating and encouraging buffers, erosion and shoreline stabilization, runoff from watershed, the culvert over the state highway, nutrient levels and the water level.

There has also been expressed a desire to address the zebra mussels infestation, though many feel that since they are already in Lake Lida, there's not much we can do. Keeping up to date with the latest research and property owner education could have a positive impact on the situation.

Lake Use: Several of the identified themes from the visioning session can be combined to reflect a larger area of work that still has manageable work areas and tangible outcomes. The action plan in this category will likely focus on identifying maintenance and management solutions, as well as communicating with lake users information on everything from water quality to aquatic invasive species to rules around jet skis and speed boats. In addition, those who work on this category will want to pass on information about shorelines being impacted by waves, and the importance of minding your wake.

Access maintenance was also discussed as a need to improve and increase lake use as well as education at access (ranging from slot limit to wake impact to laws and common courtesies when using jet skis and speed boats).

Management of the lake for sustainable fishing was identified as a priority. In regard to the slot limit, there was lots of discrepancy about what should be done ranging from finding out what can be done to eliminate it, to changing it to keeping it as is.

Water Supply: While this issue wasn't a top priority, there does appear to be a strong desire to look into the option of rural water, or investigate rural water as opposed to well water.

In order to respond to the priorities listed above, the lake association needs to increase involvement of property owners, work with the proper organizations and agencies and increase education and communication to and with the shoreline lake owners.

At this time, funding is not a concern, the Lake Association is healthy financially, but increasing membership and explicitly, increasing the contact information of the membership will be key in accomplishing the issues identified.

Prioritized Goals and Action Plan

PRIORITY ISSUE: WATER QUALITY

Water Quality Goal:

Improve water quality of North and South Lida Lakes through education, decrease of runoff, wetland restorations, compliant ISTS, and more visible vegetation along the shoreline.

Water Quality Objectives:

Objective A: Continue the collection of data for future water clarity protection.

Action

1. Review past water quality testing within lake to determine trends. Develop educational visuals for annual meeting and post on website for property owners & Facebook page regarding the results.

   Timeline: 2017
   Agency (Who): LLPOA
   Cost: Cost of WQ monitoring ($1000/yr); Hire analyst & designer for materials ($1000)

2. Conduct a survey of shoreline status. Photos will be taken of existing shoreline to be utilized for determination of existing vegetation, future reference on developments, assessment of existing erosion problems and to determine need for increased education of residents.

   Timeline: Summer 2017
   Agency (Who): LLPOA / Intern / GIS
   Cost: Cost TBD for mapping, cost TBD for intern

3. Work with WOTSWCD to establish program to correlate lake level monitoring with rain gauge data.

   Timeline: 2017 and ongoing
   Agency (Who): LLPOA, WOTSWCD
   Cost: TBD

4. Inventory the lakeshed area for culverts, intermittent inlets and exposed soil areas and prioritize for their potential to reach the lake. Work with WOTSWCD and landowner to vegetate these areas.

   Timeline: 2018-2019
   Agency (Who): LLPOA, WOTSWCD
   Cost: Cost TBD for Intern

5. Map and prioritize restorable wetlands within the lakeshed of North and South Lida Lakes for water quality benefits.

Timeline: 2017-2018
Agency (Who): LLPOA, WOTSWCD, GIS, DU, USFWS
Cost: Agency Time

Objective B: Ten percent of un-vegetated shoreline will be returned to its native state.

Action

1. Educate lakeshore residents in the benefits of lakescaping. Present workshop through the Minnesota Extension Services. Make educational materials on Water Quality management available to members. Supply articles about the benefits in the lake association website.

Timeline: 2017-2018
Agency (Who): LLPOA, Extension
Cost: $100 for supplies

2. Provide information and incentive about the DNR Shoreland Habitat restoration grants and Lake Lida Association grants to residents along North and South Lida Lakes shoreline. Encourage both in-lake and upland plantings of native vegetation to decrease erosion into the lake and improve both water quality and habitat. Recognize participants at annual meeting and in newsletter and on the website.

Timeline: 2017 and ongoing
Agency (Who): LLPOA, DNR Wildlife Section
Cost: Dependant on funds available and landowner requests.

Objective C: Address the need for weed control.

1. Send Lake Lida Board member to Aquatic Species Summit, fall 2017, for education to share with the Board.
    a. **Timeline:** Fall 2017 attendance, spring 2018 share recommendations with Board
    b. **Agency (Who):** LLPOA
    c. **Cost:** $400
2. Develop a Committee to develop and implement plan.
    a. **Timeline:** Fall 2018
    b. **Agency (Who):** LLPOA
    c. **Cost:** Up to $100 for meeting expenses

PRIORITY ISSUE: ORGANIZATIONAL GROWTH

Community Goal:

Enhance sense of community among property owners within the lakeshed of North and South Lida Lakes. Increase engagement of property owners in Association and implementation of this Plan.

Community Objectives:

Objective A: Increase membership in LLPOA to 450 by 2019 and engagement of membership.

Action

1. Create a membership drive and collect email addresses of lakeshed members. Hire someone to solicit beaches with no Beach Captain.
    a. **Timeline:** 2017 and ongoing
    b. **Agency (Who):** LLPOA
    c. **Cost:** Dependent on Beach Captain vacancies.
2. Supply information to members such as: lists of government agencies and how to contact them, ISTS maintenance handbooks, and various brochures available for distribution through Beach Captains. Keep membership informed of current issues through a spring newsletter – include all non-members in the newsletter mailing with list of "perks" for members.
    a. **Timeline:** Spring 2018
    b. **Agency (Who):** LLPOA, Extension, MPCA, DNR
    c. **Cost:** Up to $500 per year if needed
3. Determine interest in having a lake clean-up day. Rent a large dumpster and allow all residents within the lakeshed to bring junk. Encourage owners of "junk-strewn" properties to participate and offer assistance in clean up. Encourage membership during contact.
    a. **Timeline:** 2018
    b. **Agency (Who):** LLPOA
    c. **Cost:** $6000 plus
4. Update Lake Lida Directory. Place updated directory on website for access by membership. Distribute hard copies as requested.
    a. **Timeline:** 2017
    b. **Agency (Who):** LLPOA, hired graphic artist
    c. **Cost:** Approximately $4,000 depending on number of ads secured
5. Utilize the publication Institute for Conservation Leadership's publication, *Benchmarking Your Organization's Development.*
    a. **Timeline:** 2017
    b. **Agency (Who):** LLPOA
    c. **Cost:** n/a

Objective B: Investigate viability and support of becoming a Lake Improvement District.

1. Recruit three to five members to become educated on what a LID is, the benefits to becoming a LID and the requirements to become a LID and share the information with LLPOA members at Annual Meeting, 2017.
    a. **Timeline:** July 2017
    b. **Agency (who):** LLPOA
    c. **Cost**: n/a

PRIORITY ISSUE: LAKE USE

Objective A: Educate lake property owners and general public regarding recreational use of lake/rules and regulations.

2. Set up committee to determine need & message and mode of communication.
    a. **Timeline:** Summer, 2018
    b. **Agency (Who):** LLPOA, DNR
    c. **Cost:** TBD

Objective B: Investigate pros and cons of advocating to change the slot limit and viability of implementing change.

1. Set up committee to investigate pros and cons of advocating a change in the slot limit and share findings with membership at the Annual Meeting.
    a. **Timeline:** Spring 2017, Summer 2017
    b. **Agency (Who):** DNR, LLPOA
    c. **Cost:** n/a

9. Organizational Development and Communication

III. Summary/Conclusion

Revisiting this plan

This plan is designed to be relevant for only 3-5 years. In fact, at least every 5 years, you should plan to engage in an update process. Issues change, people change, and resources change, so this plan should change, too! If you've been effective in building and maintaining relationships with your local resource experts, all you will really need to do to update this plan is the following:

1. Review your plan
    a. Make sure your membership and leadership remember the purpose of the plan (especially useful for new members)
    b. What has changed in the lake and lakeshed based on new data?
        i. Contact your resource experts for updated data if you do not have it
        ii. Review new data for changes in status or trends
    c. What is the status of the action plans
        i. Are the action plans still relevant?
        ii. If you were not successful, why? (These can help you as you identify obstacles in the new action plans)
2. Identify your new action plans
    a. Hold a community visioning session
    b. Identify your new priority issues or opportunity your group wants to work on
    c. Research new funding opportunities
    d. Draft your new action plans
3. Update the full document, and approve it at an upcoming meeting!

Glossary

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bioaccumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll *a*: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevents groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and non-point source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

Common Biological or Chemical Abbreviations

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

Guide to common acronyms

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

110B	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five “Injection” well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Recreational Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code

Lake Management Plan

for

Lake Six

Lake Six Lake Association, 2017

-For love of lakes

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Section 1: Overview

Goals without plans are just wishes

-Antoine de Saint-Exupery

LETTER FROM ORGANIZATION PRESIDENT:

In late 2015, the Lake Six Lake Association was invited to participate in the Initiative Foundation's Healthy Lakes and Rivers Partnership program along with three other Lake Associations in Otter Tail County. Under the coordination of Jen Kader (Freshwater Society) and with strong support from Darrin Newville (East Otter Tail Soil and Water Conservation District) representatives attended a day of training on lake ecology, strategic planning and communications.

Representatives of state and local agencies, as well as nonprofit organizations also attended the training sessions in order to offer their assistance to each group in developing a strategic Lake Management Plan. The Lake Six Lake Association was represented at the Healthy Lakes and Rivers Partnership training sessions by: Leanda Cheney, Greg Ogard, Sharyl Ogard, Dick Peterson, Marlene Peterson, Shawn Olson

Following the training sessions, each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Lake Six Lake Association held this planning session on Friday, June 3rd 2016, facilitated by Jen Kader. About 50 people were in attendance, with about 40 percent of the participants describing themselves as year round residents. Details of the public input received at this session are provided within this plan.

This document is intended to create a record of historic and existing conditions and influences on Lake Six, and to identify the goals of the surrounding community. Ultimately it is meant to help prioritize goals, and guide citizen action and engagement in the priority action areas. While state agencies and local units of government have a vital role and responsibility in managing surface waters and other natural resources, this Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

This Lake Management Plan is also intended to be a "living document;" as new or better information becomes available. As we accomplish our goals or discover that alternative strategies are needed, it is our intent to update this plan so that it continues to serve as a useful guide to future leaders.

In discussing lake management issues it is impossible to avoid all scientific or technical terms. We have tried to express our goals, measures of success, and other themes as simply and clearly as possible, but have included a glossary of common limnological terms at the end of the plan to assist the reader. Limnology is the state of lake conditions and behavior.

Finally, we would like to recognize the Legislative-Citizen Commission on Minnesota Resources who, through the Environment and Natural Resources Trust Fund, made this round of the program possible. We would also like to thank Initiative Foundation, Don Hickman in particular

who was such an inspiring presenter and leader at the training, West Central Initiative who is providing the $5000 grant, and Freshwater Society for undertaking the Healthy Lakes and Rivers Partnership who facilitates the lake associations through writing the lake management plan process. A special thank you to Jen Kader from Freshwater Society who has answered so many questions and has been an outstanding facilitator, mentor and cheerleader as the Lake Six Management Plan comes to fruition. To all these organizations we are truly appreciative and grateful.

Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul.

-John Muir

Executive Summary

Brief Introduction to Lake Six Lake Association

Lake Six is a unique little lake in a county of over 1000 lakes. If in conversation, it is brought up that we have a cabin on Lake Six, people in the area say, "Oh, I've heard of that lake. It's suppose to be so clean and pretty." They are right, of course, and our mission and purpose is to keep it that way. The west side of the lake is crowded with lake residents and the east side is in a forest conservancy and left in its natural state. For Lake Six to remain pristine, it needs a guardian, a protector, and that would be the Lake Six Lake Association. That is not to say that residents who don't belong to the association are not good stewards because for the most part they are. But for the long term health of the lake, when it has many households on it, the lake needs an organization to advocate for it.

Lake Six has 50 lakeshore lots, almost all of them belonging to married couples, mostly with children or grandchildren. This year 42 households are members. The criteria for being a member is paying your dues of $25 a year. The percentage of association members is 84%, a statistic of which we are proud. Also, many of the properties on the lake are passed on from generation to generation. What a wonderful legacy to people who are on the lake and for the lake itself. Most of the people teach their children, grandchildren about ecology and nature using the wonderful, irreplaceable resource of Lake Six. People often times become environmentalists because of the time spent with their elders on the lake.

There are several reasons we are proud of our lake association

- **In 2014, the secchi disc reading in Lake Six was 41.5 feet!**
- **As noted earlier, we have consistently had over 80% membership over the last six years. Membership is determined by payment of dues at $25 per year. Lake Six residents are generally committed to the lake and its organization.**
- **Every year the association has an annual meeting / free breakfast where we enjoy each other's company and then discuss matters and vote on decisions related to the lake and our lives at the lake.**
- **Also there is an end of the season potluck picnic. This year a person that is not directly on the lake hosted the picnic. We were pleased because the organization broadened itself to not just include residents directly on the lake. Second tier landowners or those who don't have property directly on the lake shore should be included in the Lake Six community. Generally speaking, most people if they feel welcomed into a group start to feel kinship and ownership to the common interest, which in this case is Lake Six. In effect, they also become stewards of the lake.**
- **When "ice out " occurs, the dock crew gets busy with a 6 – 8 men who install their own docks and lifts along with elderly and disabled people's docks who have asked for that service. In late fall, the same group takes out docks and lifts.**

- **When new residents arrive at the lake, our Welcome Wagon committee gets busy with a basket of information, gifts, and homemade goodies**
- **Lake Six Lake Assn belongs to the Ottertail County Coalition of Lake Associations, Coalition of MN Lake Associations, MN Lakes and Rivers Advocates**
- **A small group of men also do water testing through RMB Labs during May –September to monitor water quality**
- **The "beaver crew" which monitors beaver activity as they like to build dams on the outlet from Lake Six flowing to Lake Seven.**

Other recent activity of the Association:

- **The main policy change: five years ago, the association wrote bylaws to help guide our association and give it purpose and direction. The bylaws have been very helpful when controversy and difficult questions arose.**
- **After many years of complaints about the culvert that leads water from Lake Six to Lake Seven, a group of Lake Six individuals convinced Hobart Township that a larger, newer culvert was needed. A new one was installed.**
- **A joint project with Lake Six and Seven, a private property owner from Lake Seven, and Hobart Township was the installation of a prominent large sign close to the public accesses of both lakes warning about Aquatic Invasive Species. So far both lakes are AIS free.**

WHAT DID THE COLLECTED INFORMATION FROM OUR RIPARIAN AND NON-RIPARIAN LANDOWNERS TELL US

A. What are the overarching issues that we face?

***Lake Six has an enviable position of a lake in protective status. It is consistently one of the top three lakes in Ottertail County for water quality based on clarity because of low algae growth. However, as new lake residents replace the older residents who were satisfied with the lake lots remaining natural, the newer residents are more apt to want a more "polished" look to their structures and lots. Thus, we have more impervious surfaces, more "grassy" lawns, less native buffers. The health of Lake Six is somewhat in jeopardy as more nutrients enter the lake due to increased use of fertilizer and loss of buffer zones. More residents seem to be using higher speed watercraft than in previous years. This negatively impacts the lake through increased erosion and turning up of shallow water.**

***Of course, the lake residents are very concerned about keeping all exotic species out of the lake. We have a minor infestation of invasive yellow irises, but lake residents like the irises as they are very pretty. In fact, uninformed lakeshore owners prefer having them and have been known to spread the yellow iris seed to other areas of their shorelines.**

***Ninety percent of the eastern shore of the lake is owned by Fair Hills Resort, more specifically the Kaldahl family. It has never been developed and currently is in a forest conservancy. It is always a worrisome question that the Kaldahls might sell their property, which would create more of the above concerns.**

B. What are the implications of these issues for Lake Six Lake Association?

Our mission statement is to "preserve and protect Lake Six for current and future generations." We take that very seriously and will do what is necessary to:

- **Maintain water quality as healthy or healthier than the present**
- **Within our power, keep out Aquatic Invasive Species**
- **Hopefully, we can play a part in keeping the privately owned east side of the lake in a forest conservancy**

C. What does the lake association need to do in response to these implications?

***<u>Increase membership</u>* –**

Our issue is not necessarily to increase membership as 80% of our lake residents are members now (by paying their dues), but to have them be <u>active</u> members. Right now, eighteen percent of the people on the lake donate their time for the good of the lake or the association. To increase the number of volunteers, we sent out an email / letter where we had 30 ways to volunteer. We had some people respond, so now we have 25% of our lake residents being volunteers.

***<u>Increase finances</u>* –Our treasury is funding what we are doing currently, but as we plan for the future the money we have will probably not be enough. The $5000 that we receive for writing our Lake Management Plan will certainly be a tremendous bonus. However if we plan a major project or an unforeseen issue occurs, then we would need some outside help. To increase the value of the grant dollars we could collaborate with EOTSWCD who ialso has some funding sources that we could possibly tap into.**

<u>Build Partnerships –</u>

-Currently we have a strong relationship with East Ottertail Soil and Water Conservation District (EO SWCD). Eight different property owners on Lake Six have had rain gardens, shoreline buffers, and coir logs planted and installed. The property owners pay 25 percent while the Legacy Grant of MN pays the other 75 percent. We hope to increase that number as long as the grant is available. We have a cordial, good working relationship with Lake Seven to collaborate with on different projects and events.

-Marlene Peterson, the president of the Association, is also a part of the executive board of Ottertail County COLA (Coalition of Lakes Association). Besides being environmental director, she is networking with other lake associations on behalf of Lake Six.

-Also by attending Hobart Township meetings on occasions, the lake association is hopefully in good standing with the township board.

-We have partnered with Freshwater Society for the writing of the Lake Management Plan. They are knowledgeable about many different resources we could tap in

-A very important step for the lake residents and the lake assn. is to continue to build a friendly relationship with the Kaldahls who own the east side of the lakeshore. The original owners have retired, and their children now own it. We need to find as many ways as possible for them to see us in a positive light.

-As time goes on and we become less insular, we will be looking for more partnerships.

Increase visibility –

***Presently, there are two yearly newsletters with emails sent as needed.**

***We have Tshirts and hats for sale with our logo**

***In the future, we plan on creating a facebook page**

***We definitely need to be more visible, but the personality of our small lake does not trend toward high visibility**

D. WHAT ARE THE NEXT STEPS?

Desired outcomes

As a result of educating the lakeshore owners, we hope to reduce nutrient flow into the lake, stabilize the shoreline, and prevent further erosion, thus retaining the healthy clear waters of Lake Six

Through vigilance, education, signage, monitoring, and good luck we hope to prevent aquatic invasive species (AIS) entering into Lake Six and control the yellow iris.

It is necessary for the lake residents to have common goals for the lake and believe in the mission statement of the lake association. With that in mind, we hope to increase membership and active involvement in the lake association.

The east shore remains in a nature conservancy and undisturbed.

The ultimate goal of the lake association is to preserve and protect Lake Six. Therefore, the long term success of the lake association needs to be secured.

Without the wildlife and lake vegetation, the lake is a "dead" body of water. We must protect wildlife and their habitat in and on the shores of Lake Six.

As stewards of the lake, we need to be invested in taking care of the lake. However, multi-generation families, friends, citizens using the DNR access to enter the lake will hopefully enjoy, appreciate and ultimately understand what the lake has to offer: habitat, recreation, memories, beauty, transcendence that only nature can bring. Thus, we need to educate and guide people on appropriate and safe recreational activities on Lake Six.

When people come to the lake, it is important for them to enjoy the experience and want to come again and again. To do that, there should be a high "quality of life" that encourages people to take care of the one ingredient that is essential for them being at the lake: a healthy Lake Six

WHAT IS NEEDED FOR LONG TERM SUCCESS?

The outside agencies that will help us to gain and sustain our goals include Ottertail County COLA, RMB Labs, Chris Vinton, DNR enforcement officer, and other relevant members of the DNR, executive committee of Lake Seven, Jen Kader and Freshwater Society, East Ottertail Soil and Water conservation District, other participants of Healthy Lakes and Rivers Partnership who are writing lake management plans, and Hobart Township Board.

Ultimately, the long term success of the Lake Six Lake Management Plan falls on us, the residents of the lake and its leadership, who have to be willing to work together toward our common goals.

Section 2: Plan Detail

History and purpose of Lake Six Lake Association

A. Lake Six Lake Association is committed to pristine Lake Six located 10 miles southeast of Detroit lakes, MN and 4.5 miles west of Frazee in Ottertail County. Lake Six is part of the Ottertail and ultimately Red River Watersheds.

B. The lake association was formed on Labor Day, 1985. Right now there are 43 lake households that are part of the association. Since there are only 50 residences, that would make membership in Lake Six Lake Association at 86%.

History of Lake Six Lake Association

Lake Six Lake Assn was established on Labor Day, 1985, 31 years ago. According to the minutes of that first meeting, the association was established "to make improvements which will benefit its property owners." Annual dues was $5. The first president was George Frenzel and the secretary / treasurer was Jerry Price. One of the first orders of business was to keep the outlet ditch open near the culvert going to Lake Seven. This was urgent to keep the lake level from being too high. Another pressing issue was to assign fire numbers and to resurface the road. It is interesting to note that in the following years after the basic structure and the pressing infrastructure problems were addressed and solved, many of the issues that we have today are the same as they were 20 -30 years ago. Some of these are keeping the Lake Six Rd clean, water levels, the outlet to Lake Seven clear, invasive species, public access use and misuse, speedboat regulations.

In 1992, Marvin Mindermann was elected president and he held that office for 18 years! A remarkable feat. He had many achievements, but his most impactful accomplishment was "persuading" nine lake residents to install septic systems. The secchi disc reading went from 11 feet to 24 feet over a span of 3 years! Remarkable. The current leadership is doing their best to follow in Marvin's footsteps and be as strong an advocate for Lake Six as he was. In 2010 he was the first to receive the Ottertail County Coalition of Lakes Associations (COLA) Volunteer of the year Award.

Through the many years that Lake Six has been populated, it has always has been defined as of one of the cleanest, clearest lakes in all of Minnesota. So whether it was or wasn't written down, the leaders of the lake even before the association was formed always had an interest in keeping the lake pristine and make life better through its organized efforts for the people living on the lake.

To that end, our current lake association reflects that purpose through our mission statement and goals.

