Lake Ida 21-0123-00 DOUGLAS COUNTY

Lake Water Quality

Summary

Lake Ida is located 3 miles northwest of Alexandria, MN in Douglas County. It is a large lake, covering 4,427 acres, and is part of the Alexandria Chain of Lakes.

Lake Ida has three inlets and one outlet, which classify it as a drainage lake. Inlets include an intermittent stream, a ditch, and a northern connection to Lake Miltona. Water exits Lake Ida to the south through a channelized stream and into Lake Charley.

Water quality data have been collected on Lake Ida since 1979 (Tables 2-3). These data show that the lake is mesotrophic (TSI 43) with moderately clear water conditions most of the summer and excellent recreational opportunities (page 9).

The mission of the Lake Ida Association is to “preserve and protect the serenity, quality, and natural beauty of Lake Ida. In addition, it is our purpose to organize and educate all those concerned with Lake Ida including lakeshore owners, area residents, and visitors. We acknowledge our role as caretakers and propose to work as one to accomplish our responsibility to water and the land." Association activities include water quality monitoring, exotic species education and prevention, fish stocking, and education. The Lake Ida Association is a member of the Douglas County Lakes Association (DCLA).

Table 1. Lake Ida location and key physical characteristics.

Location Data	
MN Lake ID:	21-0123-00
County:	Douglas
Ecoregion:	North Central Hardwood Forests
Major Drainage Basin:	Upper Mississippi River
Latitude/Longitude:	46.00000000 / -95.41694444
Invasive Species:	None

Physical Characteristics	
Surface area (acres):	4427
Littoral area (acres):	2107
% Littoral area:	48%
Max depth (ft), (m):	106, 32
Inlets:	3
Outlets:	1
Public Accesses:	3

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

Data Availability

Transparency data		Excellent data source from 1979 to 2011
Chemical data		Excellent data source from 1997-2002, 2004-2011
Inlet/Outlet data		Citizen Stream Monitoring Program data is available from 1999-2006 for the ditch inlet.

Recommendations **For recommendations refer to page 19.**

Lake Map

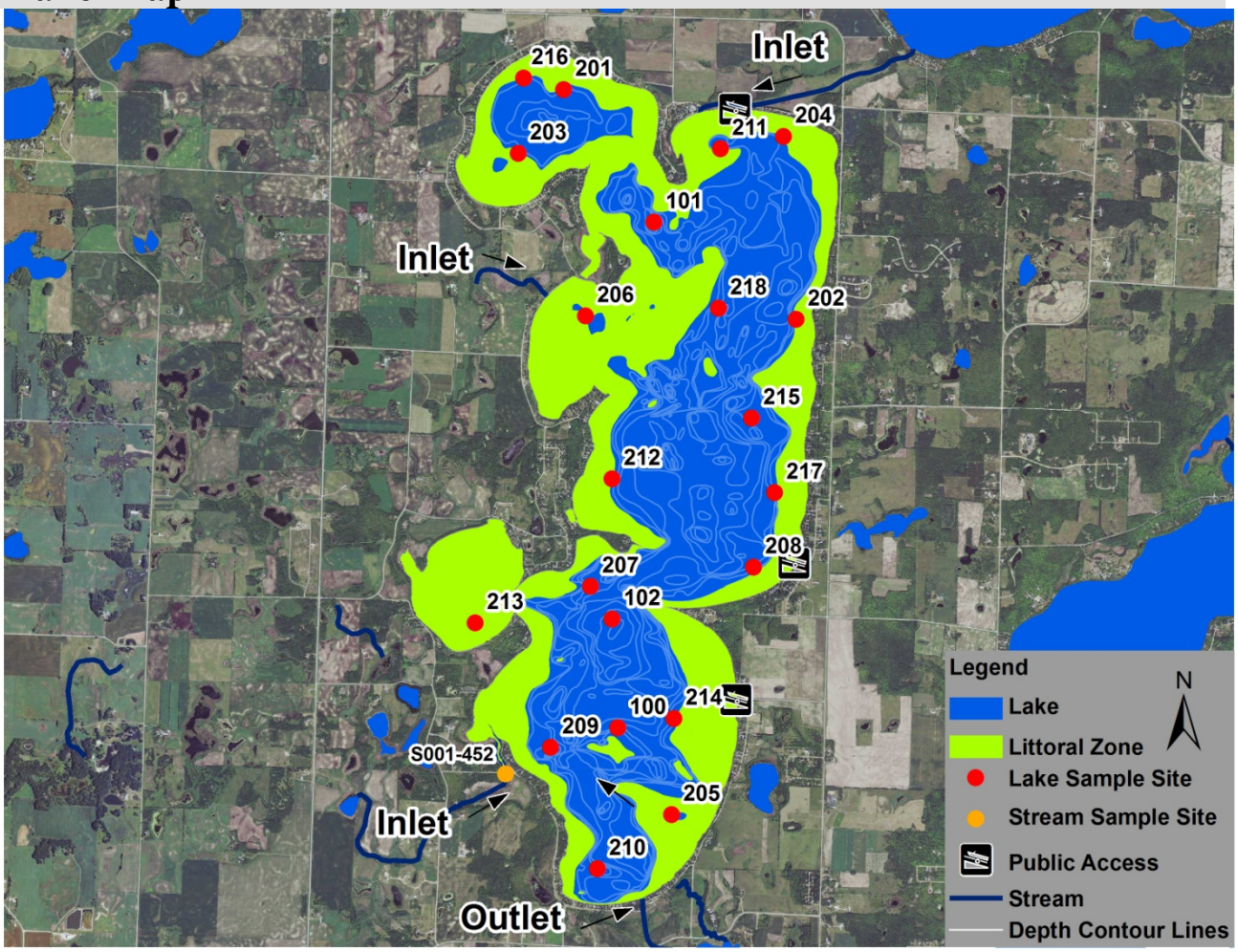


Figure 1. Map of Lake Ida with 2010 aerial imagery and illustrations of lake depth contour lines, sample site locations, inlets and outlets, and public access points. The light green areas in the lake illustrate the littoral zone, where the sunlight can usually reach the lake bottom allowing aquatic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

Table 3. Monitoring programs and associated monitoring sites. Programs include the Minnesota Pollution Control Agency Monitoring Program (MPCA), Citizen Lake Monitoring Program (CLMP), RMB Environmental Lab Monitoring (RMBEL), and the Alexandria Lakes Area Sanitary District Program (ALASD).

Lake Site	Depth (ft)	Monitoring Programs
100	50	MPCA: 1966, 1998; ALASD: 2004-2005, 2007-2009
101	65	MPCA: 1980, 1998; CLMP: 2009-2010
102	95	MPCA: 1980, 1998
201	30	MPCA: 1979-1981; CLMP: 1979-2010; RMBEL: 2001-2002, 2004-2006
202	17	CLMP: 1991-2010
203	20	CLMP: 1991-2006, 2010
204	18	CLMP: 1991-2007
205	20	CLMP: 1991-2010
206	15	CLMP: 1991-2006, 2010
207	50	CLMP: 1991-1994, 1996-2010
208	35	CLMP: 1991-2010
209	30	CLMP: 1991-1992, 1994-2010; RMBEL: 2010
210	30	CLMP: 1991-2008, 2010

Table 3. Continued…

Lake Site	Depth (ft)	Monitoring Programs
211	30	CLMP: 1991-1995, 1997-2008
212	20	CLMP: 1991-1996, 1998-2004
213	5	CLMP: 1991
214	25	CLMP: 1991-2006, 2008-2010
215	45	CLMP: 1994-1995, 1998-2010
216	20	CLMP: 1995; RMBEL: 2007-2011
217* Primary Site	40	RMBEL: 1997-2002, 2004-2011
218		ALASD: 2010

Average Water Quality Statistics

The information below describes available chemical data for Lake Ida through 2010 (Table 4). Data for total phosphorus, chlorophyll a, and secchi depth are from the primary site 217. Sites and date ranges for additional chemical data are listed within the table.

