VADNAIS LAKE AREA WATER MANAGEMENT ORGANIZATION

2010 WATER QUALITY MONITORING PROGRAM REPORT

Prepared by

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VLAWMO would like to thank the volunteers for their vital role in the Citizens Lake Monitoring Program. The volunteers for 2010 were: Ron Auger & Jim Grisim (Birch Lake), Paul Peterson (Amelia)), Sue Fox (Gilfillan Lake), Doug & Harry Tiffany (Charlie), Bernie Napolski (Goose Lake West), Shannon Stewart (Tamarack Lake) and Chris Mann (Wilkinson Lake). VLAWMO recognizes the work of Eric Iverson (VLAWMO summer intern) on several lakes and streams.

VLAWMO would also like to acknowledge and thank the following agencies for their assistance with assuring the quality of water within the watershed: St. Paul Regional Water Service, the Citizen's Lake Monitoring Program at the Minnesota Pollution Control Agency, the Lake Level Program at the Minnesota Department of Natural Resources, and the Ramsey County Limnology Lab.

Definitions & Abbreviations

Ammonia (NH3) – an inorganic form of nitrogen that is contained in fertilizers, septic system effluent, and animal wastes. It is also a product of bacterial decomposition of organic matter. NH3 becomes a concern if high levels of the un-ionized form are present. In this form NH3 can be toxic to aquatic organisms. The presence of un-ionized ammonia is a function of the NH3 concentration, pH, and temperature. Conversion of NH3 to NO2 by nitrification requires large quantities of oxygen which can kill aquatic organisms due to the lowered dissolved oxygen concentrations in water.

Chlorophyll-a (Chl A) - Chl A is a green pigment in algae. Measuring Chl A concentration gives an indication of how abundant algae are in a waterbody.

Colony Forming Units (CFU) – unit used in measuring the level of E. coli in a water sample.

Conductivity (uS/cm) - Conductivity is a good measure of salinity in water. The measurement detects chloride ions from the salt. Salinity affects the potential dissolved oxygen levels in the water. The greater the salinity, the lower the saturation point.

Dissolved Oxygen (DO) - The concentration of molecular oxygen (O2) dissolved in water. The DO level represents one of the most important measurements of water quality and is a critical indicator of a water body's ability to support healthy ecosystems. Levels above 5 mg/L are considered optimal, and most fish cannot survive for prolonged periods at levels below 3 mg/L. Microbial communities in water use oxygen to breakdown organic materials, such as animal waste products and decomposing algae and other vegetation. Low levels of dissolved oxygen can be a sign that too much organic material is in a water body.

Eutrophic – a water body that is high in nutrients and low oxygen content. A eutrophic lake is usually shallow, green, with limited oxygen in the bottom layer of water.

Eutrophication – The aging process by which lakes are fertilized with nutrients. Natural eutrophication will gradually change the character of a lake. Human activities can accelerate the process.

Hypereutrophic – A very nutrient-rich lake with murky water, frequent algal blooms and fish kills, foul odor, and rough fish

Impaired Waters – The Clean Water Act requires states to publish, every two years, a list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the 303(d) list, is based on violations of water quality standards.

Mesotrophic – the classification between eutrophic and oligotrophic lakes. These lakes have moderately clear water, late-summer algal blooms, moderate macrophyte populations, and occasional fish kills.

Nitrate (NO3) – High NO3 levels are often caused by over application of fertilizers that leach into waterbodies. Nitrate loading from water bodies in Minnesota has national implications as it is the primary chemical contributing to the hypoxia (low oxygen) zone at the mouth of the Mississippi River in the Gulf of Mexico. The Enviromental Protection Agency (EPA) has a standard for nitrates in drinking water of 10ppb, infants and children are especially at risk.

Nitrite (NO2) – The second stage of the nitrogen cycle. Nitrite is poisonous to fish. Levels over 75 ug/L can cause stress in fish and greater than 500 ug/L can be toxic

Nitrogen (N) – Nitrogen is second only to phosphorus as an important nutrient for plant and algae growth. The amount of nitrogen in a water body strongly correlates to land use. Nitrogen comes from fertilizers, animal waste, sewage treatment plants and septic systems through surface runoff or groundwater sources. Nitrogen does not occur naturally in soil minerals but is a major component of all organic matter.

Nitrogen Cycle - the process of nitrogen breakdown in water. The first stage is the production of NH3. The second stage is the oxidation of NH3 into NO2 which is very poisonous to fish. The final stage is conversion of NO3 which aquatic plants use. Once the plants have used their share of NO3, bacteria change it back into a gaseous form and release it back to the atmosphere. The Nitrogen Cycle is dependent on oxygen. If a water body has low DO, organic decay of nitrogen is slower and the water will have increased interim levels of toxic products (NH3 and NO2). The cycle also moves quicker in warmer water.

Oligotrophic – a water body that is generally clear, deep, and free of weeds or large algae blooms.

Particulate Phosphorus – a form of phosphorus that is attached to sediment particles and in plant and animal fragments suspended in the water and may not be immediately available to support algae growth. Some of this phosphorus is readily available but the amount can vary.

Phosphorus (P) - Phosphorus is the primary cause of excessive plant and algae growth in lake systems. Phosphorus originates from a variety of sources, many of which are human related. Major sources include human and animal wastes, soil erosion, detergents, septic systems and runoff from farmland, yards, and streets.

Secchi Disk – a round, white, metal disk that is used to determine water clarity. It is lowered into the water until it is not visible. The depth is recorded, and then the disk is raised until it is visible. The mean value of the two readings gives the clarity.

Secchi Disk Transparency (SDT) - the term used in describing the results of a secchi reading expressed in feet or meters.

Soluble Reactive Phosphorus (SRP) – a form of phosphorus that dissolves in water and is readily available (bio-available) to algae and has an immediate effect on algae growth and DO depletion. Its concentration varies widely over short periods of time as plants take it up and release it.

St. Paul Regional Water Service (SPRWS) – Agency which assists VLAWMO with water quality testing and controls the Vadnais chain of lakes, which supplies drinking water to the city of St. Paul.

STORET - (short for STOrage and RETrieval), a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others. The MPCA uses the information entered into the database to determine the quality of the state's water bodies. If water quality standards are not met, the water body will designated as impaired and will need to have a TMDL study conducted.

Surface Water Assessment Grant (SWAG) - Grant awarded by the PCA to help fund surface water monitoring

Total Kjehldahl Nitrogen (TKN) – The sum of NO2, NO3, and NH3 in a water body. High measurements of TKN typically results from sewage and manure discharges to water bodies.

Total Maximum Daily Load (TMDL) – Calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and an allocation of that amount to the pollutant's source.

Total Nitrate and Nitrite Nitrogen - Nitrate (NO3) plus nitrite (NO2) as nitrogen. In lakes, most nitrate/nitrogen is in NO3 form.

Total Phosphorus (TP) – A nutrient essential to the growth of organisms, and is commonly the limiting factor in the primary productivity of surface water bodies. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies.

Total Suspended Solids (TSS) – Very small particles remaining dispersed in a liquid due to turbulent mixing that can create turbid or cloudy conditions. A measure of the material suspended in water in mg/l. Total suspended solids (TSS) cause: a) interference with light penetration, b) buildup of sediment and c) potential reduction in aquatic habitat. Solids also carry nutrients that cause algal blooms and other toxic pollutants that are harmful to fish. Clay, silt, and sand from soils, phytoplankton (suspended algae), bits of decaying vegetation, industrial wastes, and sewage are common suspended solids.

Trophic Status Indicator (TSI) – TSI is an indicator of water quality. Lakes can be divided into three categories based on trophic state – oligotrophic, mesotrophic and eutrophic. A natural aging process occurs in lakes which cause them to change from oligotrophic to eutrophic over time and eventually fill in. Humans can accelerate this process by allowing nutrients from agriculture, lawn fertilizers, streets, septic systems, and urban storm drains to enter lakes. Trophic status is determined through TP, Chl A, and SDT measurements.

Turbidity – a water quality parameter that refers to how clear the water is. It is an indicator of the concentration of suspended solids in the water. Excessive sedimentation in streams and rivers is considered to be the major source of surface water pollution in the United States. Polluted waters are commonly turbid. Turbidity is expressed in NTU (Nephelometric Turbidity Units).

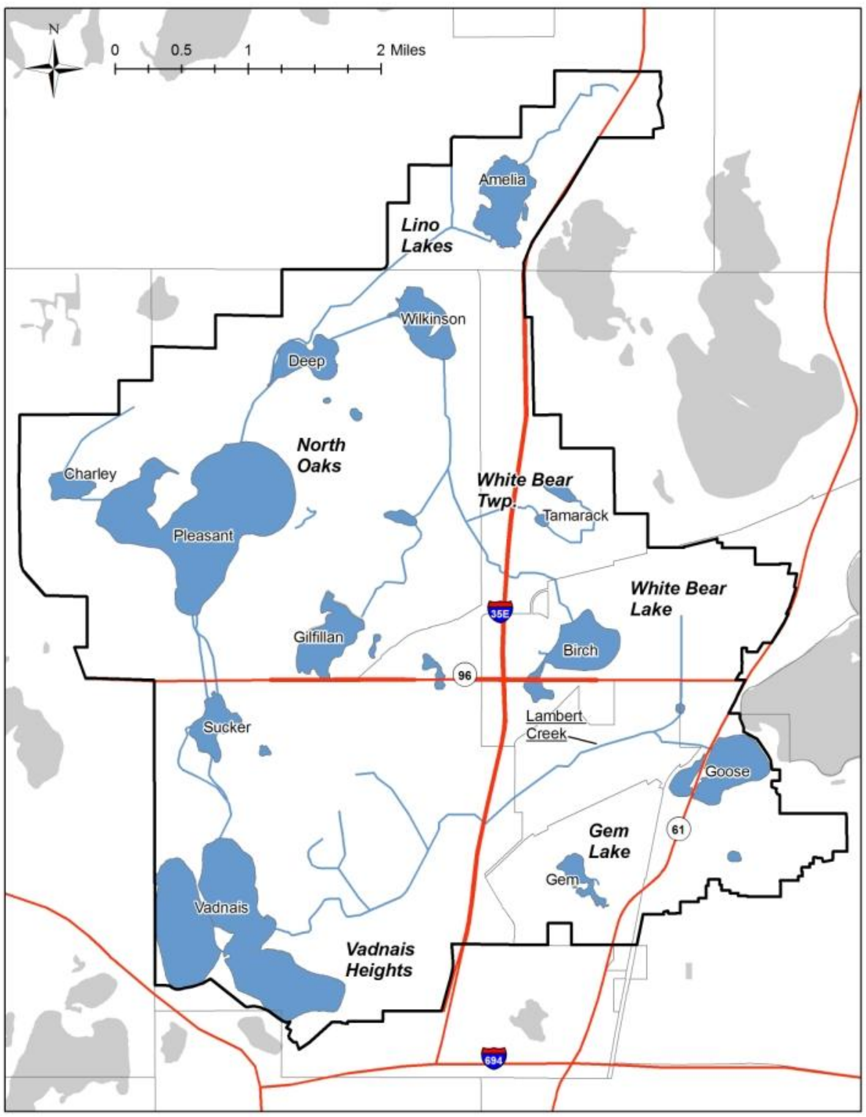
Volatile Suspended Solids (VSS) – a measure of the organic matter in suspended particles. When measured in conjunction with TSS, the proportions of organic versus mineral content of the particles can be determined.

Introduction

The Vadnais Lake Area Water Management Organization (VLAWMO) covers approximately 25 square miles in the northeast metropolitan area. The watershed encompasses the City of North Oaks and portions of the Cities of White Bear Lake, Gem Lake, Vadnais Heights, Lino Lakes, and White Bear Township. The watershed is 96% urbanized; agricultural land exists in the northern end of the boundaries. New land development is occurring near Gem Lake and Wilkinson Lake. Data collected through this program tracks changes in water quality in conjunction with the change in land use around these water bodies.

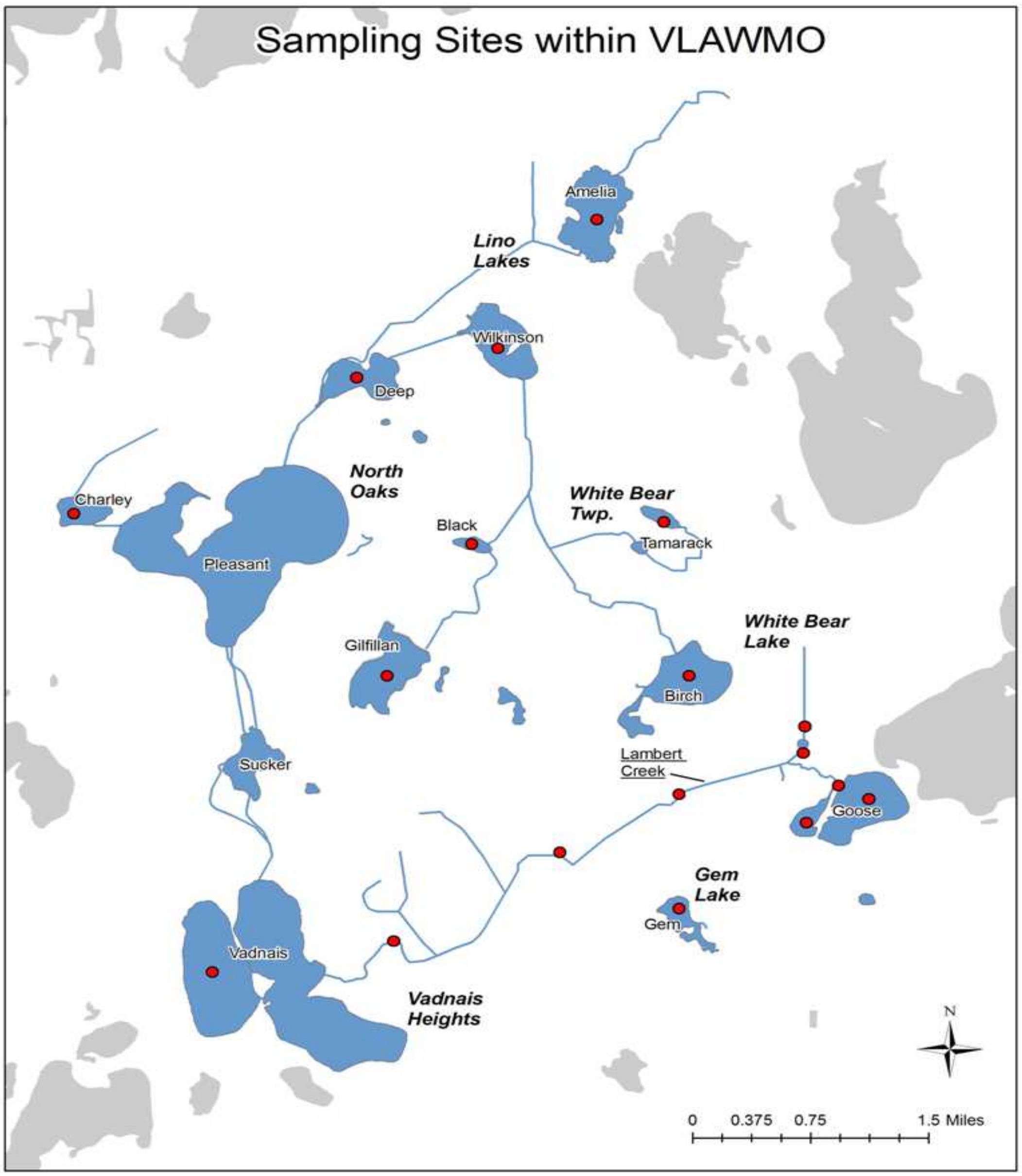
VLAWMO works in conjunction with the St. Paul Regional Water Service (SPRWS) on water quality monitoring. The SPRWS monitors the direct surface water flow into Vadnais Lake to assure high quality drinking water for over 400,000 consumers. The SPRWS monitors the main chain of lakes (Charley Lake, Pleasant Lake, Sucker Lake and Vadnais Lake) and while VLAWMO monitors Lambert Creek which flows directly into Vadnais Lake.

Figure 1: Map of VLAWMO



VLAWMO began the Citizens Lake Monitoring Program (CLMP) in 1997 to monitor several lakes and ponds within the watershed that were identified as having local significance. CLMP volunteers have helped collect samples from 12 water bodies: Amelia Lake, Birch Lake, Black Lake, Charlie Lake, Deep Lake, Gem Lake, Gilfillan Lake, Goose Lake East, Goose Lake West, Tamarack Lake, West Vadnais Lake and Wilkinson Lake. These lakes are all shallow with average depths no greater than 9 feet. Six areas along Lambert Creek are also sampled as part of the Organization's mission to protect and improve the water-related environment. The data received from the monitoring is used by VLAWMO and the Minnesota Pollution Control Agency (MPCA) to determine the health of the state's waters.

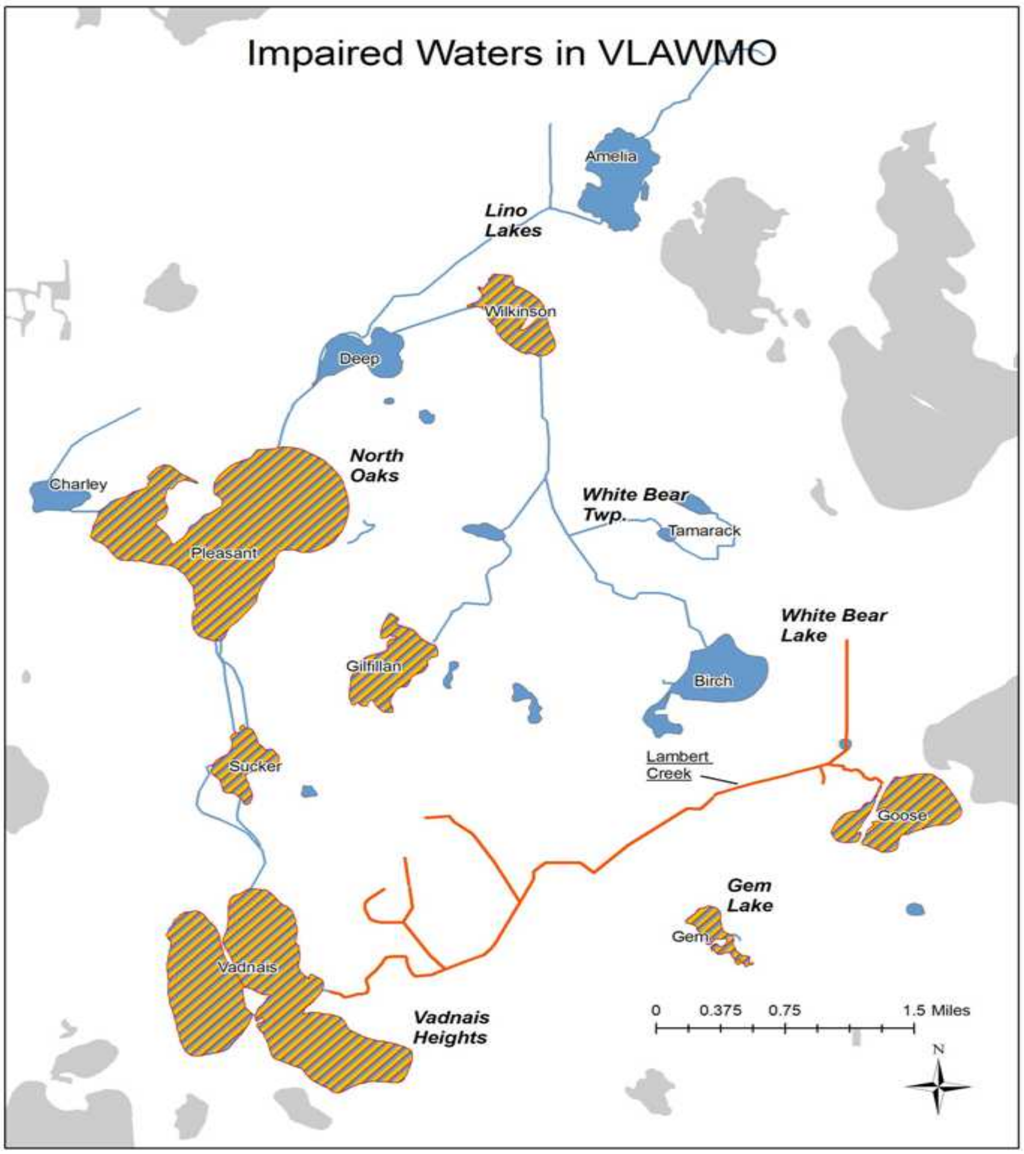
Figure 2: Sites Monitored by VLAWMO



Impaired Water Designations

The watershed has had several water bodies listed on the MPCA 303(d) list for Impaired Waters recently. The SPRWS Chain of Lakes (Pleasant, Sucker and Vadnais Lakes) have all been listed for nutrient pollution, specifically mercury. These lakes have been infested with zebra mussels, an aquatic invasive species, though this is not a condition of the Impaired Waters listing. This chain of lakes is fed by the Mississippi River through a pump in Fridley, MN. Lambert Creek (including Goose Lake and Whitaker Pond) has been added to the impaired list for bacteria, specifically fecal coliform or E. coli. Gem Lake, Gilfillan Lake, Goose Lake and Wilkinson Lake, impaired for nutrients, have also been added to the study due to the PCA's new "watershed wide' approach for TMDL's to make them more efficient. These water bodies are now scheduled for a TMDL study to determine the extent of pollution and if possible, where the pollutant is coming from. VLAWMO will initiate the study for Lambert Creek while SPRWS will manage the study for Pleasant, Sucker, and Vadnais. Study begin fall of 2010.

Figure 3: Waterbodies listed on the MPCA 303(d) Impaired Waters List



Typical Measurements for Lakes and Streams

VLAWMO's watershed falls with the North Central Hardwood Forest (CHF) ecoregion. This ecoregion is an area of transition between the forested areas to the north and east and the agricultural areas to the south and west. The terrain varies from rolling hills to smaller plains. Non-urbanized upland areas are forested by hardwoods and conifers. Plains include livestock pastures, hay fields and row crops such as potatoes, beans, peas and corn.

The ecoregion contains many lakes, and water clarity and nutrient levels are moderate. Land surrounding many of these lakes has been developed for housing and recreation, and the densely populated metropolitan area dominates the eastern portion of this region. Water quality problems that face many of the water bodies in the area are associated with contaminated runoff from paved surfaces and lawns.

Below are typical measurements one might find for lakes and streams in the CHF ecoregion:

Lakes							
Field pH	TSS (mg/L)	NO_X (µg/L)	TP (µg/L)	Turb (NTU)	SDT (m)	Chl-a (µg/L)	TKN (µg /L)
8.6 – 8.8	2 – 6	<100	23 – 50	1 – 2	1.5 – 3.2	5 – 22	600 - 1200
Streams							
Field pH	TSS (mg/L)	NO_X (µg/L)	TP (µg/L)	Turb (NTU)	Fecal Coliform (cfu/100 ml)	Temp (˚C)	BOD (in mg/L)
7.9 – 8.3	4.8 – 16	4 - 26	6 – 15	3 – 8.5	40 – 360	2 – 21	1.5 – 3.2

The MPCA has water quality standards based on a designated use for the water body. VLAWMO's water is classified as "2B". The SPRWS chain of lakes has a stricter designation of "2Bd" due to it being the drinking water source for St. Paul. The quality of Class 2B water must be suitable for aquatic recreation of all kinds as well as to support fish and aquatic plant life. In 2008, the MPCA approved new standards which will separate deep from shallow lakes. All of the lakes VLAWMO monitors are considered shallow and therefore those standards will apply. For those parameters which the MPCA does not have standards, the federal Environmental Protection Agency (EPA) has maximum contaminant level standards. VLAWMO's goal is to have its waterbodies within these standards.

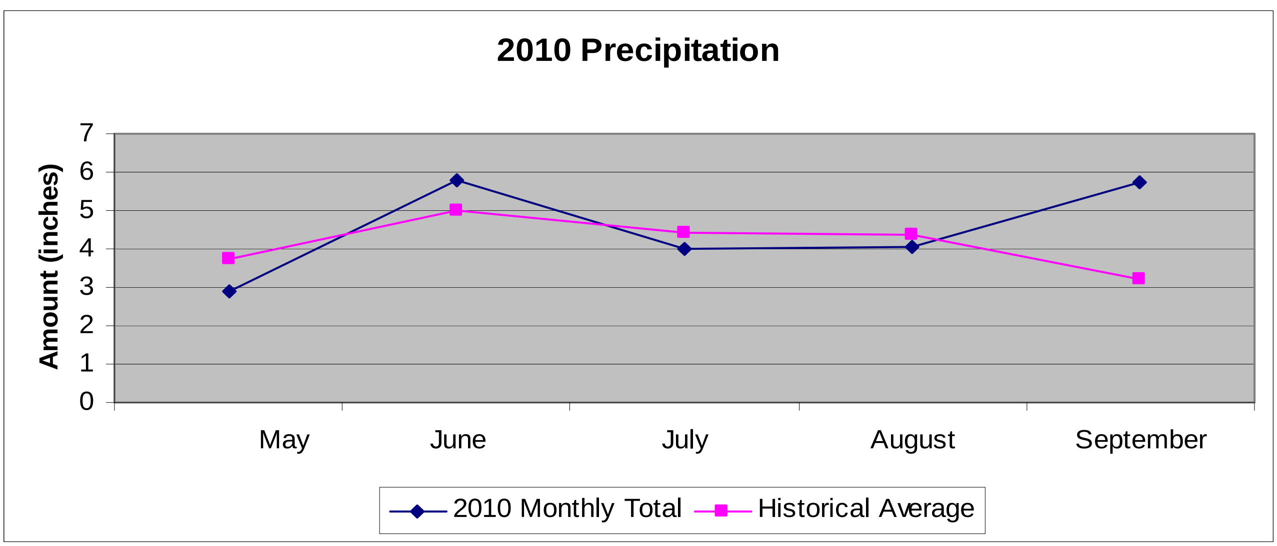
MPCA Standards Lakes					**EPA Standards**	
TP (µg/L)	Chl A (µg/L)	SDT (m)	Turb (NTU)	TSS (mg/L)	TKN (µg/L)	NO_2 (µg/L)
< 60	< 20	> 1	< 25	< 100	< 1000	< 100
MPCA Standards – Rivers and Streams					**EPA Standards**	
Fecal Coliform daily maximum (cfu/100 ml)	Fecal Coliform 30 day mean (cfu/100 ml)	Turb (NTU)	TSS (mg/L)	Un-ionized Ammonia (µg/L)	TKN (µg/L)	NO_2 (µg/L)
< 1260	< 126	< 25	< 100	<40	< 1000	< 100

Precipitation in 2010

Major factors influence water quality including the amount of precipitation, timing of precipitation events, and land use practices in the watershed. Long-term monitoring is necessary to characterize the impacts of various land use practices on surface water runoff within VLAWMO.