MISSION STATEMENT

To preserve and protect Lake Six for current and future generations.

PURPOSE AND GOALS

1. **To promote and protect the water quality of Lake Six. Continue to monitor the tropic status of the lake through regular water testing.**

2. **To maintain natural habitat conducive to loons, fish, etc.**

3. **To prevent aquatic invasive species from entering Lake Six.**

4. To promote safe and responsible boating practices.

5. To educate lakeshore residents and other users on beneficial lakeshore stewardship practices.

6. To encourage respect for one's lakeshore neighbors – their property, their interests, activities, etc.

7. To encourage a sense of community among the residents

8. To actively oppose indiscriminate development or overdevelopment of the lakeshore or access thereto which could lead to overuse or improper use of the lake and deterioration of its quality, including, but not limited to, the negative impact that such development would have on lakeshore property owners.

9. To actively support the Minnesota Lakes and Rivers Advocates and other lake associations in all matters that will promote the conservation of water quality and supply.

****ALL OF WHAT WE DO AS A LAKE ASSOCIATION RELATES TO THE MISSION STATEMENT OR GOALS.**

Our Membership Provides Several Services.

We have a "dock crew" which takes docks and lifts in and out every year. For those who are not physically able to be part of the crew and want their docks put out in the spring and taken in during fall, the dock crew gladly does it. After it is done, there is a lunch where the crew enjoys time together.

In addition, we have a "beaver crew" which watches over the outlet to Lake Seven. During spring and fall the beaver like to build dams that hinders the flow of water to Lake Seven, thus raising the water levels in Lake Six. This can be quite a job because the dams can be torn down in one day and rebuilt by the beaver overnight. We also hire a trapper in the fall who traps several of them, but of course, more move in the following spring.

We have a welcome wagon person(s) that welcomes new people on the lake.

A basket is given to them which has the book, *A Citizen's Guide to Lake Protection*, a copy of the newsletter, lake directory, important phone numbers, other useful information, a hat and a kitchen towel with the lake Six logo on it, and some homemade goodies. In the future an up to date copy of the MN Boating Guide and Fishing Regulations will also be provided.

In the spring and fall two men take care of the loon's nest. The idea of a swan's nest has been discussed which would add to the diversity of the wildlife plus adding to the beauty of the lake.

From May through September we have our TSI crew that checks chlorophyll, phosphorus, and the secchi disc reading of the lake. This service is vital to monitoring the

health of the lake. The TSI readings started in 1996 and for the last twenty years we have been able to see trends on the lake.

Socially, the lake association sponsors breakfasts and picnics for the residents to get together and visit.

Every year at the annual meeting / breakfast, a speaker presents information that is directly related to Lake Six. In the past we've had a scuba instructor who shared what's beneath the surface, DNR fishery officer, AIS prevention agent, tent caterpillar expert, master gardener who specializes in rain and pollinator gardens, lake buffers. Hopefully our lake residents become more educated of the science of what is happening on Lake Six and all lakes, and to build an awareness of what is occurring in the larger world around our lake but yet still relevant to it.

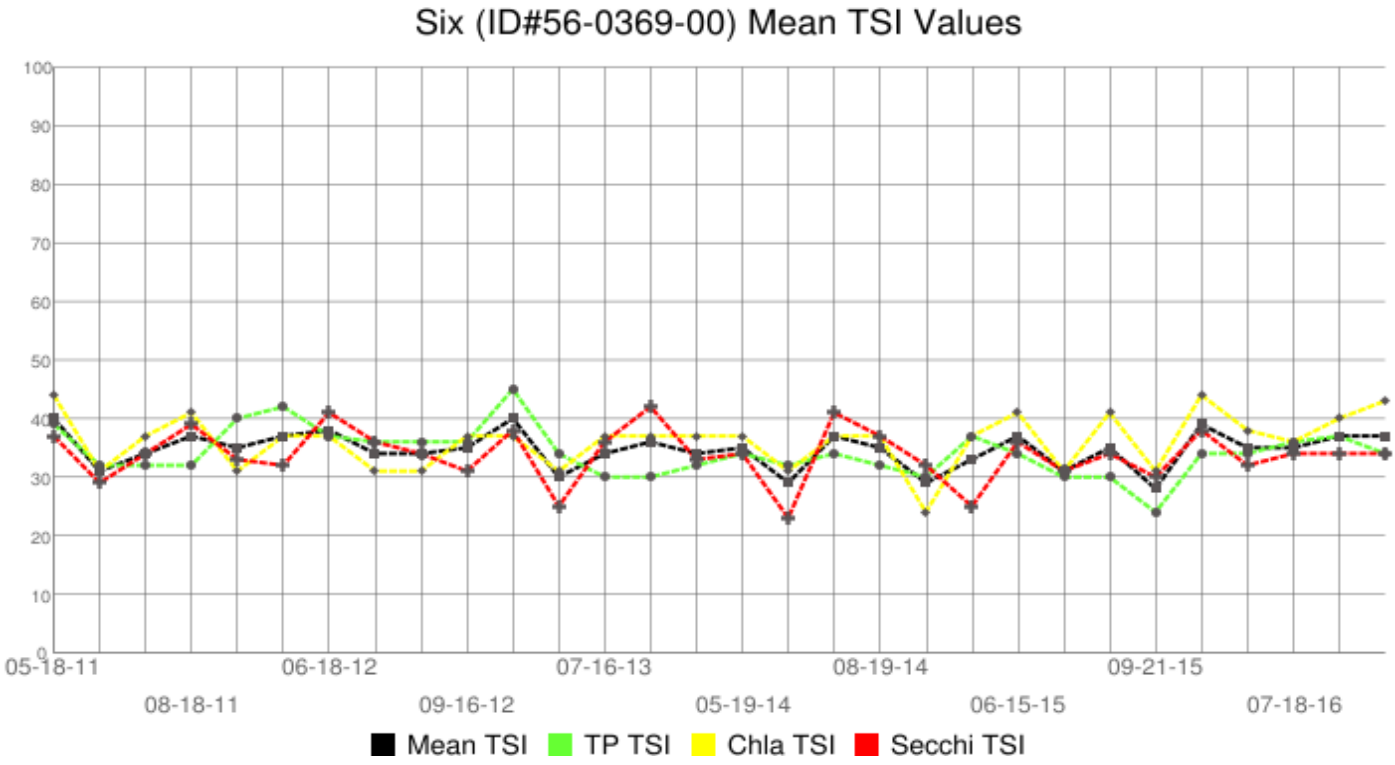
The association does not operate in a closed little world of the Lake Six community. We belong to other organizations, formal and informal to help us and in turn we help them. Lake Six belongs to MN Lakes and Rivers Advocates, Ottertail County Coalition of Lakes Associations, strongly tied to East Ottertail Soil and Water Conservation District, and informally connected with Lake Seven Lake Association.

The leadership is strong and committed to the lake, its residents, and the association. The most current elected leaders have written bylaws, newsletters, attend different meetings and conferences, organize social events along with official meetings, take care of lake business, help to solve problems, provide a forum for lake residents to express their opinions, inform and educate residents on lake ecology, and generally watch over what is happening in, on and around Lake Six.

RMB Laboratories report concerning Water Quality

The below graph shows the Yearly TSI readings for the summer seasons of 2011 through 2016. The Trophic State Index (TSI) is a classification system designed to "rate" individual lakes based on the amount of "biological productivity" occurring in the water. Using the index, one can gain a quick idea about how healthy a lake is by its TSI number. It is always important to remember the lower the number of the TSI reading, the more desirable the lake is for people.

Specifically the line graph shows the phosphorous, chlorophyll, and secchi disc reading which are the three components of a lakes TSI reading.



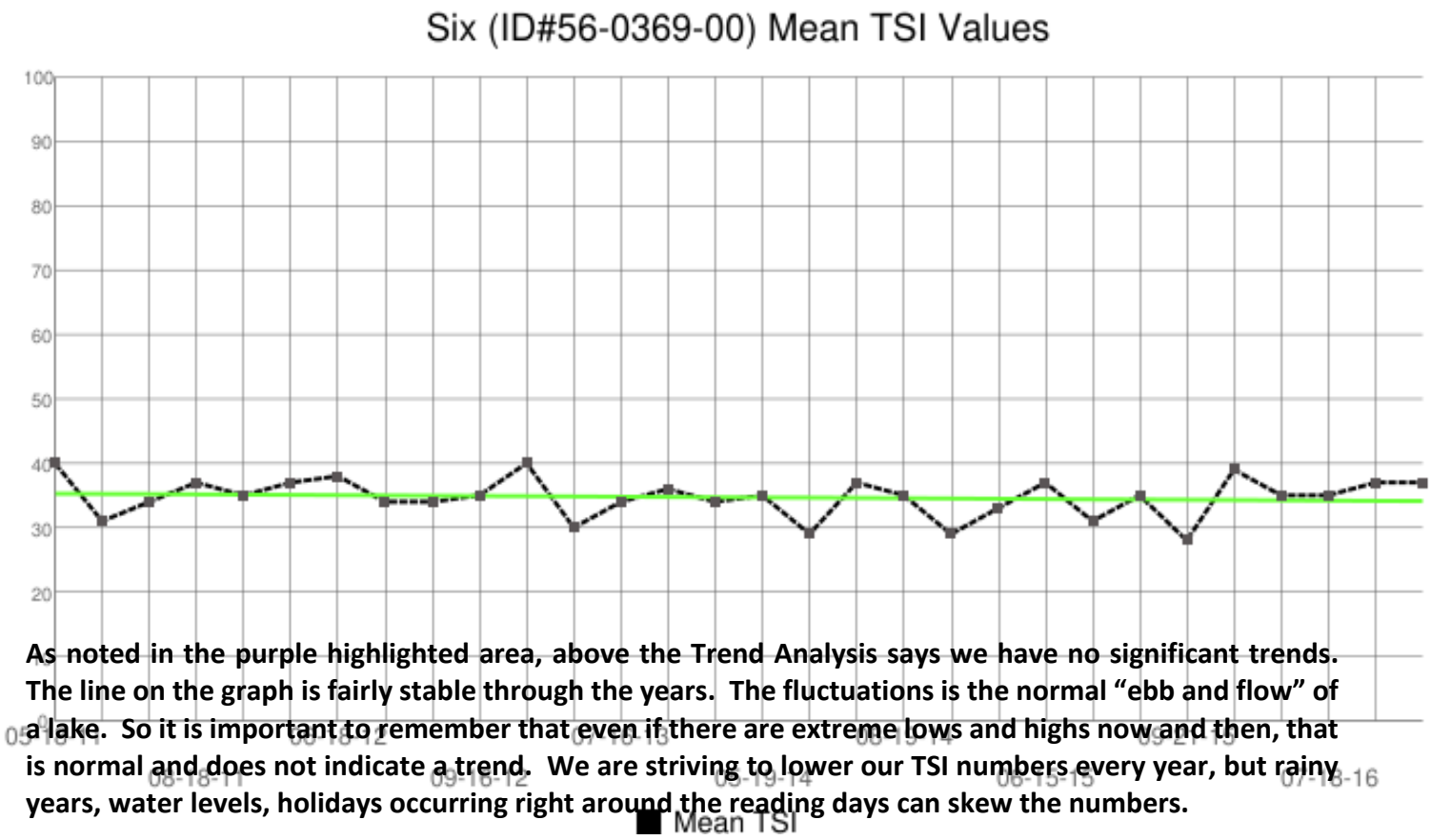
TSI RANGE	TROPHIC STATUS	CHARACTERISTICS
-40	Oligotrophic	Clean lake
41-50	Mesotrohic	Moderate amount of algae growth
50-70	Eutrophic	Persistent algae growth
70+	Hyper-eutrophic	Extreme algae problem

Our best component of the TSI reading is our secchi disc readings through the years.
It appears our weak area is the relatively higher amount of chlorophyll in the water which is produced from nutrients that wash into the lake. Therefore it is essential that lake residents understand how phosphorus and nitrogen are nutrients and fertilizers which feed lawns bordering lakes but also when washed into the lake feed lake plants and algae. The lake plants do just fine without being fertilized!

Trend Analysis Report

County	MN Lake ID	Lake	Site	Data Evaluated	Date Range	Data Source
Otter Tail	56-0369-00	Six	203	Mean TSI	05-18-2011 - 09-19-2016	RMB

No significant trend exists.



As noted in the purple highlighted area, above the Trend Analysis says we have no significant trends. The line on the graph is fairly stable through the years. The fluctuations is the normal "ebb and flow" of a lake. So it is important to remember that even if there are extreme lows and highs now and then, that is normal and does not indicate a trend. We are striving to lower our TSI numbers every year, but rainy years, water levels, holidays occurring right around the reading days can skew the numbers.

The trend for Lake Six is to be an oligotrophic lake that is defined as clean and wonderful for water activities such as swimming and boating.

Aquatic Vegetation

Aquatic plants or "weeds" are often not a desirable part of the lake but are absolutely necessary for freshwater ecosystems. Here are some of the things they provide for the lake.

Aquatic plants provide habitat for small animals such as insects, snails that are food for fish and water waterfowl. Sturdy bulrushes and cattails are building materials for many types of birds' nests. Also mammals such as muskrats use them for building their homes and dens.

Submerged plants give cover and protection for baby fish, turtles and salamanders from predatory birds and fish. Since the plants are rich in food supply, they make an ideal nursery for baby fish and some waterfowl. (such as the loon)

Emergent plants and submerged aquatic vegetation prevent shorelines and lake bottom erosion due to wave action from boats, storms, etc. Aquatic plants also can soak up and break down polluting chemicals. They can use nutrients that would otherwise feed algae, consequently improving water clarity. If you have a diverse native plant community, the lake is less susceptible to invasive, exotic plants.

That said, however, too much of a good thing is not necessarily a good situation. Too many aquatic plants can impede swimming and boating. A balance between the two is a worthy goal. However, people have different interests and opinions about how that balance should look like. Nevertheless, the lake should remain as undisturbed as possible, but the lake is meant for recreation, as well. It is important to note that aesthetics is not a determinant in whether a lake has too much aquatic vegetation.

Also, the unwanted exotic, invasive plants such as Eurasian milfoil, Starry Stonewort, Curly Leaf Pondweed, Flowering Rush, Purple Loosestrife pose serious problems to our lakes. They will choke out native plants and lessen diversity in the underwater plant community. Sometimes the exotic plants grow so quickly they form a mat on top of the lake. Once introduced into the lake they are almost impossible to eradicate. To manage them can cost tens of thousands of dollars a year! Obviously, an ounce of prevention is worth a pound of cure with invasive species.

There were two sources of information that were found that identifies and gives the location of aquatic vegetation communities . One was from a pdf file from MN DNR website *entitled Minnesota Biological Survey List of Plant Species Observed at Lake Six.* It listed a diverse group of plants under these categories:

> **Submerged plants (plants with most leaves growing beneath the water surface) Northern Watermilfoil, 6 different types of pondweed, intermediate bladderwort**

Floating-leaf plants (plants with leaves that float on the water surface) yellow and white water lily, three types of pondweed

Emergent plants (plants with leaves extending above the water surface) Bottle-shaped sedge, common reed grass, Broad-leaved, Hard-stem bulrush, Broad-leaved cattail

Shoreline plants (plants associated with the wetland habitat) Swamp milkweed, Porcupine like sedge, Common boneset, Yellow flag, Reed canary grass, Willow, Yellow iris (which is an invasive)

The other source of information (which was incomplete) was from the 2013 RMB Laboratories Lake Assessment that said "emergent plants like hardstem bulrush and cattails are located in various areas throughout the lake."

There are no "site specific assets" on the lake, but there is a master gardener on Lake Seven who could be consulted. Books, magazine, pamphlets could be made available to lake residents. We also own the book "Lake Plants You Should Know: A Visual Field Guide" It is spiral bound and laminated which allows for taking it out on the lake and using the scanned images of the actual plants. The book also shows invasive species plants so they could be identified.

Most definitely our stronger asset is East Ottertail Soil and Water Conservation District. They have already provided seven different lakeshore owners with rain gardens, buffer zones, native planting gardens. Through the use of grants our residents are able to afford these native plant gardens and buffers. Possibly in the future, some of the grant money could help defer the cost of the 25% that the lakeshore owner needs to pay or a stipend of $100 to help pay for plants. The lakeshore assn could work with the SWCD to suggest other ways to encourage lake residents to apply for grant dollars from the EOTSWCD.

Wildlife

The "Blue Book," *Developing a Lake Management Plan* notes that:

> "Minnesota's lakes are home to many species of wildlife. From our famous loons and bald eagles to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife.
>
> The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and wild rice along the shoreline provide both feeding and nesting areas for wildlife. Loons, black terns and red-necked grebes are important Minnesota birds that are particularly affected by destruction of this

vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young."

The MN DNR also recognizes the unique importance of shallow lakes:

> "Minnesota's diverse wildlife populations are influenced in large part by our state's abundant water resources. While all lakes support wildlife needs, it is the shallow water zone, characterized by aquatic plants and generally less than 15 feet deep, that provides the most important wildlife habitat."

The littoral zone, generally the first 15 feet of lake water, is the near shore area where sunlight penetrates all the way to the bottom and allows aquatic plants to grow. Littoral zones are critical for wildlife habitat, water quality and erosion control that are all important for a lake to have a healthy ecosystem.

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section. For Lake Six, the DNR Area Wildlife Manager is:

Don Schultz, 1509 First Ave North, Fergus Falls, MN 56537, (218) 739-7576 x228

Lake Six is blessed with many different types of wildlife from eagles to chipmunks. It is typical of many lakes in the area where we enjoy our loons. Most years we have one mating pair. Two loons nest platforms are put out every year, but we only one pair. Most years we have a baby, but sometimes the egg(s) don't hatch or are eaten by animals. A swans' nest platform has been suggested in the hopes a mating pair of swans would make Lake Six their home. They would add diversity and beauty to the lake. After some research, though, apparently geese like to take over those nests. So that is delayed until there is more research done. Also, ducks are enjoyable to watch as they swim around the lake with the ducklings in a straight row behind the parent.

Of course, we have our nuisance wildlife. It needs to be remembered the lake is a natural place and these animals use the shoreline as their homes. Raccoons are considered pests on the lake because they like to eat bird food put out in the feeders. Not only do they eat the bird food they knock over the feeders and leave their scat behind. Geese can be a headache as well. They leave their droppings on docks, rafts, etc. The lake residents have been encouraged to plant shoreline buffers because the geese don't like to climb through the tall vegetation on the buffers. Beavers, our very tenacious hardworking "engineers," are a problem. It is hard not admire them, but they cut down trees to build their dams that are built on the stream leading out of Lake Six to Lake Seven. Our beaver crew tries to keep up with the beavers by tearing up their dams, but they are very persistent and rebuild them. We do hire a trapper for a longer term solution.

Turtle of all sizes have been spotted swimming and sunning on tree branches hanging over the lake . Also we have a blue and white heron that grace our docks and shorelines for much of the summer along with ducks and swans. In the data collected from the vision meeting where the residents were able to have a voice in the future of Lake Six and its community, people commented the most about wildlife and protecting their habitats.

Status of the fisheries

The following is copied from the Standard Lake Survey Report which was completed July 7, 2015

"Walleye is a primary management species in Lake Six. Walleye abundance was in the normal range for this type of lake. Walleyes ranged in length from 12.7 to 22.4 inches with an average length and weight of 16.6 inches and 1.6 pounds. Walleyes attain an average length of 14.7 inches at 4 years of age. An abundant Northern Pike population exists. Pike ranged in length from8.7 to 31.9 inches with an average length and weight 20.2 inches and 1.8 pounds, Northern pike attain an average length of 21.5 inches at five years of age. A balanced Largemouth Bass population is present. Bass reproduction is consistently good. Bass ranged in length from 7.4 to 13.5 inches with an average length of 11.1 inches. Largemouth Bass attain an average length of 11.0 inches at four year. Bluegill abundance historically fluctuated due to inconsistent reproduction. Bluegill abundance in this survey was within the normal range for this type of lake. Thirty-one percent of the bluegills were 7.0 inches or greater in length. Bluegills attain average length of 7.0 inches at seven years of age.

July 2013 survey of fisheries…

> **Northern pike** – above average
> **Walleye** – Average. Lake Six is stocked with walleyes in odd years. The DNR tries to use fingerlings or larger to avoid the predation by northern pike.
> **Yellow perch** – Provide primary forage for walleye and northern pike.
> **Blue gill** – down slightly
> **Large mouth bass** – down slightly
> **Black crappie** – higher numbers
> **Yellow bullhead** numbers skyrocketed. Not necessarily bad as they are an indication of good water quality.
> **White sucker -** Spawning along shoreline provides forage for pike and walleye.
> **Black bullhead** numbers down which is an indication of good water quality]

…Anglers can maintain or improve the quality of their fishing experience for all species in Lake Six by practicing selective harvest. Selective harvest encourages the release of medium to large fish while allowing the harvest of the more numerous, smaller fish for eating. Releasing medium to large fish ensures that the lake will have enough spawning aged fish and will also provide anglers with opportunities to catch larger fish in the future."

There are game fish in Lake Six, although some fisherman disagree. I jest to them, "You just have to be a good enough fisherman to catch them!"

Exotic Species

Lake Six has been fortunate to have no invasive species as of 2013 when RMB Labs finished a lake assessment. Since then, there is such an awareness of aquatic invasive species that most lake residents are vigilant in not introducing them into the lake. The lake association through the newsletters, a small billboard warning about AIS at the public access, email notifications about newly infested lakes in the area are educating and keeping the public alerted to exotic species.

There are high traffic lakes that are within twenty miles that are confirmed with exotic species. There is no official plan as to what the lake association would do, if unwanted species are discovered. Presently, the lake association is in a protective stance to keep exotics out. The lake residents have a phone number on a refrigerator magnet that they can call if they think they found AIS. If it is actually an exotic species, then the DNR will go into action to possibly keep them from spreading all around the lake. However, if there are several spots on the lake where they are discovered, then it is probably too late. Vigilance is the key action to keep them from entering the lake. To be vigilant the public and lake residents need to be informed about them, and always realize the danger and consequences of transporting them into an uninfested body of water.

Background

"Exotic" species -- organisms introduced into habitats where they are not native -- are severe world-wide agents of habitat alternation and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing

so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and also by waterbirds, it reached Midwestern states between the 1950s and 1980s.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Purple loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals and are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Reed Canary Grass (*Phalaris arundinacea)* is considered a major threat to natural wetlands as it out competes most native species and presents a major challenge in wetland mitigation efforts.