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)	14.3	23 – 50	> 40	Results are better than the expected range for the ecoregion.
[3]Chlorophyll *a* (ug/L)	4.8	5 – 22	> 14	
Chlorophyll *a* max (ug/L)	9	7 – 37		
Secchi depth (ft)	13.4	4.9 – 10.5	< 1.4	
Dissolved oxygen	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)	0.71	<0.60 – 1.2		Indicates insufficient nitrogen to support summer nitrogen-induced algae blooms. (site 201: 1979-1981)
Alkalinity (mg/L)	180	75 – 150		Indicates a low sensitivity to acid rain and a good buffering capacity. (site 102: 1980, 1998)
Color (Pt-Co Units)	5.7	10 – 20		Indicates clear water with little to no tannins (brown stain). (site 201: 1979-1981)
pH	8.8	8.6 – 8.8		Within the expected range for the ecoregion. Lake water pH less than 6.5 can affect fish spawning and the solubility of metals in the water. (site 102: 1980, 1998)
Chloride (mg/L)	6.1	4 – 10		Within the expected range for the ecoregion. (site 102: 1980, 1998)
Total Suspended Solids (mg/L)	2.4	2 – 6		Indicates low suspended solids and clear water. (site 102: 1998)
Conductivity (umhos/cm)	343.3	300 – 400		Within the expected range for the ecoregion. (site 100: 2007-2009)
Total Nitrogen : Total Phosphorus	50:1	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. (site 201: 1979-1981)

[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 217	100	201	216	214	210
Total Phosphorus Mean (ug/L):	**14.3**	**19.3**	**22.2**	**16.6**		
Total Phosphorus Min:	1.5	5	5	9		
Total Phosphorus Max:	23	41	68	29		
Number of Observations:	63	31	36	19		
Chlorophyll *a* Mean (ug/L):	**4.8**	**4.5**	**4.4**	**5.1**		
Chlorophyll-a Min:	2	1	1	1		
Chlorophyll-a Max:	9	9	10	9		
Number of Observations:	58	22	24	19		
Secchi Depth Mean (ft):	**13.4**	**13.4**	**13.3**	**10.8**	**14.4**	**12.4**
Secchi Depth Min:	8.5	10	8	8	9	6
Secchi Depth Max:	24	22	24	18	24	20
Number of Observations:	61	20	434	30	82	129

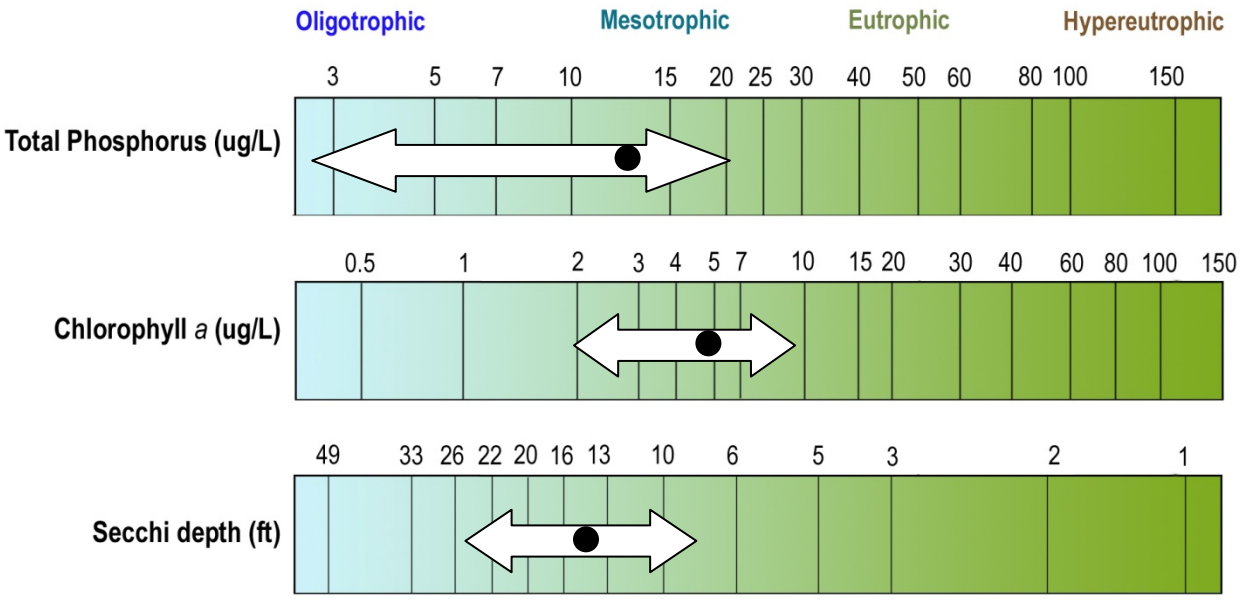


Figure 2. Lake Ida total phosphorus, chlorophyll *a* and transparency historical ranges. The arrow represents the range and the black dot represents the historical mean (Primary Site 217). Figure adapted after Moore and Thornton, [Ed.]. 1988. Lake and Reservoir Restoration Guidance Manual. (Doc. No. 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.

For all the sites that had more than 20 transparency data points, the mean transparency ranges from 10.8 to 14.4 feet. The transparency throughout the lake appears to be relatively uniform, with the best transparency recorded at sites 214 and 211. No distinct water clarity differences are present between sites in the northern and southern sections of the lake.

Transparency monitoring should be continued annually at sites 203 and 205 in order to track water quality changes.

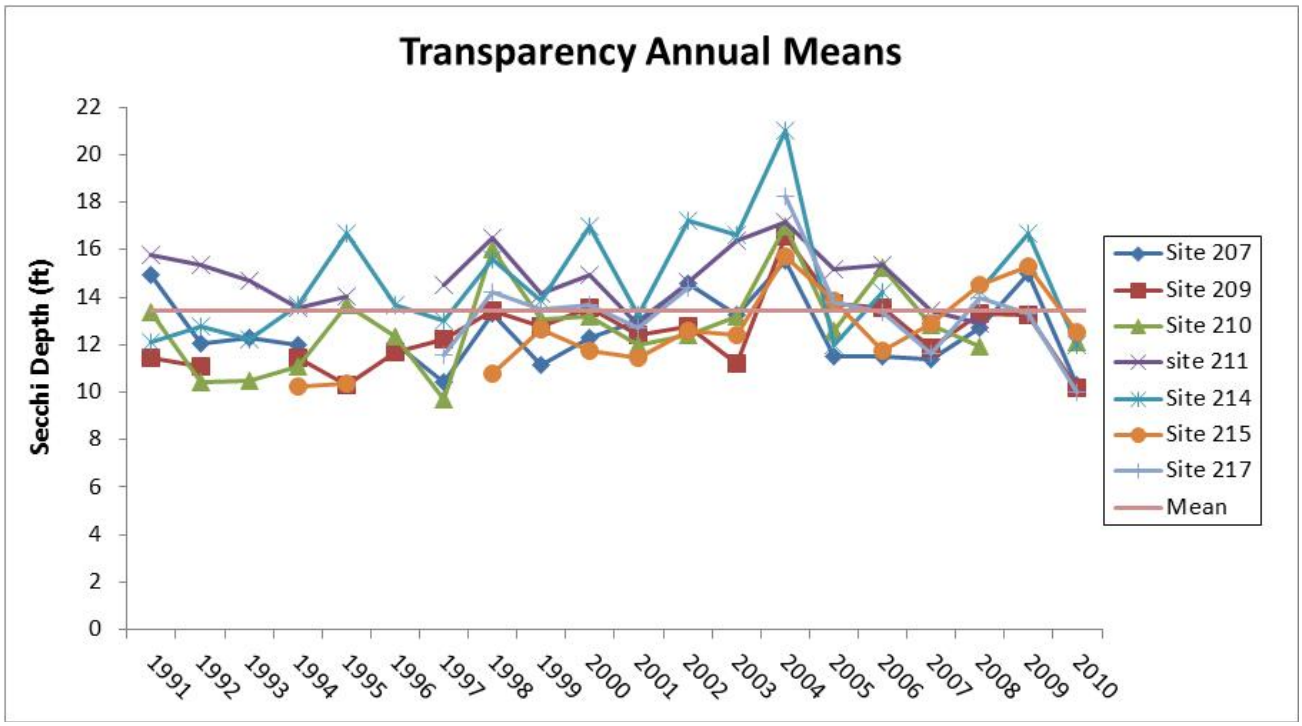


Figure 3. Annual mean transparency compared to long-term mean transparency. The Mean value is for the primary site 217.