The 2010 monitoring season was much wetter than 2009, although our lakes are still very low. The sampling season was 0.37" above average (May through September), compared to 3.9" below average in 2009. Precipitation moves contaminants resting on lawns, roofs, streets, and parking lots into nearby water bodies or into storm sewers that outlet into water bodies. Typically, the more precipitation that occurs, the more runoff there will be in the watershed. However, the timing and intensity of the precipitation, as well as soil types, land slopes, land uses, as well as other factors can influence the amount of runoff that reaches the water bodies. Lack of rain can also have an effect on the concentration of nutrients and chemicals in our water bodies. With a smaller volume of water in our water bodies, the more concentrated the nutrients and chemicals can become.

2010 Precipitation Data (in inches) White Bear Lake Rain Gauge, White Bear Lake, MN			
	2010 monthly total	Historical Average	Deviation
May	2.92	3.73	-0.81
June	5.80	4.98	0.82
July	4.02	4.41	-0.39
August	4.06	4.37	-0.31
September	5.75	3.2	2.55
Avg. for Season	4.51	4.14	0.37



Changes in the VLAWMO Monitoring Program for 2010

With a grant from the PCA, assistance from the Minnesota Conservation Corps, and VLAWMO staff, we were able to complete a 1600 foot restoration of Lambert Creek and also a newly constructed storm pond and plantings at Witaker Pond. A summer intern worked in the monitoring program April through September. VLAWMO staff supplemented the volunteer sampling program to collect data. The intern along with the water resource technician spent a great deal of time entering data into the MPCA's STORET database and evaluating the year end results. The third and final flume was also installed this winter on Lambert Creek at County Rd. F.

The two flumes along Lambert Creek that were replaced in 2007and the newly installed flume at County Rd. F. recorded accurate flow for the stream. Additionally, VLAWMO staff, with the help of EOR installed monitoring equipment at Whitaker Pond to monitor continuous flow into the pond and pond level. An automated rain gauge was also installed at this site.

The 2010 SLMP was on Wilkinson Lake, the final report will be completed early 2011. Gilfillan Lake SLMP was completed this year. SLMP's are a tool for watersheds to set goals for specific waterbodies to enhance water quality, waterbody aesthetics and the overall quality of the waterbody and the surrounding watershed. SLMP's set goals to allow for proper management of a waterbody over time and to educate stakeholders and policy makers on resources and techniques to help waterbodies function at their highest and to limit potential impairments.

Preliminary Analysis of Lake Data

VLAWMO staff worked with volunteers to collect samples from the lakes at two-week intervals from May through September. At the time of collection, volunteers measure water transparency with a Secchi disk (SDT), evaluate the physical and recreational conditions of the water, and if available, take a lake level reading. The samples are collected by an integrated sampler and are stored in coolers. Samples are brought to the Ramsey County Department of Public Works Limnology Lab by VLAWMO staff within 24 hours for chemical analysis. Parameters measured at the lab include Total Phosphorus (TP), and Chlorophyll-a (Chl A), total Kjeldahl Nitrogrn, nitrate and ammonia. The data from these tests aid in the determination of the state of the water quality in a particular lake. Standards for water quality are set by the US Environmental Protection Agency (EPA) and enforced through the MPCA.

A measure of the lake health and lake age is Carlson's Trophic State Index (TSI), which measures the productivity level of a lake or degree of eutrophication. As a lake ages, it becomes more eutrophic, however human impact speeds up the process. High TSI values correspond to poorer water quality.

TSI	TP (µg/L)	Chl A (µg/L)	SDT (m)
Oligotrophic	3-10	2-5	2.4-3.66
Mesotrophic	18-27	8-10	2
Eutrophic	30-50	11-15	1.2-1.5
Hypereutrophic	>50	>15	<1.2

Water quality grades are given to each lake based on standards established by the Metropolitan Council. The standards give a range to each letter grade for the June – September averages of TP concentration, Chl A concentration, and SDT. The overall lake water quality grade is the average of the grades for each parameter. Other indicators of lake condition, such as aquatic plant growth or invasive species are not factored into the grades. As of 2010, the letter grades assigned to VLAWMO water bodies are as listed below:

Lake	Grade	TSI Status
Amelia	C+	Eutrophic
Birch	B	Mesotrophic
Black	B	Mesotrophic
Charlie	C+	Eutrophic
Deep	C	Eutrophic
Gem	C	Eutrophic
Gilffilan	C-	Eutrophic
E. Goose	D+	Eutrophic - Hypereutrophic
W. Goose	C-	Eutrophic
Tamarack	D	Eutrophic - Hypereutrophic
Wilkinson	C	Eutrophic

VLAWMO's water resource technician completed the data entry into the MPCA STORET program which makes the determination of impairment and opens opportunities for grants to help remedy the impairments.

Projects Completed / Continued Monitoring

VLAWMO partnered with the Ramsey Conservation District (RCD) and received a Clean Water Partnership Grant from the MN Pollution Control Agency (PCA) to do a study of the Lambert Creek Subwatershed. The study identified and recommended the placement of Best Management Practice (BMP) projects. The term "retrofit" means adding something new to an older system - or in this case, finding where we can incorporate water quality projects into an existing neighborhood setting. Putting in storm ponds and raingardens is easier in a new development. It is more complicated to install them in an older neighborhood.

The subwatershed was divided into smaller catchments and analyzed to determine their pollutant loading into Lambert Creek. In all, 33 catchments were analyzed and 10 of those were selected to have computer modeling done to see how much effect BMPs would have to reduce the amount of pollution reaching the creek.

VLAWMO is now working with RCD to install a couple of pilot projects identified in the report.

A 150 foot stretch of lakeshore on Birch Lake, in White Bear Lake was improved this summer. The area had erosion issues and was filled with invasive weeds. The area was cleared and a pathway to the lake was constructed with large stones for fishing and a bench up near the trail. The area was replanted with native plants and will be maintained and weeded regularly to ensure the plants are successful. This project received funding from the Board of Water & Soil Resources (BWSR) Native Buffer Grant which was awarded to VLAWMO from the Ramsey Conservation District (RCD).

Throughout 2009 and 2010, VLAWMO has been carefully analyzing Lambert Creek to determine areas that have good potential for restoration. Lambert Creek has been found to have high levels of phosphorus which can come from many sources but stormwater runoff, soil, and grass clippings are the major causes. Areas along the creek have erosion issues; soil is being washed away into the creek and causing damage to plants and the water. Additionally, Lambert Creek has been listed on the State's Impaired Waters List for high levels of e.coli and more studies are being conducted to determine if there is a direct cause of this pollutant.

VLAWMO, with the support of the City of Vadnais Heights, has partnered with the engineering and environmental consulting company, Wenck Associates, Inc., to come up with a plan to restore the creek bend north of Kohler Road. Ed Matthiesen from Wenck is the Project Engineer with a lot of stream restoration experience in the Twin Cities area. This summer vegetation was thinned and cleared along the slopes of the creek. This allows for more sunlight to reach both the ground and the creek. Much of the vegetation on the slopes was invasive species such as buckthorn, honeysuckle and box elder trees. The vegetation was then used to create brush bundles which were tucked into the creek bank to rebuild the areas that have eroded away. Erosion blanket and seed were installed in September. In March 2011, willow stakes will be planted. This project began July 12, 2010 and will be completed with the help of a Minnesota Conservation Corps crew for which VLAWMO received a grant.

Beginning in mid December 2009, Landwehr Construction started on improvements to Whitaker Pond and the channel downstream of the Dillon storm sewer. This pond empties into Lambert Creek which in turn empties into Vadnais Lake. Vadnais Lake is the drinking water reservoir for the City of St. Paul and surrounding communities. VLAWMO has partnered with the City of White Bear Lake, White Bear Township, Ramsey County and the St. Paul Regional Water Service (SPRWS) to improve the effectiveness of the pond and forbay, and to enhance the water quality leaving Whitaker Pond. Funding also came from a grant from the SPRWS and a Native Buffer Grant from the Board of Water & Soil Resources via the Ramsey Conservation District.

The area was graded, hydro-mulched and seeded, and more rip-rap was added this spring. Through a state grant, native vegetation including trees, shrubs, perennial wildflowers, and grasses were planted in June 2010. Issues with the weir construction will require some repair in winter 2011.

1. In 2010 VLAWMO continued collecting snowmelt runoff samples at lake and stream sites to measure Chloride levels running into them. The State Choride standard is 230 mg/l..

2. Testing for fecal coliform could also be done on a more regular basis on our lakes. Lambert Creek was tested for fecal coliform weekly, but VLAWMO may start testing some lakes this summer.

3. VLAWMO conducted sediment sampling on Goose Lake this summer and those samples were analyzed by Wenck. This data provides good information about possible nutrient loading within the lake. Some lakes have internal nutrient loading from their sediments and these test can help us determine if there is significant internal loading based on the results we get. Not all waterbody impairments are due from runoff. Results will be in the Lambert Creek TMDL Sediment sampling does not need to be done on an annual basis; every ten years may be sufficient.

VLAWMO will continue lake and stream restoration next year and hopefully those efforts will have a positive impact on the water quality.

2010 VLAWMO Lake Monitoring Results

Introduction

The following pages will show you the 2010 sampling results for all of the VLAWMO waterbodies. The numbers in red identify those reading that are above state standards. The standards are below.

Lakes							
Field pH	TSS (mg/L)	NO_X (µg/L)	TP (µg/L)	Turb (NTU)	SDT (m)	Chl-a (µg/L)	TKN (µg /L)
8.6 – 8.8	2 – 6	<100	23 – 50	1 – 2	1.5 – 3.2	5 – 22	600 - 1200
Streams							
Field pH	TSS (mg/L)	NO_X (µg/L)	TP (µg/L)	Turb (NTU)	Fecal Coliform (cfu/100 ml)	Temp (˚C)	BOD (in mg/L)
7.9 – 8.3	4.8 – 16	4 - 26	6 – 15	3 – 8.5	40 – 360	2 – 21	1.6 – 3.2

All lake data was collected by an integrated sampler, which takes a sample containing multiple depths in the water column. This data includes Nitrates, Phosphorus, Chlorophyll, Pheophytin, and TKN. Stream samples were all surface grab samples, and turbidity was measured by a Turbidity tube.

Pheophytin is the unactive pigment in photosynthesis and our lab gives us values for both chlorophyll and pheophytin.

The conductivity tables show measurement taken at the top of the water column, bottom of the water column, and sometimes in the middle. This will show you how the conductivity is usually greater the further down in the water column due to the water being heavier. (conductivity essentially measure the salt in the water) Salt water is heavier than regular water and over time the salt water will settle to the bottom of the lake. It may become mixed during lake turn over,

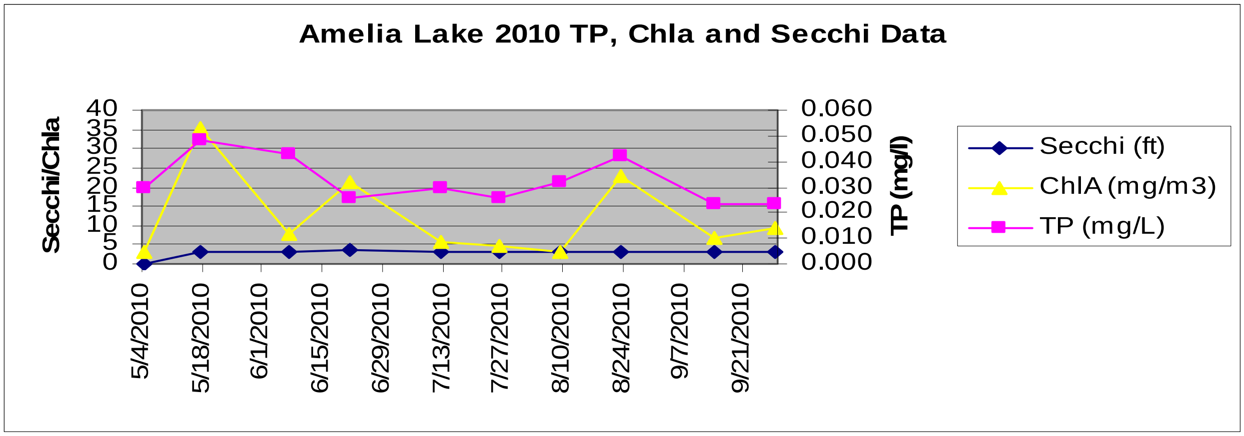
One interesting result this year was that all of the VLAWMO lakes saw improvement in water quality, The could be due to the high amount of rain we had compared to the previous few year and may have caused dilution of the lake nutrients giving lower lab readings.

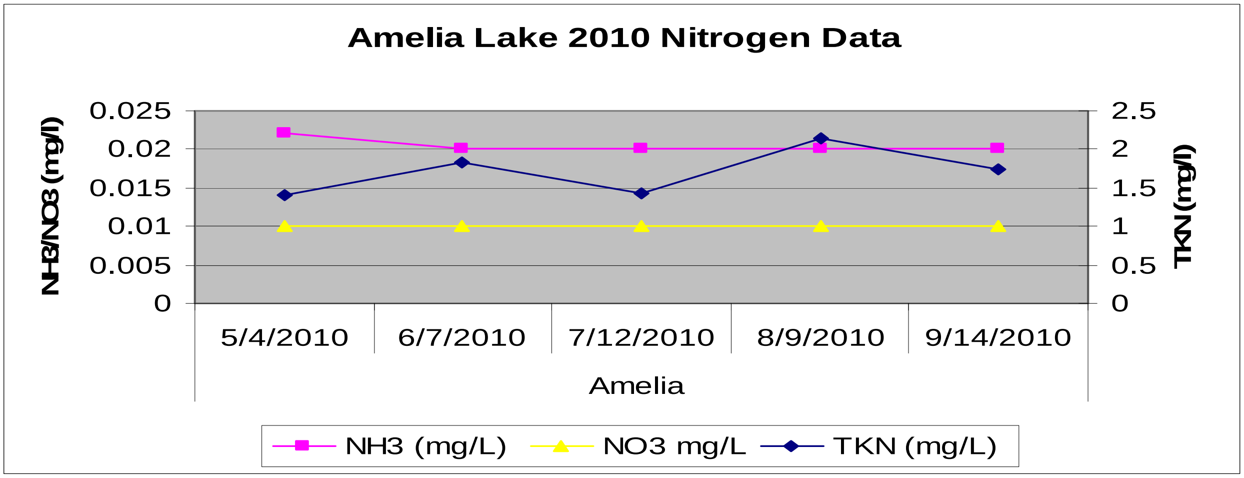
After the 2010 data, a table and graph puts this last year into historical context.

Amelia Lake

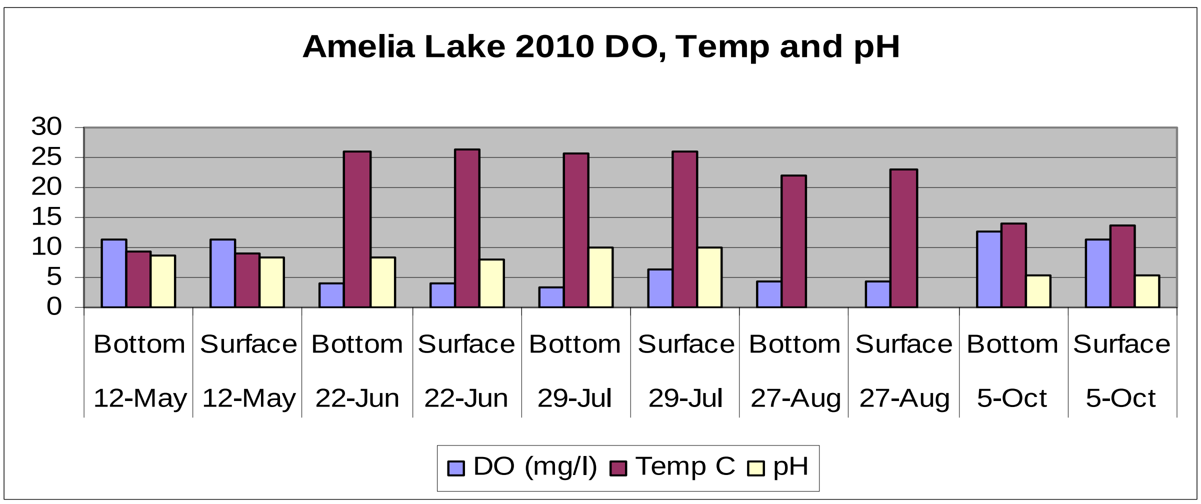
Amelia is located in Anoka County and is approximately 217 acres. Maximum depth for the lake is 3 feet. The majority of agricultural land left in the watershed is near Amelia Lake. Paul Peterson was kind enough to be our volunteer lake sampler for a second year on Amelia. Floating bogs at our access point made accessing the lake a bit difficult, but all samples for the year were collected. VLAWMO staff was also able to collect all DO and YSI parameter reading on Amelia.

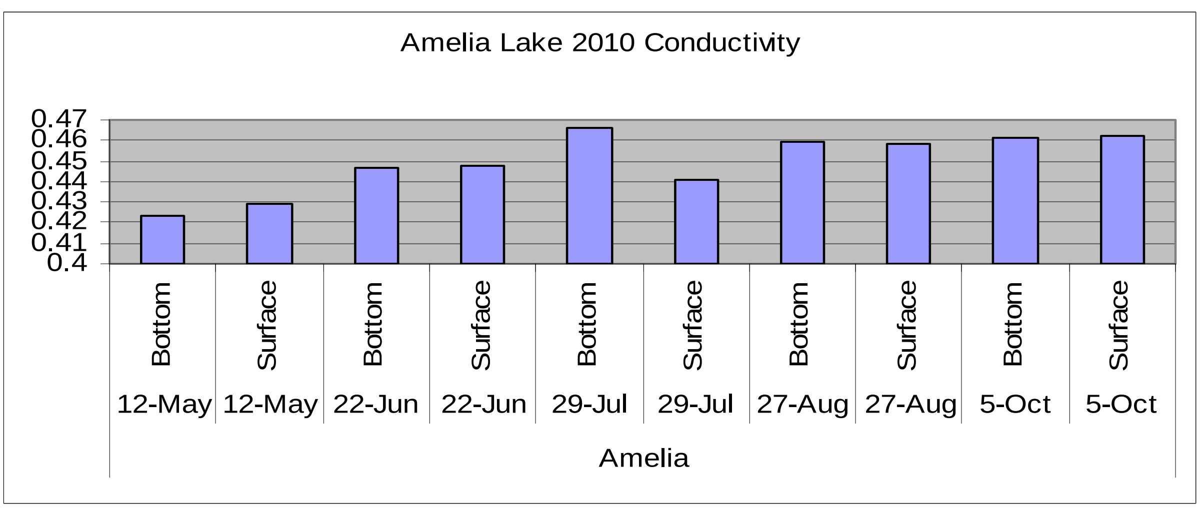
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	3.0'	0.030	3.20	0.80	2.70	1.41	0.022	0.01
5/17/2010	3	0.048	35.10	13.30	26.40			
6/7/2010	3	0.043	7.80	0.90	7.00	1.84	0.02	0.01
6/21/2010	3.5	0.026	21.30	2.80	19.10			
7/12/2010	3	0.030	5.89	1.84	4.69	1.43	0.02	0.01
7/26/2010	3	0.026	4.62	2.47	3.07			
8/9/2010	3	0.032	2.97	0.92	2.35	2.14	0.02	0.01
8/23/2010	3	0.042	23.02	3.30	20.41			
9/14/2010	3	0.023	6.83	2.59	5.08	1.74	0.02	0.01
9/28/2010	3	0.023	9.50	6.20	5.69			
avg	**3.056**	**0.032**	**12.022**	**3.514**	**9.650**	**1.712**	**0.020**	**0.010**



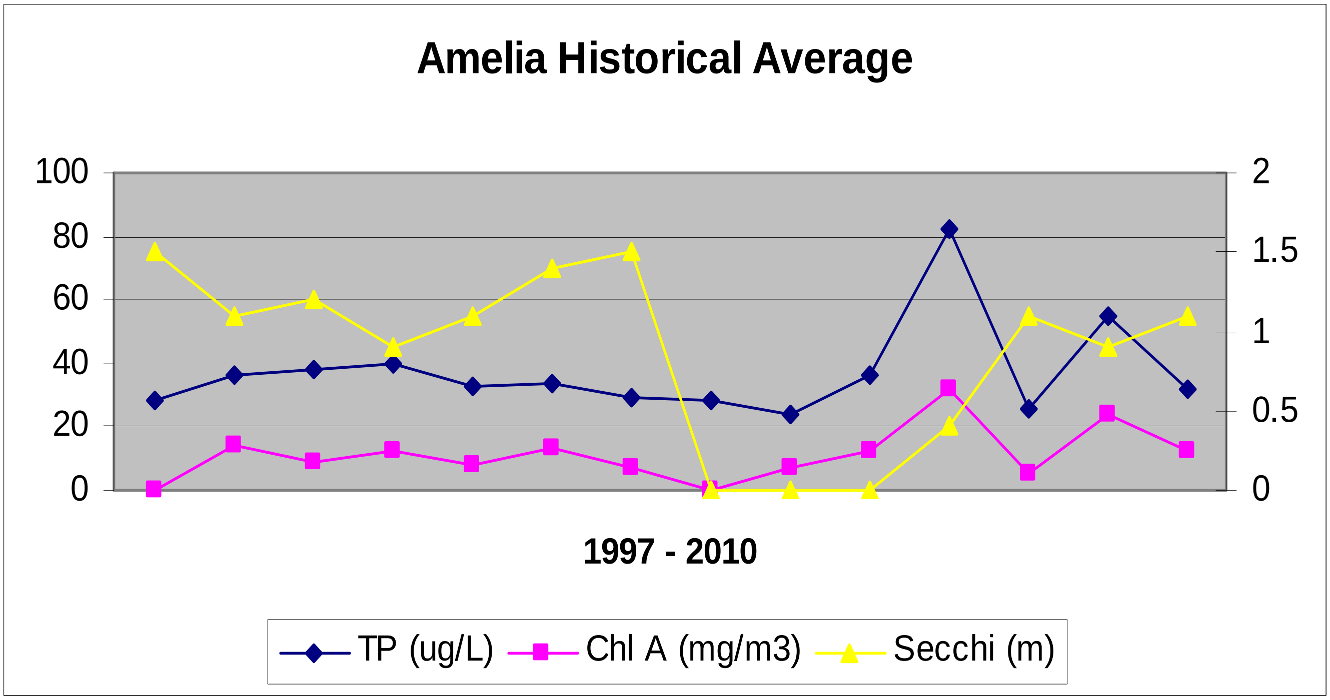


Date	reading location	DO (mg/l)	Temp (C)	pH	conductivity
12-May	Bottom	11.45	9.33	8.66	0.423
12-May	Surface	11.22	8.99	8.5	0.429
22-Jun	Bottom	4.05	25.9	8.3	0.447
22-Jun	Surface	4.02	26.27	8.12	0.448
29-Jul	Bottom	3.35	25.7	9.85	0.466
29-Jul	Surface	6.46	26	10.13	0.441
27-Aug	Bottom	4.36	22.12		0.459
27-Aug	Surface	4.48	23.01		0.458
5-Oct	Bottom	12.7	13.86	5.33	0.461
5-Oct	Surface	11.22	13.55	5.27	0.462