Planted throughout the U.S. for forage and erosion control since the 1800s, it forms large, single-species stands, with which other species cannot compete. Invasion is associated with disturbances, such as ditch building, stream channeling sedimentation and intentional planting and if cut during the growing season a second growth spurt occurs in the fall.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

Starry Stonewort (*Nitellopsis obtuse*) is a grass-like form of algae that are not native to North America. The plant was first confirmed in Minnesota in Lake Koronis in late August of 2015. Plant fragments were probably brought into the state on a trailered watercraft from infested waters in another state.

It is similar in appearance to native grass-like algae such as other stoneworts and musk-grass. Native stoneworts and musk-grass are both commonly found in Minnesota waters. Starry stonewort can be distinguished from other grass-like algae by the presence of star-shaped bulbils.

Starry stonewort can interfere with recreational and other uses of lakes where it can produce dense mats at the water's surface. These mats are similar to, but can be more extensive then, those produced by native vegetation. Dense starry stonewort mats may displace native aquatic plants.

Like all plants, starry stonewort may grow differently in different lakes, depending on many factors. At this time, we cannot predict how it might grow in any one Minnesota lake. It is believed to be spread from one body of water to another by the unintentional transfer of bulbils, the star-like structures produced by the plant. These fragments are most likely attached to trailered boats, personal watercraft, docks, boat lifts, anchors or any other water-related equipment that was not properly cleaned.

Zebra Mussels (*Dreissena polymorpha*) Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized animals that attach to solid surfaces in water. They can cause problems for

lakeshore residents and recreationists and present a threat to the ecological integrity of lakes a rivers by potentially disrupting food chains and crowding out native species.

Zebra mussels can be a costly problem for cities and power plants when they clog water intakes. Zebra mussels also cause problems for lakeshore residents and recreationists. They can attach to boat motors and boat hulls, reducing performance and efficiency; attach to rocks, swim rafts and ladders where swimmers can cut their feet on the mussel shells; and clog irrigation intakes and other pipes.

Zebra mussels also can impact the environment of lakes and rivers where they live. They eat tiny food particles that they filter out of the water, which can reduce available food for larval fish and other animals, and cause aquatic vegetation to grow as a result of increased water clarity. Zebra mussels can also attach to and smother native mussels.

6. **Land Use and zoning**

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. Martin County Soil and Water Conservation District recognizes the multiple areas that impact water health including residential development, agriculture and shoreline management. The Martin County Local Water Plan was created by the SWCD in partnership with Martin County Planning and Zoning to evaluate the multiple sources of decreasing water quality and propose programs to address those challenges. The priorities listed in the plan include:

- **Surface Water Quality**
    - To improve the water quality of surface waters in East Otter Tail County by reducing or minimizing the amount and extent of contaminants entering surface waters.
    - Example Action Items : Provide technical assistance to shore land owners on water quality projects. Assist with feedlot runoff projects providing technical assistance and financial assistance when available to projects that meet criteria.
- **Ground Water Quality and Quantity**
  To improve and protect the quality and quantity of groundwater resources in East Otter Tail County by minimizing or reducing the amount and extent of contaminants entering the groundwater resources, and ensuring that there will be a stable and adequate source of useable water for municipal, industrial and agricultural purposes.
- **Development Pressure**
  To protect the natural resources of Otter Tail County by reducing or minimizing the impacts of ongoing and future development within the county.
- **Soil Erosion**
  Promote best management practices that reduce soil losses through wind and water erosion to below 2T (T is a technical abbreviation for tolerable soil loss).
- **Wildlife Habitat**
  To protect and preserve wildlife habitat and wetlands from conversion to cropland and urban development, and promote the re-establishment of wildlife habitat.

- **Sustainable Agriculture**To assist agricultural producers in maintaining productivity through the use of conservation practices that protect and preserve our natural resources and maintain a sustainable agricultural base in the county.
- **Education Promotion**
  Promote soil and water conservation through an effective information and education program to the residents, seasonal property owners, schools, and elected officials in Otter Tail County.
- **Funding/Partnering/Administration**
  Provide assistance to the public through the most efficient use of public funds and administration of programs, and maintain and develop a strong working relationship with other resource agencies.

The specific impacts to a lake from various land uses vary as a function of local soils, topography, vegetation, precipitation and other factors. However, one of the most important ways that citizens can work to positively impact their local waters is through ensuring that prudent local zoning ordinances are in place.

Many zoning regulations are based upon the Shoreland Management Act and/or the Minnesota Department of Natural Resources (DNR) classification of a given lake. The DNR has classified all lakes within Minnesota as General Development (GD), Recreational Development (RD), or Natural Environmental (NE) lakes, and assigned a unique identification number to the lake for ease of reference. Counties in turn have used these classifications as a tool to establish minimum lot area (width and setbacks) that is intended to protect and preserve the character reflected in the classification. It should be noted that counties will often make local ordinances more strict than the minimum standards set by the DNR.

On any shoreland the permissible density and setbacks for virtually all new uses are determined by the lake or river classification standards established by the Department of Natural Resources. Otter Tail County has three categories for defining development around area lakes: Natural Environment, General Development, and Recreational Development. **Lake Six is classified by Otter Tail County as a Recreational Development Lake**.

Natural Environment lakes are generally small, often shallow lakes with limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock, and unsuitable soils. These lakes, particularly in rural areas, usually do not have much existing development or recreational use.

Recreational Development lakes are generally medium-sized lakes of varying depths and shapes with a variety of landform, soil, and ground water situations on the lands around them. They often are characterized by moderate levels of recreational use and existing development. Development consists mainly of seasonal and year-round residences and recreationally-oriented commercial uses. Many of these lakes have capacities for accommodating additional development and use.

General Development lakes are generally large, deep lakes or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation

and, except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use.

Below are zoning standards associated with each of you lakes. Please note that this chart does not represent all the zoning requirements that are involved with land use and property development.

You will want to contact the Otter Tail County Zoning staff to determine the zoning district and the specific regulations that apply to your property.

	General Development (Lake Lida, Wall Lake)	**Recreational Development** (Big McDonald, Lake Six)
Structure Setback from OHWL	75 ft	100 ft
Water Frontage/Lot Width	100 ft	150 ft
Lot Area*	20,000 ft^2	40,000 ft^2
Buildable Area	8,400 ft^2	8,400 ft^2
Sewage Treatment Area	2,500 ft^2	2,500 ft^2

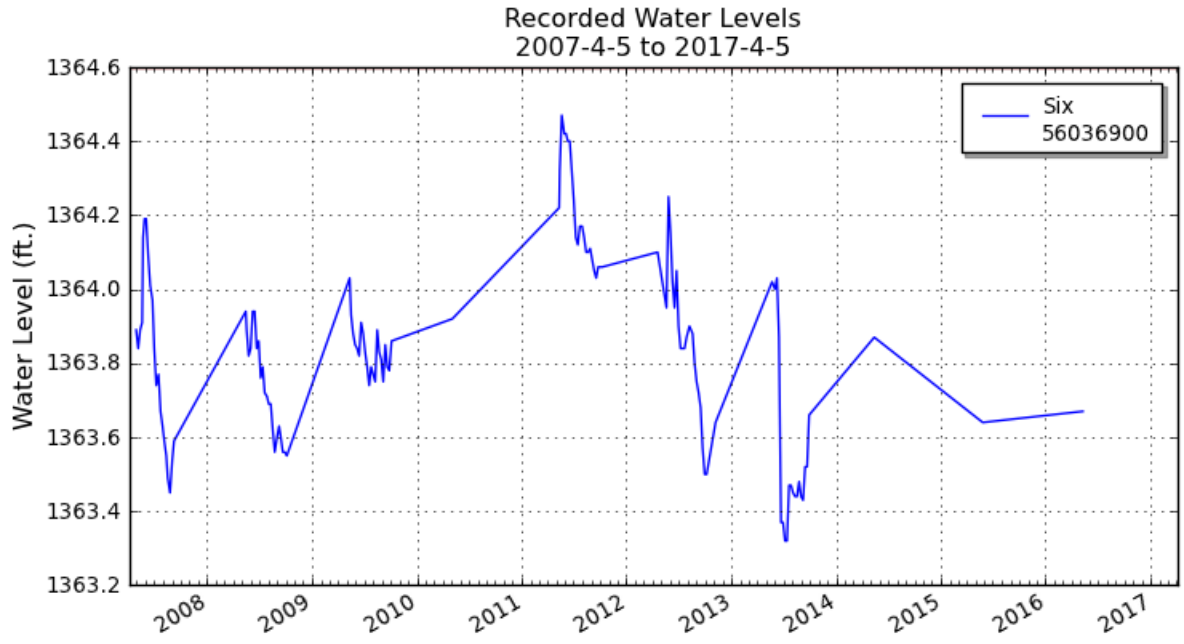
**Setbacks are measured from the Ordinary High Water Level (OHWL)*
***excluding public road right-of-ways, bluffs, wetlands, and land below the OHWL of public waters*

Please Note: Otter Tail County is in the process of revising their shoreland ordinance. As you make plans, be sure to check in with the Otter Tail County Land and Resource Management Department for any updates.

Many lakes have numerous properties that are considered to have "vested rights" or were developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment, or are destroyed by natural, accidental causes or in association with significant renovation.

Additional questions may be directed to:

Bill Kalar, Land & Resource Management Director
Phone: 218-998-8095
Email: bkalar@co.ottertail.mn.us
Location: 540 Fir Ave. W, Fergus Falls, MN 56537



Lake Six Water Level Report

Water Level Data
Period of record: 06/25/1948 to 05/10/2016
# of readings 368
Highest recorded: 1364.47 ft (05/21/2011)
Lowest recorded: 1362.87 ft (09/08/1970)
Recorded range: 1.6 ft
Last recording 1363.67 ft (05/10/2016)
Ordinary High Water Level (OHWL) elevation: 1364.6 ft
Datum: MSL 1912 (ft)

Historical and Existing Conditions

Lake Six is comprised of 193 acres, so is considered a small lake with 3.3 miles of Shoreline. It has no inlet and is the headwaters of several lakes and is spring-fed. There is one unnavigable outlet to Lake Seven. It is defined as an oligotrophic lake. (clear water conditions with excellent recreational opportunities)

The maximum depth is 140 feet with 1/3 of lake 15 or less. The average depth is 71 feet.The bottom of the lake is primarily sand and gravel. The immediate ecoregion is Northen Lakes and Forest Region which contain the clearest of lakes.

Land use and zoning on Lake Six follow the Shoreland Management Ordinance of Ottertail County. There are no extra restrictions and many would say that Ottertail County has some of the most restrictive ordinances in the state.

In 1982 there were 22 seasonal homes and 19 permanent homes for a total of 41 homes, In 1997 there were 23 seasonal homes and 21 permanent homes for a total of 44 homes. In 2016 there are 35 seasonal homes and 16 permanent homes. As you can see, the trend is definitely toward seasonal residences and permanent residences are declining.

After doing some research and contacting Bill Kahler, head of Land and Resources Department of Ottertail County, there is no comprehensive County Plan for land use. Although there is a water Management Plan for Ottertail County in effect from 2009 – 2019.

Lake Six is a mix of new, modern year-round homes to a more rustic quaint cabins to mobile homes. There are probably not any substandard homes on the lake. It is a mix of upscale to modest dwellings. Upscale homes next to older, simple homes are not uncommon.

Our waste treatment is taken care of through individual septic systems whether they are contained septic tanks or drain fields. As of now everyone has one of these two types of systems on the lake. It is unknown though if they are all updated or up to code.

We have one non-residential land use. On the southwest corner of the lake, there is lot owned by Camp Cherith, a Christian camp mostly for girls. They use the lot only for their water activities, and the camp itself is about 3 miles away. They are an asset to our lakeshore as they are learning about how the environment and gaining an appreciation for lakes and nature in a beautiful setting.

The northwest and southwest areas of the lake have steep hills that potentially could be an area for soil erosion. They are also more vulnerable to runoff from shoreline development. There are no point stormwater discharges and non point would be developed lots with the non-permeable areas as well as roofs. We are fortunate not to have feedlots or row crop farming in the lakeshed.

One-half of the land around Lake Six is owned by the Kaldahl family who have put it in a forest conservation easement. They have owned the property for many years and are true environmentalists. Hopefully they have the financial resources to keep the land and not to develop it. Adjacent to the camp is a protected wildlife refuge owned by the DNR. There are many different types of vegetation that range from submerged, to floating leaf, to emergent, to shoreline plants. The diversity in the wildlife ranges from fish, turtles, muskrats, beavers, ducks, and more.

A very important piece of this lake management plan is finding our philosophical stance on how we feel about major issues affecting the lake and will we even be aware of the issues. For example, if the land on the east side of the lake would be turned into a golf course, what would be our stance? What if the DNR decided to pave the public water access,

how would we react? First, obviously, the lake association would have to know what would be happening!! So first, it is vital that we as an association reach out to the organizations that can keep us informed about important decisions directly affecting Lake Six. Otherwise, we might not be a "player "in what is happening on or around the lake. In the action plan, we will specify who we will reach out to, who will be the contact person, and what is the deadline. The second important piece is what will be our stance. It should not be dictated by emotions, what other people are thinking, personalities and opinions. Rather there should be a firm stance based on science and principles. We as a lake association have decided that would be our mission statement and our nine goals that are a part of the bylaws would be the fulcrum around which we take our stance.

7. Public Water Access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80 percent of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources, Trails and Waterways Unit. They are responsible for the acquisition, development and management of public water access sites. The DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government such as townships and municipalities. The DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

According to Minnesota Department of Natural Resources Fisheries Survey, there is one public access on Lake Six.

Lake Six's public access is on its very south end and gets a moderate amount of traffic. It has nine parking spaces which is appropriate for the size of the lake. No one seriously speaks of having the public access removed or closed because all of Minnesota's lakes are public waters unless there is only one riparian owner. Also it seems self-centered to not want to share the lake with non-lakeshore owners. However, if the visitors to the lake do not recognize the lake as a place that needs to be conserved and treated with care, then they will not be the most welcome. Being not welcome might be shown by a gentle reminder to having the local authorities called to stop the illegal behavior.

What has been done to constructively manage the public access is

At least once a year on a busy weekend, having a person at the access to remind people to *Clean, Drain, Dry.* Next year lemonade and cookies may be served so they see the inspector as an ally against aquatic invasive species.

Through the cooperation of Lake Six and Lake Seven, a large bright sign was paid for and installed on private land that warned about AIS. The Hobart Township board was notified that it would not be on the road right-of-way.

There are several signs posted: loon habitat nesting area, scuba divers, Aquatic Invasive Species sign saying that we are a non-infested lake. Unfortunately these signs manage to "disappear" or fall off the sign holder. Unfortunately, when you contact the DNR, they are often busy with larger issues, so often times it is in the hands of the lake association to take care of problems. Yet, the DNR is very restrictive in what can be done on the access, so it can be very frustrating when there is a problem, people want to solve it, but are told it can't be done. But the DNR who can do it, often times can't. In defense of the DNR, they are understaffed. What often times is done, is compromise with the DNR and the lake association. As long as what is being done to take care of the access is not obtrusive, it is overlooked. Often times our access can have garbage which can lead to bigger problems. . What the lake association is not doing is cleaning up after people. That seems to ask a lot of volunteers to clean up garbage. In lieu of that, a large garbage receptacle is going to be placed at the access and once a week, the local garbage people will empty that. Also a sign will be added to the sign holder asking people not to litter. Hopefully, these ideas work in maintaining and managing the public access.

9. Organizational Development and Communication

in 1985 Lake Six Lake Association was formed with these items on their agenda:

Establishing and maintaining the water level of the lake as well as the outlet to Lake Seven

Obtain proper fire protection

Develop better roads

Get cable TV

Organize social events

Thirty-one years year later we have cable TV and fire protection. We are still working on the water level and the Lake Seven Outlet. One of the quality of life goals now is to enforce the speed limit on our well maintained road. Of course, socialization is as important now as back then as we have in our action plan, having picnics and potlucks.

In this span of time our organization has grown from 20 to 42 members. The officers then were men, now they're all women. Our goals and priorities presently focus more on ecology than anything else. As years have gone by, lake lots have become more of an extension of year round houses in towns and cities. The rustic little cabins without much change to the lot has changed. That isn't necessarily a bad thing, but the environment does suffer and as a lake association it is our job to preserve the lake and its environs while still enjoying a high quality of life at the lake.

The leadership of the association is the same as it was back in 1985: president, vice president, secretary, and treasure. Our dues are $25. For the 2016 year, 86% of the people are members. It is hard to attain a higher membership number than that as some people just don't like to join organizations. Even though the membership number is very high, the number of people who attend our social events and meetings could be improved. Most of the attendees are full time residents and older people. I think younger working people come to the lake for the weekend and want to freely enjoy themselves. We need to find a way to reach these younger working people with young children who come on a Friday night and leave on a Sunday.

One comment and compliment is that people are happy for all the communication they receive about the lake. It may be to order Lake Six T-shirts, about the death of one our neighbors, another warning about AIS, or simply a beautiful sunrise picture.

Benchmarking

At this time, the lake association is not in the process of benchmarking. When this Lake Management plan is completed, we then can examine closely the goals we want to benchmark, identify indicators to measure if we really are making progress, then set a standard for those indicators (a benchmark), then track them over a designated period of time, and finally analyze the results to see if we have met our benchmarks. If not find out why, or celebrate our success.

For example: According to our action plan is the goal: to establish and maintain a strong, active lake association

Action item: Increase membership and active involvement in the lake association

Send an email survey or SAS postcards trying to determine why people don't attend the annual meeting and what might entice them to attend

-Our goal would be to increase the number of people to come to the annual meeting

-Indicator is the average number of people who came the last ten years

-A benchmark would be to increase the number of people by 20%

-Follow the action plan of sending out emails and SAS envelopes

-Follow the wishes of the people to make it more enticing to attend the meetings if they are reasonable

-Count the number of people who come to the meeting for the next two years.

-See if we gained 20% more attendees

-If we don't reexamine the problem or celebrate more people coming

Generally speaking, that is how we would benchmark important priority goals. For us to be an effective organization, it is key that we benchmark our goals.

Summary of Visioning/Planning Session

The raw data gathered from the visioning meeting which is found in the appendix. The comments were made and written down in small groups during the breakout session. Comments were organized into categories.

Our visioning session was held on a Friday night, June 3rd. The leadership felt it was good turnout being that we have 56 riparian owners on Lake Six. One disappointment was there were very few seasonal people who attended. That is in keeping with the turnout for all events on Lake Six. One of our goals is to try to engage them more.

<u>Our priority themes are</u>

- **Shoreline Stabilization**
- **Strong Lake Association**
- **Water Quality and Clarity**
- **Aquatic weed management**
- **Aquatic invasive species**
- **Public Access and Use of Lake**
- **Wildlife Habitat and Preservation of Natural Spaces**

Success would look like this if the above priorities are worked on, bench marked, and then evaluated

- **Most shorelines would have native plant buffer zones.**
- **The Lake Six Lake Association would still be operational with its mission statement and goals serving as its philosophical base**
- **Our water quality and clarity would stay at an average 36 TSI or lower for a five year period.**
- **There is a variety of lake weeds, but not so many they overwhelm fisherman and swimmers**
- **No Aquatic Invasive Species in the lake!**
- **A clean, well maintained public access where people are considerate of others and their interests**
- **People using the lake, resident and non-resident, are respectful of each other and their recreational activities**
- **There is diverse wildlife on the lake: fish and other water life, birds, insects, water mammals, etc. The nuisance animals are controlled, but not eliminated for they are a part of the ecosystem**

Community and organizational assets are

- **Our lake association**
- **Lake Seven Lake Association who can be our collaborative partner**
- **Freshwater Society**

- **East Ottertail Soil and Water Conservation District**
- **The other three lake associations that were part of the Healthy Lakes and Rivers Partnership: Lake Lida, Big McDonald Lake, and Wall Lake**
- **Ottertail County COLA**
- **Hobart Township Board**

As mentioned earlier, it is essential for the success of our shared goals that all lake residents including seasonal, those newer to the area, and year round, need to be on board. Past outreach efforts have shown to be a challenge, something that needs to be addressed.

More research needs to be done on lake weeds. There has to be a healthy balance of not having a weed choked lake vs maintaining an optimal habitat for the wildlife. The public access is a controversial issue, but we need to reach out to the DNR and other lakes as to how they manage their public access problems. The age old problem of speed boats vs nonspeed boat people has to be addressed. More research needs to be done as to *if and how* speed boats create a water clarity problem. Then if they do, we need to research what speedboats should not be doing to make the lake less healthy (a worse TSI score)

Who is going to be doing this research has not been decided yet, but it will be important that we partner with the DNR and SWCD to address boat speeds and lake weeds respectively.

Action Plan Introduction

Following is the Action Plan which is the functional, accountable part of the lake management plan. The action plan is comprised of goals, action items, timeline, budget, and people in charge of getting the jobs done. This is where the work gets done. The rest of the Lake Management Plan is the history, philosophy, science, and facts that are all essential to the process.

Our mission statement and goals were adopted by the lake membership four years ago. Consequently, the following paragraph demonstrates how the five priorities of the action plan dovetail into the mission statement and the goals.

First the mission statement is to preserve and protect Lake Six for current and future generations.

- **Goal no 1 to preserve and protect the water quality is essentially saying the same thing;**
- **Goal No 2 to maintain a strong, active lake association provides the vehicle through which we protect our waters.**
- **Goal no.3 to preserve and protect wildlife and habitat broadens the definition of Lake Six not just as a body of water, but a home to fish and other wildlife. A whole ecosystem is being preserved and protected for people, animals, and the lake to exist in harmony.**
- **Goal no. 4 to promote appropriate and safe recreational activities has two desired outcomes: one to protect the lake and for people to enjoy themselves using the lake. Ideally, for the lake to remain as pristine as it was would be to allow no motors on the lake. However, this is not a private lake, so that will not happen. People must be guided and educated to not harm the lake or its wildlife.**
- **Goal no. 5 to promote a high quality of life does not directly fit the mission statement. Indirectly it does because lake residents are aware and newcomers have been informed how cherished Lake Six is. They then treat it accordingly.**

To synthesize our purposes and goals in our bylaws' goals # 1-7 and the action plan's goals in the LMP becomes redundant and also self-evident. However, taking a closer look at our bylaws 7 and 9 could be explained more closely.