Lake Ida transparency ranges from 8.5 to 24 ft at the primary site (217). Figure 4 shows the seasonal transparency dynamics. Lake Ida transparency follows a pattern typical for Minnesota Lakes. The dynamics have to do with algae and zooplankton population dynamics, and lake turnover. Transparency is low in early May during spring turnover, it peaks in early June and then declines into fall turnover. After fall turnover in October the transparency rebounds.

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.

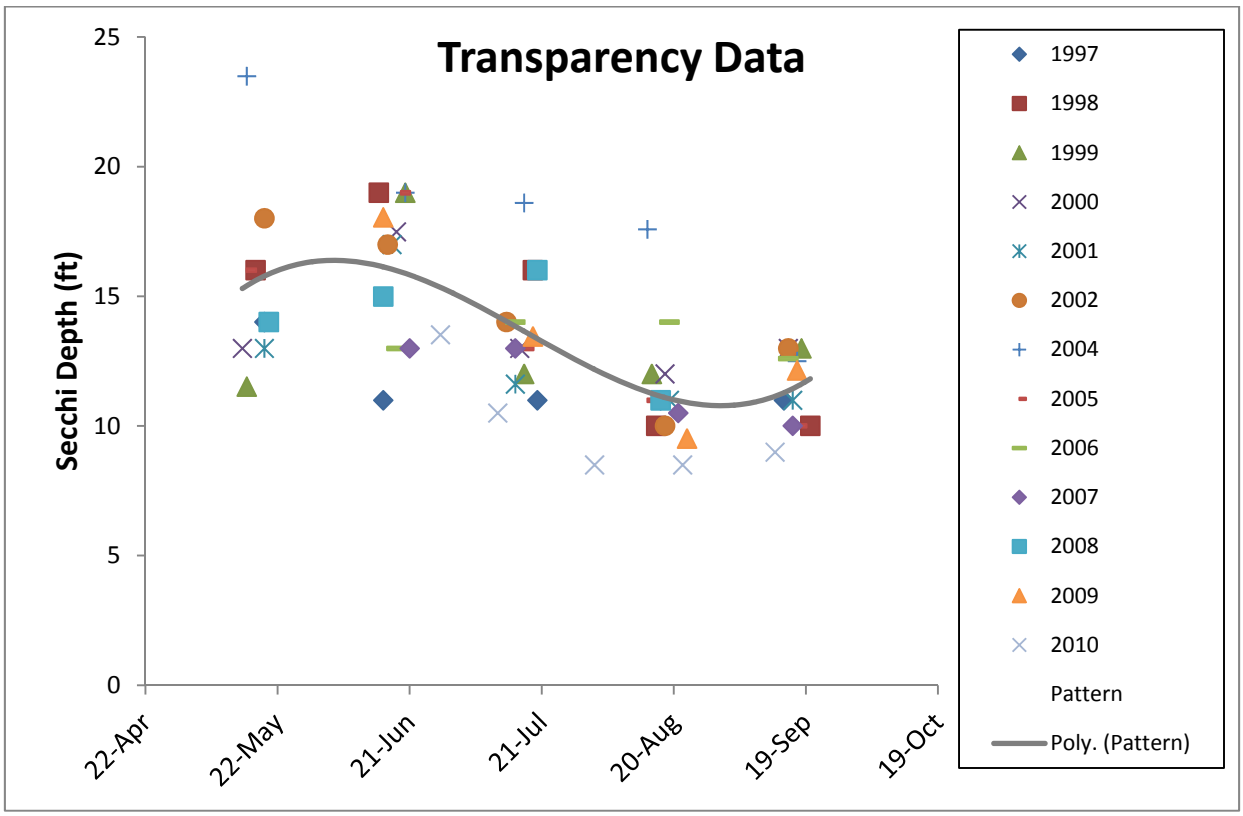


Figure 4. Seasonal transparency dynamics and year to year comparison (Primary Site 217). The grey line represents the pattern in the data.

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 Ida was rated as being "crystal clear" 36% of the time between 1987-2010 (Figure 5).

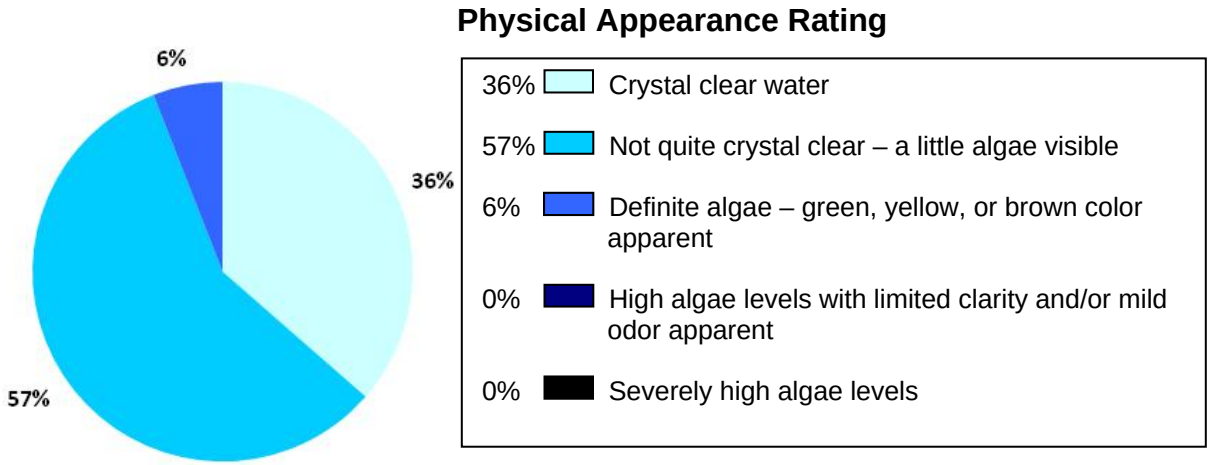


Figure 5. Physical appearance rating, as rated by the volunteer monitor at site 201.

As the secchi depth decreases, the perception of recreational suitability of the lake decreases. Lake Ida was rated as being "beautiful" 59% of the time from 1987-2010 (Figure 6).

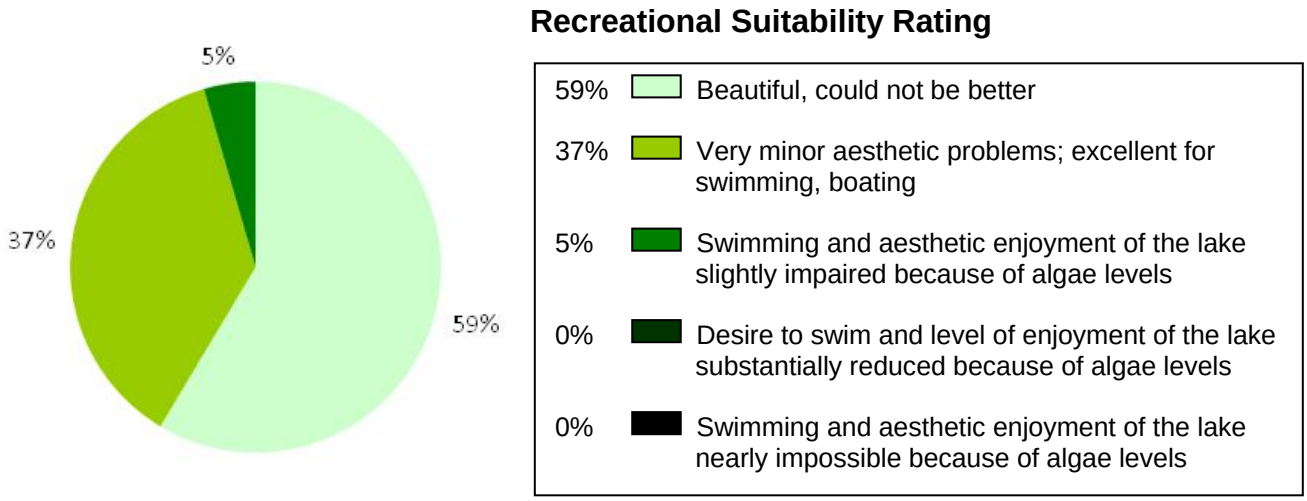


Figure 6. Recreational suitability rating, as rated by the volunteer monitor at site 201.