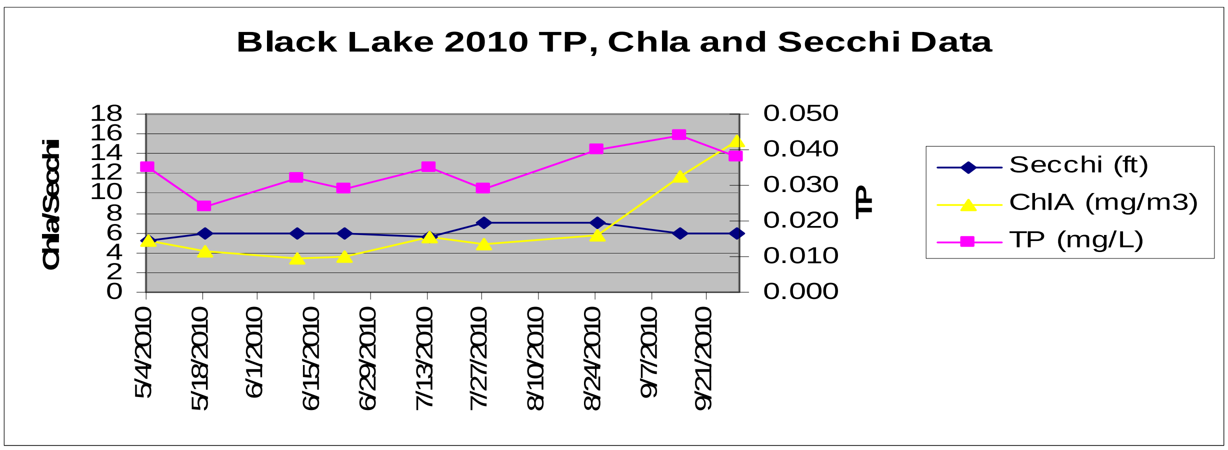
Amelia Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	28		1.5
1998	36	14	1.1
1999	38	9	1.2
2000	40	12	0.9
2001	33	8	1.1
2002	34	13	1.4
2003	29	7	1.5
2004	28		
2005	24	7	
2006	36	12	
2007	82	32	0.4
2008	26	5	1.1
2009	55	24	0.9
2010	32	12	1.1

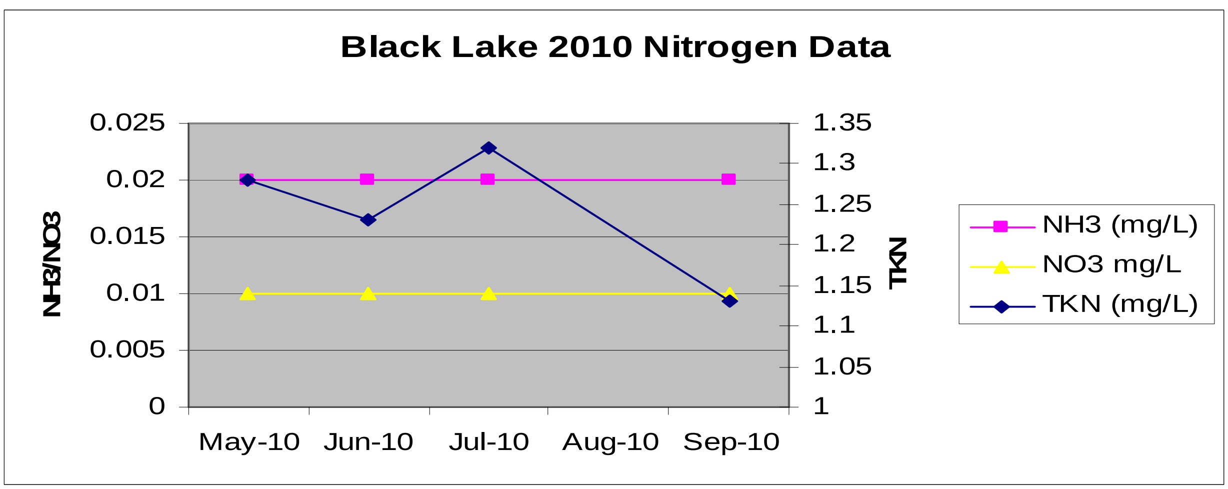


Black Lake

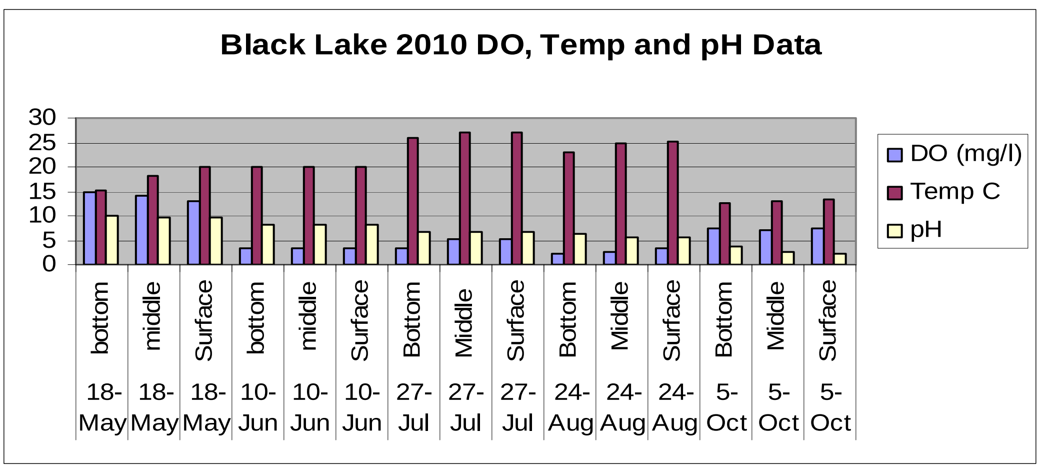
Black Lake is located in North Oaks. There is very little developed land or roads around the lake. The lake is about 10 acres and has a maximum depth of 8 feet. VLAWMO began to monitor Black Lake in 2009 with the assistance of the SWAG grant. The grant was for one year, but we have continued to monitor the lake. Black Lake is also one of, if not the only lake left within VLAWMO that has a significant population of wild rice. Access to the lake is minimal and the lake is surrounded by private property, is very isolated and has a wetland fringe.

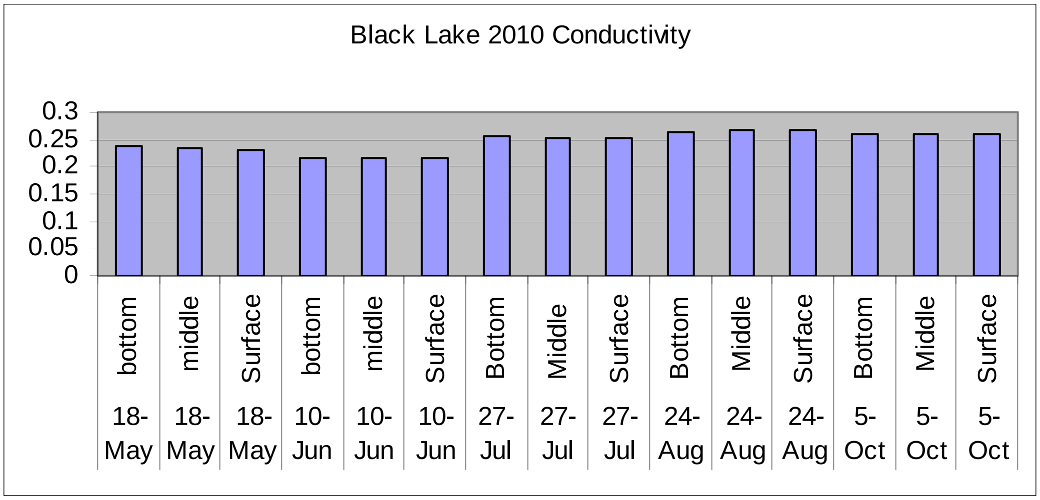
DATE	Secchi (ft)	TP (mg/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	5.25	0.035	5.30	0.90	4.60	1.28	0.02	0.01
5/18/2010	6	0.024	4.20	0.40	3.80			
6/10/2010	6	0.032	3.50	0.20	3.30	1.23	0.02	0.01
6/22/2010	6	0.029	3.60	0.40	3.30			
7/13/2010	5.5	0.035	5.60	1.58	4.50	1.32	0.02	
7/27/2010	7	0.029	4.88	1.10	4.06			
8/24/2010	7	0.040	5.77	1.11	4.96			
9/14/2010	6	0.044	11.68	1.58	10.34	1.13	0.02	0.01
9/28/2010	6	0.038	15.30	1.77	13.70			
avg	6.083	0.034	6.647	1.005	5.841	1.240	0.020	0.010





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
18-May	bottom	14.72	15.33	9.93	0.239
18-May	middle	14.14	18.24	9.61	0.234
18-May	Surface	12.82	19.9	9.53	0.23
10-Jun	bottom	3.44	20.14	8.27	0.217
10-Jun	middle	3.36	20.15	8.27	0.217
10-Jun	Surface	3.33	20.16	8.28	0.217
27-Jul	Bottom	3.45	26.03	6.8	0.256
27-Jul	Middle	5.02	26.86	6.71	0.252
27-Jul	Surface	5.13	26.96	6.66	0.252
24-Aug	Bottom	2.04	23.04	6.39	0.265
24-Aug	Middle	2.54	24.88	5.68	0.266
24-Aug	Surface	3.19	25.03	5.68	0.267
5-Oct	Bottom	7.55	12.71	3.85	0.26
5-Oct	Middle	7.19	12.78	2.45	0.259
5-Oct	Surface	7.36	13.47	2.15	0.259





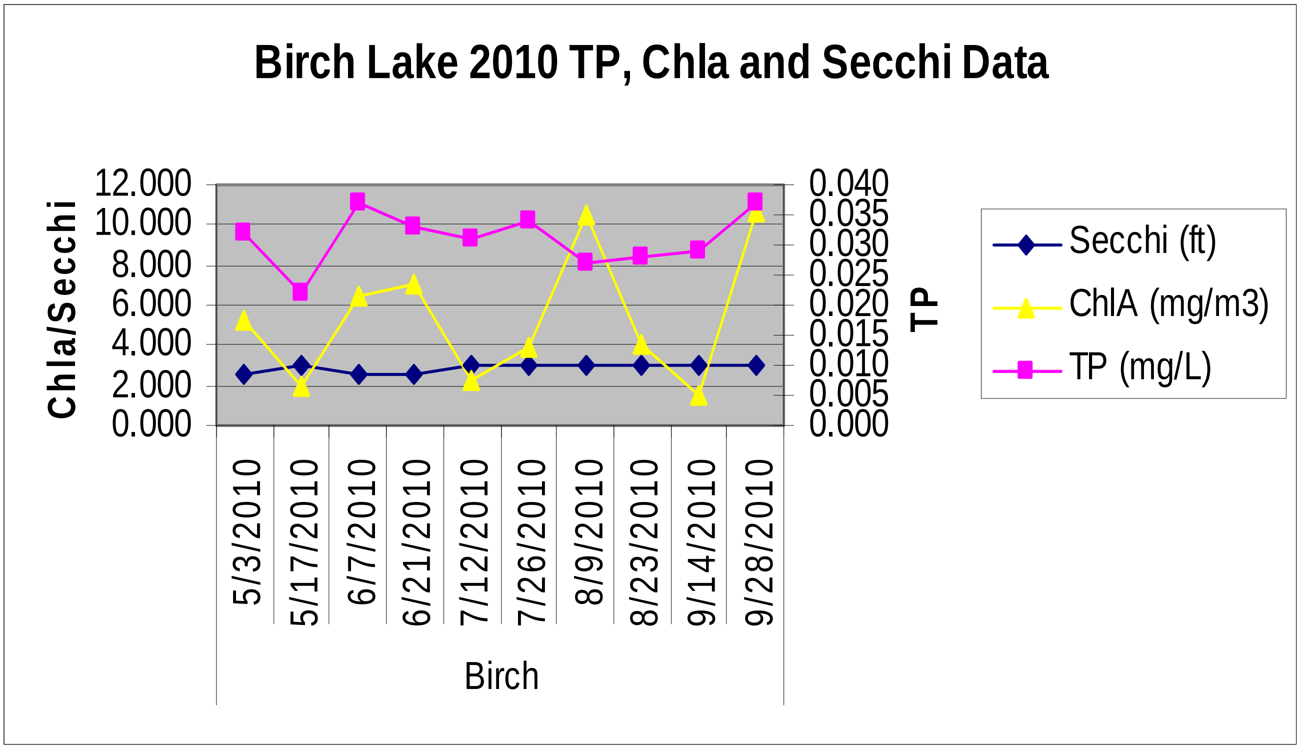
Black Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
2009	23	5.9	2
2010	34	6.6	2.1

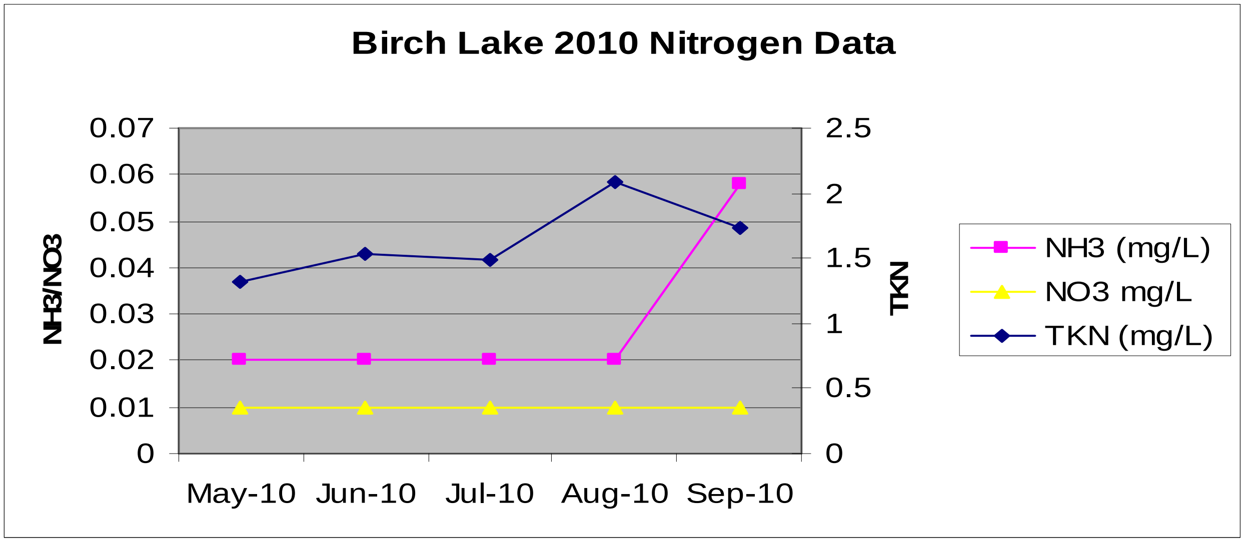
Birch Lake

Birch Lake is located within the City of White Bear Lake and is 127 acres with a maximum depth of 6 feet. Land is completely developed around Birch Lake and there are 4 storm sewer inlets around the lake. Birch Lake is a rare find in the metropolitan area because of its clarity. Secchi disks are continuously visible at the bottom of the lake. Results of Chl A and TP are very low for such an urbanized water body. Secchi disk readings are lower again this year due to the lower water level in the lake, however you can still see to the bottom. VLAWMO did not monitor the culverts draining into Birch Lake this year. Culverts were monitored on Wilkinson lake instead.

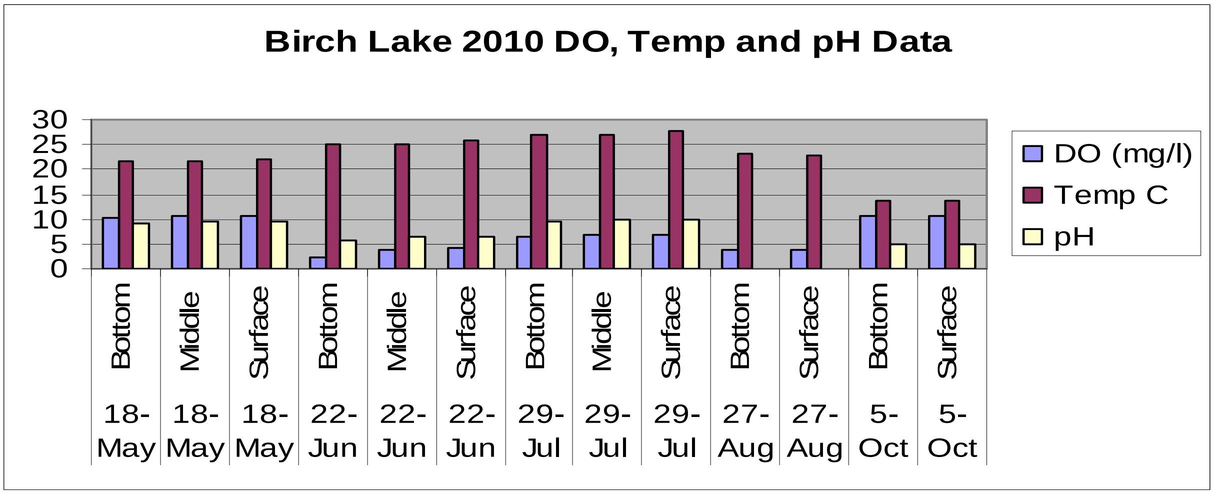
Birch Lake water level has stayed low this year even with the high precipitation. Again water quality on Birch is very good.

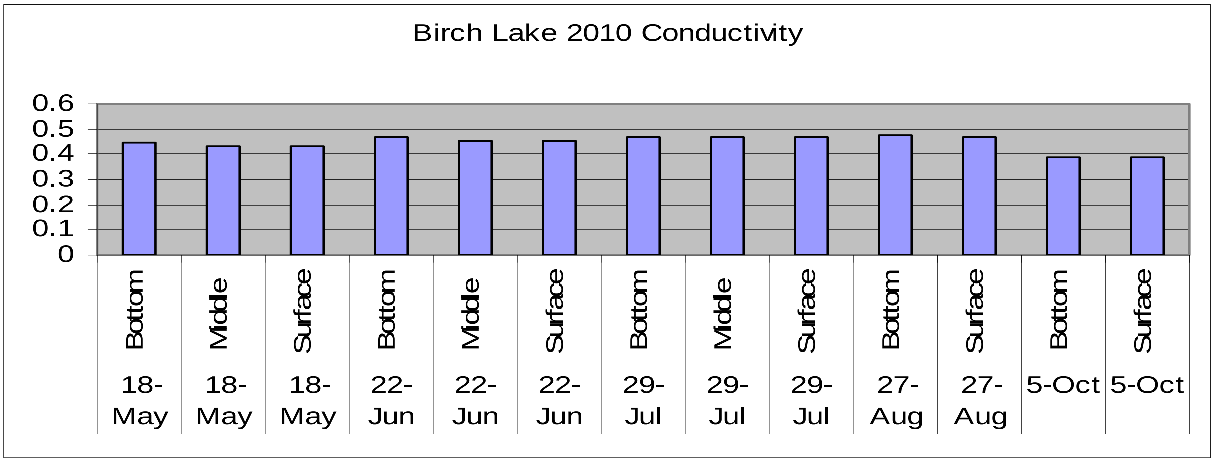
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/3/2010	2.500	0.032	5.300	1.200	4.400	1.320	0.020	0.010
5/17/2010	3.000	0.022	2.000	0.200	1.900			
6/7/2010	2.500	0.037	6.400	0.800	5.800	1.530	0.020	0.010
6/21/2010	2.500	0.033	7.100	0.900	6.400			
7/12/2010	3.000	0.031	2.321	0.937	1.716	1.490	0.020	0.010
7/26/2010	3.000	0.034	3.904	0.679	3.468			
8/9/2010	3.000	0.027	10.538	1.508	9.359	2.080	0.020	0.010
8/23/2010	3.000	0.028	3.979	0.308	3.685			
9/14/2010	3.000	0.029	1.479	0.240	1.305	1.740	0.058	0.010
9/28/2010	3.000	0.037	10.588	3.017	8.532			
avg		0.031	5.368	0.954	4.685	1.710	0.030	0.010



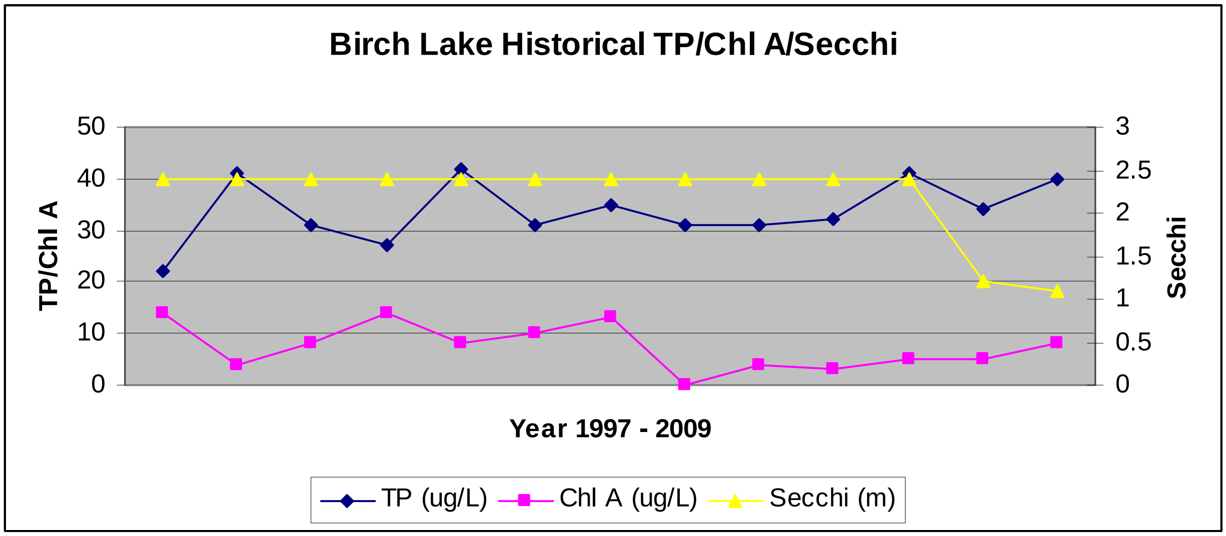


Date	reading location	DO (mg/l)	Temp C	pH	conductivity
18-May	Bottom	10.35	21.49	9.26	0.444
18-May	Middle	10.59	21.81	9.5	0.434
18-May	Surface	10.48	21.89	9.52	0.433
22-Jun	Bottom	2.18	24.88	5.75	0.468
22-Jun	Middle	3.95	25.2	6.44	0.455
22-Jun	Surface	4.01	25.87	6.46	0.455
29-Jul	Bottom	6.36	26.89	9.51	0.468
29-Jul	Middle	6.92	27.09	9.83	0.468
29-Jul	Surface	6.79	27.55	9.81	0.468
27-Aug	Bottom	3.64	23.07		0.478
27-Aug	Surface	3.91	22.96		0.468
5-Oct	Bottom	10.51	13.59	4.97	0.389
5-Oct	Surface	10.5	13.5	4.99	0.39





Birch Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	22	14	2.4
1998	41	4	2.4
1999	31	8	2.4
2000	27	14	2.4
2001	42	8	2.4
2002	31	10	2.4
2003	35	13	2.4
2004	31	0	2.4
2005	31	4	2.4
2006	32	3	2.4
2007	41	5	2.4
2008	34	5	1.2
2009	40	8	1.1
2010	31	5	1



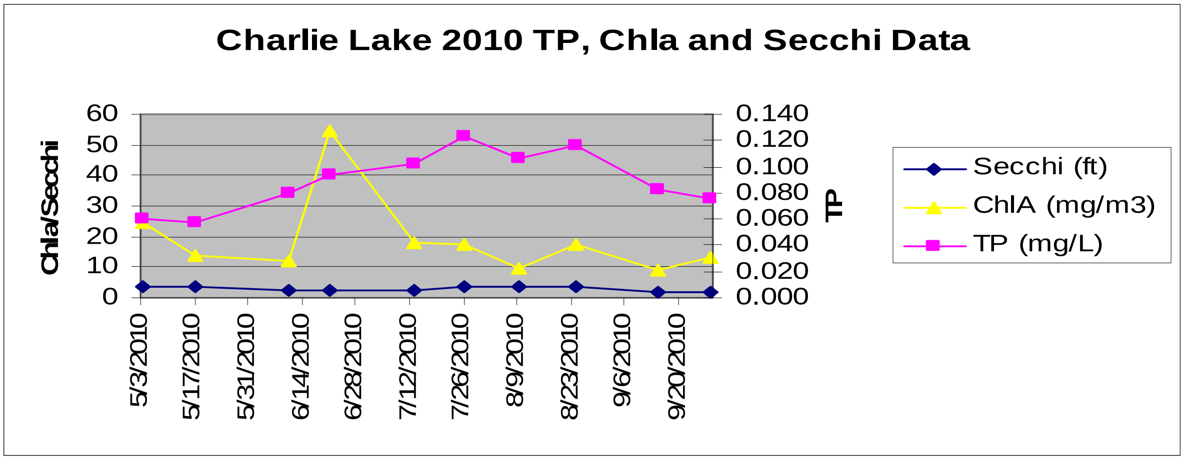
* The Dramatic drop in Secchi the last two yrs. is due to water level, you can still see clearly to the bottom of the lake.

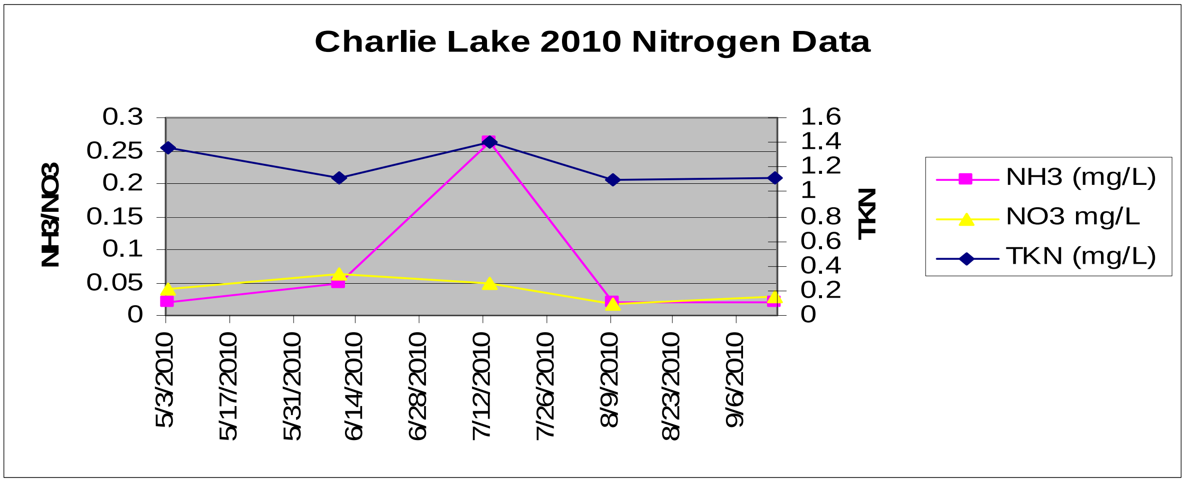
Charlie Lake

Water is pumped from the Mississippi River to Charlie Lake via a 60 inch 8 mile long pipe from a pumping station in Fridley. An average of 32 million gallons of water is pumped into Charley Lake each day. Charley Lake is the start of the chain of lakes controlled by the St. Paul Water Utility. This chain of lakes supplies drinking water for more than 400,000 customers. As of 2009, all the water is still coming from the Mississippi River.