- **Goal #7 - to encourage a sense of community among the residents. It is often said it takes a village to raise a child. It also means it takes a village to preserve and protect the lake. When we are united in a common cause, the odds of success multiply greatly. That is why a community spirit should be fostered in the lake residents.**
- **Goal #9 – to actively support the Minnesota Lakes and River Advocates, COLA, and other lake associations. State legislators, local units of government, voluntary organizations all have the power to make a difference. They can provide a wealth of knowledge, help and resources that can be tapped into for the well being of the lake and its lakeshore residents. To not support them is to look backwards and hope that everything stays the same or like it was. That is regressive thinking and puts the lake in jeopardy because things do change.**

TOP FIVE PRIORITIES FOR LAKE SIX MANAGEMENT PLAN

The steering committee for the Lake Six management plan has established the following focus areas based on the results of the visioning meeting held June 3, 2016: water quality, a strong lake association, wildlife habitat, safe use of the lake, and quality of life. The goals, action plan, timeline, and budget are detailed below.

GOAL No. 1: To preserve and protect the water quality of Lake Six for current and future generations.			
Person Leading	**Action Plan**	**Timeline**	**Budget**
	Action Item #1: Reduce nutrient flow into the lake, improve shoreline stabilization, and prevent erosion.		
M. Peterson S. Ogard	a. Educate residents at the annual meeting and through newsletters* about the importance of preventing direct runoff into the lake and stabilizing their shoreline through the use of rain gardens, rain barrels, and native buffers. Include information about cost sharing options for installation through EOT SWCD. *100% of property owners receive the newsletter.	Done/ On-going	Cost of newsletter: $90-100 annually from assoc. dues
M. Peterson	b. Promote and coordinate efforts with East Ottertail SWCD to provide cost sharing for property owners to install rain gardens, native buffers, or shoreline stabilization projects. Offer to pay all or a portion of the property owner's 25% cost share in areas of severe erosion.	DONE/On-going through 2018	Cost sharing from SWCD/HLRP grant funds
M. Peterson	c. Schedule a visit from SWCD to evaluate and make recommendations for several properties in one day.	Summer 2017 & 2018	No Cost
Lake Assn Officers	d. Provide incentives for property owners to install rain gardens and/or native buffers by offering gift cards (donated by businesses or Lake Six association) to a nursery which carries native plants. Present a "Certificate of Stewardship" to all property owners who complete a project, along with a gift card to a local nursery which carries native plants. Send article and picture to local media.	Annually	$400 HLRP grant funds

L. Cheney	e. Provide every resident with a copy of "A Guide to Lake Protection and Management" from the Freshwater Society. Include a cover letter from association officers and a copy of the action plan.	Annual Meeting June 2017	Books free from Freshwater Society
L. Cheney	f. Include an article in the annual newsletter about the benefits of installing rain barrels. Contact OTC Environmental Office/EOT SWCD about the availability and cost of rain barrels. Consider a cost sharing program for 2017-18 for purchase of rain barrels using HLRP grant money.	Summer 2017 & 2018	$70-170 per barrel. Possible cost share using HLRP grant $$

GOAL No. 1 (cont.): To preserve and protect the water quality of Lake Six for current and future generations.			
Person Leading	**Action Plan**	**Timeline**	**Budget**
M. Peterson	g. Schedule and invite residents to open house/pot luck events at sites where rain gardens/native buffers/shoreline restorations have been installed. Invite a rep from SWCD to be on hand to educate attendees. Include a list of properties with restorations projects in the annual newsletter.	Summer 2017 & 2018	No Cost
S. Ogard	h. Ask local media to write a story featuring shoreline restoration/native buffer/rain garden projects on Lake Six.	Late summer 2017	No cost
D. Durow	i. Lake residents will continue to monitor the outlet to prevent obstructions (debris and beaver dams) from slowing the flow of water and thus raising the level of the lake.	DONE/On-going	No Cost
L. Cheney	j. Check with septic inspectors about the cost of conducting septic system inspections on Lake Six. Consider a cost sharing program with residents.	90 days Summer 2017 & 2018	$200-320/property. Possible use of HLRP grant money
P. Puetz	k. Investigate the possibility of recruiting local youth groups or lake resident volunteers to provide labor for installing rain gardens and native buffers, especially for seniors unable to provide labor themselves.	On-going	No Cost

Person Leading	**Action Item #2: Continue to monitor the water quality of Lake Six so as to contribute to our understanding of the lake and to develop long-term trends.**	**Timeline**	**Budget**

Greg Ogard	a. Continue monthly water monitoring in conjunction with MPCA, CLMP, Otter Tail County COLA and RMB Lab.	Done/ On-going	$210 annually to OTC COLA from assoc. dues
Greg Ogard	b. Report and interpret results to residents through annual meeting and newsletters, educating them as to the significance of chlorophyll a, phosphorus, and Secchi disk readings and the role they play in maintaining water quality.	Completed at annual meeting 2016/ On-going every year	No Cost
Greg Ogard	c. Monitor and inform residents of long-term trends based on RMB Lab analysis.	Annually	No cost

GOAL No. 1 (cont.): To preserve and protect the water quality of Lake Six for current and future generations.			
Person Leading	**Action Item #3: Prevent the introduction of aquatic invasive species (AIS) into Lake Six and control those already present (yellow iris).**	**Timeline**	**Budget**
M. Peterson S. Ogard	a. Provide residents with a pictorial identification guide of various AIS and how they can be prevented. Distribute through annual newsletters or with the Freshwater Society guide mentioned above.	Done/On-going	Cost of newsletter: $90-100 annually from assoc. dues; Free brochures from DNR
M. Peterson	b. Check with MN DNR about posting AIS information at the public access.	Done	$100 from assoc. dues
Dick Peterson	c. Maintain the Clean, Drain, and Dry billboard installed by Lake Six and Lake Seven associations near the public access. Investigate the possibility of partnering with other organizations on AIS prevention to reach a broader audience.	On-going	No Cost at this point.
S. Ogard B. Anderson	d. Educate residents through the annual newsletter on the detrimental effects of yellow iris on native shoreline vegetation and the habitats for pollinators and other wildlife. Recruit volunteers to dead head yellow iris along the shoreline to prevent its spread. (Some residents state the yellow iris is preventing shoreline erosion and don't want it sprayed.)	Summer 2017 On-going	No Cost

Lake Six Association decision	e. Research the possibility of establishing a "set-aside" fund for combating AIS if the need should arise (i.e. charitable fund through WCI). Use OTC COLA as a resource to identify possible funding for AIS prevention.	Long Term	To be determined by association vote annual meeting 2017.
M. Peterson	f. Contact other lake associations who have had to combat infestations of AIS in recent years to find out what they have learned. Invite a representative of one of them to speak at the annual meeting.	Summer 2017	No cost or small honorarium
S. Ogard M. Peterson	g. Contact DNR about setting up a rapid response plan if AIS is discovered. Provide residents with a magnet with contact information of who to call if they suspect AIS.	90 days	$20 from association dues
D. Peterson	h. Construct and install zebra mussel detection devices in various locations around the lake.	Summer 2017	$50 HLRP grant

GOAL No. 2: To establish and maintain a strong, active lake association.			
Person Leading	**Action Item #1: Increase membership and active involvement in the lake association.**	**Timeline**	**Budget**
L. Cheney & P. Puetz	a. Develop and distribute a directory of all lake residents. Include a parcel map.	Summer 2017	$200 HLRP grant
M. Peterson	b. Establish a welcome wagon committee to welcome new residents and to provide them with information about the lake association and educational materials on lake stewardship. Include the LMP Executive Summary, Action Plan and "A Guide to Lake Management and Protection" mentioned in 1e.	Spring 2017	No cost.
M. Peterson K. Hanson	c. Increase the number of social events on the lake from one per year to three to encourage a sense of community. Make one event an appreciation event for volunteers and lake stewards.	Summer 2017 & 2018	$100 annually; association dues and HLRP grant
M. Peterson	d. Establish sub-committees for various projects so it is easier for members with special skills to be able to contribute (i.e. incorporation, forest tent caterpillars, welcome wagon, public access monitoring).	Done: FTC/incorporation; Others on-going	No Cost

S. Ogard	e. Send an email survey (SAS postcards to those without email) to lake residents with a list of opportunities for which they might volunteer.	Done	$10 for postcards and stamps
L. Cheney	f. Send an email survey (or SAS postcards) trying to determine what would draw residents to meetings (food, music, time of day/week/season, activities, door prizes).	Summer 2017	$10 for postcards and stamps
Assn. officers	g. Increase attendance at the annual meeting from 30% of property owners to 40% through ideas garnered from survey.	Summer 2018	$100 from assoc. dues
A. Coombs	h. Establish a Lake Six Facebook page to help disseminate information on lake stewardship, AIS, wildlife habitat, safety issues, etc. and information on association events and activities.	Summer 2017	$100 annually; HLRP grant
Assn. officers	i. Defray costs for residents to attend educational meetings and conferences regarding water quality, AIS, wildlife habitat, etc.	On-going	$200 annually; HLRP grant
S. Ogard	j. Send minutes of annual meetings to 100% of property owners whether they are members of the association or not so everyone is informed about lake association activities.	On-going	Minimal postage. Most done by e-mail.

GOAL No. 2 (cont.): To establish and maintain a strong, active lake association.			
Person Leading	**Action Item #2: Ensure the long term success of the lake association.**	**Timeline**	**Budget**
M. Peterson	a. Establish a committee to investigate the requirements and costs associated with acquiring a non-profit incorporated status in order to avoid liability issues, allow donations to be deductible, and to increase our eligibility for grants.	Done	No Cost
L. Cheney	b. Apply for non-profit incorporated status.	Summer 2017	Estimated $1,000 in attorney's fees; From assn. dues and HLRP grant

S. Ogard & Officers	c. Review association by-laws every 4 years and make appropriate changes.	Done 2016	No Cost
M. Peterson	d. Establish and maintain a good working relationship with Lake Seven, Five Lakes Resort, DNR, SWCD, OTC COLA, OTC Land and Resource Department, the Initiative Foundation and other pertinent organizations.	On-going	No Cost
M. Peterson	e. Continue membership in the OTC COLA and send a representative to monthly meetings who will report back to Lake Six residents. President Marlene Peterson is now a member of the OTC COLA board of directors serving as the Environmental Officer.	On-going	$46 annually from association dues (plus $210 for water testing)

GOAL No. 3: To preserve and protect wildlife and habitat in and around Lake Six.

Person Leading	Action Item #1: Promote wildlife habitat for loons, pollinators, birds, fish and other wildlife.	Timeline	Budget
D. Rudquist B. Anderson	a. Provide two man-made nesting sites for loons at the north and south ends of the lake. Educate residents about loons and the importance of staying away from them while boating on the lake.	Done annually	$50 association dues
S. Ogard M. Peterson	b. Provide information about the importance of pollinators (bees and butterflies) through the annual meeting and newsletters. Encourage residents to plant native plants and flowers to provide habitat for pollinators and birds and to minimize the use of pesticides and herbicides.	Done/On-going	No Cost
S. Ogard	c. Provide residents with information about bee houses and instructions on how to build and install them to attract pollinators which do not sting.	Summer 2017	No cost
S. Ogard	d. Provide 75 packets of milk weed seeds at the annual meeting and encourage residents to plant milkweed for monarch butterflies.	Done	No Cost - Seeds donated
P. Puetz	e. Provide information on native bird species, their habitat, and how to attract them to yards. Schedule a speaker for a future event.	90 days Summer 2017	$50 HLRP grant

M. Peterson	f. Educate residents at the annual meeting or through newsletters of the importance of lake vegetation as habitat for fish and shoreline stabilization and not as “weeds” needing to be removed.	Spring 2017	Cost of newsletter: $90-100 annually from assoc. dues
Dick Peterson	g. Continue to monitor DNR fish surveys to determine if populations are stabilized at healthy levels. Educate residents about what the data mean regarding "catch and release" vs. "catching to eat". Post fishing survey and analysis on Facebook.	On-going	No Cost
D. Peterson	h. Distribute 2017 DNR fishing rules and regulations guide book to all interested residents.	On-going	Free brochures
Assn. officers	i. Provide residents with information on Minnesota Noxious Weeds and ask them to report any findings to the Lake Six officers or to county weed control .	On-going	Free brochures from county agencies.

GOAL No. 4: To promote appropriate and safe recreational activities on and around Lake Six.

Person Leading	Action Item # 1: Monitor the use of the public access	Timeline	Budget
S. Ogard	a. Contract with garbage service for garbage pickup at the public access May - September.	Summer 2017	$120 annually; association dues
M. Peterson	b. Check with the DNR about the possibility of installing "No Littering" signs at the public access. Include wording "Paid for by Lake Six Association member dues".	Called 8/16; installation 2017	$100 association dues
M. Peterson	c. Provide all residents with a refrigerator magnet showing the OTC Sheriff’s phone number and encourage residents to report any illegal or dangerous activity at the public access.	Done	$10 from association dues

Person Leading	Action Item #2: Promote safe and considerate use of the waters of Lake Six.	Timeline	Budget
P. Puetz	a. Educate residents about safe boating practices by distributing the DNR 2017 Boating Guide.	Summer 2017	Free from DNR

P. Puetz	b. Educate residents about water safety/drowning prevention through presentation by water safety instructor.	Summer 2017	No Cost
M. Peterson	c. Educate residents through annual meeting and/or newsletter about the damage done to shorelines by wakes and revving engines close to shore.	Spring 2017	Cost of newsletter: $90-100 annually from assoc. dues
M. Peterson	d. Get input at an OTC COLA meeting about what other lake associations have done to control speed of boats and jet skis.	Done	No Cost
B. Anderson	e. Appoint a liaison to serve as the contact between Camp Cherith and the Lake Six Lake Association to relay any concerns.	Done	No Cost
M. Peterson	f. Provide all residents with a refrigerator magnet showing the OTC Sheriff's phone number and encourage residents to report any illegal or dangerous activity on the lake.	Done	$10 from association dues

GOAL No. 5: To promote a high quality of life on Lake Six.

Person Leading	Action Item #1: Monitor and control the infestations of forest tent caterpillars. (FTC)	Timeline	Budget
M. Peterson	a. Talk to a DNR forester about the life cycle and appropriate control of FTC. Distribute the information to residents through the annual meeting and email.	Done	No Cost
M. Peterson	b. Establish a committee to monitor egg masses in the fall and early hatch in the spring.	Done	No Cost
Lake Assn. Decision	c. Establish a protocol for the annual decision making on whether or not to spray.	Annually in spring.	No Cost

Person Leading	Action Item #2: Promote a safe and clean roadside along Lake Six.	Timeline	Budget
P. Nunn	a. Write a letter to the Hobart Township board, signed by residents, about dangerous drivers and the lack of a speed limit sign on the south end of Lake Six Road.	Done	No Cost
S. Ogard	b. Recruit volunteers through the survey mentioned earlier to conduct a periodic clean up of ditches.	90 days/ On going	No Cost

M. Peterson	c. Provide residents with an OTC law enforcement website where excessive speeders can be reported anonymously.	Done	No Cost
Person Leading	**Action Item #3: Stay informed about any changes in regulations regarding land use on or near Lake Six.**		
M. Peterson	a. Contact the Land & Resource Management Dept. of Otter Tail County and ask to be formally notified of any regulatory decisions pending in the Lake Six area.	Spring 2017	No Cost
Person Leading	**Action Item #3: Encourage residents to test and monitor their private well water used for drinking. (Hobart Township has been identified as vulnerable for high nitrates which is harmful to infants, pregnant women, and anyone going through intensive medical treatments.)**		
Greg Ogard	a. Recruit volunteers to collect water samples from residents and deliver them to EOT SWCD for analysis.	On-going	Free service provided by SWCD
Greg Ogard	b. Research the need for and cost of arsenic testing for private wells and provide information to residents. Consider cost sharing with residents if data shows there is a concern in our area.	Summer 2017	No Cost for now

Glossary

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bioaccumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll *a*: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevents groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and non-point source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

Common Biological or Chemical Abbreviations

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

Guide to common acronyms

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

110B	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five "Injection" well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Recreational Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code

INDIVIDUAL COMMENTS MADE AT VISIONING

Below is the raw data gathered from the visioning meeting. The comments were made and written down in small groups during the breakout session. Comments were organized into categories.

Category	Item
General (comments without a specific category)	use water for fertilizer
	get OAT in formation over and over and over
	June 25th Lake 7 annual meeting Hobart Township Hall; John's Meeting
	June 25th Lake 7 annual meeting Hobart Township Hall; John's Meeting
	speed limit on road-more signs
	clean distance from dock
	need boat checks at landing again for invasive species
	Kaldah's east shore remains undeveloped
	future development pressure?
Lake Access	access issues
	access is public and swimming is allowed
	garbage cans-who will take of these?
	Invasive species-who is checking boats?
	keep out spiny starwort
	keep out Eurasian milfoil
	$$$$$$ NEEDS $2000
	Hire a boat landing captain; weekends and holidays
	organize volunteers
	close public access
	have good caretakers of public access
	help us protect the public access
	Docks, lifts, boats coming from other lakes; How do you control?
	hire a captain
	organize volunteers
	we need a sheet to know what to do
	we need a sheet to know what to do
	water quality
	avoid invasive species
	SWCD grants
	Get garbage cans set up; Check with DNR for proper set up
	Get garbage cans set up; Check with DNR for proper set up
	Funds from association for above projects

	garbage can and pick up
	designate parking area(s)
	No wake zone at access
	No minnow dumping
	add signs
	add raccoon proof garbage cans and service
	hire boat launch manager; volunteers to check boats
	more tidy public access
	no zebra mussels or IS
	inspectors at public access for AIS
	public access garbage solution
	Invasive species
	littering
	sanitation
	toileting-diapers, etc?
Shoreline and Runoff	Too much dirt washing into the lake
	Buffer zones all around the lake with native species and deep roots
	Coconut logs
	Have chemist check to see if springs are bringing in too many chemicals
	Should we lower the lake level?
	Are native buffers better than rip rap?
	Educate homeowners on native buffers to protect shoreline
	Educate homeowners on impervious surface
	Cost of coconut logs
	Does the yellow iris help erosion?
	How do we pay for buffers?
	Recruit youth group i.e. scouts, etc. for labor
	SWCD
	Rocks, coconut logs, sediment logs
	No more loss of shoreline
	Use large root system plants to stabilize beach--yellow iris is a PLUS
	RMB Labs
	Hobart Township
	DNR
	UMN
	? Printing Company
	OT County
	shoreline erosion
	shoreline management
	Buffer

	native plantings
	spraying weeds and fetilizer; sumack along road
	SWCD grants
	Shore land regulations
	Shore land regulations
	At lake meetings, ask residents to minimize fertilizing and spraying
	Resources: coordinate between shoreline management and SWCD
	Resources: coordinate between shoreline management and SWCD
	shoreline management area leading to lake
	lake vegetation management
	rainwater management
	SWCD-a qualified lake management person to inspect individual properties and advise them what they might do to help
	schedule a specific day and multiple owners and can have a visit
	someone to investigate the root system of the water iris-ours is better than any other!
	to what extent do we need shore line control? Do large waves effect the shoreline?
	healthy plant growth management
	Buffer zones all around the lake-restoring shoreline
	rain gardens-rainwater runoff
	no yellow irises; invasives will crowd out natural plants
	Reduce shoreline erosion
	no fall leaves blowing/raking into lake
	Increase in shoreline erosion protection and hillside runoff
	better understanding of shore (15 ft lake) vegetation
	what is the advantage of rip rap? Erosion control
Strong Lake Association	Why won't lake people join the lake association?
	Why do people think the lake association is the watch dog and enforcer of lake rules and regulations?
	People get scared off
	Worry about time commitment
	People think it may be boring to attend meetings
	Build on social aspect
	Extend to family beyond owners--children and grandchildren
	Phone book with map (where people live, contact info/email, update as needed, info about person)
	Block party funding with an officer in attendance--NO AGENDA!
	SWCD
	EOT SWCD

	Membership drive assistance
	Welcome wagon meet new property owners with binder of important lake information
	Annual Meeting--place on agenda: block party, 1st party at Jeff Giefer's, date/time TBD
	Welcome wagon info packet
	End of season party/picnic (coordinate with dock removal)
	Get together with neighbor lake associations
	get to know all the neighbors
	more social events
	communication
	Are there any possibilites of more lots built on?
	talk to neighbors
	continue C.O.L.A
	upon finding AIS- rapid response plan
	community development-neighbors meet neighbors regardless of membership
	more neighbor involvement in Lake Assoc
Use of Lake	No wake signage
	worry about how the speed boats affect shoreline
	wake control
	wake control
	maintaining swim area
	signs about staying far from shore at high speeds
	add "no wake zone buoy"
	boat traffic- use middle of lake and avoid shoreline, watch for swimmers, etc
	lake speed limits
	boats and ski doos too close to shore
	no wake zone-limit speed
	beach covered in weeds
	Eliminate large ski boats
	limit shoreline waves/ horsepower of motors??
	no divers on resident side of lake
	are other resorts sending people to our lake to swim because their lake isnt clean?
	What happened to the beach? Is it related to the canal?
	need more children to play in the water to keep beach clean
Water Quality and Clarity	What are the "peat moss clumps"--find someone to identify and explain (are they good or bad?)
	Clarity
	lawn fertilizer
	encourage people limit lawn fertilizer

	septic maintenance-continued inspections; Lake Association Meeting, more input
	list of people to educate on our needs
	lake vegetation management
	Amy/money
	improve water quality
	reduce fertilizer and herbicides along shoreline and roads
	septic system checks mandatory
	Improved water quality
	maintaining clarity
	aging of lake-does that promote weed growth?
Wildlife Habitat and preservation of natural spaces	habitat for pollinators
	beaver population-can we accommodate them? Destruction to trees
	monitor invasive species
	yellow irises-leave alone-no spray-kills birds and other creatures
	yellow irises-leave alone-no spray-kills birds and other creatures
	marten houses-good for mosquito control
	fireflies-keep going
	preserve flowers for bees and butterflies
	beavers-how to coexist
	chicken wire trees-beavers
	encourage more birds-feeders and houses
	no weed rollers-limit?
	address concerns for education on flowers and birds at next lake assoc. meeting
	Plan Workshops
	Butterflies newsletter-snippets
	Bees Newsletter
	Birds Newsletter
	Bird house types- for martens and others
	Check Nursery-Neo Nicotinoids in nursery available
	Iris Control without spraying- learn how to dead head
	grants-rain gardens
	Money for news letters and postage
	email
	locate experts
	shoreline control necessary
	checking incoming boats for invasive
	public access garbage solution
	publicize SWCD consult
	damaging sprays for bees and butterflies
	money for workshops? $100

	educate about birds
	educate about dead heading irises
	good bee and butterfly flowers to plant-milkweed
	get EVERYONE on board-priority for generations to come
	fertilizers-no phosphorus
	workshop on building bird houses
	shoreline buffer-reduce runoff
	ask lake 7 association
	involve neighbors
	newsletter
	check diving school assoc. about locations for diving
	all plants and fish; monitoring
	protect the fishery in the lake
	protect the loons
	get more emergent plants-aquatic for fish habitat
	fish spawning
	Maintain wildlife habitat

Lake Management Plan

for

Wall Lake

Wall Lake Association

Sept 2016

TABLE OF CONTENTS

Section 1: Overview

Executive Summary:

In late 2015, the Wall Lake Association was invited to participate in the Healthy Lakes and Rivers Partnership program along with three other Lake Associations in Otter Tail County. Under the coordination of Jen Kader (Freshwater Society) and Don Hickman (Initiative Foundation), and with strong support from Darrin Newman (East Otter Tail Soil and Water Conservation District) representatives attended a 1-1/2 days of training on lake ecology, strategic planning and communications on May 2016.