Total Phosphorus

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

Total phosphorus was evaluated in Lake Ida at site 217 from 1997-2002, and 2004-2011 (Figure 7). In some years the total phosphorus concentrations increase steadily from June to September. Data points fall within the mesotrophic and oligotrophic ranges.

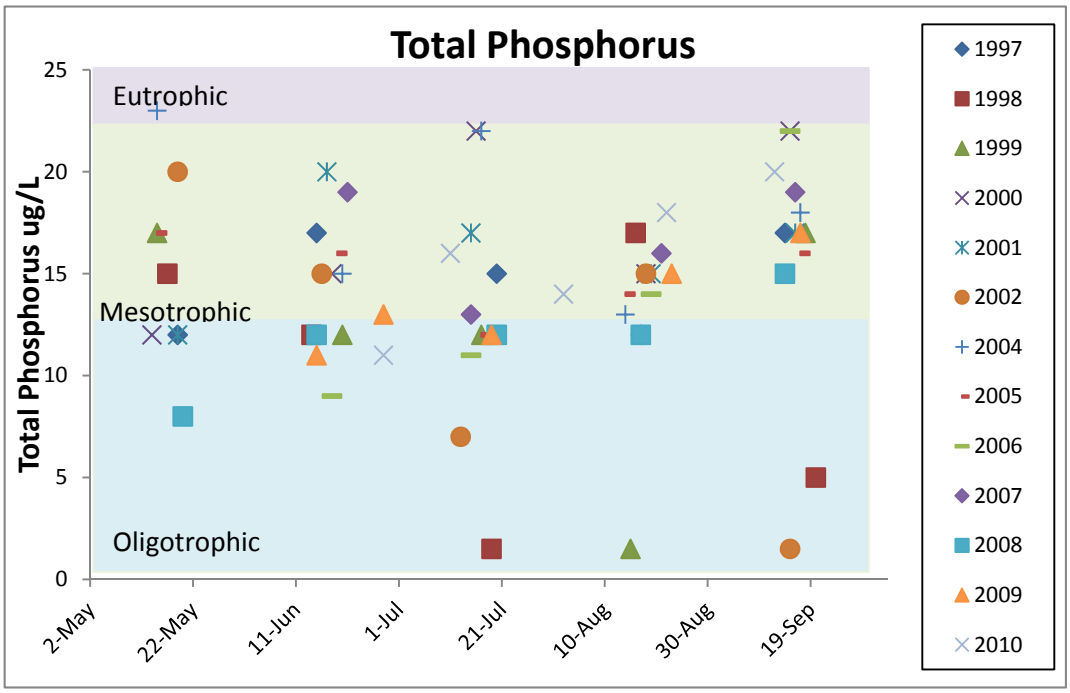


Figure 7. Historical total phosphorus concentrations (ug/L) for Lake Ida

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. Chlorophyll *a* 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.

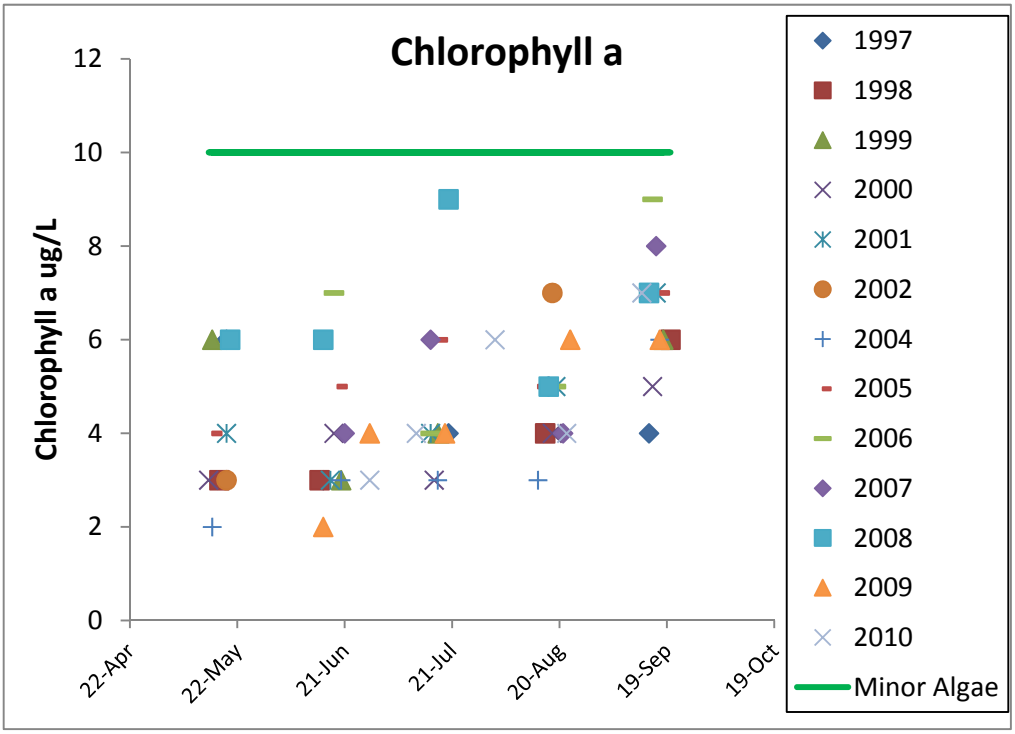
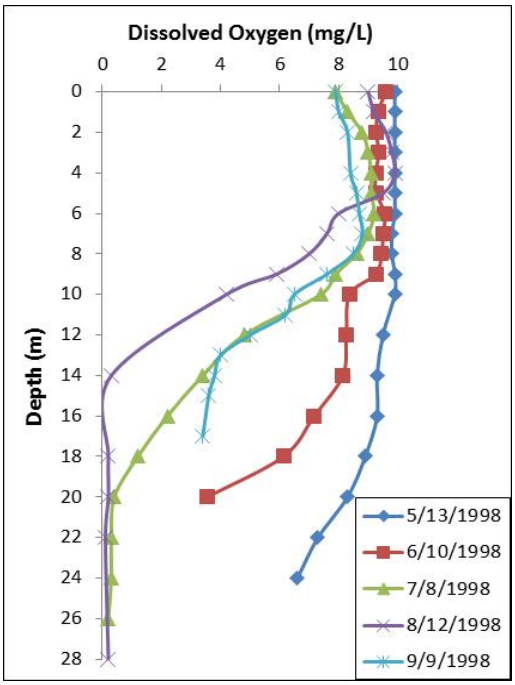


Figure 8. Chlorophyll *a* concentrations (ug/L) for Lake Ida at site 217.

Chlorophyll *a* was evaluated in Lake Ida at site 217 from 1997-2002, and 2004-2011 (Figure 8). Chlorophyll *a* concentrations remained below 10 ug/L on all sample dates, indicating clear water most of the summer. There was not much variation over the years monitored, and chlorophyll *a* concentrations remained relatively steady over the summer.

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 Ida is a relatively deep lake, with a maximum depth of 106 ft. Dissolved oxygen profiles from data collected in 1998 at site 102 show stratification developing mid-summer. In late summer, the thermocline develops at approximately 10 meters (33 ft), which means that gamefish will be scarce below this depth. Figure 9 is a representative DO profile for Lake Ida.

Figure 9. Dissolved oxygen and temperature profile for Lake Ida in 1998 at site 102.

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 to each other or averaged. In order to standardize these three measurements to make them directly comparable, we convert them to a trophic state index (TSI).

The mean TSI for site 217 of Lake Ida falls on the border between oligotrophic and mesotrophic (39-41) (Figure 10). There is good agreement between the TSI for phosphorus, chlorophyll *a* and transparency, indicating that these variables are strongly related (Table 6).

Mesotrophic lakes (TSI 40-50) are characterized by moderately clear water most of the summer. "Meso" means middle or mid; therefore, mesotrophic means a medium amount of productivity. Mesotrophic lakes are commonly found in central Minnesota and have clear water with algal blooms in late summer (Table 7). They are also good for walleye fishing.

Table 6. Trophic State Index for site 217.