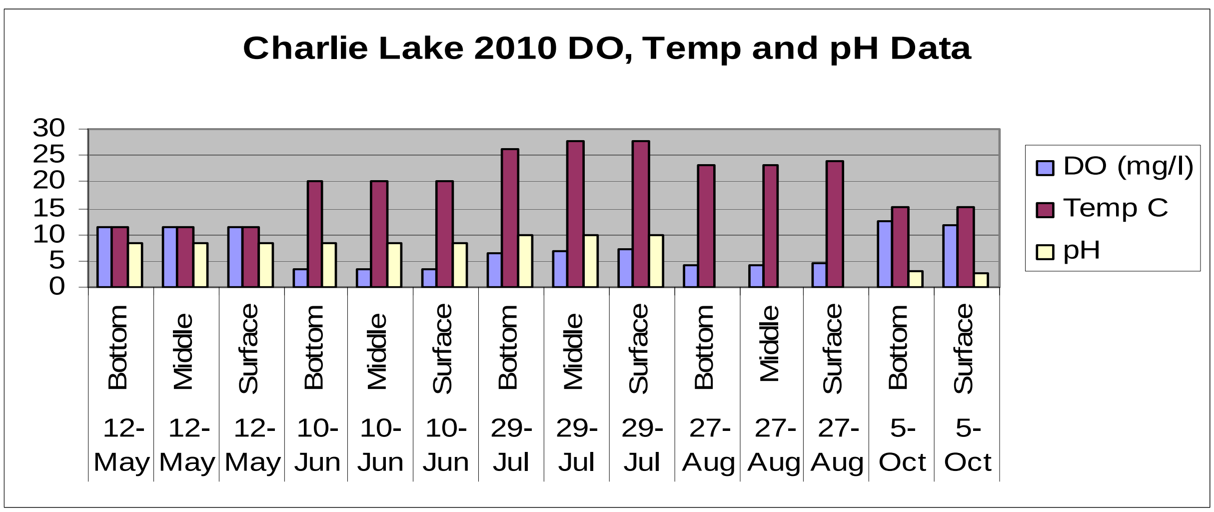
VLAWMO began to monitor Charley Lake in 2009.

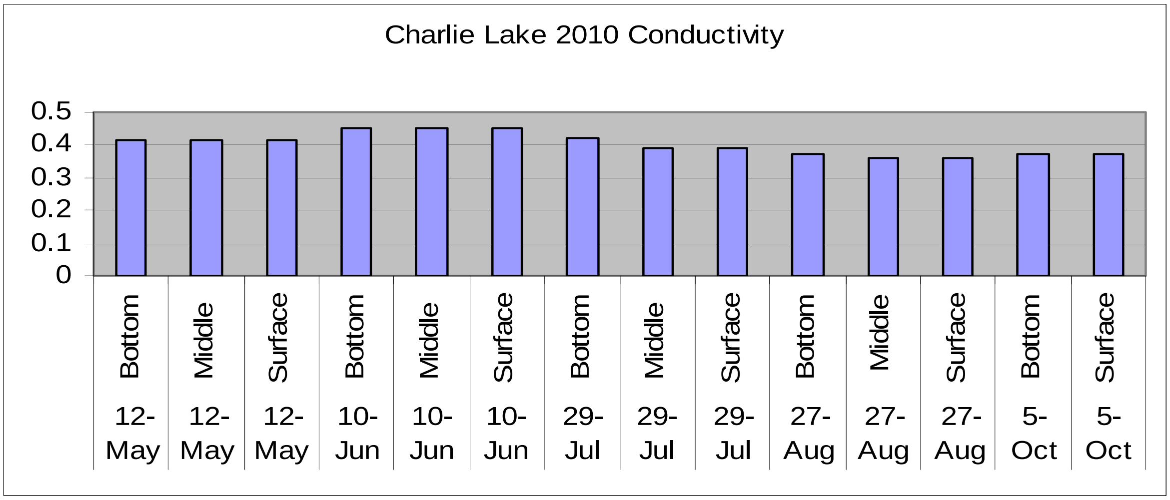
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/3/2010	3.5	0.060	24.40	3.10	21.70	1.35	0.02	0.0394
5/17/2010	3.5	0.057	13.70	2.20	12.00			
6/10/2010	2.5	0.080	11.90	5.20	8.40	1.12	0.050	0.0629
6/21/2010	2.5	0.094	54.80	6.20	49.30			
7/13/2010	2.5	0.102	18.07	10.55	11.41	1.40	0.263	0.0475
7/26/2010	3.5	0.123	17.13	4.70	13.80			
8/9/2010	3.5	0.107	9.75	2.68	7.86	1.10	0.02	0.0163
8/24/2010	3.5	0.116	17.15	3.83	14.35			
9/14/2010	2	0.082	8.93	1.93	7.45	1.12	0.02	0.0288
9/28/2010	2	0.076	13.17	1.66	11.71			
avg	2.900	0.090	18.900	4.206	15.799	1.218	0.075	0.039





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
12-May	Bottom	11.27	11.33	8.46	0.414
12-May	Middle	11.38	11.32	8.46	0.412
12-May	Surface	11.47	11.36	8.47	0.412
10-Jun	Bottom	3.35	20.23	8.25	0.45
10-Jun	Middle	3.28	20.26	8.31	0.449
10-Jun	Surface	3.25	20.26	8.31	0.449
29-Jul	Bottom	6.36	26.25	9.86	0.422
29-Jul	Middle	6.97	27.77	10.05	0.389
29-Jul	Surface	7.29	27.82	9.95	0.389
27-Aug	Bottom	4.16	23.08		0.375
27-Aug	Middle	4.24	23.08		0.362
27-Aug	Surface	4.57	23.84		0.361
5-Oct	Bottom	12.52	15.17	2.89	0.375
5-Oct	Surface	11.8	15.15	2.8	0.375





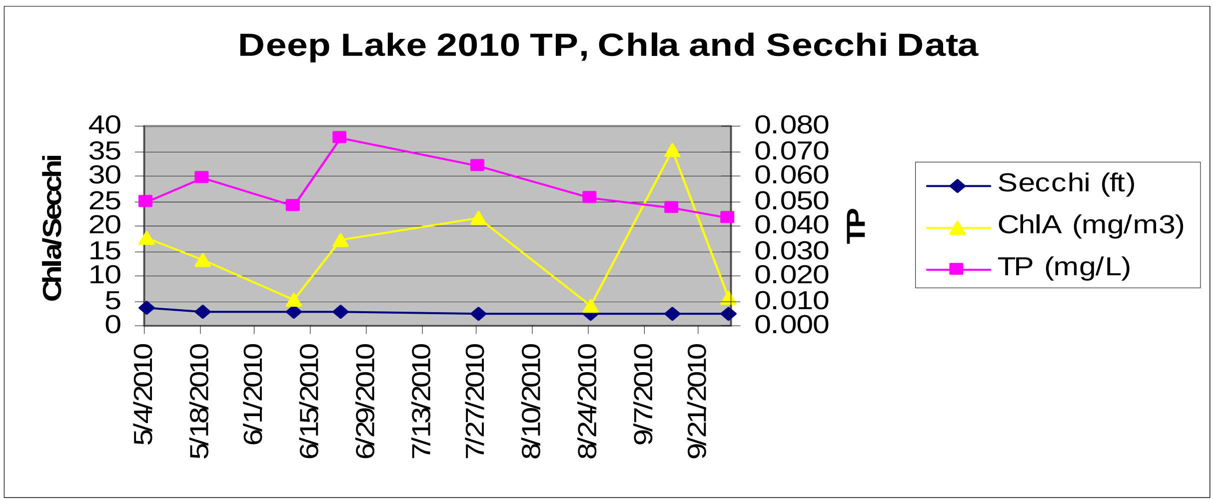
Charlie Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
2009	39	18	1
2010	90	18.9	1

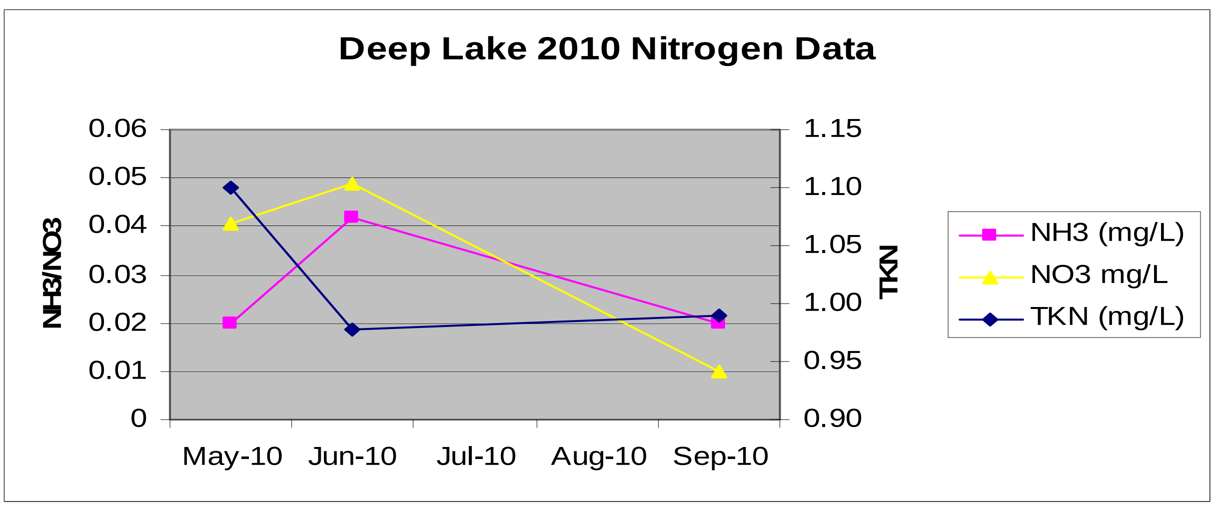
Deep Lake

Deep lake is a little over 80 acres and sits between and is hydrologically connected to Wilkinson Lake to the north and Pleasant Lake to the south. A canal connects the three lakes. A Deep Lake Preservation Committee was formed in 2009 by the residents living around Deep Lake to help maintain and improve the quality of the lake. A lake level gauge was also installed by VLAWMO on the lake.

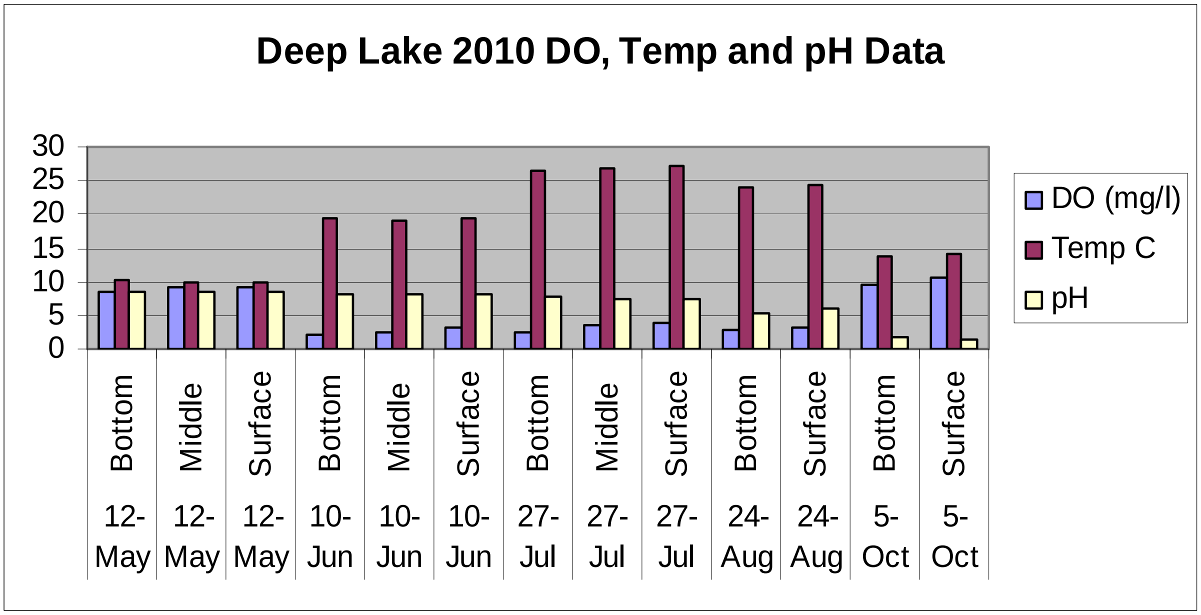
VLAWMO began to Monitor Deep Lake in 2009.

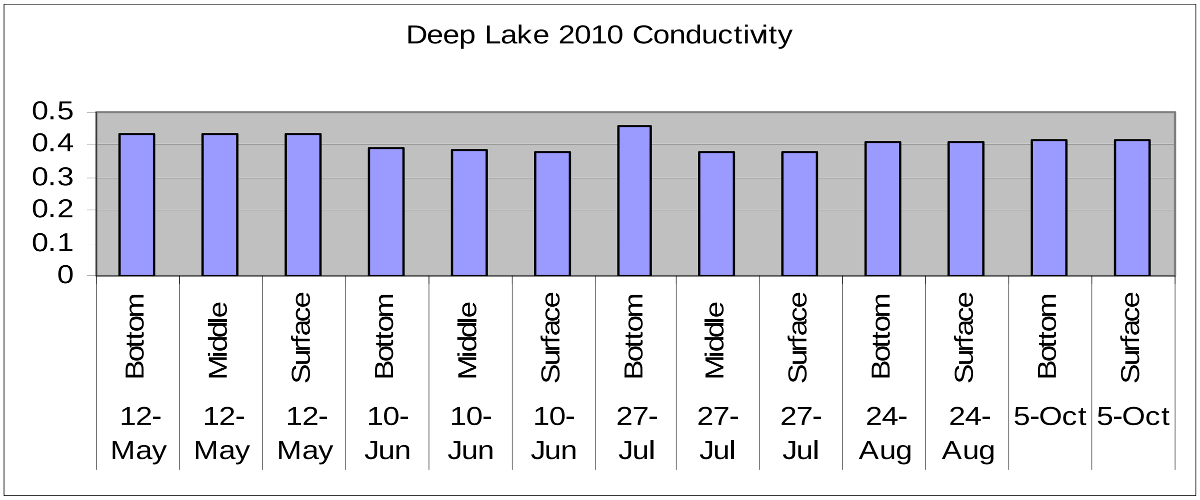
DATE	Secchi (ft)	TP (ug/L) *	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	3.75	0.050	17.60	1.90	15.90	1.10	0.02	0.0407
5/18/2010	3	0.059	13.10	1.40	11.80			
6/10/2010	3	0.048	5.40	1.60	4.30	0.977	0.042	0.049
6/22/2010	3	0.075	17.10	2.70	15.00			
7/27/2010	2.5	0.064	21.49	2.84	19.25			
8/24/2010	2.5	0.051	3.83	0.65	3.31			
9/14/2010	2.5	0.047	35.01	7.77	29.48	0.989	0.02	0.01
9/28/2010	2.5	0.043	5.41	0.60	4.84			
avg	2.844	0.055	14.867	2.433	12.984	1.022	0.027	0.033





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
12-May	Bottom	8.51	10.07	8.48	0.433
12-May	Middle	9.35	9.91	8.33	0.431
12-May	Surface	9.32	9.9	8.3	0.431
10-Jun	Bottom	2.1	19.31	8.19	0.388
10-Jun	Middle	2.46	19.22	8.15	0.382
10-Jun	Surface	3.3	19.25	8.25	0.377
27-Jul	Bottom	2.44	26.34	7.59	0.459
27-Jul	Middle	3.51	26.86	7.58	0.379
27-Jul	Surface	3.82	27.15	7.49	0.378
24-Aug	Bottom	2.74	23.96	5.44	0.407
24-Aug	Surface	3.16	24.48	5.86	0.406
5-Oct	Bottom	9.58	13.89	1.71	0.415
5-Oct	Surface	10.45	14.05	1.54	0.416





Deep Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
2009	112	21	1
2010	55	15	0.9

Gem Lake

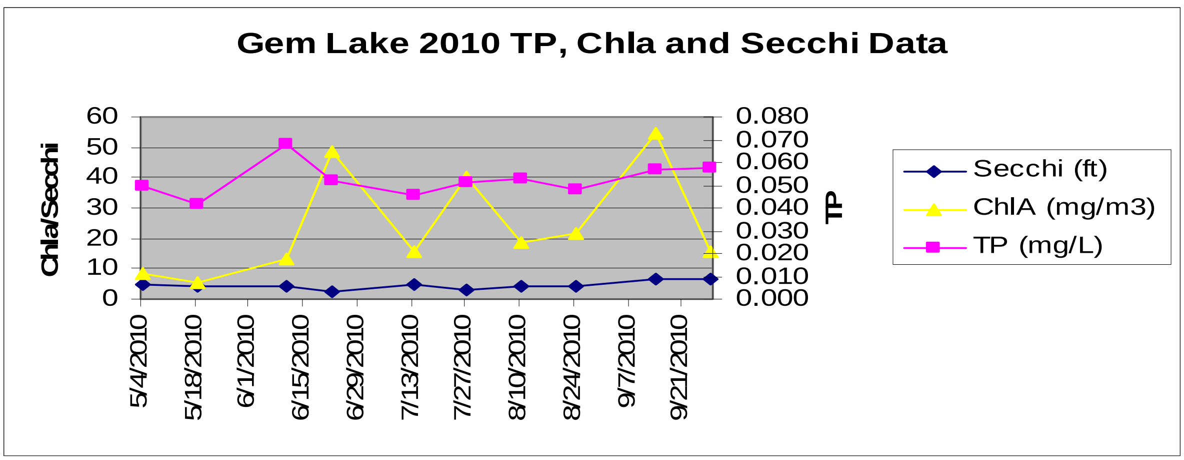
Gem Lake is within the City of Gem Lake and has no public access. It is 25 acres in size and is 17 feet deep. There has been development along portions of the lake in recent years. In 2000, volunteers noticed a distinct algae bloom and noted that water clarity was getting poorer.

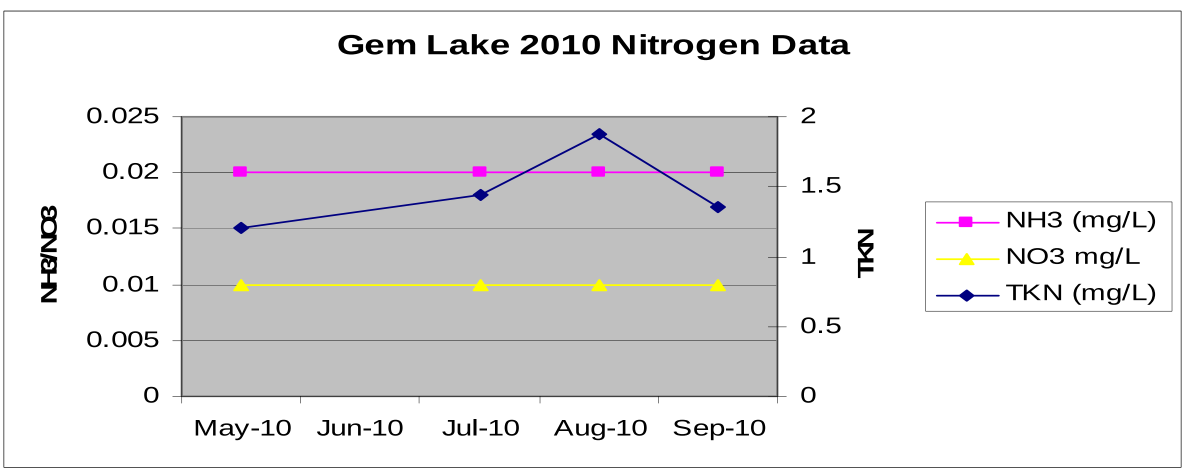
Access to the lake was very good this year. VLAWMO was able to collect all of the readings this monitoring season.

Gem is still having problems with algae blooms during mid summer and may be due to curly leaf pondweed. This weed dies off in mid summer and may be contributing to the algae blooms. An aquatic plant survey was done by VLAWMO Staff this summer and pondweed was present.

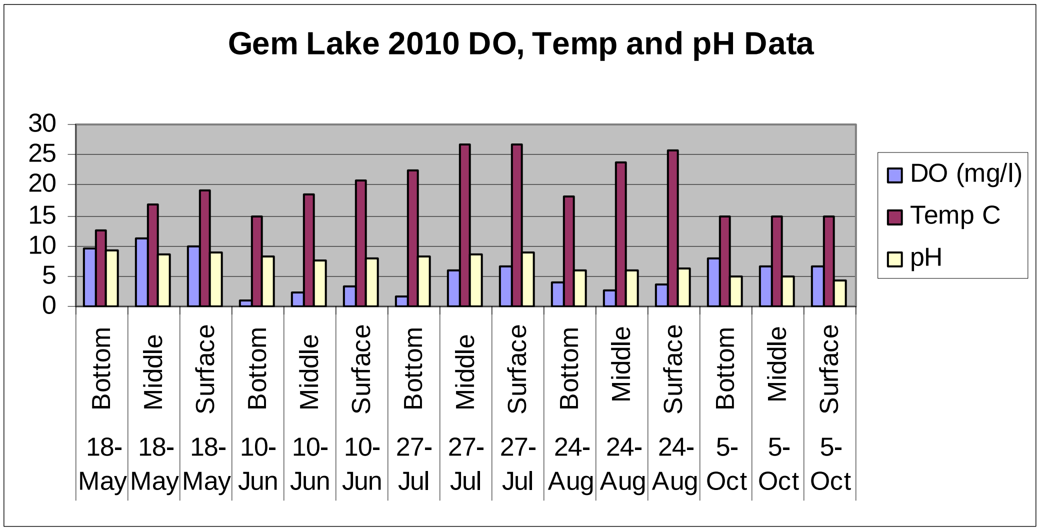
Gem Lake has also been included on the Lambert Creek TMDL plan for nutrient impairment to which began this fall. The City of Gem Lake and VLAWMO are planning a collaborative study on the effect of runoff from eastern Highway 61 drainage area on Gem Lake.