The Wall Lake Association was represented at the Healthy Lakes and Rivers Partnership training sessions by: John Carlson, Alwayne Draeger, Darlene Draeger, Jackie Hendrickson, Lanny Hendrickson, Mike Rudh, LuAnn Rudh, John Whartnaby and Jannine Whartnaby.

Following the training sessions, each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Wall Lake Association held this planning session on June 11 2016, facilitated by Jen Kader, Freshwater Society. Approximately 45 people were in attendance, with about 50 percent of the participants describing themselves as year round residents.

Taking what was learned at the Vision/Planning session, this action plan was create to identify the goals of the Wall Lake community as a part of the overall Wall Lake Management Plan. This document will help prioritize goals, guide citizen action and engagement in the priority action areas. As goals and priorities are accomplished or it's discovered that alternative strategies are needed, it is the intent to update the plan so that it continues to serve as a useful guide to future leaders.

The following Wall Lake community priorities have been identified:

1. To preserve and protect water quality for current and future generations (maintain or improve water quality trends).
2. Educate Wall lake users on water and boating safety
3. Preserve and protect wildlife on and around Wall Lake
4. Build a strong association with increased involvement

While state agencies and local units of government have a vital role and responsibility in managing surface waters and other natural resources, the Wall Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

We thank the Legislative-Citizen Commission on Minnesota Resources who, through the Environment and Natural Resources Trust Fund, made this round of the program possible.

Section 2: Plan Detail

History and purpose of Wall Lake Association

Wall Lake (MN Lake ID: #56-0658-00) is located 5 miles east of Fergus Falls, MN in Otter Tail County. It covers 683 acres and has a maximum depth area of 34 ft. Wall Lake is part of the Otter Tail River Watershed which is composed primarily of agricultural land interspersed with hardwood woodlots. The lake has a larger north basin and a smaller south basin, which are separated by a shallow sandbar. The maximum depth of Wall Lake is 34 feet; however, 33% of the lake is less than 15 feet in depth. Secchi disk readings range from 5' to 14'.

Wall Lake is classified as a general development lake. It receives water through an inlet on the southeast side of the north basin, which drains the area east of the lake, and the lake drains through an outlet on the west side of the north basin, which flows a short distance to the Otter Tail River.

Water quality data have been collected on Wall Lake since 1986. These data show that the lake is mesotrophic (TSI 40-50), which is characteristic of moderately clear water throughout the summer and excellent recreational opportunities.

The Wall Lake Association was incorporated in 1980 to deal with water quality issues. The Wall Lake Association is also a member of the Otter Tail COLA. There are approximately 235 residents around Wall Lake with approximately 50% being year round. Currently, about 50% of this group are Wall Lake Association members.

Volunteers within the Wall Lake Community conduct the monthly water sampling, Secchi disk testing for the Minnesota Pollution Agency and once a year Loon counting on the lake.

The Association pays for the COLA membership, which includes once a month water sampling from May through September. Other projects include T-shirt fundraising and holding directors and annual meetings. The Association would like to grow in the areas of community education on water quality and water safety. They would also like to increase promotion of native restoration buffers throughout the Wall Lake community and gain more knowledge on fishing regulations and whether this is a fit for Wall Lake.

In 2012, the East Otter Tail County Soil and Water Conservation conducted a lake assessment of Wall Lake through RMB Laboratories, and the subsequent report is cited frequently as a source of information. This report is what follows next.

RMB Environmental Laboratories Report

Lake Map

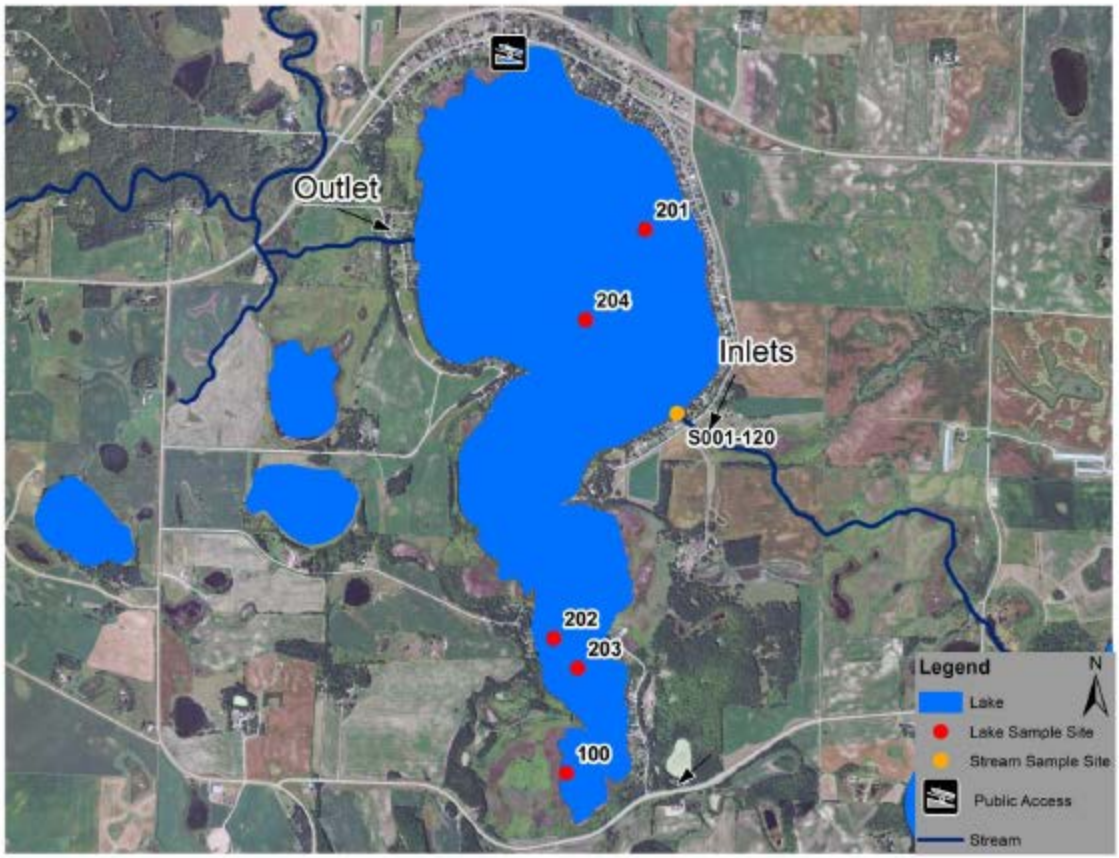


Figure 1. Map of Wall Lake with 2010 aerial imagery and illustrations of lake depth contour lines, sample site locations, inlets and outlets, and public access points. The light green areas in the lake illustrate the littoral zone, where the sunlight can usually reach the lake bottom allowing aquatic plants to grow.

Table 3. Monitoring programs and associated monitoring sites. Monitoring programs include the Citizens Lake Monitoring Program (CLMP), the Minnesota Pollution Control Agency (MPCA) and the RMB Environmental Laboratories Lakes Program (RMBEL).

Lake Site	Depth (ft)	Monitoring Programs
201	20	CLMP: 1985–1995
202	25	CLMP: 1985–1986; MPCA: 1980, 1987, 1995
203	27	CLMP: 1987–1995, 2001–2010
204*primary site	27	CLMP: 1996–2011; RMBEL: 1996–2000, 2005–2011

Average Water Quality Statistics

The information below describes available chemical data for the primary site (204) of Wall Lake through 2011. The data set is limited, and all parameters with the exception of total phosphorus, chlorophyll *a* and Secchi depth, are means for just 1980, 1987 and 1995 data.

Minnesota is divided into 7 ecoregions based on land use, vegetation, precipitation, and geology. The MPCA has developed a way to determine the average range of water quality expected for lakes in each ecoregion. For more information on ecoregions and expected water quality ranges, see page 11.

Table 4. Water quality means compared to ecoregion ranges and impaired waters standard.

Parameter	Mean	Ecoregion Range[1]	Impaired Waters Standard[2]	Interpretation
Total phosphorus (ug/L)	30	23 – 50	> 40	Results are within the expected range for the ecoregion.
[3]Chlorophyll *a* (ug/L)	9	5 – 22	> 14	
Chlorophyll *a* max (ug/L)	20	7 – 37		
Secchi depth (ft)	9.2	4.9 – 10.5	< 7.0	
Dissolved oxygen	*Polymictic* See page 8			Dissolved oxygen depth profiles show that the lake mixes periodically throughout the summer.
Total Kjeldahl Nitrogen (mg/L)	1.0	<0.60 – 1.2		Indicates insufficient nitrogen to support summer nitrogen-induced algae blooms.
Alkalinity (mg/L)	208	75 – 150		Indicates a low sensitivity to acid rain and a good buffering capacity.
Color (Pt-Co Units)	13	10 – 20		Indicates clear water with little to no tannins (brown stain).
pH	8.4	8.6 – 8.8		Indicates a hard water lake. Lake water pH less than 6.5 can affect fish spawning and the solubility of metals in the water.
Chloride (mg/L)	8.0	4 – 10		On the high end of the expected range for the ecoregion.
Total Suspended Solids (mg/L)	4	2 – 6		Within the expected range for the ecoregion. Indicates low suspended solids and clear water.
Specific Conductance (umhos/cm)	512	300 – 400		Higher than the expected range for the ecoregion, and indicates high runoff.
Total Nitrogen :Total Phosphorus	35:1	25:1 – 35:1		Indicates the lake is phosphorus limited, which means that algae growth is limited by the amount of phosphorus in the lake.

[1]The ecoregion range is the 25th–75th percentile of summer means from ecoregion reference lakes
[2]For further information regarding the Impaired Waters Assessment program, refer to http://www.pca.state.mn.us/water/tmdl/index.html
[3]Chlorophyll *a* measurements have been corrected for pheophytin
Units: 1 mg/L (ppm) = 1,000 ug/L (ppb)

Water Quality Characteristics - Historical Means and Ranges

Table 5. Water quality means and ranges for primary sites.

Parameters	Primary Site 204	203	201
Total Phosphorus Mean (ug/L):	30		
Total Phosphorus Min:	10		
Total Phosphorus Max:	108		
Number of Observations:	64		
Chlorophyll *a* Mean (ug/L):	9		
Chlorophyll-a Min:	0.5		
Chlorophyll-a Max:	20		
Number of Observations:	64		
Secchi Depth Mean (ft):	9.2	9.8	9.5
Secchi Depth Min:	4	4	4.5
Secchi Depth Max:	27	25	25
Number of Observations:	146	187	122

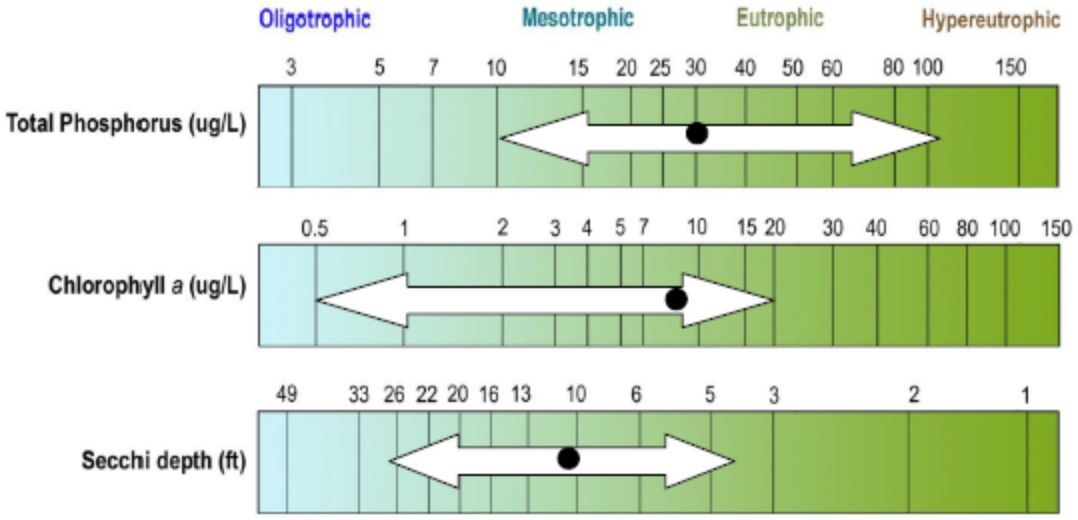


Figure 2. Wall Lake total phosphorus, chlorophyll *a*, and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 204). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. EPA 440/5-88-002)

Transparency (Secchi Depth)

Transparency is how easily light can pass through a substance. In lakes it is how deep sunlight penetrates through the water. Plants and algae need sunlight to grow, so they are only able to grow in areas of lakes where the sun penetrates. Water transparency depends on the amount of particles in the water. An increase in particulates results in a decrease in transparency. The transparency varies annually due to changes in weather, precipitation, lake use, flooding, temperature, lake levels, etc.

For all three transparency monitoring sites, the mean ranges from 9.2 to 9.8 feet. The transparency throughout the lake appears to be relatively uniform, with all three sites showing almost identical annual means each year (Figure 3). The highs and lows illustrate the year-to-year variability in transparency.

The transparency at site 201 was better than the long-term average in 1987, 1989, and 1992–1994. Transparency at site 203 was better than the long-term average in 1987, 1989–1990, 1992–1994, and 2001–2006. At primary site 204, the transparency was better than the long-term average in 1996, 1998–2000, 2002–2004, 2006, and 2008. Monitoring should be continued annually at sites 203 and 204 in order to track water quality changes.

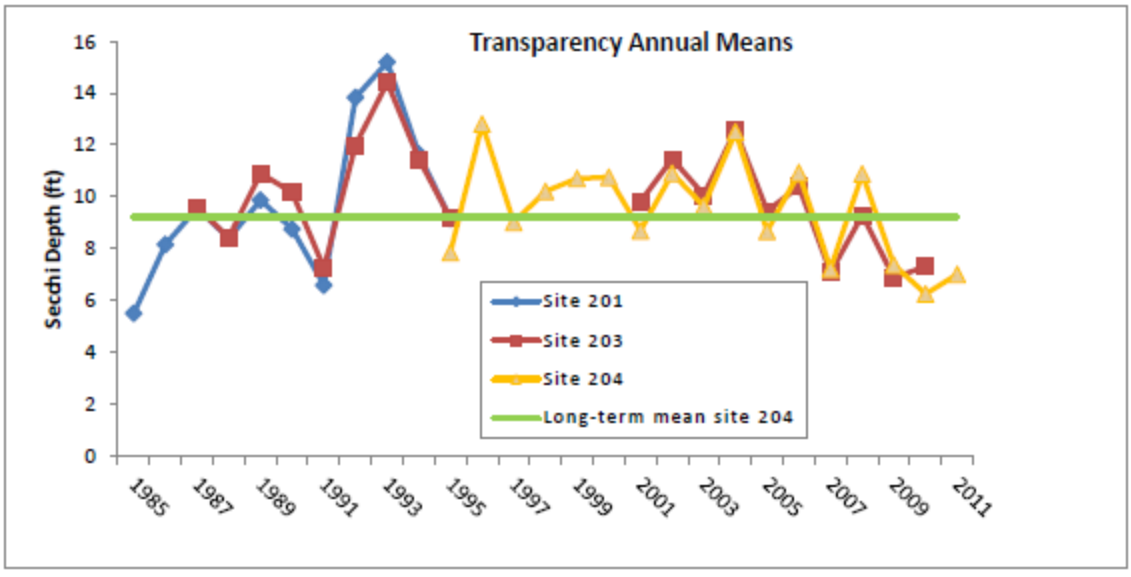


Figure 3. Annual mean transparency compared to long-term mean transparency, sites 201, 203, and 204.

Wall Lake transparency ranges from 4 to 27 feet at the primary site (204). Figure 4 shows the seasonal transparency dynamics. The maximum Secchi reading is usually obtained in early summer; correlating with the high visibility seen in May and June, which then declines through August. The transparency then rebounds in October after fall turnover. This transparency dynamic is typical of a northern Minnesota lake, and is influenced by the algae and zooplankton population dynamics and lake turnover.

It is important for lake residents to understand the seasonal transparency dynamics in their lake so they are not worried about why their transparency is lower in August than it is in June; it is typical for a lake to vary throughout the summer.

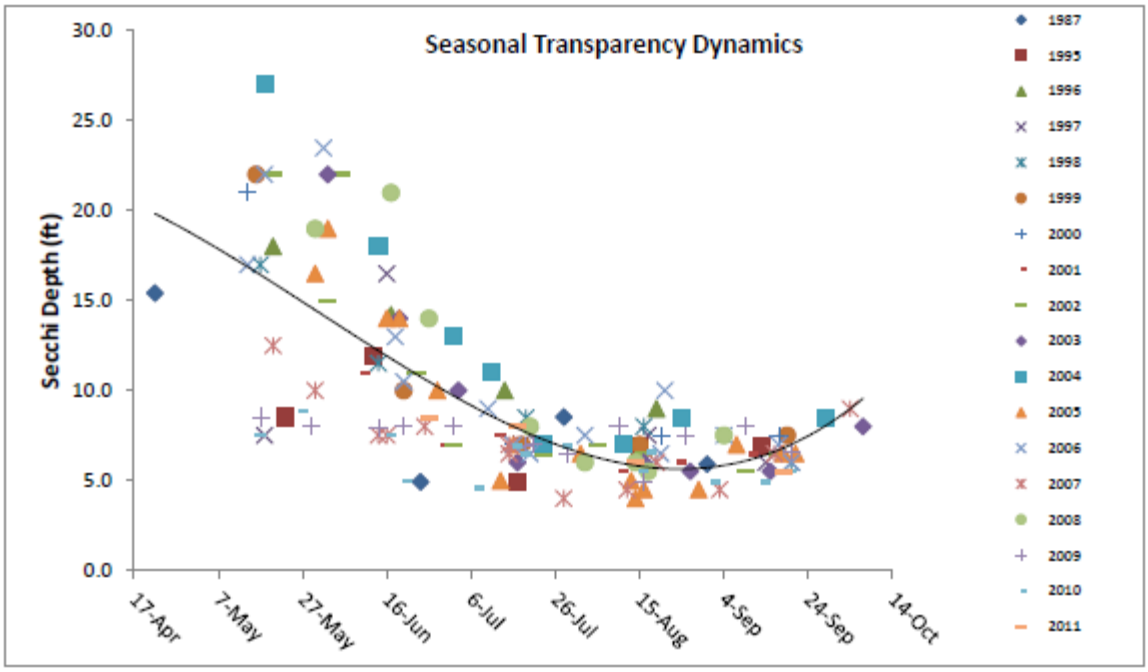


Figure 4. Seasonal transparency dynamics and year-to-year comparison (Primary Site 204). The black line represents the seasonal pattern.

User Perceptions

When volunteers collect Secchi depth readings, they record their observations of the water based on the physical appearance and the recreational suitability. These perceptions can be compared to water quality parameters to see how the lake user would experience the lake at that time. Looking at transparency data, as the Secchi depth decreases the perception of the lake's physical appearance rating decreases. Wall Lake was rated as being crystal clear 26% of the time in 1987, 1995, and 2001–2011 (Figure 5).

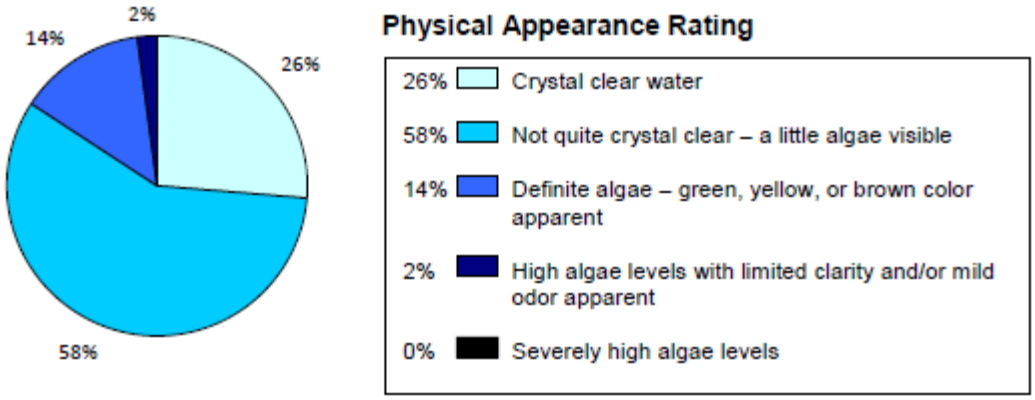


Figure 5. Physical appearance rating, as rated by the volunteer monitor (1987, 1995, and 2001–2011).

As the Secchi depth decreases, the perception of recreational suitability of the lake decreases. Wall Lake was rated as being beautiful 34% of the time in 1987, 1995, and 2001–2011.