Trophic State Index	Site 217
TSI Total Phosphorus	42
TSI Chlorophyll-a	44
TSI Secchi	40
TSI Mean	42
Trophic State:	mesotrophic

Numbers represent the mean TSI for each parameter.

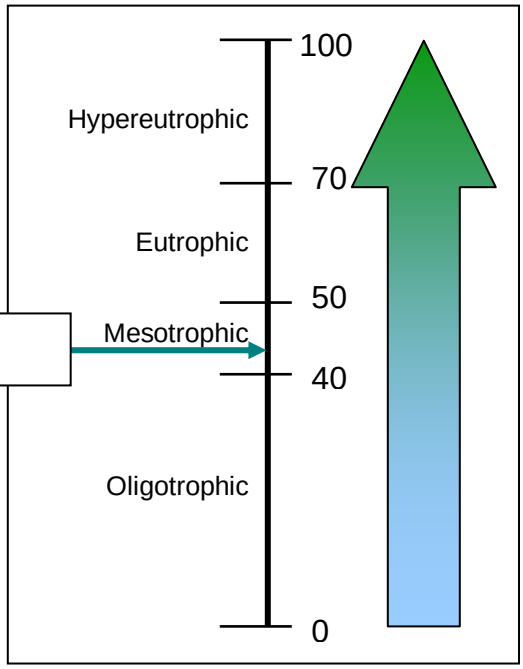


Figure 10. Trophic state index chart with corresponding trophic status.

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 wet years and dry years, water levels, weather, etc, that affect the water quality naturally.

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

Lake Site	Parameter	Date Range	Trend
217	Total Phosphorus	1997-2011	No trend
217	Chlorophyll a	1997-2011	No trend
217	Transparency	1997-2011	No trend

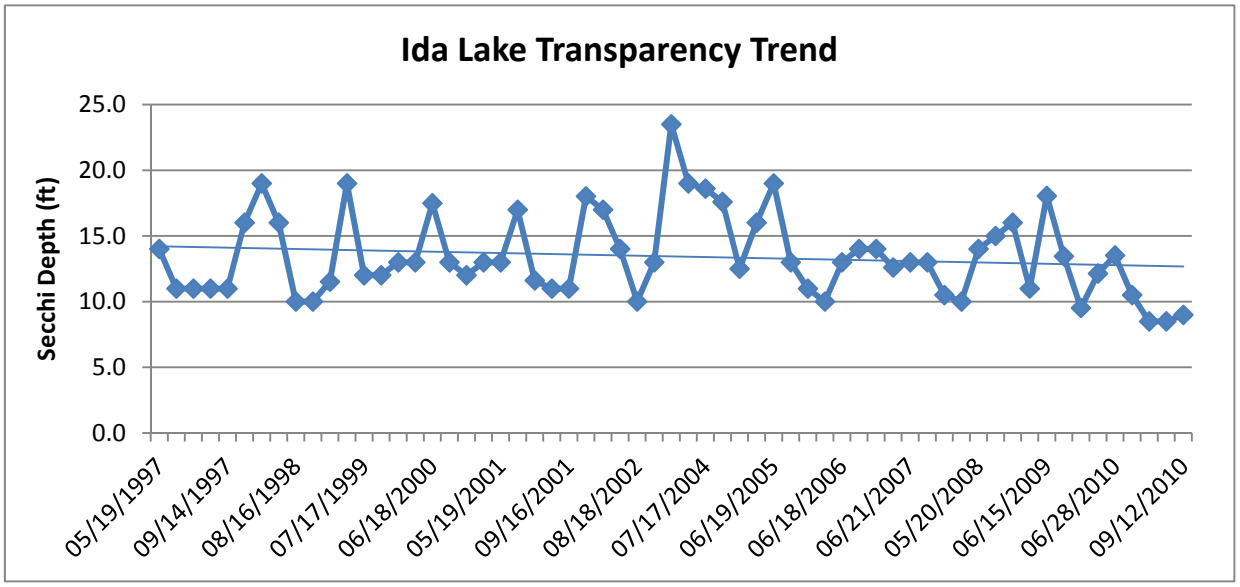


Figure 11. Transparency (ft) trend for site 217 from 1997-2010.

Lake Ida shows no evidence of water quality trends (Figure 11). 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 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 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 - 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.

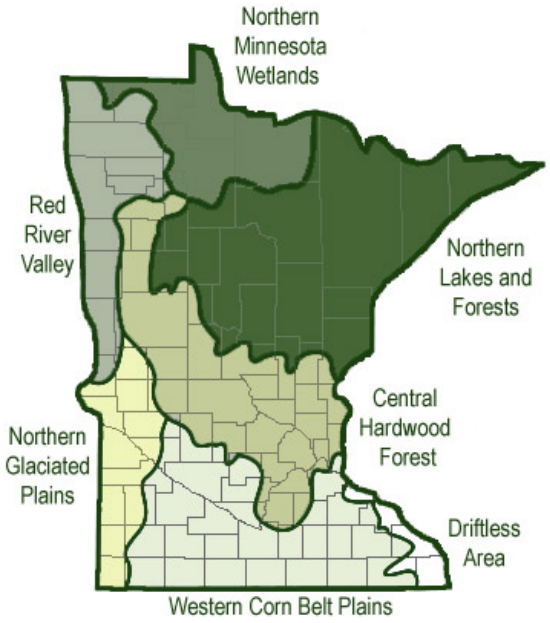
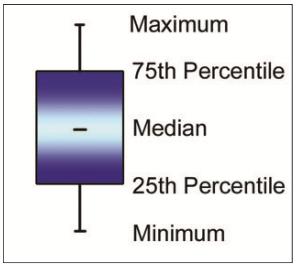
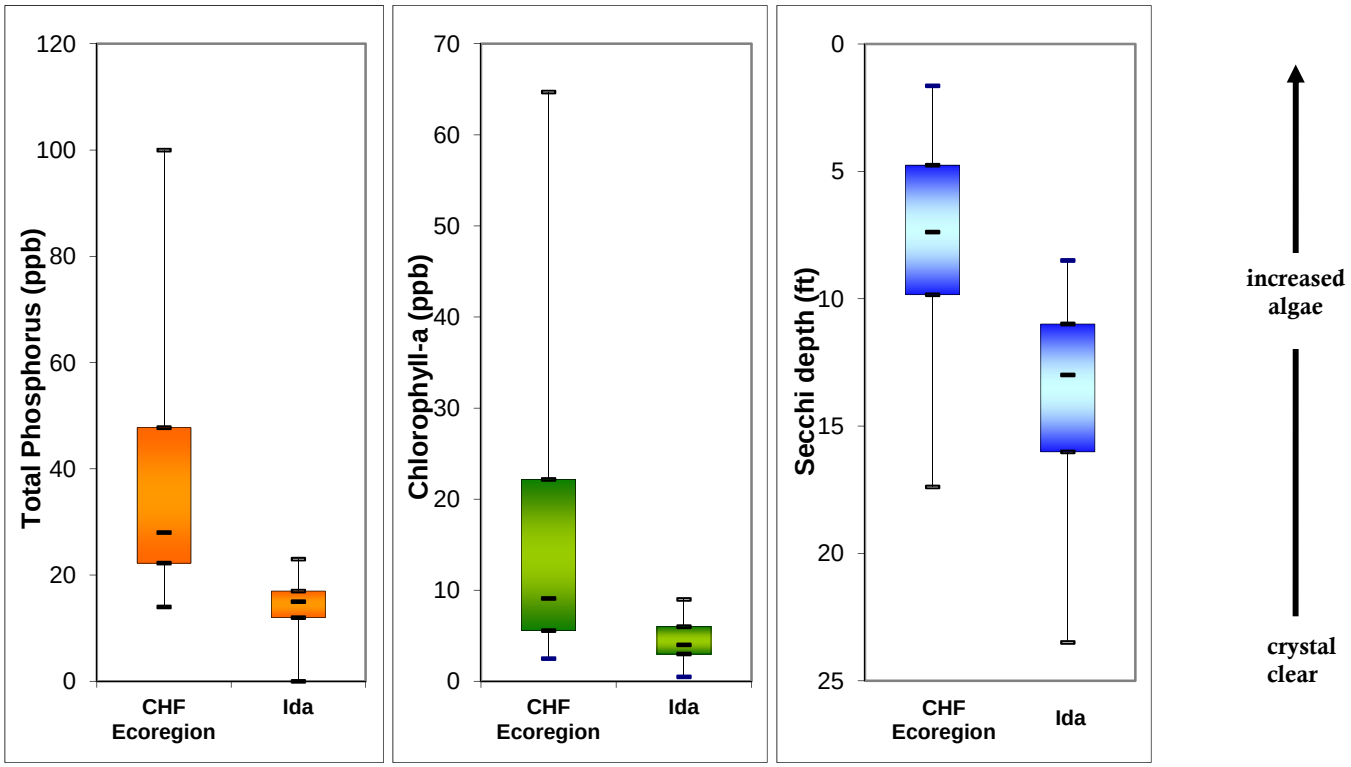


Figure 12. Minnesota Ecoregions.