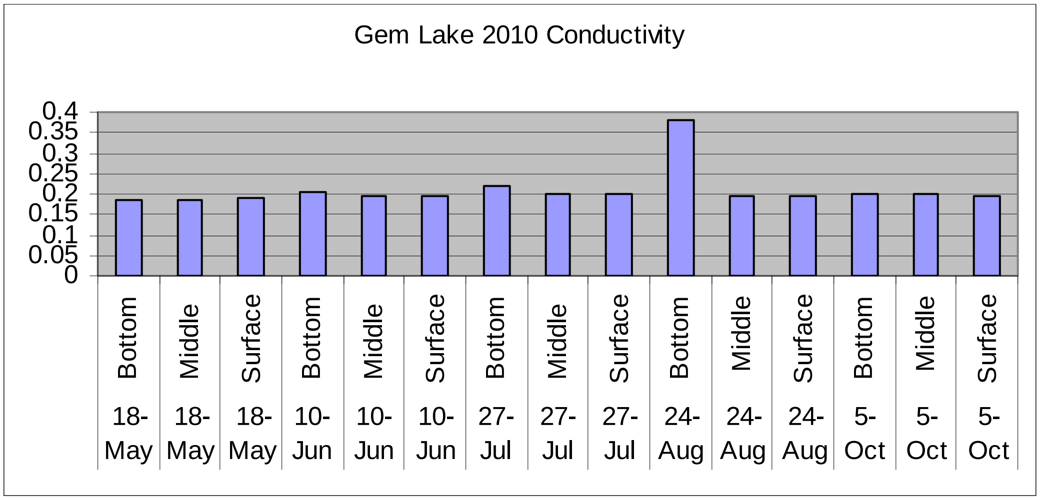
DATE	Secchi (ft)	TP (ug/L) *	ChlA (mg/m3) *	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	5	0.050	8.20	1.00	7.40	1.21	0.02	0.01
5/18/2010	4	0.042	5.30	0.40	5.00			
6/10/2010	4	0.068	13.10	1.40	11.90			0.01
6/22/2010	2.25	0.052	48.90	-1.00	47.60			
7/13/2010	5	0.046	15.84	4.29	12.87	1.44	0.02	0.01
7/27/2010	2.75	0.051	39.92	1.43	37.68			
8/10/2010	4	0.053	18.70	1.56	17.24	1.87	0.02	0.01
8/24/2010	4	0.048	21.32	2.18	19.52			
9/14/2010	6.5	0.057	54.70	12.34	45.85	1.35	0.02	0.01
9/28/2010	6.5	0.058	15.45	3.23	13.13			
avg	4.4	0.052	24.14	2.68	21.81	1.46	0.02	0.01





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
18-May	Bottom	9.6	12.47	9.14	0.185
18-May	Middle	11.34	16.69	8.73	0.186
18-May	Surface	9.95	19.12	8.79	0.188
10-Jun	Bottom	1.1	14.69	8.3	0.203
10-Jun	Middle	2.45	18.45	7.71	0.194
10-Jun	Surface	3.39	20.88	7.75	0.193
27-Jul	Bottom	1.65	22.45	8.17	0.22
27-Jul	Middle	5.94	26.77	8.45	0.199
27-Jul	Surface	6.55	26.81	8.8	0.2
24-Aug	Bottom	3.97	18.15	5.94	0.379
24-Aug	Middle	2.8	23.59	6.04	0.195
24-Aug	Surface	3.49	25.78	6.34	0.194
5-Oct	Bottom	7.84	14.69	4.98	0.198
5-Oct	Middle	6.7	14.74	4.82	0.198
5-Oct	Surface	6.64	14.77	4.36	0.197





Gem Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	54	23	1.2
1998	33	24	
1999	26	16	1.2
2000	36	17	1.1
2001	56	12	1.8
2002	39	25	1.3
2003	52	20	1.4
2004	49	0	1.5
2005	43	26	0
2006	63	25	0
2007	48	33	1.1
2008	64	17	1.5
2009	89	28	1.3
2010	53	24	1.4

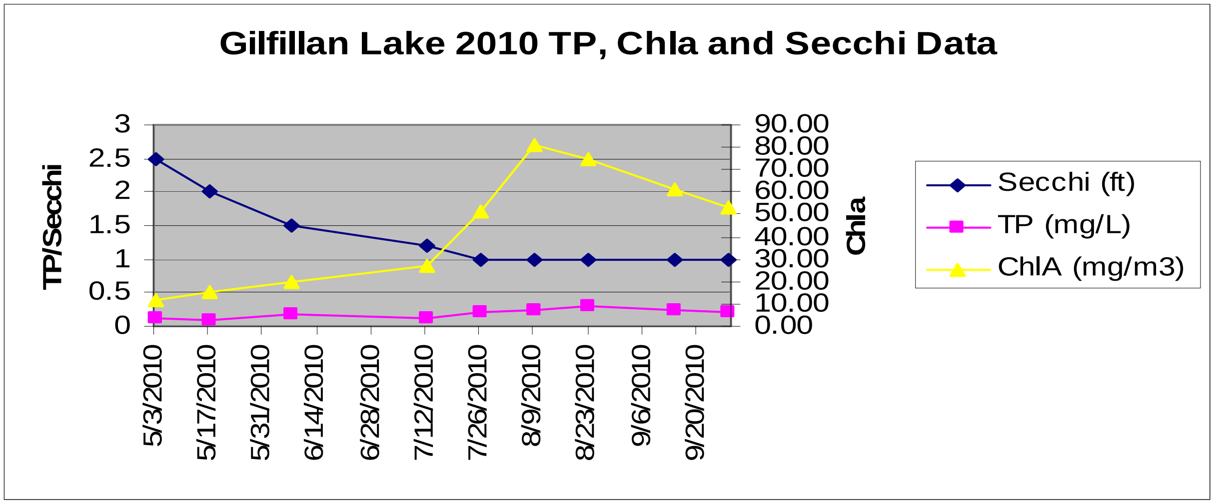
Gilfillan Lake

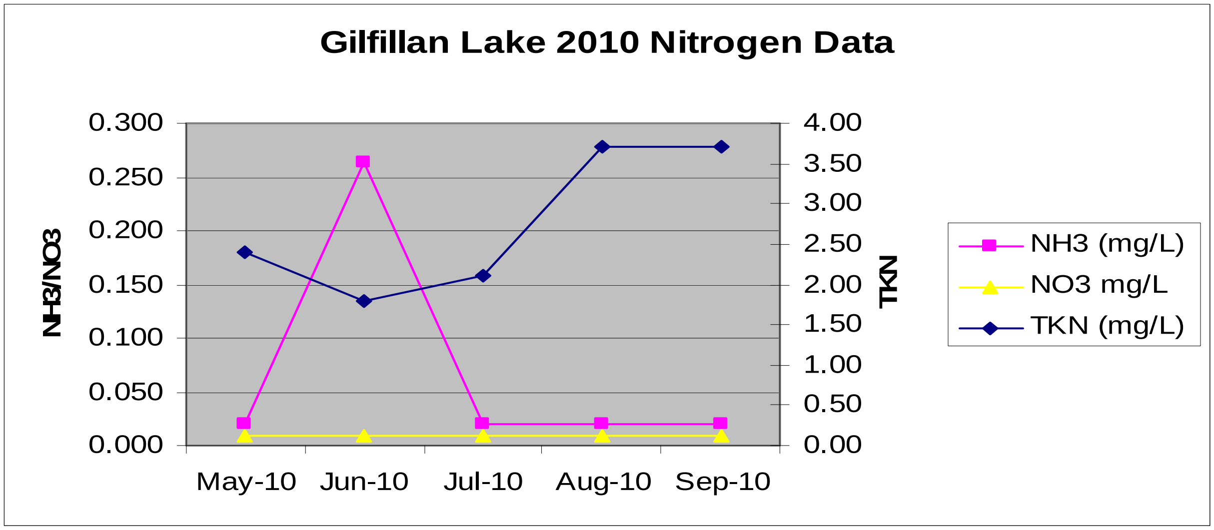
Gilfillan Lake is located within the City of North Oaks and is surrounded by homes. It is 110 acres with a maximum depth of 6 feet. The volunteers that have been collecting samples since 1998 said there does not seem to be a change in its quality. They said it has always been a light brown color, with no odor.

The Minnesota Department of Natural Resources has used the lake for walleye stocking and has been successful in the past. According to available information, there has not been any fish stocking activity for a few years.

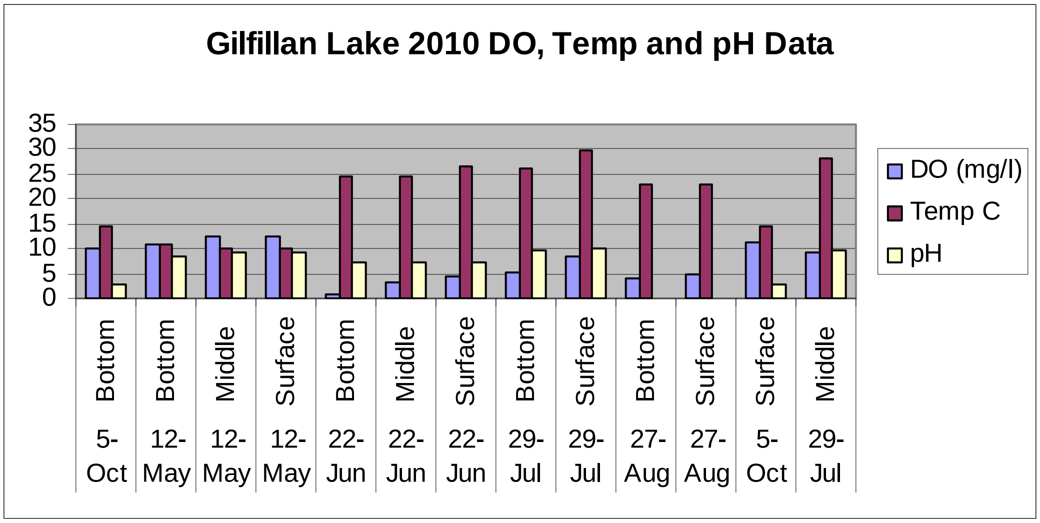
Gilfillan is one of four VLAWMO lakes that are part of the TMDL study due to nutrient imparment. The sudy began fall of 2010. Low lake level is still a hot topic on Gilfillan, the lake association has been putting a lot of time and energy into finding possible solutions to this problem. Gilfillan storm pond was not monitored again this year because of lack of water.

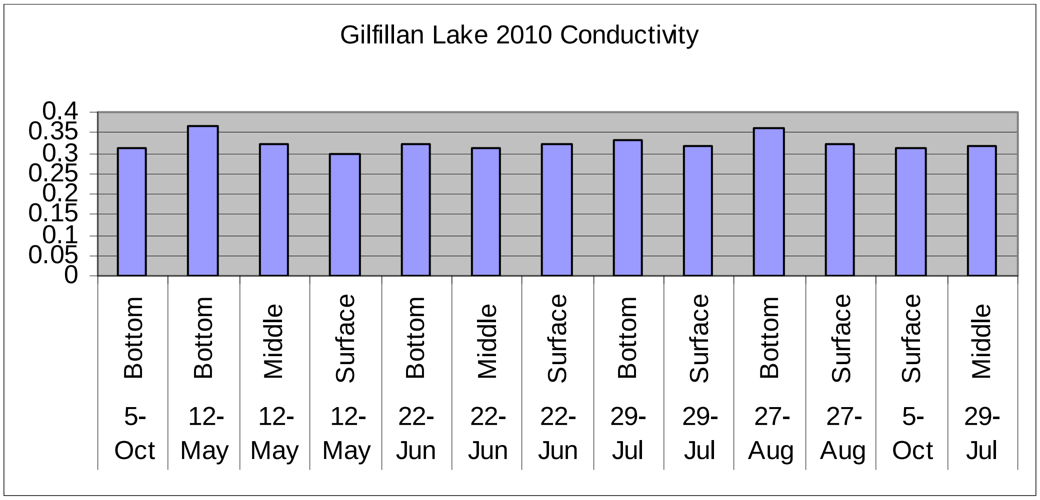
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/3/2010	2.5	0.129	11.40	-1.70	12.20	2.39	0.020	0.01
5/17/2010	2	0.093	15.20	0.80	14.20			
6/7/2010	1.5	0.177	19.70	6.80	15.20	1.79	0.264	0.01
7/12/2010	1.2	0.129	26.57	3.33	23.69	2.10	0.02	0.01
7/26/2010	1	0.219	51.46	6.04	46.09			
8/9/2010	1	0.237	80.83	13.25	71.26	3.70	0.02	0.01
8/23/2010	1	0.289	74.27	7.94	66.93			
9/14/2010	1	0.238	61.35	13.17	51.36	3.72	0.02	0.01
9/28/2010	1	0.216	53.33	7.35	46.87			
avg	1.356	0.192	43.791	6.331	38.644	2.740	0.069	0.010





Date	reading location	DO (mg/l)	Temp C	pH	Cond.
5-Oct	Bottom	10.08	14.39	2.83	0.312
12-May	Bottom	10.82	10.77	8.31	0.364
12-May	Middle	12.48	10.01	9.1	0.321
12-May	Surface	12.63	9.96	9.12	0.3
22-Jun	Bottom	0.95	24.68	7.38	0.32
22-Jun	Middle	3.41	24.41	7.24	0.314
22-Jun	Surface	4.4	26.73	7.07	0.324
29-Jul	Bottom	5.28	26.35	9.69	0.333
29-Jul	Surface	8.48	29.61	10.12	0.315
27-Aug	Bottom	4.06	22.89		0.361
27-Aug	Surface	4.75	22.99		0.322
5-Oct	Surface	11.45	14.56	2.86	0.312
29-Jul	Middle	9.15	28.1	9.53	0.315





Gilfillan Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	96	32	0.5
1998	47	44	0.5
1999	72	23	0
2000	35	47	0
2001	84	20	0
2002	81	43	0.4
2003	44	25	1.4
2004	58	0	0
2005	52	8	0
2006	91	19	0
2007	100	33	0.7
2008	96	31	0.5
2009	152	44	0.4
2010	192	44	0.4

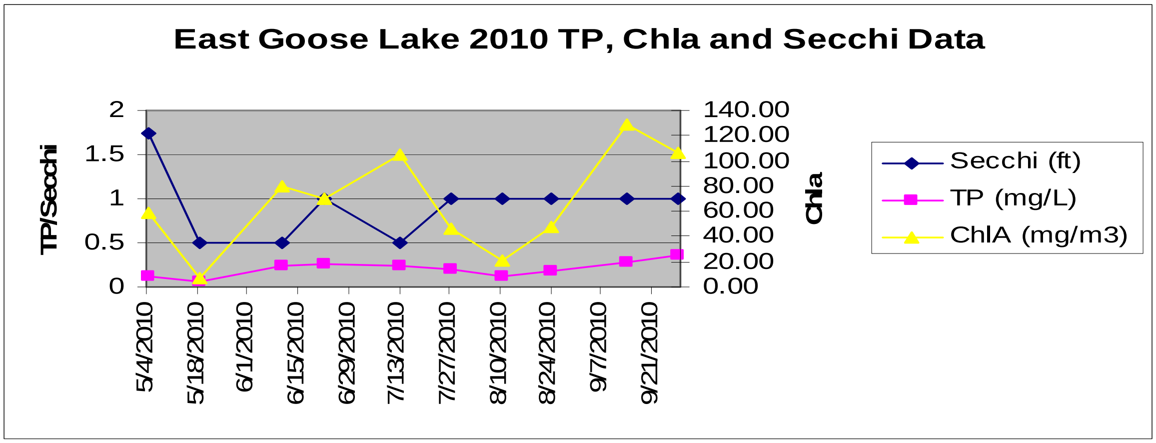
Goose Lake

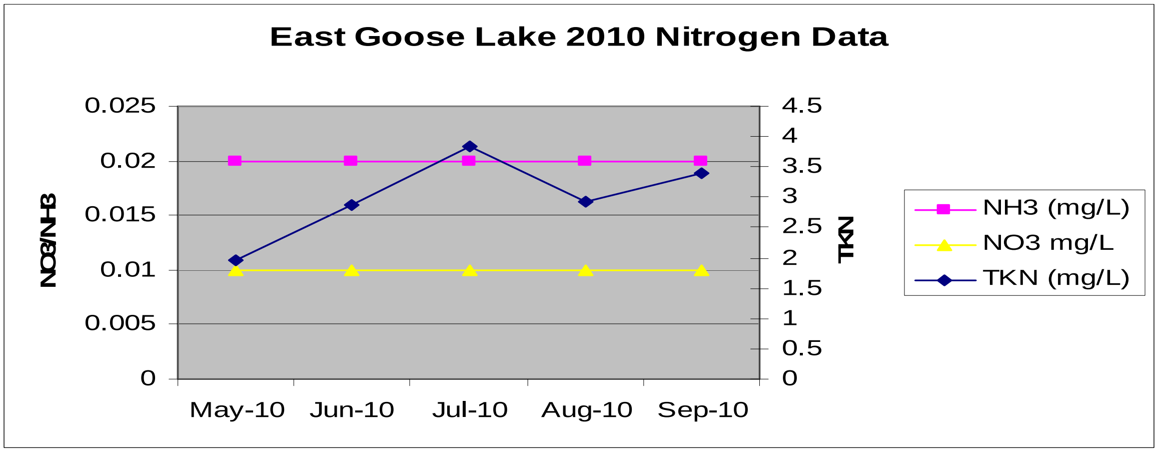
Goose Lake is located in White Bear Lake and is 145 acres with a maximum depth of 6 feet. The land use is largely residential and industrial around the lake and Highway 61 cuts through the lake. The old White Bear Lake sewage treatment plant discharged to Goose Lake for almost 50 years. A sediment study conducted in 1989 found that there was PCB contamination as well as high levels of cadmium, lead, and zinc. Another sediment study should be conducted to look for any changes in the last 20 years.

Though the lake is connected via culverts under the highway, VLAWMO began to assess the lake on each side of the road to track any differences between the two water bodies. In years past, only the east side of the lake was monitored. In 2006, VLAWMO began to collect samples from the west side. Thus, the report now has two designations of Goose Lake East and Goose Lake West with separate data.

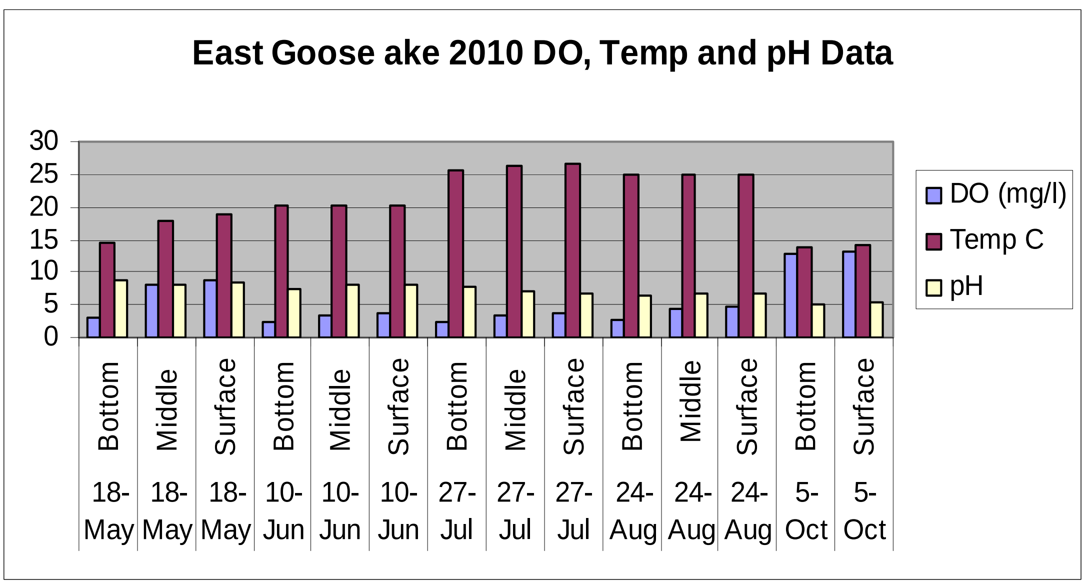
Both East and West Goose Lake are included in the Lambert Creek TMDL for nutrient impairment. VLAWMO staff with the help of Wenck Environmental Engineering Inc. took six sediment cores on West goose to study for internal phosphorus loading. Results will be in the TMDL study.

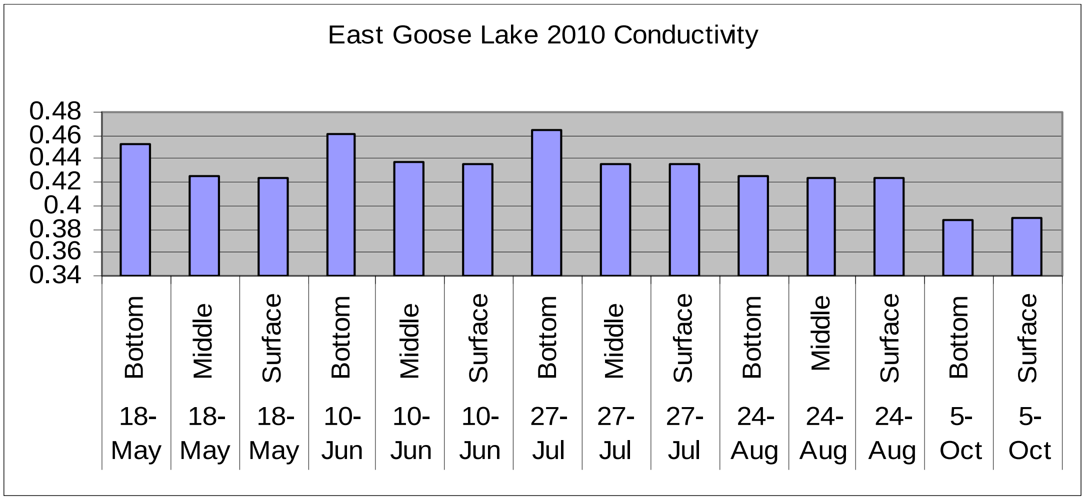
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	1.75	0.128	58.30	11.40	49.60	1.96	0.02	0.01
7/13/2010	0.5	0.245	104.76	9.28	95.12	3.84	0.02	0.01
5/18/2010	0.5	0.054	6.40	0.80	5.70			
6/10/2010	0.5	0.238	80.20	14.40	69.10	2.87	0.02	0.01
6/22/2010	1	0.253	70.20	5.10	64.50			
7/27/2010	1	0.206	45.84	3.86	41.78			
8/10/2010	1	0.130	21.54	2.70	19.10	2.92	0.02	0.01
8/24/2010	1	0.173	47.75	1.20	45.13			
9/14/2010	1	0.287	128.87	7.63	119.22	3.40	0.02	0.01
9/28/2010	1	0.357	106.06	4.06	99.28			
avg	0.833	0.207	66.993	6.044	60.852	2.998	0.020	0.010





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
18-May	Bottom	3.09	14.41	8.64	0.452
18-May	Middle	8.25	17.86	8.19	0.426
18-May	Surface	8.73	18.85	8.35	0.424
10-Jun	Bottom	2.38	20.17	7.56	0.461
10-Jun	Middle	3.35	20.23	7.93	0.437
10-Jun	Surface	3.77	20.31	8.14	0.436
27-Jul	Bottom	2.44	25.61	7.67	0.465
27-Jul	Middle	3.51	26.42	7.01	0.435
27-Jul	Surface	3.82	26.57	6.85	0.435
24-Aug	Bottom	2.78	24.9	6.25	0.426
24-Aug	Middle	4.5	24.96	6.65	0.424
24-Aug	Surface	4.74	24.93	6.65	0.424
5-Oct	Bottom	12.71	13.98	4.89	0.388
5-Oct	Surface	13.09	14.2	5.42	0.389





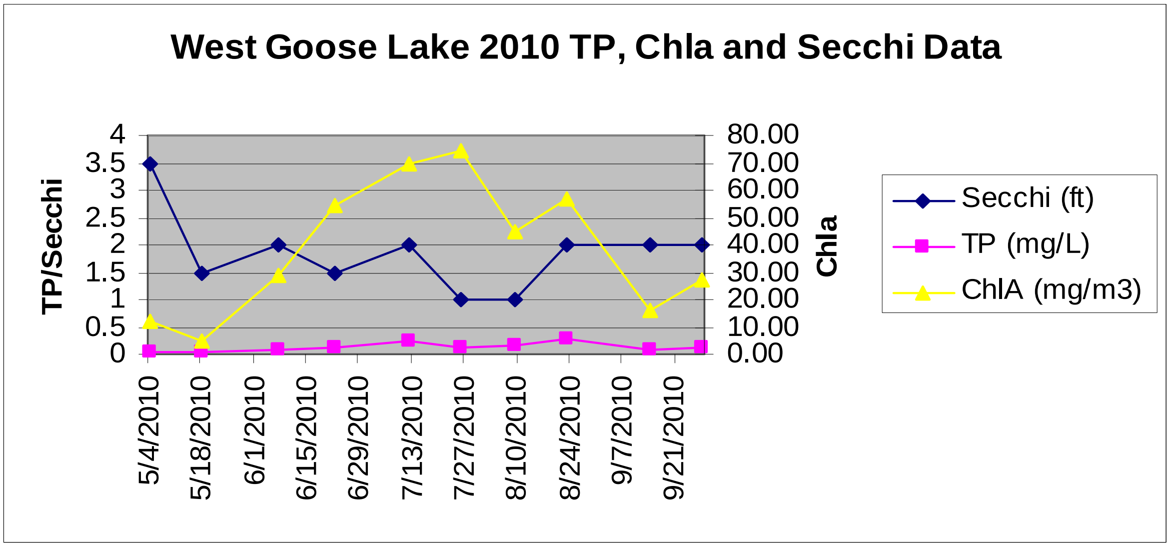
East Goose Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	21	134	0.4
1998	17	93	0.2
1999	475	56	0.3
2000	49	154	0.3
2001	603	28	0.3
2002	613	170	0.2
2003	342	66	0.3
2004	526	0	0
2005	407	38	0
2006	392	81	0
2007	260	97	0
2008	218	86	0.3
2009	237	121	0.3
2010	207	63	0.3

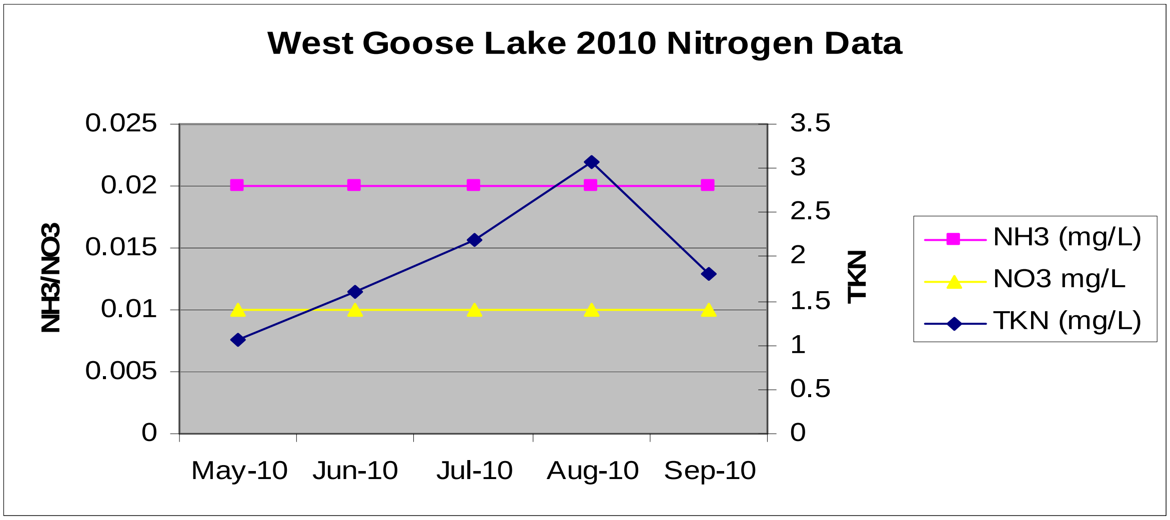
Goose Lake West

This is the fifth year of sample collection for Goose Lake West.