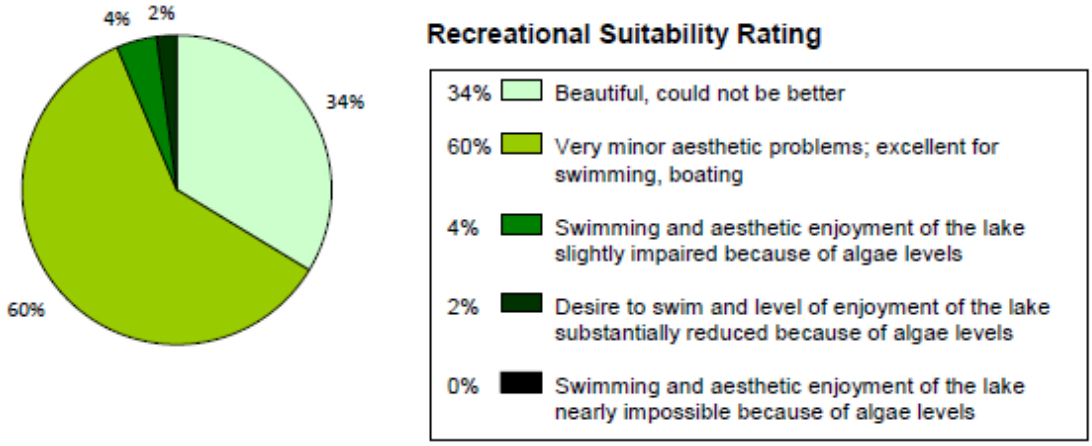


Figure 6. Recreational suitability rating, as rated by the volunteer monitor (1987, 1995, and 2001–2010).

Total Phosphorus

Wall Lake is phosphorus limited, which means that algae and aquatic plant growth is dependent upon available phosphorus.

Total phosphorus was evaluated in Wall Lake in 1987, 1995–2000, and 2005–2011 (Figure 7). The majority of the data fall into the mesotrophic and eutrophic ranges. The phosphorus concentrations appear to increase as summer persists. This could indicate internal loading, which would also be consistent with Wall Lake's depth.

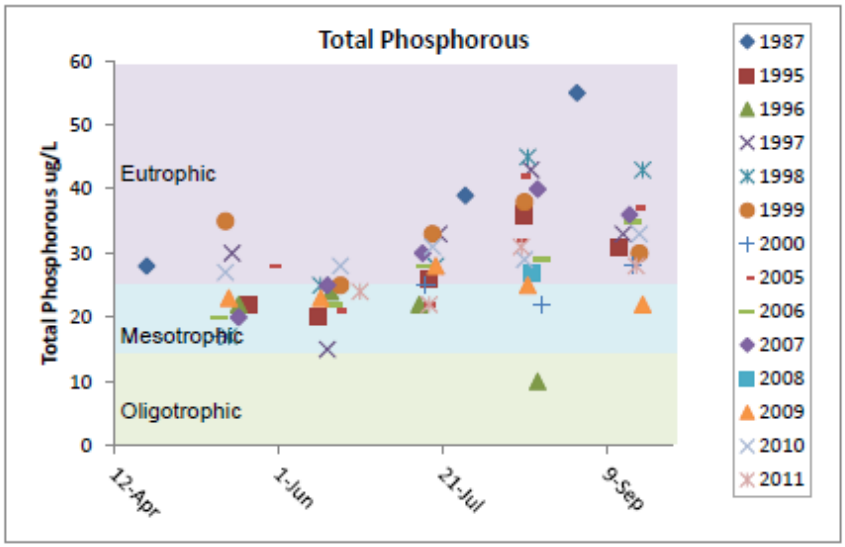


Figure 7. Historical total phosphorus concentrations (ug/L) for Wall Lake.

Phosphorus should continue to be monitored to track any future changes in water quality.

Chlorophyll *a*

Chlorophyll *a* is the pigment that makes plants and algae green. It is tested in lakes to determine the algae concentration or how green the water is.

Concentrations that are greater than 10 ug/L are perceived as a mild algae bloom, while concentrations greater than 20 ug/L are perceived as a nuisance.

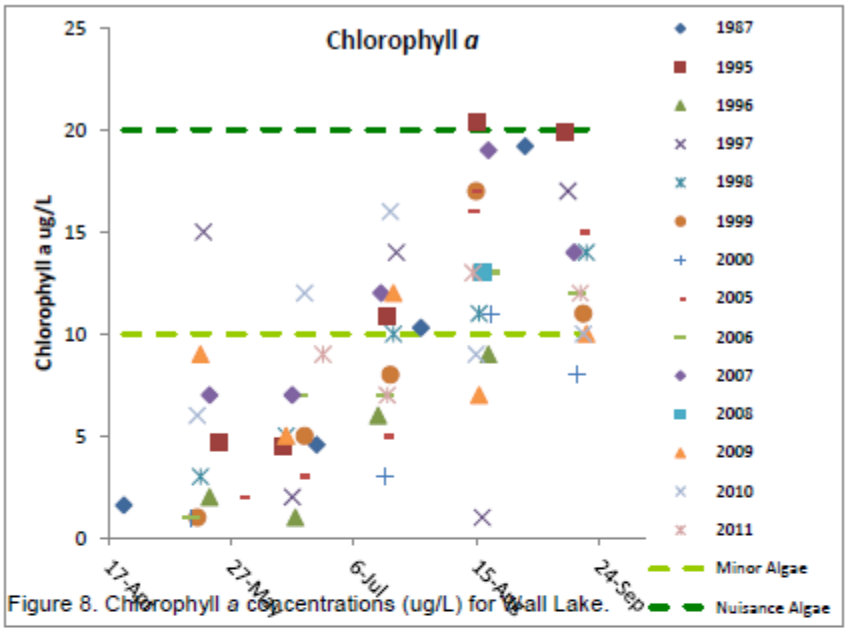
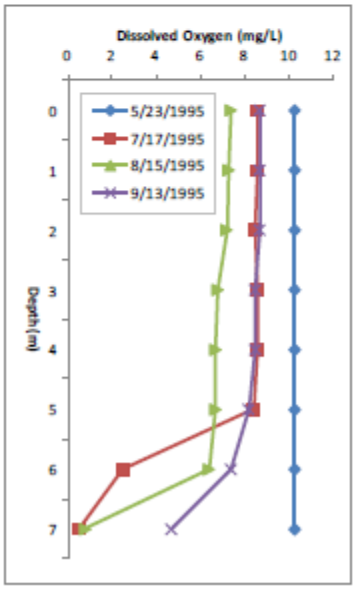


Figure 8. Chlorophyll *a* concentrations (ug/L) for Wall Lake.

Chlorophyll *a* was evaluated in Wall Lake in 1987, 1995–2000, and 2005–2011. Concentrations increase as the summer persisted, which is consistent with the increase in phosphorus (Figure 7). The data also show that the lake experiences algae blooms August through September every year.

Dissolved Oxygen



Dissolved Oxygen (DO) is the amount of oxygen dissolved in lake water. Oxygen is necessary for all living organisms to survive, except for some bacteria. Living organisms breathe in oxygen that is dissolved in the water. Dissolved oxygen levels of <5 mg/L are typically avoided by game fisheries.

Wall Lake is a relatively shallow lake, with a maximum depth of 34 feet. Dissolved oxygen profiles from 1995 indicate that the lake weakly stratifies in the summer, characteristic of a shallow lake. A windy day can mix the water column causing phosphorus from the anoxic lake bottom to re-suspend in the water. This phenomenon is known as internal loading.

Figure 9. Dissolved oxygen profile for Wall Lake in 1995 at site 204.

Trophic State Index

Phosphorus (nutrients), chlorophyll *a* (algae concentration), and Secchi depth (transparency) are related. As phosphorus increases, there is more food available for algae, resulting in increased algal concentrations. When algal concentrations increase, the water becomes less transparent and the Secchi depth decreases.

The results from these three measurements cover different units and ranges and thus cannot be directly compared or averaged. In order to standardize these measurements to make them comparable, we convert them to a trophic state index (TSI).

The mean TSI for Wall Lake falls in the eutrophic range (Figure 10). There is good agreement between the TSI for phosphorus and chlorophyll *a*, indicating that these variables are strongly related (Table 6). The TSI for transparency is lower than the other two parameters. This could be due to zooplankton grazing on the smaller algae cells, large algae particles dominating the algal community, or loss of rooted vegetation.

Eutrophic lakes (TSI 50–70) are characteristic of green water most of the summer. "Eu" means true and the root "trophy" means nutrients therefore, eutrophic literally means true nutrients or truly nutrient rich (phosphorus). These lakes are usually shallow with abundant aquatic plants and algae, and are located near fertile soils (Table 7).

Table 6. Trophic State Index for site 204.

Trophic State Index	Site 204
TSI Total Phosphorus	53
TSI Chlorophyll *a*	52
TSI Secchi	45
TSI Mean	50
Trophic State:	Eutrophic

Numbers represent the mean TSI for each parameter.

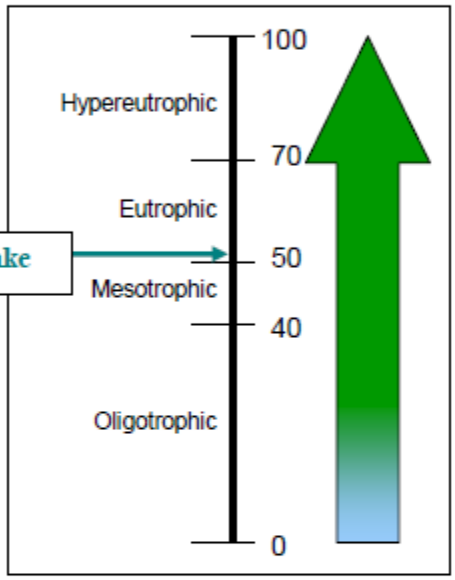


Figure 10. Trophic state index chart with corresponding trophic status.

Table 7. Trophic state index attributes and their corresponding fisheries and recreation characteristics.

TSI	Attributes	Fisheries & Recreation
<30	**Oligotrophy:** Clear water, oxygen throughout the year at the bottom of the lake, very deep cold water.	Trout fisheries dominate
30–40	Bottom of shallower lakes may become anoxic (no oxygen).	Trout fisheries in deep lakes only. Walleye, Cisco present.
40–50	**Mesotrophy:** Water moderately clear most of the summer. May be "greener" in late summer.	No oxygen at the bottom of the lake results in loss of trout. Walleye may predominate.
50–60	**Eutrophy:** Algae and aquatic plant problems possible. "Green" water most of the year.	Warm-water fisheries only. Bass may dominate.
60–70	Blue-green algae dominate, algal scums and aquatic plant problems.	Dense algae and aquatic plants. Low water clarity may discourage swimming and boating.
70–80	**Hypereutrophy:** Dense algae and aquatic plants.	Water is not suitable for recreation.
>80	Algal scums, few aquatic plants	Rough fish (carp) dominate; summer fish kills possible

Source: Carlson, R.E. 1997. A trophic state index for lakes. *Limnology and Oceanography*. 22:361-369.

Trend Analysis

For detecting trends, a minimum of 8–10 years of data, with 4 or more readings per season, are recommended. Minimum confidence accepted by the MPCA is 90%. This means that there is a 90% chance that the data are showing a true trend and a 10% chance that the trend is a random result of the data. Only short-term trends can be determined with just a few years of data, because there can be different moisture years, water levels, weather, etc., that affect the water quality naturally.

There is enough historical data to perform trend analysis for total phosphorus, chlorophyll *a*, and transparency on Wall Lake (Table 8, Figure 11). The data was analyzed using the Mann Kendall Trend Analysis.

Table 8. Trend analysis for Wall Lake.

Lake Site	Parameter	Date Range	Trend
204	Transparency	1995–2011	No trend
204	Chlorophyll a	1996–2000, 2005–2011	Insufficient data due to gap between 2000 and 2005
204	Total Phosphorus	1996–2000, 2005–2011	Insufficient data due to gap between 2000 and 2005

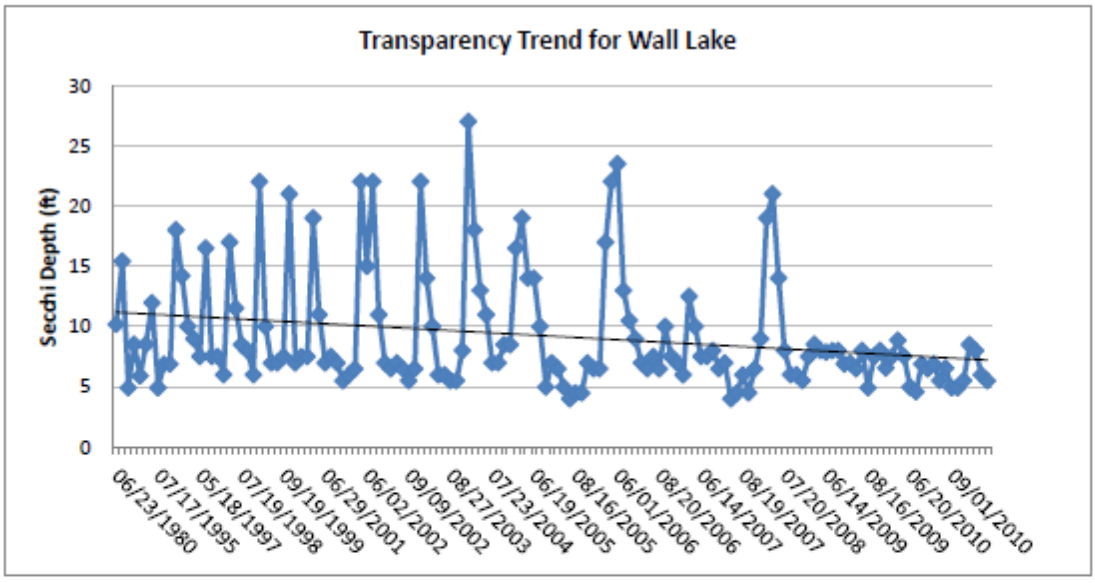


Figure 11. Transparency (ft) trend for site 204 from 1980–2011.

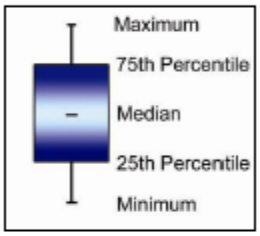
Wall Lake data show no significant trends in water quality; however, the transparency spring maximums haven't occurred since 2008. This could indicate the start of a decline in transparency. Monitoring should continue so that this trend can be tracked in future years.

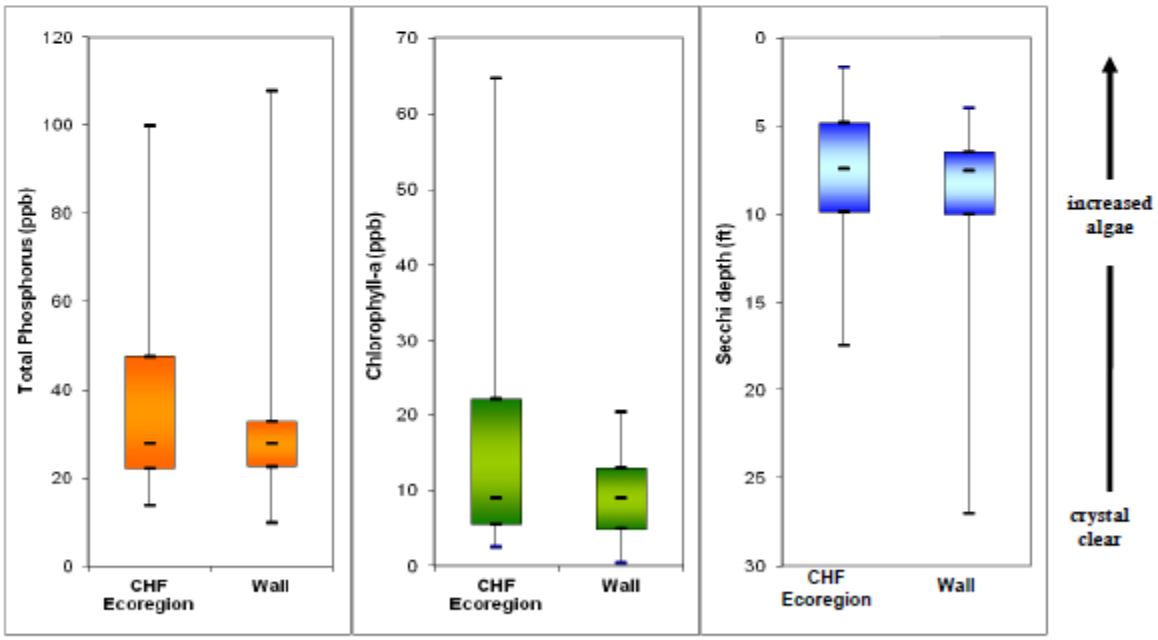
Ecoregion Comparisons

Minnesota is divided into 7 ecoregions based on land use, vegetation, precipitation, and geology (Figure 12). The MPCA has developed a way to determine the average range of water quality expected for lakes in each ecoregion. From 1985–1988, the MPCA evaluated the lake water quality for reference lakes. These lakes are not considered pristine, but have little human impact and therefore are representative of the typical lakes within the ecoregion. The average range refers to the 25th – 75th percentile range for data within each ecoregion. For the purpose of this graphical representation, the means of the reference lake data sets were used.

Figure 12. Minnesota Ecoregions.

Wall Lake is in the Central Hardwood Forests Ecoregion. The mean total phosphorus, chlorophyll *a*, and transparency (Secchi depth) for Wall are all within the expected ecoregion ranges (Figure 13).





Figures 13a-c. Wall Lake ranges compared to Central Hardwood Forest Ecoregion ranges. The Wall Lake total phosphorus and chlorophyll *a* ranges are from 64 data points collected in May-September of 1980, 1987, 1995–2000, and 2005–2011. The Wall Lake Secchi depth range is from 147 data points collected in May-September of 1980, 1987, and 1995–2011.

Lakeshed Data and Interpretations

Lakeshed

Understanding a lakeshed requires knowledge of basic hydrology. A watershed is defined as all land and water surface area that contribute excess water to a defined point. The MN DNR has delineated three basic scales of watersheds (from large to small): 1) basins, 2) major watersheds, and 3) minor watersheds.

The **Otter Tail River Major Watershed** is one of the watersheds that make up the Red River Basin, which drains north to Lake Winnipeg (Figure 14). This major watershed is made up of 106 minor watersheds. Wall Lake is located in **minor watershed 56061** (Figure 15).

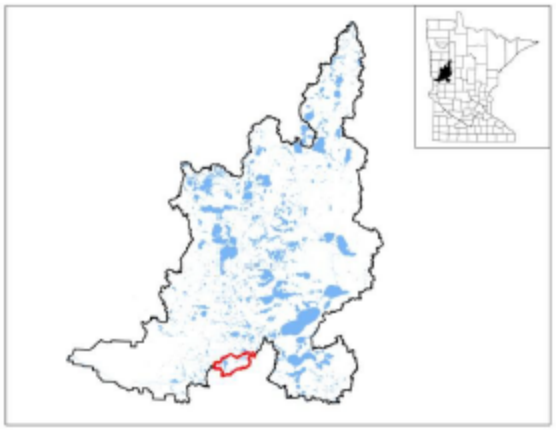


Figure 14. Otter Tail River Watershed.

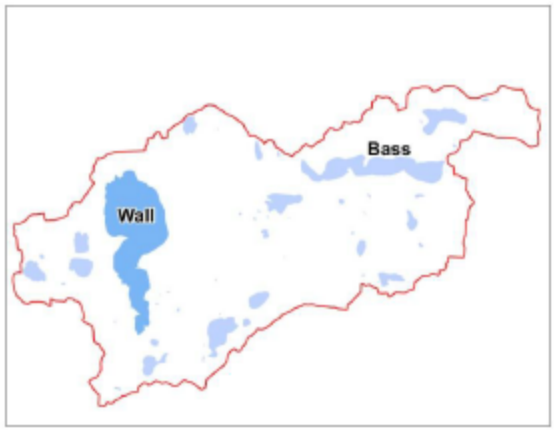


Figure 15. Minor Watershed 56061.

The MN DNR also has evaluated catchments for each individual lake with greater than 100 acres surface area. These lakesheds (catchments) are the building blocks for the larger scale watersheds. Wall Lake falls within **lakeshed 5606104** (Figure 16). Though very useful for displaying the land and water that contribute directly to a lake, lakesheds are not always true watersheds because they may not show the water flowing into a lake from upstream streams or rivers. While some lakes may have only one or two upstream lakesheds draining into them, others may be connected many, reflecting

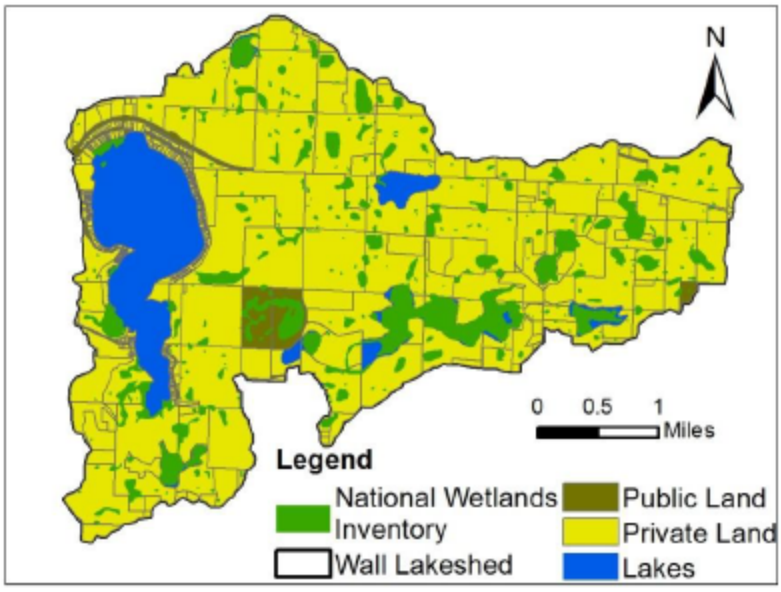


Figure 16. Wall lakeshed (5606104) with land ownership, lakes, and wetlands illustrated.

a larger drainage area via stream or river networks. For further information, see page 17. The data interpretation of the Wall lakeshed includes only the immediate lakeshed, this is the land surface that flows directly into the lake.