Lake Ida is in the North Central Hardwood Forests Ecoregion. The mean total phosphorus, chlorophyll a and transparency (secchi depth) for Ida are better than the expected ecoregion ranges (Figure 13).





Figures 13a-c. Lake Ida ranges compared to Northern Lakes and Forest Ecoregion ranges. The Lake Ida total phosphorus ranges is from 63 data points collected in May-September of 1997-2002, and 2004-2011. The Lake Ida secchi depth and chlorophyll *a* ranges range are from 63 data points collected in May-September of 1997-2011.

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 Long Prairie River Major Watershed is one of the watersheds that make up the Upper Mississippi River Basin, which drains south to the Gulf of Mexico (Figure 14). This major watershed is made up of 64 minor watersheds. Lake Ida is located in minor watershed 14009 (Figure 15).

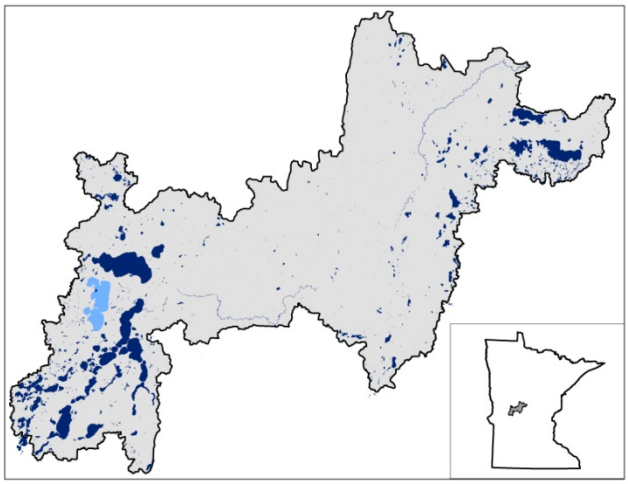


Figure 14. Long Prairie River Major Watershed.

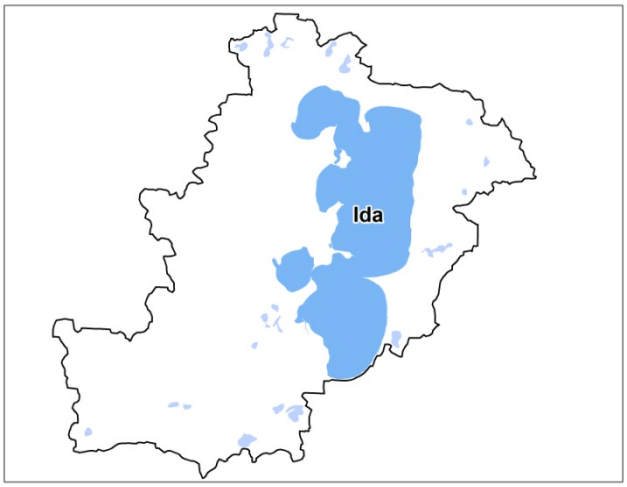


Figure 15. Minor Watershed 14009.

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 Ida falls within the **Ida (1400900) lakeshed** (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 to a large number of

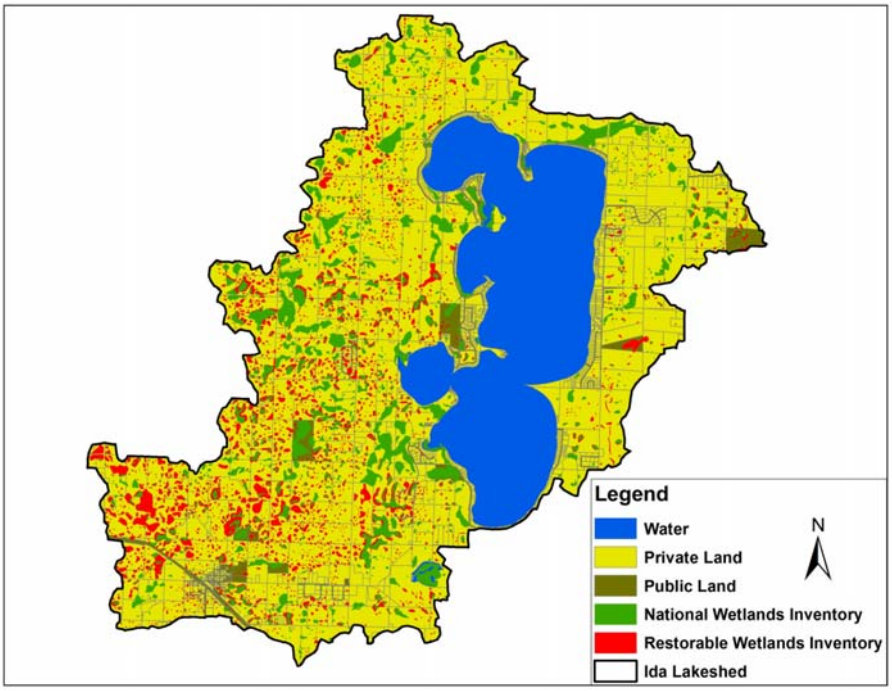


Figure 16. The Lake Ida Lakeshed (1400900) with land ownership, lakes, wetlands, and rivers illustrated.

lakesheds, reflecting a larger drainage area via stream or river networks. For further discussion of Lake Ida's full watershed, containing all the lakesheds upstream of Lake Ida lakeshed, see page 17. The data interpretation of the Lake Ida lakeshed includes only the immediate lakeshed as this area is the land surface that flows directly into Lake Ida.

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. Lake Ida lakeshed vitals table.

Lakeshed Vitals		Rating
Lake Area	4427 acres	descriptive
Littoral Zone Area	2107 acres	descriptive
Lake Max Depth	106 ft.	descriptive
Lake Mean Depth	28 ft.	
Water Residence Time	6 years	
Miles of Stream	6	descriptive
Inlets	3	
Outlets	1	
Major Watershed	14 - Long Prairie River	descriptive
Minor Watershed	14009	descriptive
Lakeshed	1400900	descriptive
Ecoregion	North Central Hardwood Forests	descriptive
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	5:1	
Standard Watershed to Lake Basin Ratio (standard watershed includes lake areas)	15:1	
Wetland Coverage	9%	
Aquatic Invasive Species	None	
Public Drainage Ditches	Present	
Public Lake Accesses	3	
Miles of Shoreline	22.3	descriptive
Shoreline Development Index	2.4	
Public Land to Private Land Ratio	0.04:1	
Development Classification	General Development	
Miles of Road	81	descriptive
Municipalities in lakeshed	Garfield	
Forestry Practices	NA	NA
Feedlots	25	
Sewage Management	Alexandria Lakes Area Sanitary District	
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 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.