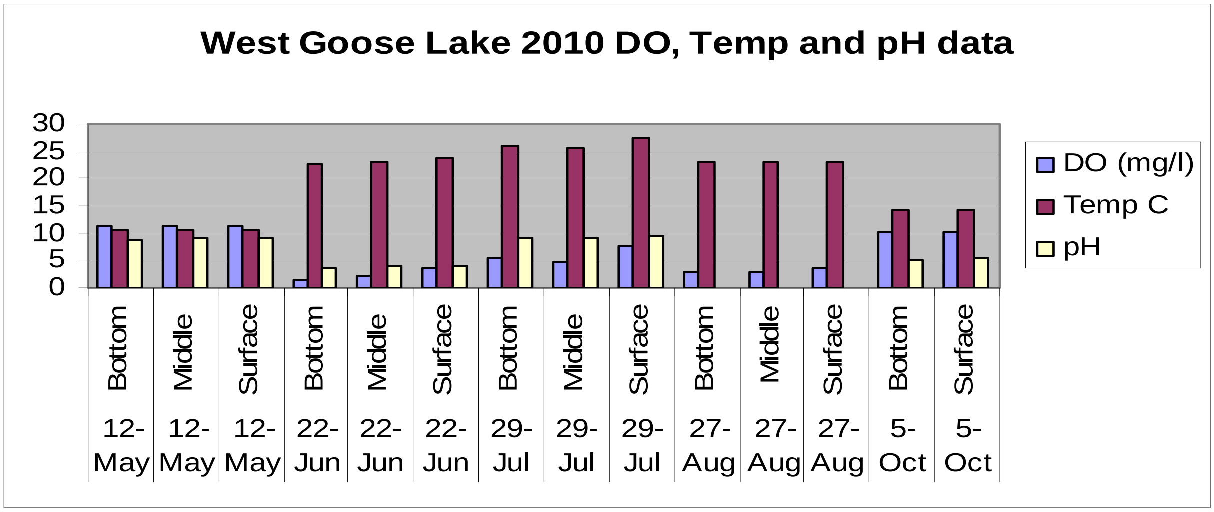
Cooling water from the Kohler plant enters Goose Lake West year round at a rate of 500 gallons/minute. West Goose on average has somewhat better water quality than East Goose possible due to the constant flow of "fresh" water from the Kohler plant. The TMDL study will look into this deeper

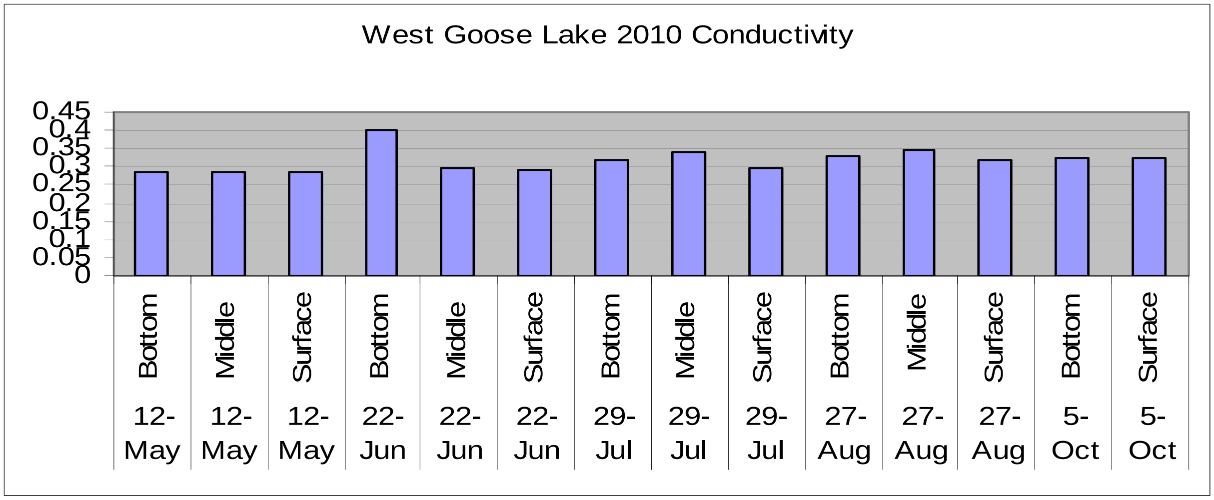
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	3.5	0.050	12.40	2.50	10.50	1.06	0.02	0.01
5/18/2010	1.5	0.045	4.70	0.50	4.20			
6/7/2010	2	0.099	28.80	4.80	25.00	1.60	0.02	0.01
6/22/2010	1.5	0.138	54.60	2.50	51.10			
7/12/2010	2	0.233	69.54	8.75	62.03	2.18	0.02	0.01
7/26/2010	1	0.123	74.16	9.18	65.97			
8/9/2010	1	0.164	44.48	8.77	37.54	3.06	0.02	0.01
8/23/2010	2	0.270	56.46	4.62	51.58			
9/14/2010	2	0.063	16.33	0.55	15.35	1.81	0.02	0.01
9/28/2010	2	0.101	27.52	0.09	26.32			
avg	1.85	0.1286	38.89904	4.22606	34.9598617	1.942	0.02	0.01





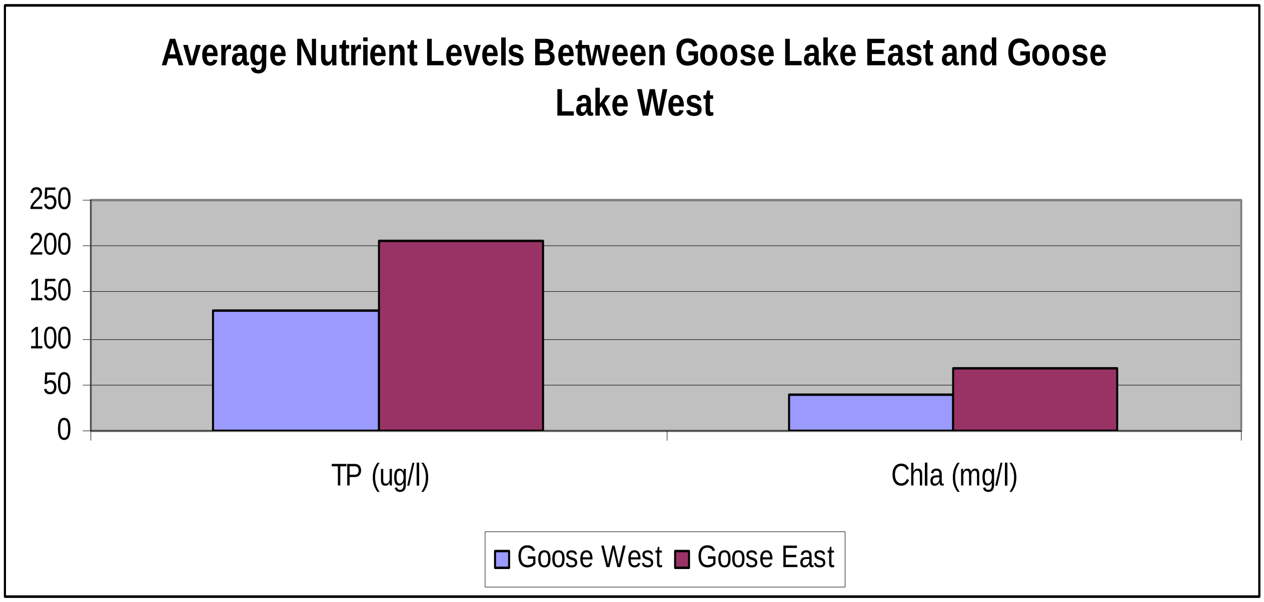
Date	reading location	DO (mg/l)	Temp C	pH	conductivity
12-May	Bottom	11.52	10.66	8.95	0.288
12-May	Middle	11.48	10.63	8.99	0.288
12-May	Surface	11.5	10.61	8.98	0.288
22-Jun	Bottom	1.45	22.53	3.59	0.401
22-Jun	Middle	2.31	23.1	4.02	0.298
22-Jun	Surface	3.65	23.9	4.19	0.289
29-Jul	Bottom	5.5	25.98	9.17	0.318
29-Jul	Middle	4.74	25.73	9.01	0.341
29-Jul	Surface	7.79	27.44	9.49	0.297
27-Aug	Bottom	2.97	23.16		0.33
27-Aug	Middle	3.02	23.18		0.347
27-Aug	Surface	3.61	23.21		0.321
5-Oct	Bottom	10.4	14.1	4.95	0.326
5-Oct	Surface	10.4	14.15	5.35	0.326





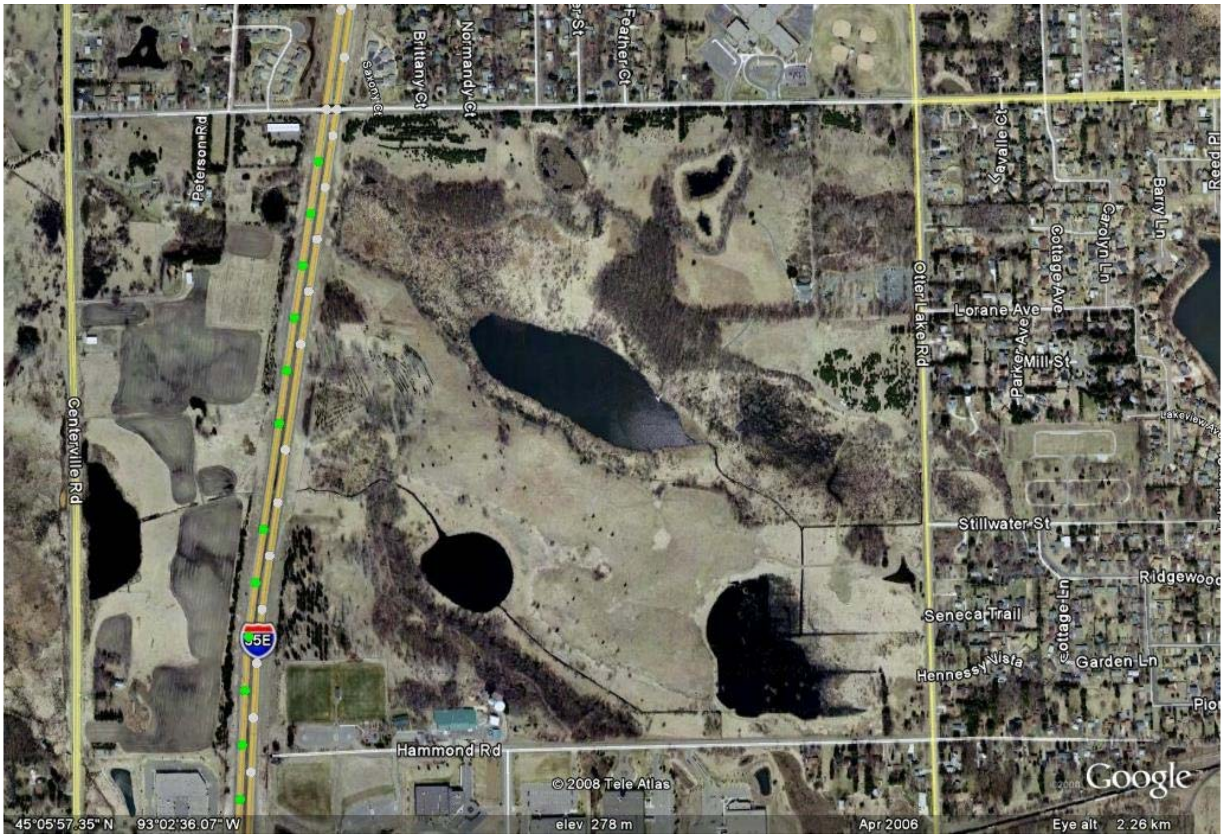
West Goose Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997			
1998			
1999			
2000			
2001			
2002			
2003			
2004			
2005			
2006	213	58	0
2007	159	66	0
2008	168	55	0.3
2009	134	40	0.5
2010	129	39	0.5

*Comparison of water quality between the two basins below shows that Goose Lake West has much better average TP and Chla levels compared to Goose Lake East

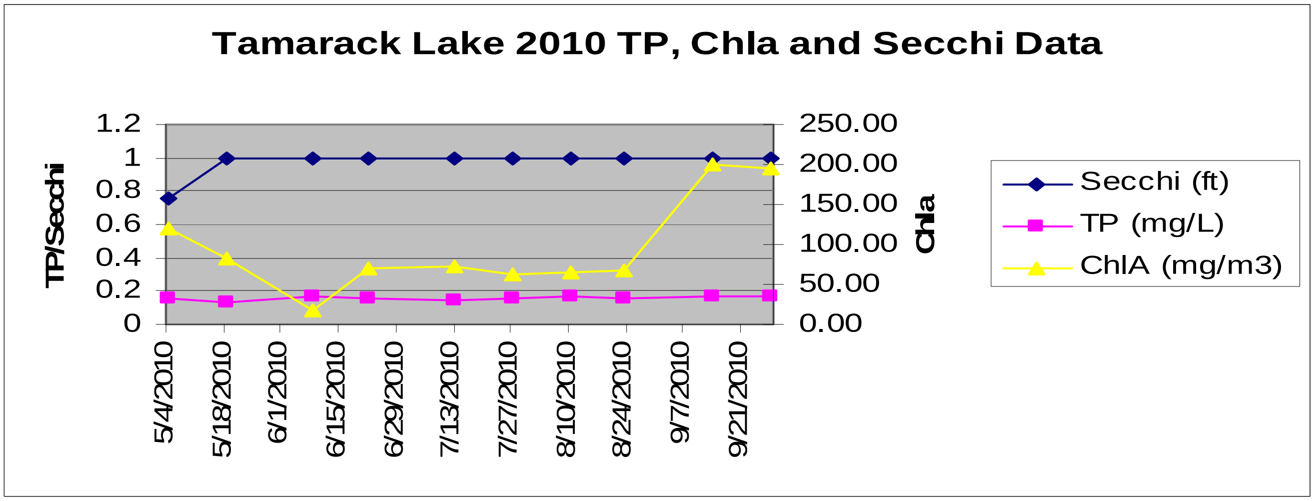


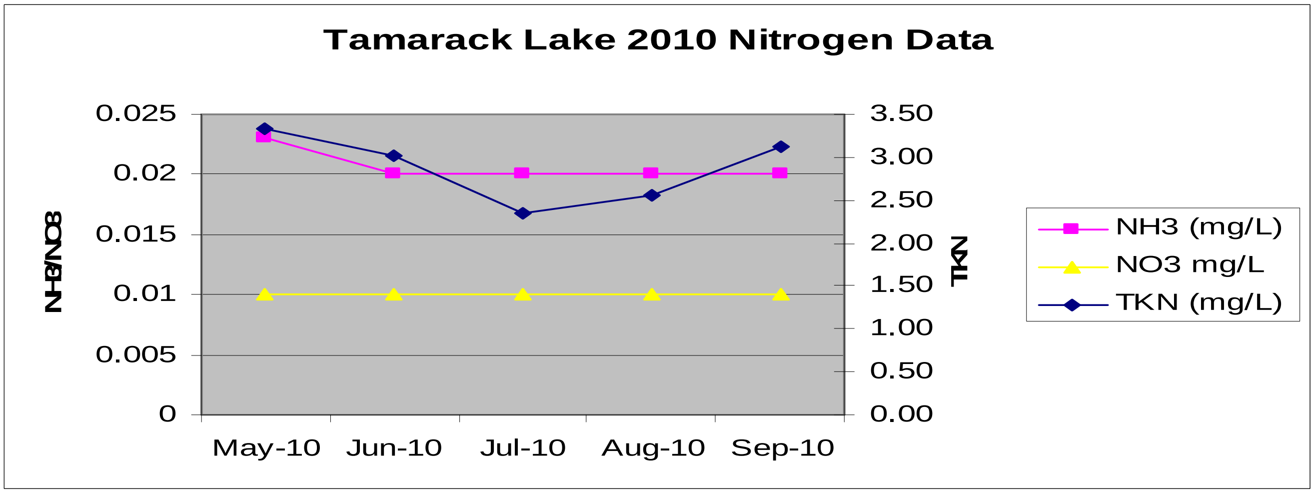
Tamarack Lake

Tamarack Lake is part of the Tamarack Nature Center. It is 86 acres with a maximum depth of 10 feet. As there is no boat access, samples are taken from the observation dock on the southeast side of the lake. Ramsey County restored a large ditched wetland downstream of Tamarack and upstream of Fish Lake, as part of a wetland-banking project in 1997.

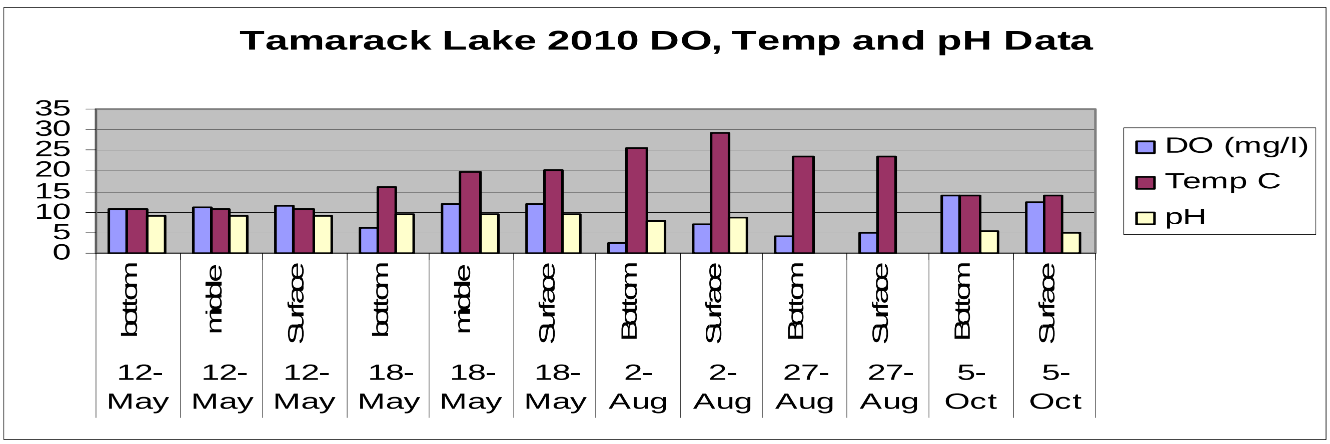


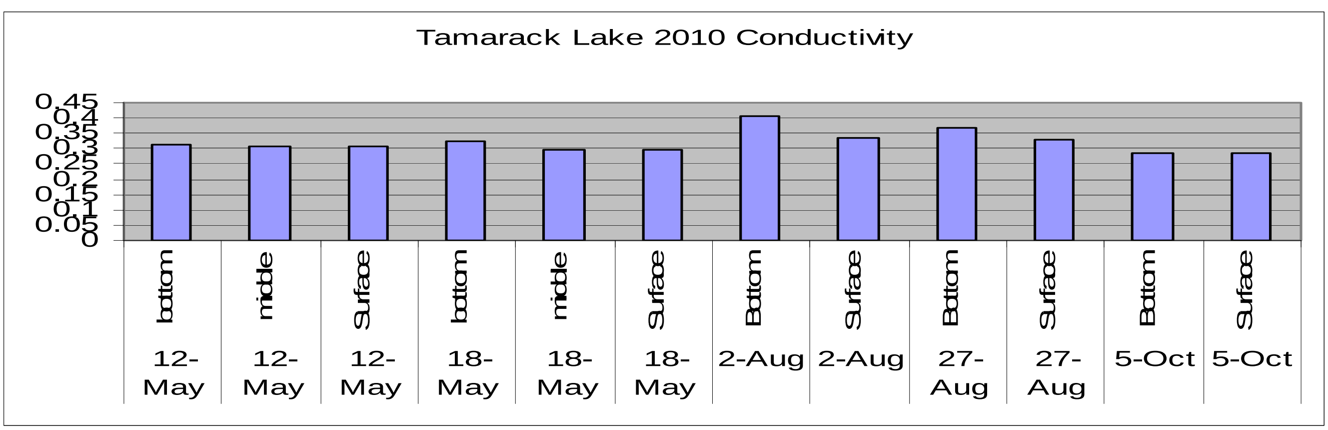
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L
5/4/2010	0.75	0.151	121.10	2.70	114.50	3.33	0.023	0.01
5/18/2010	1	0.137	81.30	-0.10	78.20			
6/8/2010	1	0.171	18.10	0.70	17.00	3.01	0.02	0.01
6/22/2010	1	0.158	70.90	-0.60	68.50			
7/13/2010	1	0.138	73.18	6.25	66.66	2.34	0.02	0.01
7/27/2010	1	0.160	63.39	4.24	58.48			
8/10/2010	1	0.166	64.72	7.85	57.63	2.55	0.02	0.01
8/23/2010	1	0.152	67.56	-0.33	65.18			
9/14/2010	1	0.172	201.10	1.39	192.24	3.13	0.02	0.01
9/28/2010	1	0.168	194.97	-0.94	187.52			
avg	0.975	0.157	95.632	2.116	90.591	2.872	0.021	0.010





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
12-May	bottom	10.56	10.6	8.92	0.311
12-May	middle	11.21	10.64	8.93	0.309
12-May	Surface	11.46	10.68	8.97	0.308
18-May	bottom	6.25	16.16	9.28	0.322
18-May	middle	11.96	19.86	9.39	0.298
18-May	Surface	12.08	20.06	9.34	0.298
2-Aug	Bottom	2.3	25.6	7.71	0.407
2-Aug	Surface	6.99	29.16	8.71	0.335
27-Aug	Bottom	4.22	23.28		0.368
27-Aug	Surface	4.78	23.48		0.327
5-Oct	Bottom	14.07	13.95	5.4	0.284
5-Oct	Surface	12.41	14.07	5.12	0.283





Tamarack Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997	17	180	0.2
1998	54	32	0.5
1999	90	26	0.4
2000	60	27	0.4
2001	132	37	0.4
2002	164	120	0.4
2003	168	95	0.3
2004	96	0	0.8
2005	143	65	0
2006	136	38	0
2007	148	109	0.5
2008	115	99	0.3
2009	161	161	0.2
2010	157	96	0.2

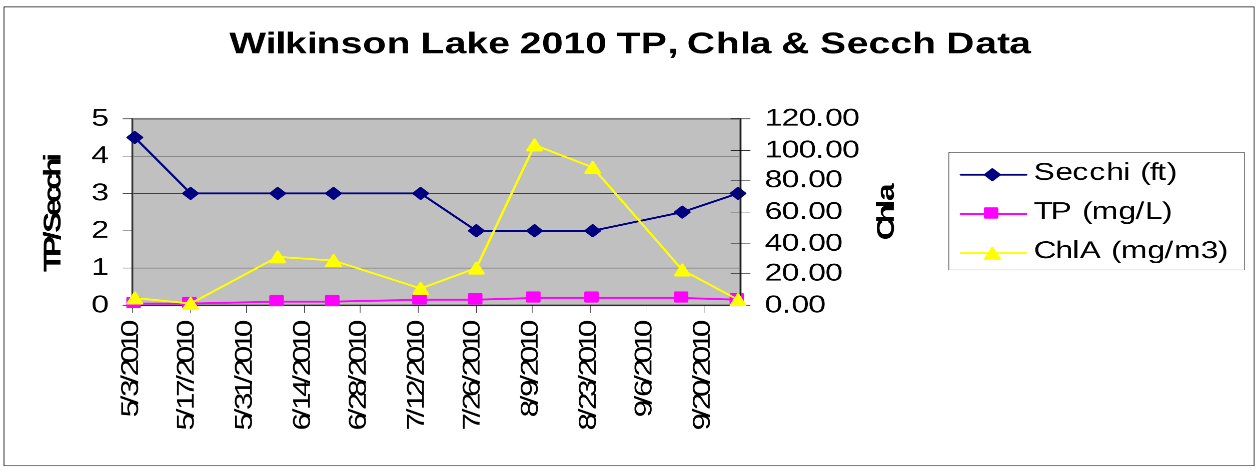
Wilkinson Lake

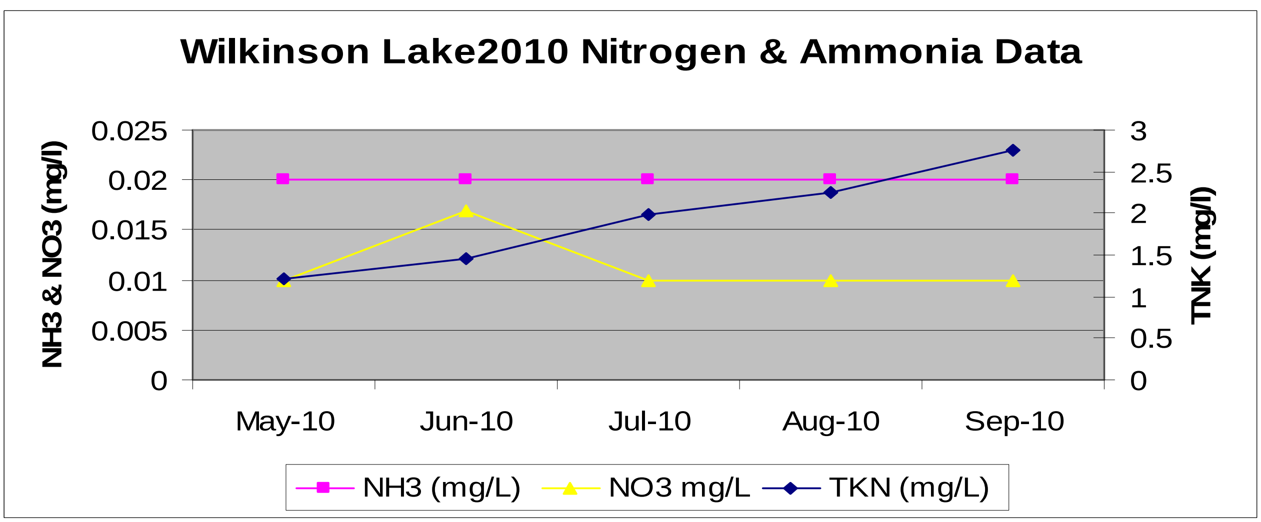
Wilkinson Lake was part of the James J. Hill experimental farm and is now part of the Minnesota Land Trust, which preserves the land in a natural condition. The City of North Oaks required 150-foot buffer between the lake edge and any structures. The property on the eastern side of the lake is currently being developed.