The lakeshed vitals table identifies where to focus organizational and management efforts for each lake (Table 9). Criteria were developed using limnological concepts to determine the effect to lake water quality.

KEY

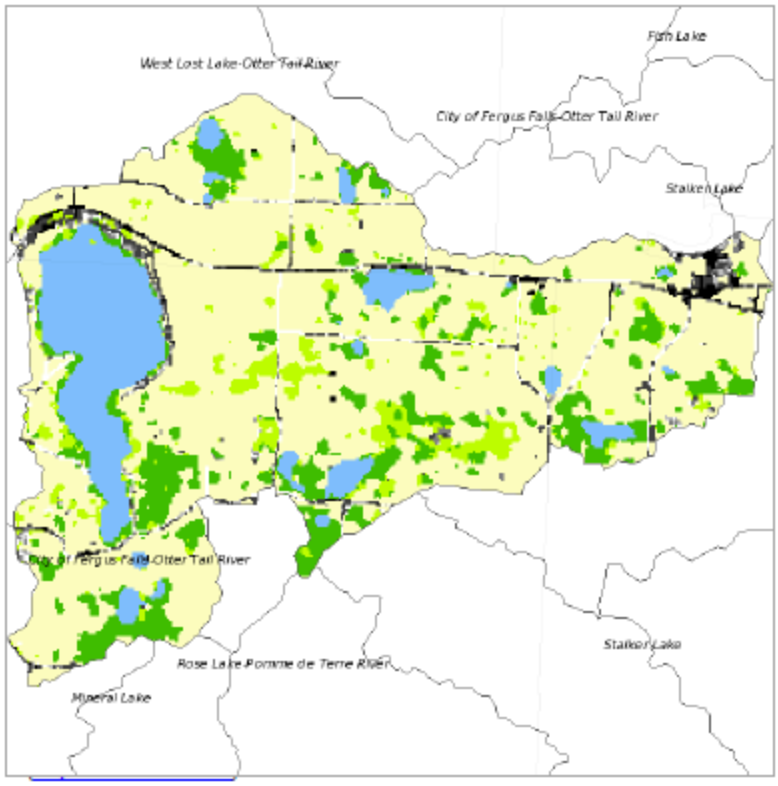
- Possibly detrimental to the lake
- Warrants attention
- Beneficial to the lake

Table 9. Lakeshed vitals for Wall Lake.

Lakeshed Vitals		Rating
Lake Area	727.7 acres	descriptive
Littoral Zone Area	229 acres	descriptive
Lake Max Depth	34 ft	descriptive
Lake Mean Depth	NA	NA
Water Residence Time	NA	NA
Miles of Stream	1.8	descriptive
Inlets	1	
Outlets	1	
Major Watershed	56-Otter Tail River	descriptive
Minor Watershed	56061	descriptive
Lakeshed	5606104	descriptive
Ecoregion	North Central Hardwood Forests	descriptive
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	11:1	
Standard Watershed to Lake Basin Ratio (standard watershed includes lake areas)	14:1	
Wetland Coverage	12.8%	
Aquatic Invasive Species	None as of 2011	
Public Drainage Ditches	None	
Public Lake Accesses	2	
Miles of Shoreline	6.9	descriptive
Shoreline Development Index	1.8	
Public Land to Private Land Ratio	0.04:1	
Development Classification	General Development	
Miles of Road	29.0	descriptive
Municipalities in lakeshed	Underwood	
Forestry Practices	No county forest plan	
Feedlots	2	
Sewage Management	Individual waste treatment systems (last county-wide inspection in 2009)	
Lake Management Plan	None	
Lake Vegetation Survey/Plan	None	

Land Cover / Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so the needs of present and future generations can be best addressed. The purpose of land use planning is to ensure each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.



Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the lands ability to absorb and store water rather than cause it to flow overland (gathering nutrients and sediment as it moves) towards the lowest point, typically the lake. Impervious intensity describes the lands inability to absorb water, the higher the % impervious intensity the more area that water cannot penetrate in to the soils. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed. Figure 17 depicts the land cover in Wall lakeshed.

The University of Minnesota has online records of land cover statistics from years 1990 and 2000 (http://land.umn.edu). Although this data is 11 years old, it is the only data set available to compare over a decade of time. Table 10 describes Wall lakeshed's land cover statistics and percent change from 1990 to 2000. Due to factors that influence demographics, one cannot determine with certainty the projected statistics over the next 10, 20, 30+ years, but one can see the transition within the lakeshed from agriculture and grass/shrub/wetland, to forest and urban acreages. The largest change in percentage is the increase in forest cover (116%). In addition, the impervious intensity has increased, which has implications for storm water runoff into the lake. The increase in impervious intensity is consistent with the increase in urban acreage.

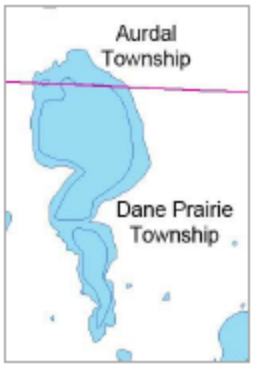
Table 10. Wall lakeshed's land cover statistics and % change from 1990 to 2000 (http://land.umn.edu).

	1990		2000		% Change
Land Cover	Acres	Percent	Acres	Percent	1990 to 2000
Agriculture	5594	68.39	5164	63.13	7.7% Decrease
Grass/Shrub/Wetland	764	9.34	469	5.73	38.6% Decrease
Forest	459	5.61	992	12.13	116.1% Increase
Water	944	11.54	976	11.93	3.4% Increase
Urban	422	5.16	581	7.1	37.7% Increase
Impervious Intensity %					
0	7853	96.03	7753	94.8	1.3% Decrease
1–10	46	0.56	57	0.7	23.9% Increase
11–25	81	0.99	92	1.12	13.6% Increase
26–40	86	1.05	95	1.16	10.5% Increase
41–60	71	0.87	95	1.16	33.8% Increase
61–80	32	0.39	56	0.68	75% Increase
81–100	8	0.1	30	0.37	275% Increase
Total Area	8180		8180		
Total Impervious Area (Percent Impervious Area Excludes Water Area)	110	1.52	163	2.26	48.2% Increase

Demographics

Wall Lake is classified as a general development lake. This type of lake usually has more than 225 acres of water per mile of shoreline, 25 dwellings per mile of shoreline, and is more than 15 feet deep.

The Minnesota Department of Administration Geographic and Demographic Analysis Division has extrapolated the future population of the area, in 5-year increments, out to 2035. Compared to Otter Tail County as a whole, Aurdal Township has a higher extrapolated growth projection, whereas Dane Prairie Township's is much lower (Figure 18).



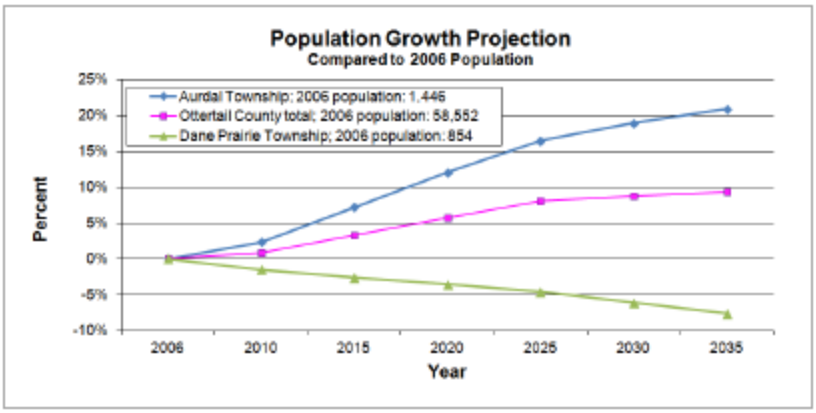


Figure 18. Population growth projection for Aurdal and Dane Prairie Township and Otter Tail County. (source: http://www.demography.state.mn.us/resource.html?Id=19332)

Wall Lake Lakeshed Water Quality Protection Strategy

Each lakeshed has a unique combination of public and private lands. Looking in more detail at the makeup of these lands can give insight on where to focus protection efforts. The protected lands (easements, wetlands, and public land) are the future water quality infrastructure for the lake. Developed land and agriculture have the highest phosphorus runoff coefficients, so this land should be minimized for water quality protection.

The majority of the land within Wall lakeshed is utilized for agricultural purposes (Table 11). These areas can be the focus of development and protection efforts in the lakeshed.

Table 11. Land ownership, land use/land cover, estimated phosphorus loading, and ideas for protection and restoration in Wall Lake lakeshed (Sources: Otter Tail County parcel data, National Wetlands Inventory, and the 2006 National Land Cover Dataset).

	Private (82%)					15%	Public (3%)		
	Developed	Agriculture	Forested Uplands	Other	Wetlands	Open Water	County	State	Federal
Land Use (%)	6.0%	54.0%	10.2%	2.4%	11.8%	15%	1.1%	0.02%	1.9%
Runoff Coefficient Lbs of phosphorus/acre/year	0.45 – 1.5	0.26 – 0.9	0.09		0.09		0.09	0.09	0.09
Estimated Phosphorus Loading Acreage x runoff coefficient	221–738	1155–3998	75		87		9	<1	15
Description	Focused on Shoreland	Cropland	Focus of develop-ment and protection efforts	Open, pasture, grass-land, shrub-land	Protected				
Potential Phase 3 Discussion Items	Shoreline restoration	Restore wetlands; CRP	Forest stewardship planning, 3rd party certification, SFIA, local woodland cooperatives		Protected by Wetland Conservation Act		County Tax Forfeit Lands	State Forest	National Forest

DNR Fisheries Approach for Lake Protection and Restoration

Credit: Peter Jacobson and Michael Duval, Minnesota DNR Fisheries

In an effort to prioritize protection and restoration efforts of fishery lakes, the MN DNR has developed a ranking system by separating lakes into two categories, those needing protection and those needing restoration. Modeling by the DNR Fisheries Research Unit suggests that total phosphorus concentrations increase significantly over natural concentrations in lakes that have watershed with disturbance greater than 25%. Therefore, lakes with watersheds that have less than 25% disturbance need protection and lakes with more than 25% need restoration (Table 12). Watershed disturbance was defined as having urban, agricultural, and mining land uses. Watershed protection is defined as publicly owned land or conservation easement.

Table 12. Suggested approaches for watershed protection and restoration of DNR-managed fish lakes in Minnesota.

Watershed Disturbance (%)	Watershed Protected (%)	Management Type	Comments
< 25%	> 75%	Vigilance	Sufficiently protected -- Water quality supports healthy and diverse native fish communities. Keep public lands protected.
	< 75%	Protection	Excellent candidates for protection -- Water quality can be maintained in a range that supports healthy and diverse native fish communities. Disturbed lands should be limited to less than 25%.
25–60%	n/a	Full Restoration	Realistic chance for full restoration of water quality and improve quality of fish communities. Disturbed land percentage should be reduced and BMPs implemented.
> 60%	n/a	Partial Restoration	Restoration will be very expensive and probably will not achieve water quality conditions necessary to sustain healthy fish communities. Restoration opportunities must be critically evaluated to assure feasible positive outcomes.

The next step was to prioritize lakes within each of these management categories. DNR Fisheries identified high value fishery lakes, such as cisco refuge lakes. Ciscos (*Coregonus artedi)* can be an early indicator of eutrophication in a lake because they require cold hypolimnetic temperatures and high dissolved oxygen levels. These watersheds, with low disturbance and high value fishery lakes, are excellent candidates for priority protection measures, especially those that are related to forestry and minimizing the effects of landscape disturbance. Forest stewardship planning, harvest coordination to reduce hydrology impacts, and forest conservation easements are some potential tools that can protect these high value resources for the long term.

Wall Lake is classified with having 19.7% of the watershed protected and 67.0% disturbed (Figure 19), indicating that the lake should have a partial restoration focus. Goals should limit any increase in disturbed land use.

Figure 20 displays the upstream lakesheds that contribute water to the lakeshed of interest. All of the land and water area in this figure has the potential to contribute water to Wall Lake, whether through direct overland flow or through a creek or river. One of the 3 upstream lakesheds has the same management focus (partial restoration).

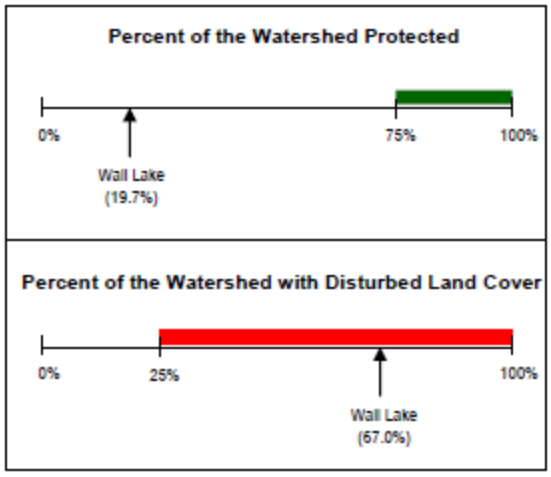


Figure 19. Wall lakeshed's percentage of watershed protected and disturbed.

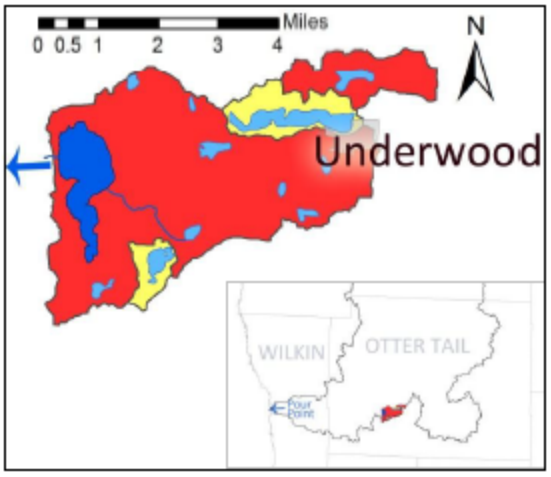


Figure 20. Upstream lakesheds that contribute water to the Wall lakeshed. Color-coded based on management focus (Table 12).

Wall Lake, Status of the Fishery (as of 07/20/2009)

Wall Lake is a 683-acre located in southwestern Otter Tail County approximately five miles east of Fergus Falls, MN, and is part of the Otter Tail River Watershed. A non-navigable outlet is located along the west shoreline of the lake, and serves as a tributary to the Otter Tail River. The immediate watershed is composed primarily of agricultural land interspersed with hardwood woodlots. The maximum depth of the lake is 34 feet; however, 33% is less than 15 feet in depth. The Secchi disk reading during the 2009 lake survey was 4.9 feet, slightly lower than previous readings ranging from 5.0 to 9.0 feet. Wall Lake experiences periodic plankton/algae blooms during the summer months which can influence Secchi disk readings.

A majority of the shoreline of Wall Lake has been developed, consisting primarily of homes and cottages. A DNR-owned public water access is located along the north shoreline, with a privately-owned access located at a campground along to the east. The shoal water substrates consist primarily of sand and gravel. Large stands of hardstem bulrush are prevalent throughout the lake. Emergent aquatic plants such as these provide valuable fish and wildlife habitat, and are critical for maintaining good water quality. They protect shorelines and lake bottoms, absorbing and breaking down pollutants, and provide spawning areas for fish such as northern pike, largemouth bass, and panfish. They also serve as an important nursery area for all species of fish. Because of their ecological value, emergent plants may not be removed without a DNR permit.

With a close proximity to Fergus Falls, Wall Lake has become a popular angling lake. It can be ecologically classified as a bass-panfish lake; this is reflected in the assemblage of the fish community. Northern pike, largemouth bass, and bluegill are the dominant game species. The prolificacy of these species can be attributed to the abundance of suitable spawning habitat. The northern pike test-net catch rate was equivalent to the lower limit of the expected range for similar lakes. Age data indicate that reproduction is consistently good. Pike ranged in length from 15.1 to 30.0 inches with an average length and weight of 22.2 inches and 2.5 pounds, reaching an average length of 22.3 inches at four years. The walleye test-net catch rate was within the expected range for similar lakes. Age data indicate that several viable year classes are present. Walleye ranged in length from 7.3 to 25.4 inches with an average length and weight of 15.8 inches and 1.7 pounds. Individuals reach an average length of 15.1 inches at four years of age. Data collected from a spring electrofishing assessment indicate that a balanced largemouth bass population also exists. Age data indicate that largemouth bass reproduction is consistently good, ranging in length from 3.0 to 18.5 inches with an average length and weight of 13.7 inches and 1.5 pounds. Bass reach an average length of 12.2 inches at four years of age. The bluegill test-net catch rate exceeded the expected range for similar lakes. The 2003 year class is very strong and should provide good angling for several years. Thirty-eight percent of the bluegill sample was 7.0 inches or greater in length, with individuals reaching an average length of 6.9 inches at six years.

Anglers can maintain the quality of fishing by practicing selective harvest. This management practice encourages the release of medium to large-size fish while allowing the harvest of more abundant, smaller fish for table fare. Releasing the medium to large fish will ensure the lake has enough spawning-age fish annually, providing anglers with more opportunities to catch large fish in the future.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. http://www.dnr.state.mn.us/lakefind/showreport.html?downum=56065800

Key Findings / Recommendations

Monitoring Recommendations

Transparency monitoring at site 204 should be continued annually. It is important to continue monitoring weekly, or at least bimonthly, every year to enable annual comparisons and trend analyses. To track future water quality trends, phosphorus and chlorophyll *a* monitoring should continue as the budget allows.

Overall Conclusions

Wall Lake is currently in fair shape regarding water quality, however, the lakeshed needs restoration from disturbed land uses. Wall Lake is a eutrophic lake (TSI=50) with no significant water quality trends. Three percent (3%) of the lakeshed is in public ownership, and 20% is protected, while 67% is disturbed (Figure 19).

Wall Lake has a very dynamic seasonal transparency pattern. It averages a high of 15 feet in May and a low of 6 feet in August. August through September, the lake experiences algae blooms that can reach nuisance levels. Since 2008, the May readings have not exceeded 10 feet, which could indicate the start of a declining trend.

The forested acreage around the lake increased by 116% (533 acres) from 1990–2000. This buffer better protects the lake from runoff in the lakeshed.

A lake-wide septic system check of the oldest systems was completed by Otter Tail County in 2009. The septic systems around Wall Lake should be up to date and working properly.

A surface runoff potential analysis with maps is located on the following pages. The last map in this sequence illustrates the very high runoff potential (red) from developed areas around the lake.

Priority Impacts to the lake

In close proximity to Fergus Falls, there is a high degree of development pressure on Wall Lake. The first tier is mostly developed, whereas the second tier is developed along the north and east sides. From 1990–2000, the urban area in the lakeshed increased by 38% (159 acres) and the impervious area increased by 48% (53 acres) (Table 9). There are also many paved, impervious, roads around the lake (Table 9). The conversion of previously farmed land to housing and second tier development along the lakeshore is a cause for concern. Storm water runoff from impervious surfaces located on developed shoreline properties and roads can add nutrients and chloride (salt) to the lake. The chloride levels and specific conductance in the lake are relatively high, indicating high runoff. Because it is fairly shallow, Wall Lake lacks the large amounts of water necessary to dilute runoff from impervious surface and turf lawns.

Agricultural land use in the lakeshed is high (54%), classifying the area as a partial restoration (Table 10, Figure 20). When the agricultural land extends to the developed shoreline, there is not a sufficient buffer from runoff. The agricultural uses include pasture/hay, cultivated crops, and animal feedlots. There is also agriculture along the stream inlet to the lake.

Due to the shallow nature of the lake and the amount of nutrients in it, it is possible that internal loading is occurring. The dissolved oxygen data show the lake mixes periodically in the summer (Figure 9). Internal loading is when the phosphorus in the lake sediment re-suspends into the water column, feeding algae and plants. Phosphorus re-suspends when large boat motors churn up sediment, when the lake is calm it loosely stratifies, and then windy days mixes the water again

Best Management Practices Recommendations
The management focus for Wall Lake should protect the water quality, and restore the lakeshed. Restoration efforts should focus on managing and/or decreasing the impact caused by additional development, including second tier development, and impervious surface area. Project ideas include protecting land with conservation easements, enforcing county shoreline ordinances, smart development, shoreline restoration, rain gardens, and septic system maintenance.

Partnering with farmers to implement conservation farming practices, restore wetlands, increase lake and stream shoreline buffers, and place priority parcels into land retirement programs can decrease the impacts of agriculture in the lakeshed.

If the majority of phosphorus in the lake stems from internal loading, an alum treatment could be applied to hold phosphorus in the sediments, preventing its re-suspension into the water column.

Native aquatic plants stabilize the lake's sediments and tie up phosphorus in their tissues. When aquatic plants are uprooted from a shallow lake, the lake bottom is disturbed, and phosphorus in the water column is utilized by algae rather than plants. This contributes to greener water and additional algae blooms. Protecting native aquatic plant beds will ensure a healthy lake and fishery.

Project Implementation
The best management practices above can be implemented by a variety of entities. Some possibilities are listed below.

Individual property owners
- Shoreline restoration
- Rain gardens
- Aquatic plant bed protection (only remove a small area for swimming)

Lake Associations
- Lake condition monitoring
- Internal loading monitoring
- Ground truthing – visual inspection upstream on stream inlets
- Shoreline inventory study by a consultant

Soil and Water Conservation District (SWCD) and Natural Resources Conservation Service (NRCS)
- Shoreline restoration
- Stream buffers
- Work with farmers to
    - Restore wetlands
    - Implement conservation farming practices
    - Participate in land retirement programs such as Conservation Reserve Program

Organizational Contacts and Reference Sites

Wall Lake Association	http://walllakeassociation.blogspot.com/
DNR Fisheries Office	1509 1st Avenue North, Fergus Falls, MN 56537 218-739-7576 fergusfalls.fisheries@state.mn.us http://www.dnr.state.mn.us/areas/fisheries/fergusfalls/index.html
Regional Minnesota Pollution Control Agency Office	714 Lake Ave., Suite 220, Detroit Lakes, MN 56501 218-847-1519, 1-800-657-3864 http://www.pca.state.mn.us/yhiz3e0
Otter Tail Soil and Water Conservation District	506 Western Ave N, Fergus Falls, MN 56537 218-739-1308 ext.3 http://www.eotswcd.org/

Aquatic Vegetation

Rooted aquatic plants are a natural part of most lake communities and provide many benefits to fish, wildlife and people. They are one of the primary producers in the aquatic food chain, converting the basic chemical nutrients in the water and soil into plant matter that becomes feed for other aquatic and terrestrial life.