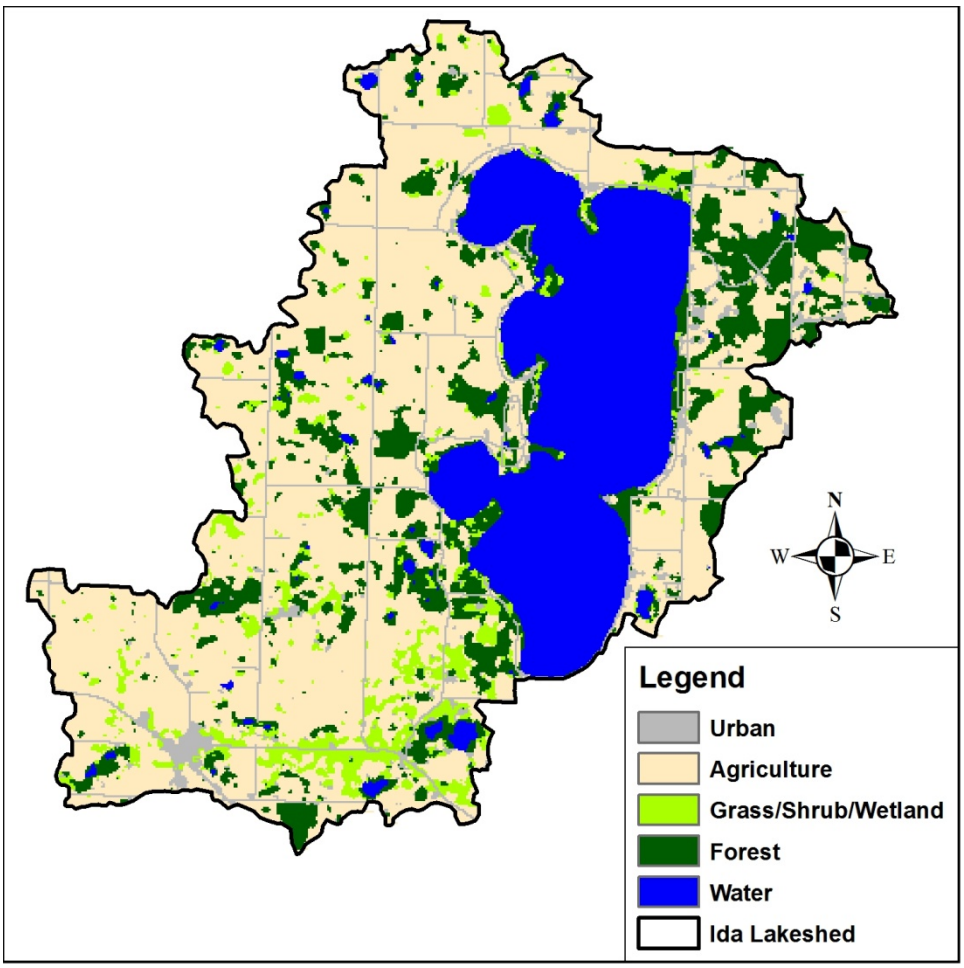


Figure 17. Lake Ida lakeshed (1400900) land cover (http://land.umn.edu).

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 Lake Ida's 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 that is comparable over a decade's time. Table 10 describes Lake Ida's lakeshed land cover statistics 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 transition within the lakeshed from agriculture, grass/shrub/wetland, and water acreages to forest and urban acreages. The largest change in percentage is the increase in forest cover (129%). 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. Lake Ida's lakeshed 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	12010	56.56	10946	51.55	8.86% Decrease
Grass/Shrub/Wetland	2247	10.58	1233	5.81	45.1% Decrease
Forest	1340	6.31	3074	14.48	129.4% Increase
Water	4754	22.39	4648	21.89	2.2% Decrease
Urban	883	4.16	1334	6.28	51.1% Increase
Impervious Intensity %					
0	20458	96.34	20041	94.38	2.0% Decrease
1-10	154	0.73	229	1.08	48.7% Increase
11-25	207	0.97	338	1.59	63.3% Increase
26-40	206	0.97	250	1.18	21.4% Increase
41-60	164	0.77	213	1	29.9% Increase
61-80	42	0.2	111	0.52	164.3% Increase
81-100	4	0.02	54	0.25	1250% Increase
Total Area	21235		21235		
Total Impervious Area (Percent Impervious Area Excludes Water Area)	223	1.35	380	2.29	70.4% Increase

Demographics

Lake Ida 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 5-year increments out to 2035. Compared to Douglas County as a whole, Ida Township has a higher extrapolated growth projection and Leaf Valley Township has a lower projection (Figure 18).
(Source: http://www.demography.state.mn.us/resource.html?Id=19332)

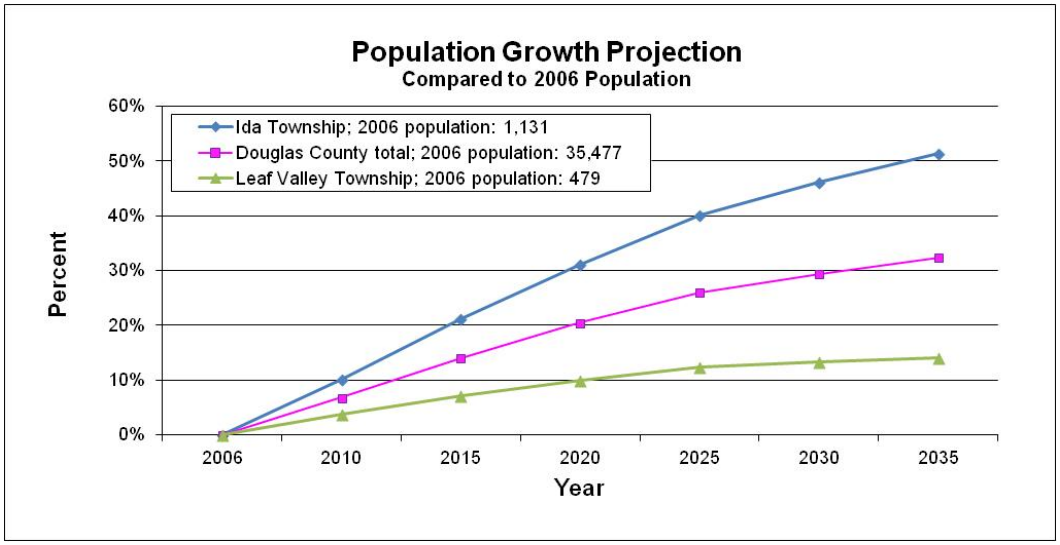


Figure 18. Population growth projection for Ida Township, Leaf Valley Township, and Douglas County.

Lake Ida 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 Ida's lakeshed is made up of private agriculture (Table 11). This land 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 Lake Idashed (Sources: Douglas County parcel data, National Wetlands Inventory, and the 2006 National Land Cover Dataset).

	Private (75%)					**22%**	**Public (3%)**		
	Developed	**Agriculture**	**Forested Uplands**	**Other**	**Wetlands**	**Open Water**	**County**	**State**	**Federal**
Land Use (%)	4.6%	46.1%	10.2%	6.1%	8 %	22%	1.4%	1.2%	0.5%
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	435 – 1450	2544 – 8806	193		152		27	24	10
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% disturbance 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.

Lake Ida's lakeshed was classified with having 30.8% of the watershed protected and 56.2% of the watershed disturbed (Figure 19). Therefore, this lakeshed should have a full restoration focus. With a slight increase in disturbed land use the management focus will switch to partial restoration. 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 Lake Ida, whether through direct overland flow or through a creek or river. Five of the 11 upstream lakesheds are more disturbed than the Lake Ida lakeshed and should have a partial restoration focus.

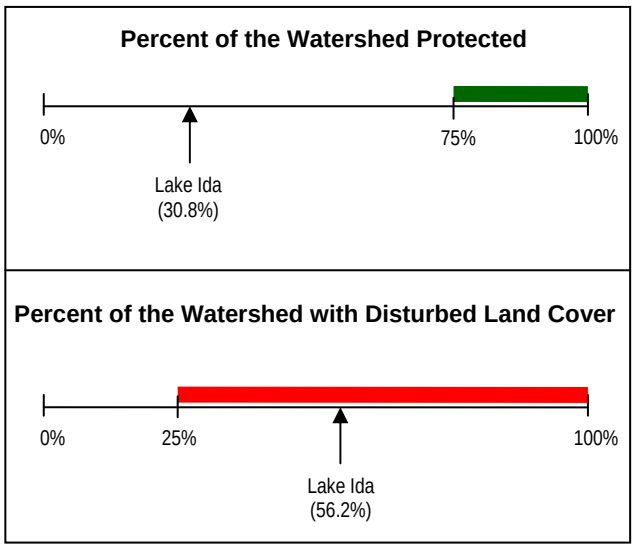


Figure 19. Lake Ida lakeshed's percentage of watershed protected and disturbed.