The bottom of Wilkinson was continuously stirred up from rough fish. The North Oaks Company has spent considerable time and effort to restore the lake including the installation of a fish barrier to attempt to keep the rough fish from destroying the natural vegetation and waterfowl habitat. The lake has also had two draw downs to kill the carp. The efficacy of the fish barrier is a yearly battle. VLAWMO was given a key to access the property Wilkinson is located and was able to get all samples this year with the help of our citizen volunteers.

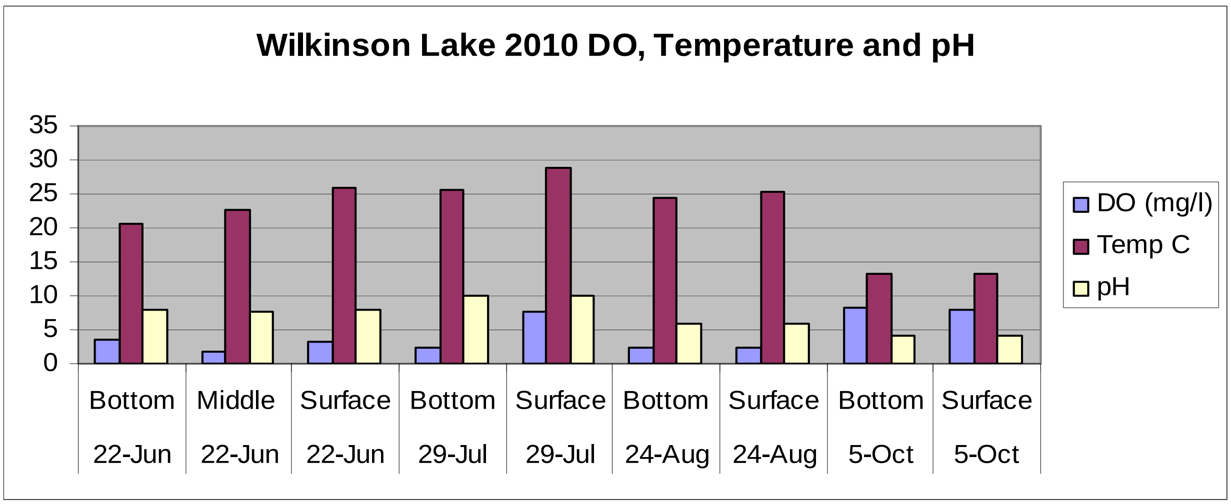
A SLMP was also started for Wilkinson spring of 2010. VLAWMO staff installed three storm samplers around the lake to measure run off entering Wilkinson. The SLMP will be completed in the spring of 2011.

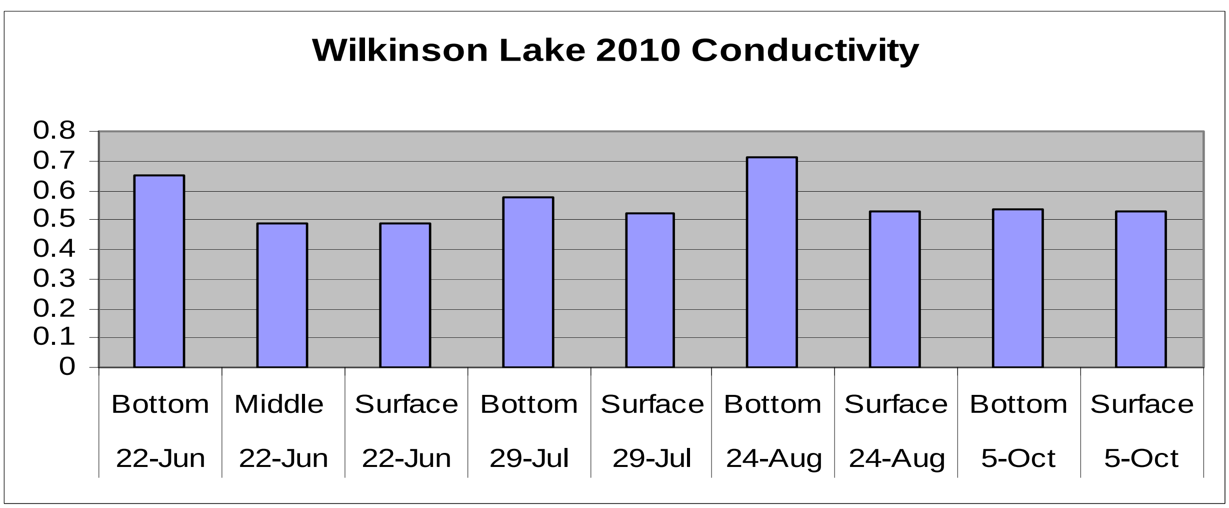
DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	Pheo	CORR Chla(mg/L)	TKN (mg/L)	NO3 (mg/L)	NH3 mg/L
5/3/2010	4.5	0.061	4.40	0.80	3.80	1.21	0.02	0.01
5/17/2010	3	0.035	1.80	0.70	1.40			
6/7/2010	3	0.103	31.30	1.20	29.50	1.45	0.02	0.017
6/21/2010	3	0.107	29.10	0.20	27.90			
7/12/2010	3	0.142	11.29	1.89	9.78	1.99	0.02	0.01
7/26/2010	2	0.171	24.49	5.24	20.67			
8/9/2010	2	0.211	102.82	19.26	87.71	2.24	0.02	0.01
8/23/2010	2	0.190	88.22	8.17	80.76			
9/14/2010	2.5	0.208	22.43	5.83	18.26	2.76	0.02	0.01
9/28/2010	3	0.165	3.07	0.66	2.63			
avg	2.800	0.139	31.892	4.396	28.241	1.930	0.020	0.011





Date	reading location	DO (mg/l)	Temp C	pH	conductivity
22-Jun	Bottom	3.4	20.52	7.83	0.649
22-Jun	Middle	1.8	22.78	7.74	0.487
22-Jun	Surface	3.14	25.81	7.92	0.485
29-Jul	Bottom	2.46	25.62	9.99	0.579
29-Jul	Surface	7.63	28.81	9.89	0.524
24-Aug	Bottom	2.24	24.52	5.83	0.712
24-Aug	Surface	2.29	25.36	5.88	0.531
5-Oct	Bottom	8.13	13.31	4.14	0.533
5-Oct	Surface	7.8	13.36	4.12	0.532

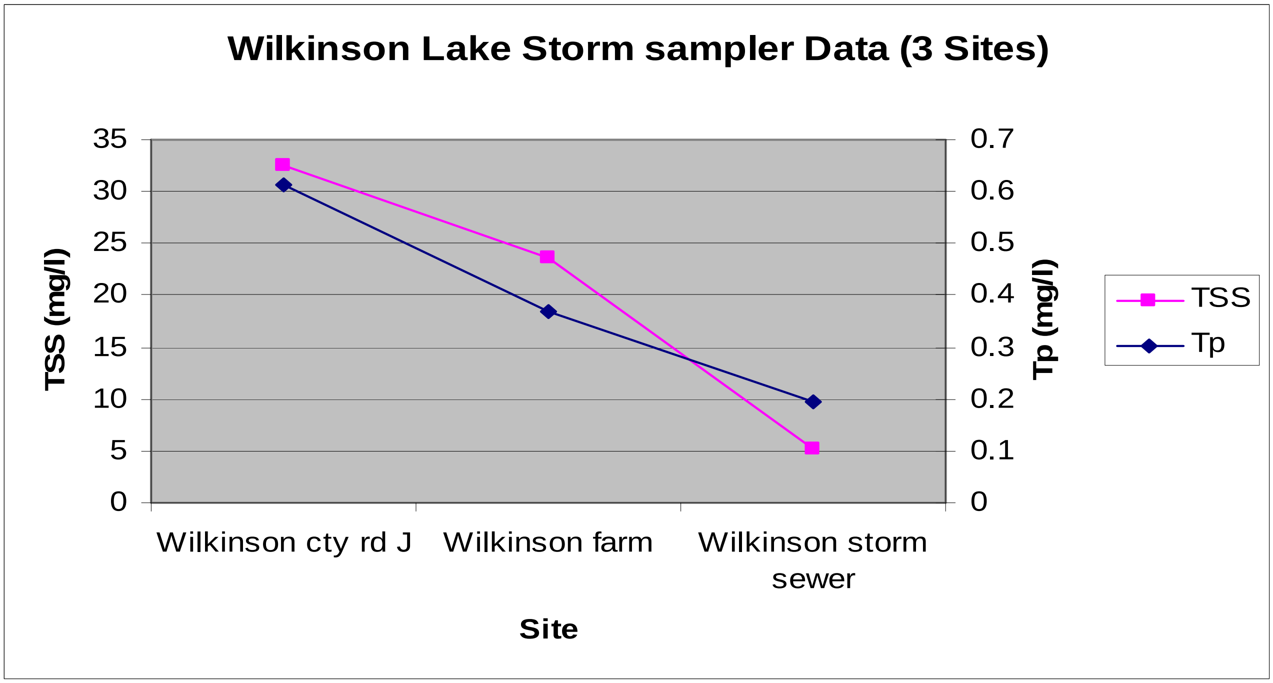




Wilkinson Lake Historical Avg TP/Chl A/SDT			
Year	TP (ug/L)	Chl A (ug/L)	Secchi (m)
1997			
1998	48	26	1.1
1999	62	8	0
2000	38	34	0
2001	299	99	0.2
2002	107	40	0
2003	130	18	0
2004	72	0	0
2005	183	52	0
2006	96	10	0
2007	104	18	0.9
2008	64	8	0.3
2009	125	17	1
2010	140	31	0.8

Wilkinson Lake Storm Sampler Data

SITE	DATE	TP (mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
wilkinson cty rd J	7/12/2010	0.745	6.80	4.47	0.015	
wilkinson cty rd J	7/28/2010	0.648	7.71	4.84	1.27	48.00
wilkinson cty rd J	9/16/2010	0.442	4.32	0.998	3.39	17.00
	avg	**0.612**	**6.277**	**3.436**	**1.558**	**32.500**
wilkinson farm	7/28/2010	0.303	2.13	0.126	0.077	12.43
wilkinson farm	8/2/2010	0.401	2.66	0.198	0.016	20.00
wilkinson farm	8/9/2010	0.412	2.12	0.181	0.01	17.86
wlikinson farm	8/11/2010	0.391	3.16	0.177	0.094	68.97
wlikinson farm	9/2/2010	0.558	2.93	0.534	0.545	17.63
wlikinson farm	9/16/2010	0.447	2.36	0.202	0.202	27.43
wlikinson farm	9/23/2010	0.079	1.03	0.02	0.01	1.28
	avg	**0.370**	**2.341**	**0.205**	**0.136**	**23.655**
wilkinson storm sewer	7/28/2010	0.174	0.921	0.099	0.136	6.00
wilkinson storm sewer	8/2/2010	0.235	0.873	0.02	0.020	6.67
wilkinson storm sewer	8/9/2010	0.243	2.20	0.329	0.186	5.07
wilkinson storm sewer	8/11/2010	0.179	1.21	0.095	0.119	5.41
wilkinson storm sewer	8/31/2010	0.163	0.998	0.02	0.153	4.00
wilkinson storm sewer	9/2/2010	0.183	1.33	0.02	0.202	4.80
wilkinson storm sewer	9/16/2010	0.142	0.864	0.02	0.523	3.29
wilkinson storm sewer	9/23/2010	0.224	1.66	0.091	0.01	6.44
	avg	**0.193**	**1.257**	**0.087**	**0.169**	**5.209**


Wilkinson Lake Storm sampler Data (3 Sites)
35
30
25
20
15
10
5
0
TSS (mg/l)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Tp (mg/l)
TSS
Tp
Wilkinson cty rd J
Wilkinson farm
Wilkinson storm sewer
Site

Historical Average TP Concentrations for all VLAWMO Lakes (ug/l)												
Year	Amelia Lake	Birch Lake	Black Lake	Charlie Lake	Deep Lake	Gem Lake	Gilfillan Lake	Goose Lake (E)	Goose Lake (W)	Tamarack Lake	West Vadnais Lake	Wilkinson Lake
1997	28	22				54	96	21		17		
1998	36	41				33	47	17		54		48
1999	38	31				26	72	475		90		62
2000	40	27				36	35	49		60		38
2001	33	42				56	84	603		132		299
2002	34	31				39	81	613		164		107
2003	29	35				52	44	342		168		130
2004	28	31				49	58	526		96		72
2005	24	31				43	52	407		143		183
2006	36	32				63	91	392	213	136		96
2007	82	41				84	100	260	159	148		104
2008	26	34				64	97	218	168	166		64
2009	59	41	30	50	111	90	150	270	130	160	190	130
2010	32	31	34	90	55	53	192	207	129	157		140

* TP overall was lower for most of the VLAWMO lakes as compared to 2009. Many are still over the state standard of 60 ug/l.

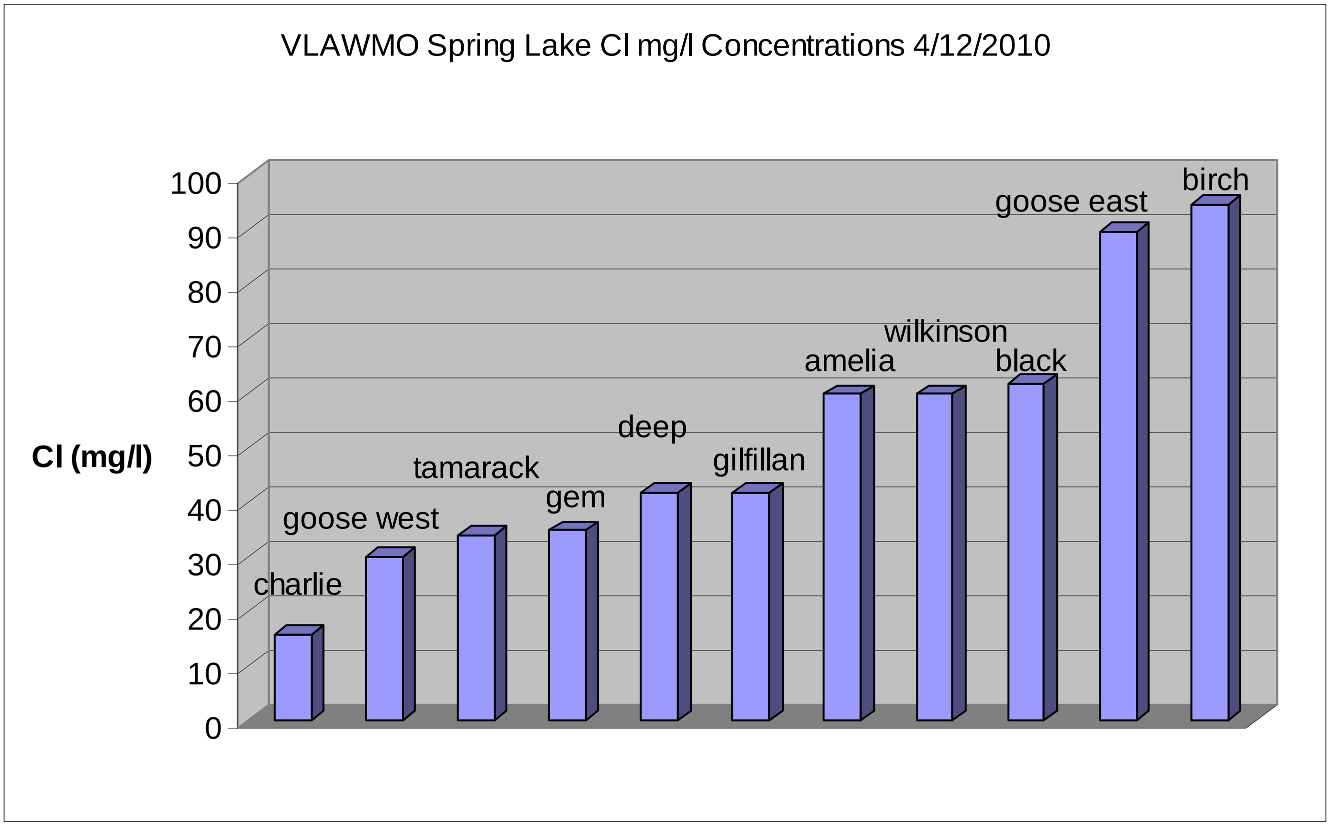
Historical Average Chl A Concentrations for all VLAWMO Lakes (mg/m3)												
Year	Amelia Lake	Birch Lake	Black Lake	Charlie Lake	Deep Lake	Gem Lake	Gilfillan Lake	Goose Lake (E)	Goose Lake (W)	Tamarack Lake	West Vadnais Lake	Wilkinson Lake
1997		14				23	32	134		180		
1998	14	4				24	44	93		32		26
1999	9	8				16	23	56		26		8
2000	12	14				17	47	154		27		34
2001	8	8				12	20	28		37		99
2002	13	10				25	43	170		120		40
2003	7	13				20	25	66		95		18
2004												
2005	7	4				26	8	38		65		52
2006	12	3				25	19	81	58	38		10
2007	32	5				33	33	97	66	109		18
2008	5	5				17	31	86	55	89		8
2009	23	7	5	17	21	28	44	120	40	161	103	16
2010	12	5	6.6	18.9	15	24	44	67	39	96		31

* As with the TP above, most VLAWMO lakes have lower ChlA levels as compared to 2009. Yet many are still above the state standard of 20 (mg/m3)

Historical Average SDT for all VLAWMO Lakes (m)												
Year	Amelia Lake	Birch Lake	Black Lake	Charlie Lake	Deep Lake	Gem Lake	Gilfillan Lake	Goose Lake (E)	Goose Lake (W)	Tamarack Lake	West Vadnais Lake	Wilkinson Lake
1997	1.5	2.4				1.2	0.5	0.4		0.2		
1998	1.1	2.4					0.5	0.2		0.5		1.1
1999	1.2	2.4				1.2		0.3		0.4		
2000	0.9	2.4				1.1		0.3		0.4		
2001	1.1	2.4				1.8		0.3		0.4		0.2
2002	1.4	2.4				1.3	0.4	0.2		0.4		
2003	1.5	2.4				1.4	1.4	0.3		0.3		
2004						1.5				0.8		
2005												
2006												
2007	0.4	2.4				1.1	0.7	0.2		0.5		0.9
2008	1.1	2.4				1.5	0.5	0.3	0.3	0.3		0.3
2009	0.9	1.2	1.7	0.8	1	1.4	0.5	0.3	0.5	0.2	0.3	1
2010	1.1	1	2.1	1	0.9	1.4	0.4	0.3	0.5	0.2		0.8

* The water levels in 2010 have stayed pretty much the same even with the above average rain this summer, therefore the SDT readings have not changed much from 2009. The standard is >1, but many of the VLAWMO lakes are not any deeper than 1 m.

VLAWMO 2010 Lake Chloride Levels



* VLAWMO staff takes Lake chloride readings in the spring right after ice-off. The samples are taken from the middle of the lake. 2010 was the first year of VLAWMO's chloride program.

2010 Lambert Creek Monitoring Results

Lambert Creek Monitoring Details

Samples are collected by VLAWMO staff at six sites along Lambert Creek on a weekly basis May through September as well as after significant storm events (at least 0.5 inches). The six sites noted in charts and graphs are: Goose Lake, WBL storm sewer, Whitaker Pond, Oakmede, County Rd F, and Kohler Rd. The samples are analyzed at the Ramsey County Lab for TP, TKN, NH3, N03, TSS, VSS, and turbidity. This spring VLAWMO staff installed an automatic flow meter in the storm sewer flowing into Whitaker Pond. An automatic rain gauge and level logger was also installed at this site.

VLAWMO staff continued to collect pH, conductivity, DO and temperature at three locations this summer. This information will also help with the TMDL process and allows us to set baselines to compare with future monitoring data.

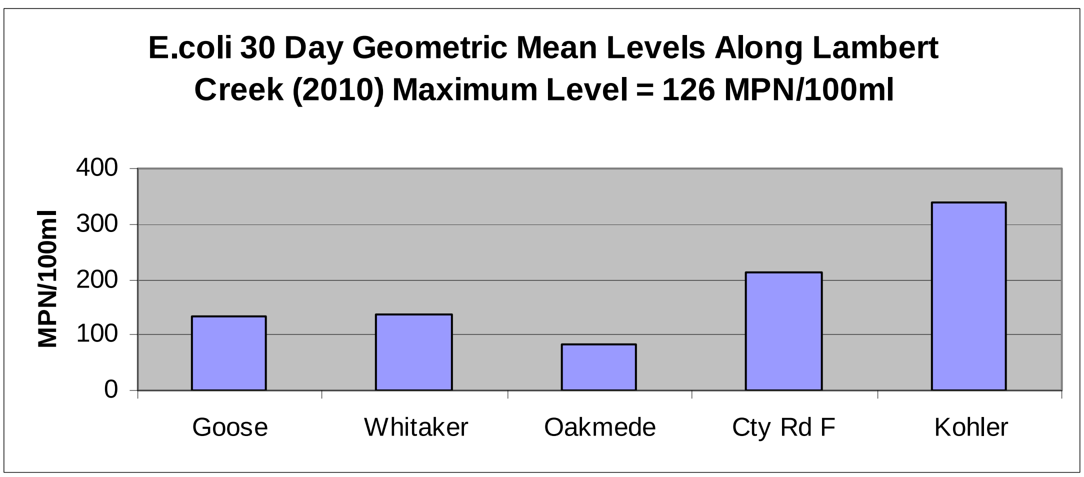
The third flume was installed at the County Rd. F site this winter along with improvements to Whitaker Pond. The flume installation was successful and is working great. He forebay and vegetation establishment at Whitaker has been successful so far, but we have ran into some design/construction problems with the weir. VLAWMO hopes to have these issues fixed this winter and have a fully working project come spring 2011.

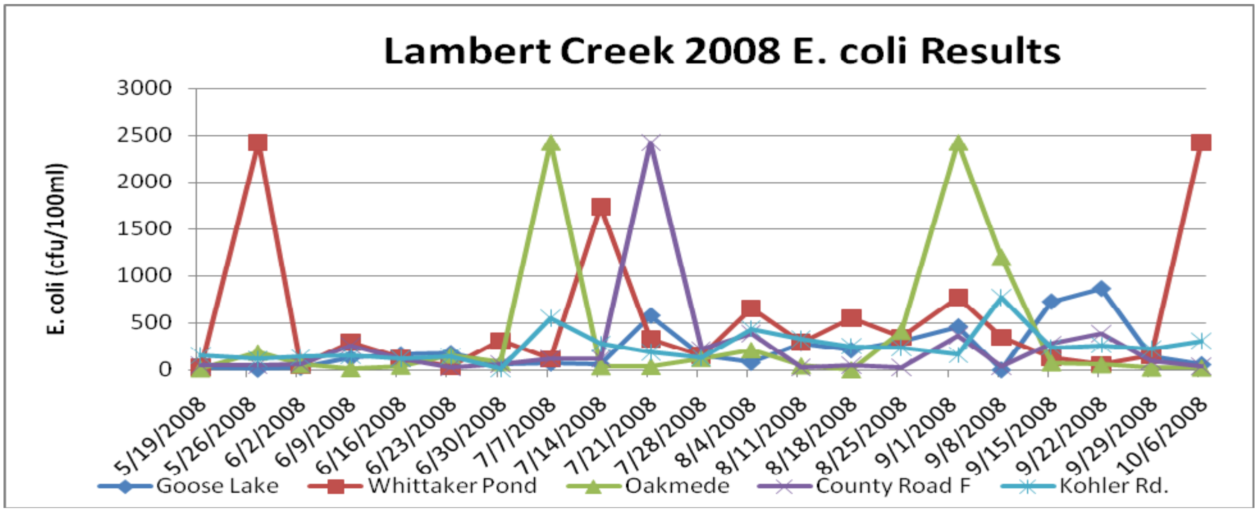
VLAWMO also collects samples at five of the six locations to test for E. coli. Samples were analyzed at the SPRWS lab. Lambert Creek is on the impaired waters list for its high levels of E. coli and we have started a TMDL study on the creek this fall. Water contaminated with bacteria from human or animal fecal material can cause illness in humans if ingested. The maximum daily level allowed is 1260 cfu/100ml. The maximum 30 day mean level is 126 cfu/100ml. Standards are designed to protect swimmers who might ingest small quantities of water from getting sick.