In-lake aquatic vegetation for Wall Lake are very important to the fishery and general health of the lake. The areas of hardstem bulrush and narrow leaved cattail are abundant and provide habitat for the fish species as well as filtration of nutrients as they enter the lake. The pondweeds are important food for fish and habitat for various insects and invertebrates that become food for other species of fish. These areas should be protected and the vegetation preserved. Some of the vegetation creates quite a nuisance for boaters and general recreation.

Aquatic plants have many other important functions, including:

-improving water quality by trapping nutrients;
-Protecting shorelines and lake bottoms by decreasing wave action; and
-improving aesthetics by adding to the biodiversity of the lakeshore.

While aquatic plants perform these important functions, they can also interfere with various uses of the lake if their growth is profuse. Control of aquatic plants is appropriate when reasonable access to and the use of the water is impeded.

Partnering with the Otter Tail SWCD office when creating shoreline buffers will allow us to make sure that native vegetation is used in shoreline buffers.

Types of aquatic vegetation that the DNR have observed at Wall Lake include:

Submersed Plants (Plants with most leaves growing beneath the water surface)

Coontail
Northern Watermilfoil
Whorled Watermilfoil
Sea Naiad
Fries' Pondweed
Pondweed
Widgeon Grass
Common Sago Pondweed
Greater bladderwort
Horned pondweed

Free-floating Plants (Plants that float freely on the water surface)

Turion-forming Duckweed
Greater Duckweed

Emergent Plants (Plants with leaves extending above the water surface)

Small's Spikerush
Broad-leaved Arrowhead
Hard-stem bulrush
Narrow-leaved cat-tail

Shoreline Plants (Plants associated with the wetland habitat)

Swamp milkweed
Bur-Marigold; Beggar-Tick
Two-stamened Sedge
False Cyperus sedge
Bulb-bearing water-hemlock
Jewelweed,Spotted touch-me-not
Northern bugleweed
Swamp Candles, Loosestrife
Tufted loosestrife
Reed canary grass
Dock; Sorrel
Willow
Marsh skullcap

Wildlife

The "Blue Book," *Developing a Lake Management Plan* notes that:

> "Minnesota's lakes are home to many species of wildlife. From our famous loons and bald eagles to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife.
>
> The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and wild rice along the shoreline provide both feeding and nesting areas for wildlife. Loons, black terns and red-necked grebes are important Minnesota birds that are particularly affected by destruction of this vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young."

The MN DNR also recognizes the unique importance of shallow lakes:

> "Minnesota's diverse wildlife populations are influenced in large part by our state's abundant water resources. While all lakes support wildlife needs, it is the shallow water zone, characterized by aquatic plants and generally less than 15 feet deep, that provides the most important wildlife habitat."

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section. For Wall Lake, the DNR Area Wildlife Manager is: Troy Richards, (218) 826-6391. The DNR Fisheries Office is located at 1509 1st Ave North, Fergus Falls MN 56537. (fergusfalls.fisheries@state.mn.us) and (http://www.dnr.state.mn.us/areas/fisheries/fergusfalls/index.html).

Loon nesting has been successful at Wall Lake. Loon counting was done on June 2016 which found a count of 22 loons to be on the lake. Bald eagles are also observed on the lake with at least 2 active nests. Various species of geese, ducks, coots, gulls and turkeys are common on the lake. Mammals noted include muskrat, beaver, fox, woodchucks, otters, mink, coyote and deer are also seen around the lake. Numerous geese in the yard of landowners can be found to be a nuisance.

Exotic Species

Wall Lake currently does not have a presence of aquatic invasive species, although it is part of the Otter Tail River watershed for which there is a zebra mussel presence.

The Aquatic Invasive Specialist for Otter Tail County is Spencer McGrew and can be contacted at the Otter Tail County Offices. The County has also developed an AIS Task Force, (http://aisfighters.net/)

Background

"Exotic" species -- organisms introduced into habitats where they are not native -- are severe world-wide agents of habitat alternation and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and also by waterbirds, it reached Midwestern states between the 1950s and 1980s.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well-established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Purple loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals and are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Reed Canary Grass (*Phalaris arundinacea)* is considered a major threat to natural wetlands as it out competes most native species and presents a major challenge in wetland mitigation efforts.

Planted throughout the U.S. for forage and erosion control since the 1800s, it forms large, single-species stands, with which other species cannot compete. Invasion is associated with disturbances, such as ditch building, stream channeling sedimentation and intentional planting and if cut during the growing season a second growth spurt occurs in the fall.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

Starry Stonewort (*Nitellopsis obtuse*) is a grass-like form of algae that are not native to North America. The plant was first confirmed in Minnesota in Lake Koronis in late August of 2015. Plant fragments were probably brought into the state on a trailered watercraft from infested waters in another state.

It is similar in appearance to native grass-like algae such as other stoneworts and musk-grass. Native stoneworts and musk-grass are both commonly found in Minnesota waters. Starry stonewort can be distinguished from other grass-like algae by the presence of star-shaped bulbils.

Starry stonewort can interfere with recreational and other uses of lakes where it can produce dense mats at the water's surface. These mats are similar to, but can be more extensive then, those produced by native vegetation. Dense starry stonewort mats may displace native aquatic plants.

Like all plants, starry stonewort may grow differently in different lakes, depending on many factors. At this time, we cannot predict how it might grow in any one Minnesota lake. It is believed to be spread from one body of water to another by the unintentional transfer of bulbils, the star-like structures produced by the plant. These fragments are most likely attached to trailered boats, personal watercraft, docks, boat lifts, anchors or any other water-related equipment that was not properly cleaned.

Zebra Mussels (*Dreissena polymorpha*) Zebra mussels and a related species, the Quagga mussel, are small, fingernail-sized animals that attach to solid surfaces in water. They can cause problems for lakeshore residents and recreationists and present a threat to the ecological integrity of lakes a rivers by potentially disrupting food chains and crowding out native species.

Zebra mussels can be a costly problem for cities and power plants when they clog water intakes. Zebra mussels also cause problems for lakeshore residents and recreationists. They can attach to boat motors and boat hulls, reducing performance and efficiency; attach to rocks, swim rafts and ladders where swimmers can cut their feet on the mussel shells; and clog irrigation intakes and other pipes.

Zebra mussels also can impact the environment of lakes and rivers where they live. They eat tiny food particles that they filter out of the water, which can reduce available food for larval fish and other animals, and cause aquatic vegetation to grow as a result of increased water clarity. Zebra mussels can also attach to and smother native mussels.

6. Land Use and zoning

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. Otter Tail County Soil and Water Conservation District recognizes the multiple areas that impact water health including residential development, agriculture and shoreline management. The Otter Tail County Local Water Plan was created by the SWCD to evaluate the multiple sources of decreasing water quality and propose programs to address those challenges. The priorities listed in the plan include:

- **Surface Water Quality**
  - To improve the water quality of surface waters in Otter Tail County by reducing or minimizing the amount and extent of contaminants entering surface waters.
  - Example Action Items: Provide technical assistance to shore land owners on water quality projects. Assist with feedlot runoff projects providing technical assistance and financial assistance when available to projects that meet criteria.

- **Ground Water Quality and Quantity**
  To improve and protect the quality and quantity of groundwater resources in Otter Tail County by minimizing or reducing the amount and extent of contaminants entering the groundwater resources, and ensuring that there will be a stable and adequate source of useable water for municipal, industrial and agricultural purposes.

- **Development Pressure**
  To protect the natural resources of Otter Tail County by reducing or minimizing the impacts of ongoing and future development within the county.

- **Soil Erosion**
  Promote best management practices that reduce soil losses through wind and water erosion to below 2T (T is a technical abbreviation for tolerable soil loss).

- **Wildlife Habitat**
  To protect and preserve wildlife habitat and wetlands from conversion to cropland and urban development, and promote the re-establishment of wildlife habitat.

- **Sustainable Agriculture**
  To assist agricultural producers in maintaining productivity through the use of conservation practices that protect and preserve our natural resources and maintain a sustainable agricultural base in the county.

- **Education Promotion**
  Promote soil and water conservation through an effective information and education program to the residents, seasonal property owners, schools, and elected officials in Otter Tail County

- **Funding/Partnering/Administration**

Provide assistance to the public through the most efficient use of public funds and administration of programs, and maintain and develop a strong working relationship with other resource agencies.

The specific impacts to a lake from various land uses vary as a function of local soils, topography, vegetation, precipitation and other factors. However, one of the most important ways that citizens can work to positively impact their local waters is through ensuring that prudent local zoning ordinances are in place.

Many zoning regulations are based upon the Shoreland Management Act and/or the Minnesota Department of Natural Resources (DNR) classification of a given lake. The DNR has classified all lakes within Minnesota as General Development (GD), Recreational Development (RD), or Natural Environmental (NE) lakes, and assigned a unique identification number to the lake for ease of reference. Counties in turn have used these classifications as a tool to establish minimum lot area (width and setbacks) that is intended to protect and preserve the character reflected in the classification. It should be noted that counties will often make local ordinances stricter than the minimum standards set by the DNR.

On any shoreland the permissible density and setbacks for virtually all new uses are determined by the lake or river classification standards established by the Department of Natural Resources. OtterTail County has three categories for defining development around area lakes: Natural Environment, General Development, and Recreational Development. Wall Lake is classified by Otter Tail County as a General Development Lake.

Natural Environment lakes are generally small, often shallow lakes with limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock, and unsuitable soils. These lakes, particularly in rural areas, usually do not have much existing development or recreational use.

Recreational Development lakes are generally medium-sized lakes of varying depths and shapes with a variety of landform, soil, and ground water situations on the lands around them. They often are characterized by moderate levels of recreational use and existing development. Development consists mainly of seasonal and year-round residences and recreationally-oriented commercial uses. Many of these lakes have capacities for accommodating additional development and use.

General Development lakes are generally large, deep lakes or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation and, except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use.

Below are zoning standards associated with a General Development lake. Please note that this chart does not represent all the zoning requirements that are involved with land use and property development.

	General Development (Wall Lake)	**Recreational Development**
Structure Setback from OHWL	75 ft	100 ft
Water Frontage/Lot Width	100 ft	150 ft
Lot Area*	20,000 ft^2	40,000 ft^2
Buildable Area	8,400 ft^2	8,400 ft^2
Sewage Treatment Area	2,500 ft^2	2,500 ft^2

**Setbacks are measured from the Ordinary High Water Level (OHWL)*
***excluding public road right-of-ways, bluffs, wetlands, and land below the OHWL of public waters*

Many lakes have numerous properties that are considered to have "vested rights" or were developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment, or are destroyed by natural, accidental causes or in association with significant renovation.

Questions may be directed to:

Bill Kalar, Land & Resource Management Director
Phone: 218-998-8095
Email: bkalar@co.ottertail.mn.us
Location: 540 Fir Ave. W, Fergus Falls, MN 56537

7. Public water access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80 percent of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources, Trails and Waterways Unit. They are responsible for the acquisition, development and management of public water access sites. The DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government such as townships and municipalities. The DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river

resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

According to Minnesota Department of Natural Resources Fisheries Survey, there is one public access on Wall Lake.

9. Organizational Development and Communication

Wall Lake Association is a nonprofit organization under Minnesota statue with a tax exempt 501 (c) (3) status from the IRS. The affairs of the association shall be managed and directed by a board of at least five but no more than nine directors. It is the expressed intention of these by-laws that there be, as nearly as possible, one director from each of the recognized areas around the lake. These areas are as follows: 1. Aurdal, 2. Hillside North, 3. Hillside South, 4. Elks Point, 5. South East, 6. South West, 7. Wall Lake Point, 8 Club 32 and 9 Farms. The Board elects officers for a 2 year term, at the annual meeting, to be held either during the months of June or July. The ongoing business of the Wall Lake Association shall be conducted through four standing committees: Water Quality & Safety, Communication, Community Events and Membership. Communication to the members is done via email, newsletter or direct mailings. During the visioning sessions held in 2016, it was determined that community via increased Association membership is a priority.

III. Summary/Conclusion

Wall Lake Association Vision Planning Session Summary

Approximately 50 individuals participated in the interactive Community Visioning Session held at Elk's Point Lodge on June 11, 2016. Participants were asked to contribute their thoughts, concerns, and ideas regarding the future of the lake, and regarding what should happen in the next 2-3 years to achieve the goals the group identified. Over the course of just under two hours, participants contributed more than 100 comments. Based on the content of the comments, three clear categories emerged: Strong Lake Association, Water Quality, and Lake Use. Those categories, and the themes in each, are detailed below.

STRONG ASSOCIATION

Comments in this category largely fell into two buckets: internal capacity building, and communication with the larger community. The benefit with this split is that enhanced communication and education can begin soon and have a noticeable change while the longer work of building partnerships and forming relationships takes place.

- Sub-themes
    - Membership Growth
    - Stronger Partnerships
    - Access to Resources
    - Enhanced Communication and Education
- Who should be at the table
    - Agency and local government
        - DNR (including Fish and Wildlife staff)
        - SWCD
        - U.S. Fish and Wildlife
        - County
        - Troy Richards—Game warden
        - State Representative
        - Commissioners—county and township
    - Community
        - Boy Scouts
        - Other Lake Associations
        - Lakeshore owners
        - Farmers
        - Those not on the lake
        - School kids
- Next 30/60/90 days
    - (30) Meeting summary sent to property owners
    - (90) Compile data and apply for grants
    - (30, 60, 90) Educate and provide on-going communication
    - (30, 60, 90) Plan with DNR
    - (30, 60, 90) Lakewide vote
    - (30, 60, 90) Address capacity building at association meetings

WATER QUALITY

Attendees are largely in agreement that water quality is a serious concern. While the sub-themes below do not directly state this, attendees are looking for improved clarity, and a lake supportive of the many uses they enjoy. Managing nutrient loads in the lake as well as the loading coming from the lakeshed will be important to achieve this over-arching goal.

- Sub-themes
    - Education on the issues
        - Baseline data
        - Figure out the "muck" issue
        - Weed management
    - Direct and upstream runoff problems
        - Shoreline habitat
        - Incentives for good landscaping for water quality
        - Runoff from lakeshore owners (fertilizer, etc.)
        - Runoff from farmers
    - Nutrient load in the lake
        - Chemical makeup
        - Excess nutrients
        - Excess weed growth
    - Property values
- Who should be at the table
    - Farmers from within the lakeshed
    - DNR
    - Extension
    - SWCD
- Next 30/60/90 days
    - (60) Talk to DNR about weed control
    - (30, 60, 90) Education and tour of restoration projects
    - (30, 60, 90) Baseline monitoring
    - (30, 60, 90) Contact DNR/extension office i.e. cattle in lake
    - *(30, 60, 90) Work with SWCD to develop an incentive program for the installation of shoreline gardens and other measures that reduce runoff into the lake*

LAKE USE

Comments in this category largely focused on making sure that all users of the lake have a safe and enjoyable time. This area is the least robust in terms of comments given and depth of topic, but it is clearly important to attendees to make sure "going to the lake" is fun for everyone.

- Sub-themes
    - Fisheries
        - Habitat
        - Stocking and slot limits
    - Safety & Recreation-communicate with the lake users
    - Public Access

- Who should be at the table
    - US Fish and Wildlife
    - DNR
- Next 30/60/90 days
    - (30,60,90) Contact US Fish and Wildlife about Stang Lake
    - (30,60,90) Print boating safety law and guideline rules and timely email of rules from WLA
    - (30,60,90) Have a map of the lake (including sandbar and rockbar) at the access and/or campgrounds.

Prioritized Goals and Action Plan

This final chapter of the Wall Lake management plan summarizes the conclusions and priority actions we have chosen to work on at this time. Specifically, for each priority action we have down our best to answer (for each goal presented):

Goal #1: Protect Water Quality **To preserve and protect the water quality of Wall Lake for current and future generations**	Responsible	Date Completed by:	Cost
Water Quality Monitoring Lead-John C/Jackie			
-Continue the present monitoring program to establish long-term trends in lake quality	Jackie/John C	Continuous	
-Determine if MPCA has Wall Lake inlet on their project list (if so, partner on testing and outcomes)	John Carlson	Oct-16	
-Recruit a larger group to share monitoring responsibilities			
- Report multi year results of chlorophyll a, phosphorus and Secchi disk readings to Wall Lake residents	Sue N/Jackie	Newsletter	
Promote projects that will enhance water quality **Lead: Jeff W and Scott C**			
-Work with SWCD to determine where and what type of buffer or rain garden projects would be most useful	Jeff W/Scott C/Jackie		
-Educate landowners about the importance of preventing runoff into the lake and stabilizing shorelines	Sue N/Jackie	Newsletter	
-Provide information to landowners on water quality restoration projects			
--Provide all residents with "Guide to Lake Protection and Management" (Freshwater Society) booklet	Jackie H	May-17	240
--Provide interested residents with Carrol Henderson's "Landscaping for Wildlife and Water Quality" (promote via newsletter)			
--Provide information via newsletters on water quality data, testimonials, etc.		May-17	
-Support installation of projects			
--Provide incentives for installations (recommend $200 per project from WLA upon installation proof from SWCD)			
--Promote the SWCD cost sharing program for property			

owners to install rain gardens and/or native buffers.			
--Look to partner with Scout Group or Gardening Group to assist with project installations.			
Promote restoration projects			
- Schedule tour of restoration projects around Wall Lake (such as a progressive breakfast)	Jeff W		
and/or provide a "self guided brochure showing locations of restorations.			
-Launch official incentive program for landowners to manage storm water runoff	Jeff/Scott/Jackie		

Goal #2: Promote Water Safety			
To promote and educate Wall Lake users (residents and visitors) on water and boating safety on the lake			
Educate lake users on sandbar hazards			
-Create and print colored topographic map showing sandbar hazards			
-Request approval from DNR to post topographic map at the access.			
-Work with Elks Point Campground to hand out water safety information and topographic map to all campers			
Promote safe and proper boating			
-Educate residents via newsletter and annual meeting on safe boating and consequences of speed boating close to shore.	Sue N	Newsletters	
Promote water safety			
-Continue working with Elks Point Campground to have handout inventory			
-Set up informational table at Elks Point with topographic map and other water safety brochures.	John W		
-Consider having a kids boating safety class	WLA Board		
-Work with local Boy Scout group to create an informational board to mount at Elks Point.			

Goal #3: Preserve and Protect Wildlife on and around Wall Lake			
To preserve and protect habitat for healthy fish, birds and pollinators for all to enjoy for current and future generations.			
Loon Monitoring			
-Continue Loon counting and provide this information to Wall lake community via newsletter and/or annual meeting		Jun-17	
-Educate residents via newsletter on the importance of staying clear of loons while boating.	Sue N	Newsletters	
AIS Prevention and education			
-Mail AIS brochure to all residents (Otter Tail Aquatic Invasive Species ID brochure)			
-Educate residents on AIS via newsletter and annual meeting			
-Investigate if Boy Scout group is interested in creating an AIS information board to post at Elks Point			
Explore the need for possible fishing regulations			
-Survey residents to gauge their thoughts on fishing regulations	John C	Summer 2017	
-Monitor DNR fish surveys to help determine the possible need for fishing regulations	John C		
--Contact DNR Fisheries	John C	Oct-16	
Wall Lake Association to make donation to local fish club			
-Wall Lake Association to make a yearly donation to the fish club, "Carpe Diem Outdoors" to show appreciation and support of their fishing/removal of carp in Wall Lake.			
--Contact Carpe Diem Outdoors to issue check	WLA Board		
Promote the importance of Monarch butterflies and other Pollinators			
-Wall Lake Association will encourage residents to plant milkweed for Monarch butterflies via newsletter			
---Gather milkweed seeds and package	Luann R	Oct-16	
-Provide milkweed seed packets at annual meeting	Jackie H	Jun-17	
-Milkweed seed packets will be included with welcome package for new residents to the lake.			
-Encourage landowners to include pollinator-friendly plants in shoreline gardens and other restoration projects.	Sue N	Newsletters	

-Promote & teach plantings - Residents and campground	Luann R-campground kids Newsletter	June 2017	
Future Activity/Programs:			
- Continue to provide milkweed seeds to new residents			
- Continue to support local fish club			

Goal #4: Build a strong lake association and increase involvement of all members			
Work towards a membership goal of at least 75% of residents and active involvement within the lake association			
Actively advertise and promote annual meeting	John C/Jackie H		
-Send flyer or mailing advertising annual meeting		Jun-17	
-Provide breakfast and door prizes at annual meeting		Jun-17	
-Provide speaker at the meeting that will draw community interest		Jun-17	
Develop new Wall Lake resident packet			
-Develop a new resident welcome committee (Beach captain)			
-Determine what needs to be in packet			
-Get Wall Lake listing from County	Jackie H	Mar-17	$0
Continue membership in the OTC COLA			
-Assign a representative that can attend the COLA meeting	John C		
-Report COLA meeting information to all members via newsletter	John C		
Future Activity/Program			
-Promote Wall Lake Assoc			
Get updated resident list from county March of every year	Jackie H		
Continue COLA membership yearly	WLA Board		
Maintain new resident program	Jackie H		

Revisiting this plan

This plan is designed to be relevant for only 3-5 years. It will be important for the Wall Lake Association Board to have a process for updating the plan at least every 5 years. As Issues change, people change, and resources change, so this plan should change, too! It will be important to build and maintain relationships with our local resource experts

To Review the plan we should:

a. Make sure the membership and leadership remember the purpose of the plan (keeping in mind new members).
b. Review what has changed in the lake and lakeshed based on new data.
    i. Contact resource experts for updated data if not already available
    ii. Review new data for changes in status or trends
c. Review the status of the action plans
    i. Are the action plans still relevant?

2. Identify new action plans. We could possibly:
    a. Hold a community visioning session
    b. Identify new priority issues or opportunities that groups want to work on
    c. Research new funding opportunities
    d. Draft an updated /new action plan
3. Update the Wall Lake Management Plan, and approve it at an upcoming meeting!

Glossary

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bioaccumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll *a*: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevents groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and non-point source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

Common Biological or Chemical Abbreviations

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

Guide to common acronyms

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
LCCMR	Legislative-Citizen Commission on Minnesota Resources
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

110B	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five “Injection” well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Recreational Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code