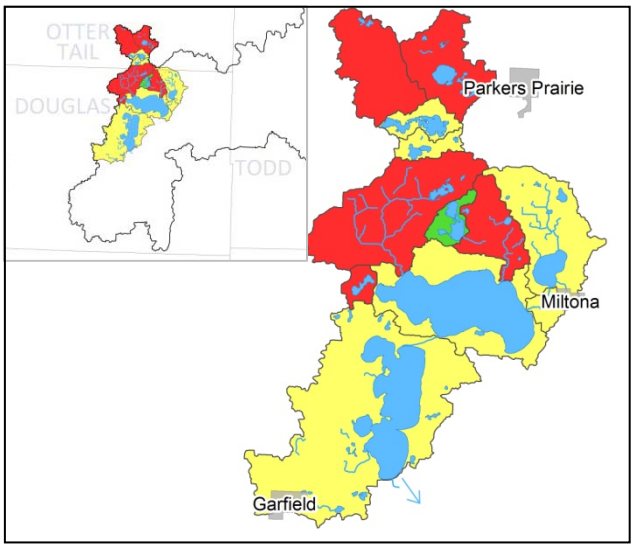


Figure 20. Upstream lakesheds that contribute water to the Lake Idashed. Color-coded based on management focus (Table 12).

Status of the Fishery (DNR, as of 07/09/2007)

Lake Ida is a large (4,289 acres), moderately fertile basin located northwest of Alexandria. Mean depth is approximately 28.0 feet. Maximum depth exceeds 100.0 feet. Residential development surrounding the lake is considered moderate to heavy. Water quality and clarity are good. Average water clarity measurements typically exceed 10.0 feet during summer months. This lake is a popular destination for both anglers and recreational boaters. Recreational pressure can be high, especially on weekend days during summer months. Lake Ida supports a complex fish community due to good water quality and exceptional habitat diversity such as shallow bays, rock bars, abundant mid-lake structure, emergent and submergent vegetation, etc.

Fish management investments are focused on sustaining a consumptive walleye fishery. Annual fry and periodic fingerling stockings are programmed in efforts to supplement natural reproduction and sustain high walleye numbers and catch rates. DNR stockings are augmented with fingerlings purchased and stocked by the Lake Ida Association. The intense stocking program has resulted in elevated survey catches in some years, but has yet to sustain desired population objectives. Catches during the 2007 survey exceeded that of the prior two surveys, but walleye abundance can be described as average when compared to similar lakes across Minnesota. Size structure of 2007 population sample meets management objectives. Mean length and weight of 2007 captures was 16.0 inches and 1.7 pounds. Walleye abundance and fishing success are projected to increase in coming years in response to above average catches of young fish observed in 2006 and 2007 fall electrofishing surveys. Successful natural reproduction and subsequent recruitment are necessary to sustaining a quality walleye fishery.

Largemouth and smallmouth bass are abundant and anglers can expect good fishing success. Smallmouth are not as common as largemouth, but abundance has increased in recent years. Size distribution of largemouth and smallmouth bass population samples were remarkably similar in 2007. Smallmouth bass averaged 13.0 inches and 1.4 pounds. Largemouth bass averaged 12.8 inches and 1.3 pounds.

Northern pike abundance increased in response to above-average precipitation and high water through the mid- and late-1990's. Currently, catch rates are higher than what is expected for this type of lake. Pike exceeding 30.0 inches are present but smaller, slow growing "hammer-handle" pike dominate the population. Harvest of these smaller pike is highly encouraged to help keep this population in check. Lower numbers of hammer-handle northern pike should also improve survival of young walleye. An occasional muskellunge has been captured during lake surveys. One 52-inch muskie was collected during the 2007 survey. This trophy gamefish is not stocked into Lake Ida, thus abundance is extremely low. Presence of this species in Lake Ida is likely a result of downstream emigration from Lake Miltona.

Panfish anglers will encounter an abundant population of bluegill. Fishing quality afforded by bluegill is fair to good. Mean length of those captured during the 2007 survey was 6.0 inches. Angler catches of eight-inch and larger sunfish are common during summer months. Black crappie are present at low to moderate density. Size structure of this population is considered moderate. Mean length during the 2007 survey was 8.0 inches. Most harvest occurs in advance of and during the spring spawning period. Rock bass sustain a moderately abundant population and contribute to fishing. Relatively few are harvested. Eight-inch or larger yellow perch are rare. Few escape predation to grow to a harvestable size. Lake Ida also supports opportunities to catch and harvest tullibee and large yellow bullheads.

Three lake access sites are available for public use. The north access has limited parking space. This access can also be relatively shallow during low water periods. Launching larger boats can be

problematic. Boaters should also be cautious of shallow rock bars off of the following points: Pilgrim and Stony (the two points that separate the north and south portions of this basin) and Betsy Ross (the point entering the northwest bay). These areas are posted with caution signs. There is also a posted fish spawning area, located at the entrance of a bay near Betsy Ross Resort on the northwest shoreline. Fishing is prohibited within the posted area during the spring spawning season.

Fishing pressure can be seasonally heavy, particularly for black crappie and walleye, while other gamefish populations are under-utilized. To help maintain fish community balance and quality fishing experiences, anglers are encouraged to adopt selective or smart harvest strategies. Selective harvest encourages release of larger fish and increased harvest of more abundant smaller or under-exploited fishes.

Walleye anglers should exercise constraint while fishing in deep water. Walleye occupy depths in excess of 60 feet in fall, winter, and spring months. Walleye caught at depths in excess of 30 feet or one atmosphere are subject to water pressure changes that result in over-inflation of their swim bladder which can force their stomach to protrude outside the mouth. The extended gas bladder prevents captured fish from leaving the water surface and moving into deeper water for some time. Such captures can be seen floating on the surface where they are subjected to predation from birds, gill desiccation, or even sunburn, which can lead to secondary infections and eventual mortality. It is wasteful and counterproductive to management efforts to practice catch and release of walleye from deep water. Many released fish will die from stress of the capture. Catch and harvest what you need for a meal and move on.

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=21012300

Key Findings / Recommendations

Monitoring Recommendations
Transparency monitoring at sites 216 and 217 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. Phosphorus and chlorophyll a monitoring should continue, as the budget allows, to track future water quality trends. For this monitoring it is best to stick with the same sites to be able to track trends.

There are so many sites being monitored on Lake Ida that it's important to focus most of the monitoring efforts on a couple primary sites. This will avoid scattered data.

Overall Summary
Lake Ida is in good shape for water quality, but the watershed is greatly disturbed by agriculture and development. Ida is a mesotrophic lake (TSI=43) with no detectable trends in water quality. Three percent (3%) of the lakeshed is in public ownership, and 30% of the lakeshed is protected, while 56% of the lakeshed is disturbed (Figure 19).

Priority Impacts to the lake
The priority impact to Lake Ida and the reason the lakeshed is rated as "full restoration (Figure 20)" is surrounding agriculture (Figure 17). Agriculture is the dominant land use type on private lands (46%) within the lakeshed. In addition, there are 25 animal feedlots within Lake Ida's lakeshed. Buffers between farmed fields and developed lakeshore parcels are thin and runoff from these fields may impact Lake Ida, especially on the north and west shores of the lake.

A second potential impact to the lake is second tier development. Several new housing developments in the lakeshed are visible in recent aerial photos. Most of the developable area in the first tier is developed (Figure 16), so future development pressure will be focused on 2nd tier parcels. From 1990-2000, the urban area around the lake increased by 451 acres (Table 10).

Best Management Practices Recommendations

The management focus for Lake Ida should be to protect the current water quality and restore the lakeshed. This can be done by partnering with farmers in the lakeshed to implement conservation farming practices, increase shoreline buffers, restore wetlands, or place priority parcels into land retirement programs to decrease the impacts of agriculture in the lakeshed.

In addition, efforts should be focused 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, and rain gardens.

Organizational contacts and reference sites

Lake Ida Association	http://www.lakeida.org/
Douglas Soil and Water Conservation District	900 Robert Street, Suite 102, Alexandria, MN 56308 (320) 763-3191 x 3 www.DouglasSWCD.com
DNR Fisheries Office	23070 North Lakeshore Drive, Glenwood, MN 56334 320-634-4573 glenwood.fisheries@state.mn.us
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