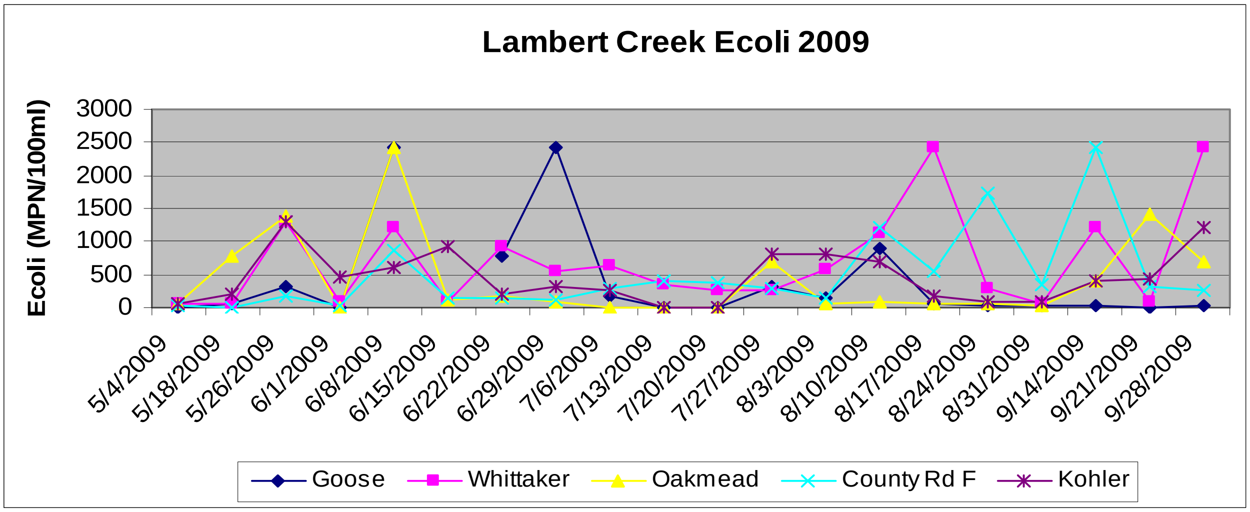
E. coli (MPN/100ml) Daily Levels Along Lambert Creek (2010) Maximum Level = 1260 MPN/100ml					
Date	**Goose**	**Whitaker**	**Oakmede**	**Cty Rd F**	**Kohler**
5/3/2010	22	10	61	236	108
5/10/2010	47	24	88	6	345
5/17/2010	20	8	21	19	236
5/24/2010	107	4	111	389	365
6/1/2010	42	55	866	56	238
6/7/2010	228	816	72	107	2420
6/14/2010	108	48	1986	1203	548
6/28/2010	40	135	67	2420	197
7/6/2010	105	980	111	397	150
7/12/2010	91	148	161	155	501
7/19/2010	307	816	365	205	488
7/26/2010	649	55	138	345	328
8/2/2010	613	2420	152	261	921
8/9/2010	461	1414	185	128	548
8/16/2010	122	42	23	387	140
8/23/2010	154	250	24	291	109
8/30/2010	240	129	20	138	649
9/7/2010	816	1986	66	687	770
9/13/2010	210	579	15	46	613
9/20/2010	194	172	27	921	179
9/27/2010	49	53	36	687	145
Average	132	137	84	213	340

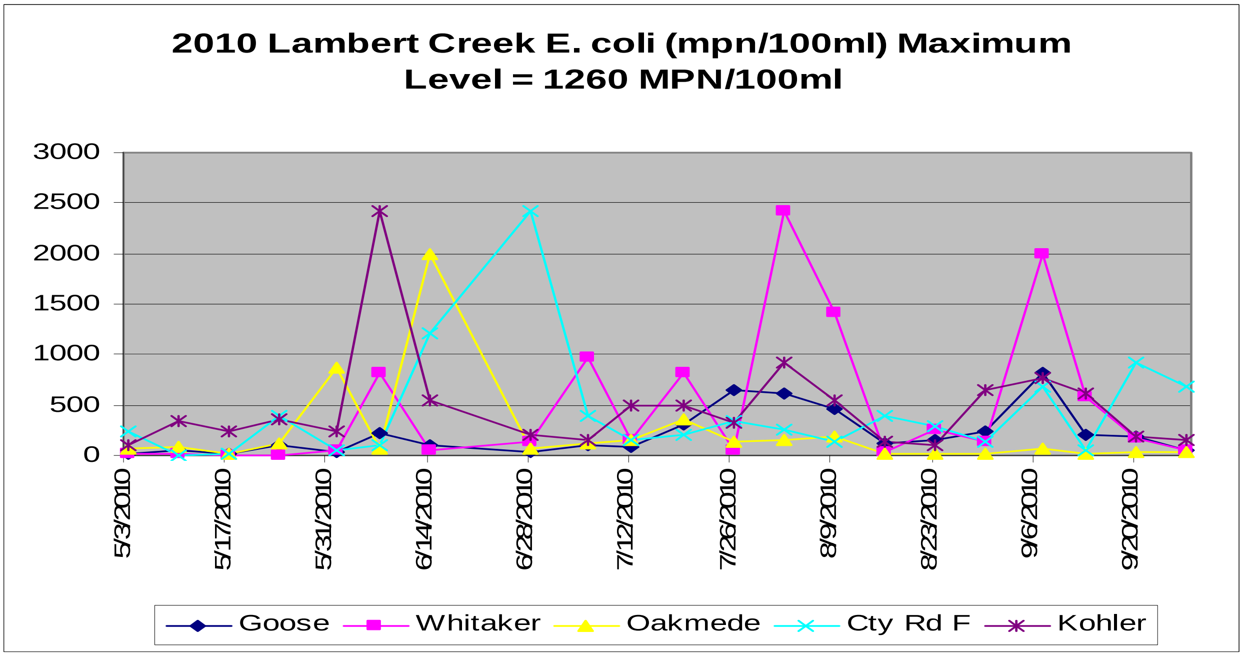
E. coli 30 Day Geometric Mean Levels Along Lambert Creek (2010) Maximum Level = 126 MPN/100ml					
	Goose	Whitaker Pond	Oakmede	County Road F	Kohler Rd.
Geomean	132	137	84	213	340

* MPN/100ml – most probable number per 100 ml. Used to estimate bacteria concentrations



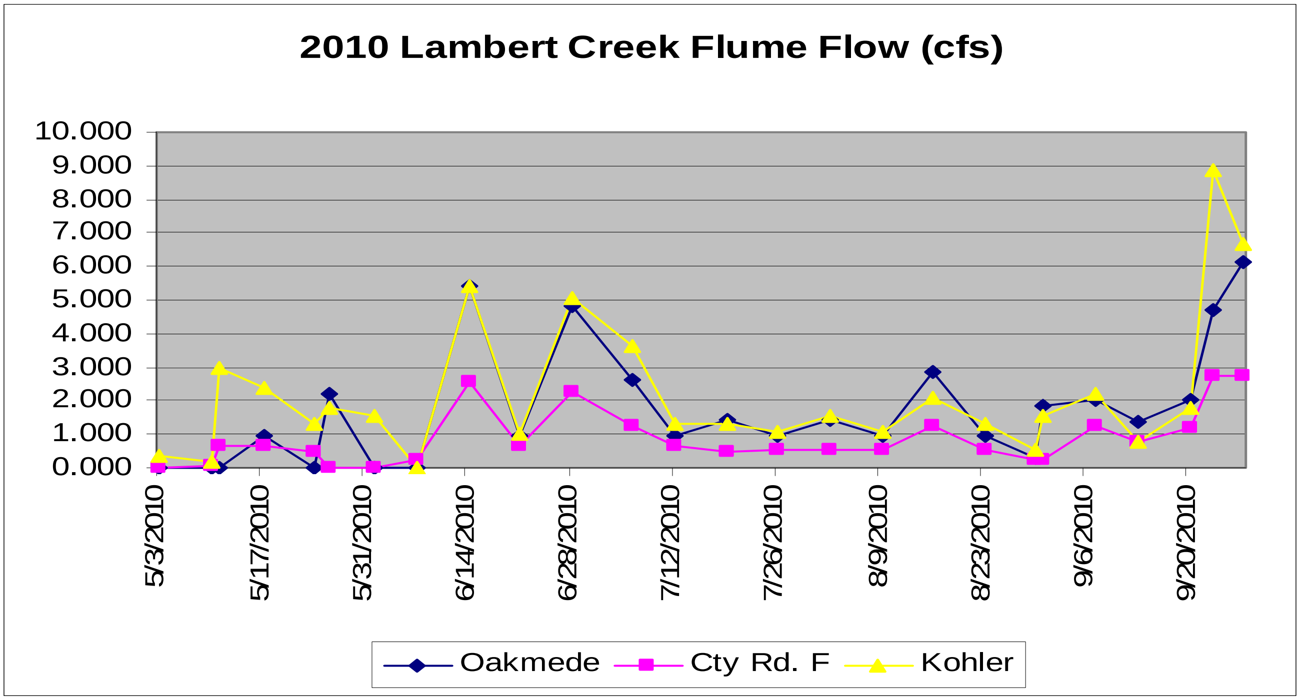

Lambert Creek 2008 E. coli Results
E. coli (cfu/100ml)
3000
2500
2000
1500
1000
500
0
5/19/2008
5/26/2008
6/2/2008
6/9/2008
6/16/2008
6/23/2008
6/30/2008
7/7/2008
7/14/2008
7/21/2008
7/28/2008
8/4/2008
8/11/2008
8/18/2008
8/25/2008
9/1/2008
9/8/2008
9/15/2008
9/22/2008
9/29/2008
10/6/2008
Goose Lake
Whittaker Pond
Oakmede
County Road F
Kohler Rd.


Lambert Creek Ecoli 2009
Ecoli (MPN/100ml)
3000
2500
2000
1500
1000
500
0
5/4/2009
5/18/2009
5/26/2009
6/1/2009
6/8/2009
6/15/2009
6/22/2009
6/29/2009
7/6/2009
7/13/2009
7/20/2009
7/27/2009
8/3/2009
8/10/2009
8/17/2009
8/24/2009
8/31/2009
9/14/2009
9/21/2009
9/28/2009
Goose
Whittaker
Oakmead
County Rd F
Kohler


2010 Lambert Creek E. coli (mpn/100ml) Maximum Level = 1260 MPN/100ml
3000
2500
2000
1500
1000
500
0
5/3/2010
5/17/2010
5/31/2010
6/14/2010
6/28/2010
7/12/2010
7/26/2010
8/9/2010
8/23/2010
9/6/2010
9/20/2010
Goose
Whitaker
Oakmede
Cty Rd F
Kohler

Lambert Creek Flow Data

2010 Lambert Creek Flow (cfs)			
date	Oakmede	Cty Rd. F	Kohler
5/3/2010	0.026	0.019	0.363
5/10/2010	0.026	0.077	0.172
5/11/2010	0.009	0.660	2.960
5/17/2010	0.965	0.660	2.358
5/24/2010	0.009	0.467	1.316
5/26/2010	2.216	0.006	1.809
6/1/2010	0.009	0.006	1.555
6/7/2010	0.009	0.225	0.013
6/14/2010	5.392	2.565	5.435
6/21/2010	0.965	0.660	0.985
6/28/2010	4.840	2.241	5.048
7/6/2010	2.637	1.238	3.610
7/12/2010	0.965	0.660	1.316
7/19/2010	1.456	0.467	1.316
7/26/2010	0.965	0.561	1.091
8/2/2010	1.456	0.561	1.555
8/9/2010	0.965	0.561	1.091
8/16/2010	2.858	1.238	2.077
8/23/2010	0.965	0.561	1.316
8/30/2010	0.326	0.225	0.518
8/31/2010	1.821	0.225	1.555
9/7/2010	2.015	1.238	2.216
9/13/2010	1.369	0.765	0.785
9/20/2010	2.015	1.174	1.809
9/23/2010	4.705	2.732	8.891
9/27/2010	6.112	2.732	6.657
average	1.734	0.866	2.224



Lambert Creek-Goose Lake 2010 Data

DATE	TP (mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
5/3/2010	0.110	1.67	0.057	0.01	15.9
5/10/2010	0.123				31.0
5/11/2010	0.074	1.37	0.087	0.026	6.1
5/17/2010	0.069	1.24	0.02	0.01	9.4
5/24/2010	0.131				12.7
5/26/2010	0.111	1.55	0.044	0.025	11.7
6/1/2010	0.083	1.44	0.098	0.035	8.0
6/7/2010	0.066				6.5
6/21/2010	0.073				3.5
6/28/2010	0.101	1.94	0.031	0.01	7.5
7/6/2010	0.106				9.0
7/12/2010	0.173	1.62	0.02	0.01	16.7
7/19/2010	0.217				19.9
7/26/2010	0.254	1.60	0.02	0.01	32.5
8/2/2010	0.247				52.8
8/9/2010	0.258	2.59	0.02	0.01	27.0
8/11/2010	0.278	3.13	0.02	0.01	36.1
8/16/2010	0.129				17.0
8/23/2010	0.142	2.36	0.02	0.01	14.2
8/30/2010	0.158				17.7
8/31/2010	0.142	1.93	0.02	0.01	17.9
9/7/2010	0.123				13.3
9/13/2010	0.054	1.44	0.02	0.01	4.7
9/20/2010	0.052				4.8
9/23/2010	0.066	1.17	0.02	0.01	7.5
9/27/2010	0.106	2.17	0.02	0.01	15.8
6/14/2010	0.058	1.27	0.025	0.01	2.3
average	**0.130**	**1.781**	**0.034**	**0.014**	**15.6**

Lambert Creek – White Bear Lake Storm Sewer 2010 Data

SITE	DATE	TP (mg/L)	SRP	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
WBL SS	5/3/2010	0.140	0.062	0.822	0.02	2.97	8.8
WBL SS	5/10/2010	0.102	0.044				10.4
WBL SS	5/11/2010	0.079	0.018	0.885	0.280	0.509	7.1
WBL SS	5/17/2010	0.098	0.038	1.00	0.078	1.73	1.4
WBL SS	5/24/2010	0.185	0.051				21.7
WBL SS	5/26/2010	0.401	0.077	2.03	0.02	0.322	16.2
WBL SS	6/1/2010	0.262	0.211	2.46	0.567	0.649	55.3
WBL SS	6/7/2010	0.265	0.055				20.1
WBL SS	6/14/2010	0.188	0.073	1.32	0.153	0.257	9.3
WBL SS	6/21/2010	0.136	0.021				10.0
WBL SS	6/28/2010	0.148	0.053	1.58	0.191	0.423	4.6
WBL SS	7/6/2010	0.125	0.040				4.8
WBL SS	7/12/2010	0.186	0.019	1.72	0.472	0.478	7.8
WBL SS	7/19/2010	0.237	0.166				4.2
WBL SS	7/26/2010	0.161	0.111	0.354	0.207	0.375	3.8
WBL SS	8/2/2010	0.143	0.087				8.2
WBL SS	8/9/2010	0.017	0.063	1.65	0.609	0.444	14.4
WBL SS	8/11/2010	0.104	0.027	0.689	0.02	0.567	2.9
WBL SS	8/16/2010	0.197	0.055				4.3
WBL SS	8/23/2010	0.189	0.033	1.23	0.486	0.212	85.0
WBL SS	8/30/2010	0.254	0.056				72.1
WBL SS	8/31/2010	0.208	0.083	0.934	0.067	0.626	11.2
WBL SS	9/7/2010	0.148	0.081				11.4
WBL SS	9/13/2010	0.100	0.014	1.40	0.02	0.493	3.7
WBL SS	9/20/2010	0.48	0.438				1.9
WBL SS	9/23/2010	0.188	0.056	1.19	0.02	0.306	19.7
WBL SS	9/27/2010	0.126	0.026	1.20	0.02	2.27	5.9
	average	**0.180**	**0.076**	**1.279**	**0.202**	**0.789**	**15.8**

Lambert Creek – Whitaker Pond 2010 Data

SITE	DATE	TP (mg/L)	SRP	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
Whitaker	5/3/2010	0.185	0.029	1.90	0.073	0.01	29.7
Whitaker	5/10/2010	0.157	0.069				13.4
Whitaker	5/11/2010	0.147	0.043	1.23	0.296	0.397	9.5
Whitaker	5/17/2010	0.383	0.122	1.87	1.41	0.064	229.5
Whitaker	5/24/2010	0.296	0.064				13.0
Whitaker	5/26/2010	0.571	0.150	3.25	0.191	0.022	20.8
Whitaker	6/1/2010	0.364	0.094	2.50	1.36	0.01	30.0
Whitaker	6/7/2010	0.255	0.155				1.1
Whitaker	6/14/2010	0.282	0.190	1.88	0.630	0.070	6.9
Whitaker	6/21/2010	0.227	0.076				1.9
Whitaker	6/28/2010	0.183	0.100	0.996	0.151	0.103	1.1
Whitaker	7/6/2010	0.191	0.111				2.6
Whitaker	7/12/2010	0.243	0.088	1.80	0.637	0.073	2.1
Whitaker	7/19/2010	0.337	0.276				3.2
Whitaker	7/26/2010	0.310	0.182	1.44	0.360	0.038	9.8
Whitaker	8/2/2010	0.236	0.133				7.3
Whitaker	8/9/2010	0.189	0.033	1.90	0.331	0.102	3.3
Whitaker	8/11/2010	0.131	0.011	1.03	0.208	0.168	6.3
Whitaker	8/16/2010	0.154	0.092				2.2
Whitaker	8/23/2010	0.171	0.029	1.47	0.526	0.036	4.3
Whitaker	8/30/2010	0.099	0.015				2.8
Whitaker	8/31/2010	0.240	0.144	1.84	0.315	0.385	27.3
Whitaker	9/7/2010	0.170	0.063				5.7
Whitaker	9/13/2010	0.247	0.012	1.93	0.237	0.01	85.7
Whitaker	9/20/2010	0.151	0.092				3.5
Whitaker	9/23/2010	0.128	0.054	0.841	0.053	0.170	6.7
Whitaker	9/27/2010	0.139	0.037	1.11	0.390	0.097	2.1
	average	**0.229**	**0.091**	**1.687**	**0.448**	**0.110**	**19.7**

Whitaker Pond Weir Data

- Did not show improvements for TP reduction
- Did show a little improvement for TSS reduction
- * one note, ecoli was down in Whitaker quite a bit this summer, see pg. 68*

		WBLSS TP (mg/L)	Whitaker TP (mg/L)	WBLSS TSS (mg/L)	whitaker TSS (mg/L)
2009	**average**	**0.11**	**0.24**	**5.91**	**11.00**
2010	**average**	**0.18**	**0.23**	**11.08**	**9.47**

MAX Storm Pipe Discharge = 96.79 cfs on 6/25/2010 with a 1.97 inch rainfall

Average discharge = 0.69 cfs

Lambert Creek – Oakmede 2010 Data

SITE	DATE	TP (mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
oakmede	5/3/2010	0.315	1.63	0.02	0.01	9.4
oakmede	5/10/2010	0.216				12.0
oakmede	5/11/2010	0.142	1.48	0.384	0.198	9.8
oakmede	5/17/2010	0.102	1.13	0.02	0.011	6.8
Oakmede	5/24/2010	0.260				7.5
Oakmede	5/26/2010	0.256	1.02	0.02	0.01	1.9
Oakmede	6/1/2010	0.220	1.05	0.110	0.01	6.9
Oakmede	6/7/2010	0.195				0.9
Oakmede	6/14/2010	0.277	1.18	0.111	0.019	3.0
Oakmede	6/21/2010	0.178				0.4
Oakmede	6/28/2010	0.193	0.979	0.064	0.01	0.8
Oakmede	7/6/2010	0.243				2.0
Oakmede	7/12/2010	0.184	1.02	0.02	0.01	0.9
Oakmede	7/19/2010	0.268				2.7
Oakmede	7/26/2010	0.253	0.153	0.02	0.01	4.0
Oakmede	8/2/2010	0.297				4.7
Oakmede	8/9/2010	0.293	1.52	0.02	0.01	3.5
Oakmede	8/11/2010	0.382	1.35	0.02	0.01	6.8
Oakmede	8/16/2010	0.262				3.4
Oakmede	8/23/2010	0.302	1.00	0.02	0.01	3.5
Oakmede	8/30/2010	0.269				4.3
Oakmede	8/31/2010	0.223	0.941	0.02	0.01	2.2
Oakmede	9/7/2010	0.215				2.6
Oakmede	9/13/2010	0.111	0.925	0.024	0.01	1.0
Oakmede	9/20/2010	0.118				0.3
Oakmede	9/23/2010	0.112	0.781	0.021	0.027	1.4
Oakmede	9/27/2010	0.116	0.776	0.02	0.115	0.6
	average	**0.222**	**1.058**	**0.057**	**0.030**	**3.8**

Lambert Creek – County Rd. F 2010 Data

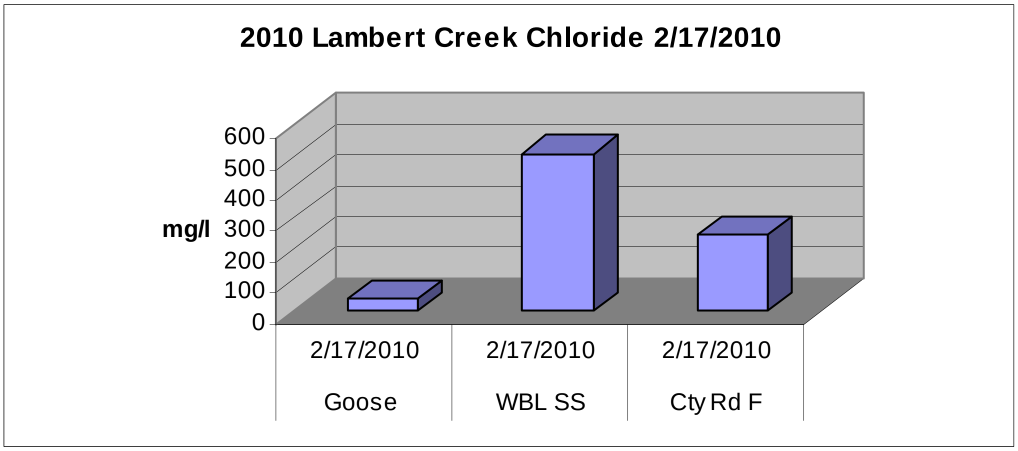
SITE	DATE	TP (mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
Cty Rd F	5/3/2010	0.247	1.73	0.440	0.589	18.1
Cty Rd F	5/10/2010	0.265				37.7
Cty Rd F	5/11/2010	0.192	1.57	0.173	0.546	6.6
Cty Rd F	5/17/2010	0.248	1.63	0.079	0.057	2.7
Cty Rd F	5/24/2010	0.290				5.1
Cty Rd F	5/26/2010	0.237	2.10	0.434	0.297	19.2
Cty Rd F	6/1/2010	0.315	1.87	0.482	0.422	14.4
Cty Rd F	6/7/2010	0.318				11.3
Cty Rd F	6/14/2010	0.619	1.96	0.143	0.037	9.4
Cty Rd F	6/21/2010	0.329				6.7
Cty Rd F	6/28/2010	0.827	1.69	0.046	0.01	9.7
Cty Rd F	7/6/2010	0.829				11.1
Cty Rd F	7/12/2010	0.705	1.40	0.066	0.015	10.2
Cty Rd F	7/19/2010	0.533				13.7
Cty Rd F	7/26/2010	0.464	1.20	0.089	0.071	7.3
Cty Rd F	8/2/2010	0.374				6.5
Cty Rd F	8/9/2010	0.363	2.05	0.157	0.051	7.7
Cty Rd F	8/11/2010	0.564	1.64	0.02	0.038	14.1
Cty Rd F	8/16/2010	0.485				6.3
Cty Rd F	8/23/2010	0.811	1.52	0.02	0.01	25.8
Cty Rd F	8/30/2010	0.277				7.5
Cty Rd F	8/31/2010	0.214	1.45	0.069	0.502	4.3
Cty Rd F	9/7/2010	0.322				5.4
Cty Rd F	9/13/2010	0.234	0.995	0.052	0.014	5.6
Cty Rd F	9/20/2010	0.281				5.8
Cty Rd F	9/23/2010	0.291	1.08	0.035	0.065	5.8
Cty Rd F	9/27/2010	0.241	1.43	0.02	0.01	3.1
	average	**0.403**	**1.582**	**0.145**	**0.171**	**10.4**

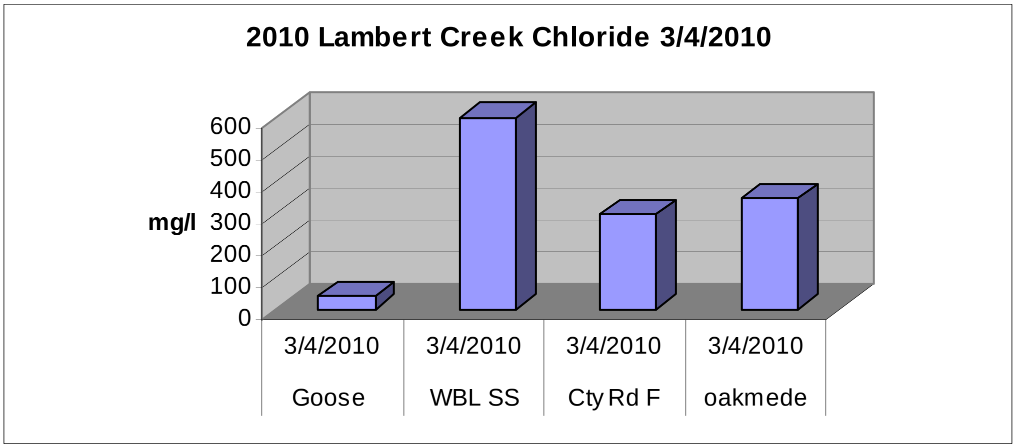
Lambert Creek – Kohler Rd. 2010 Data

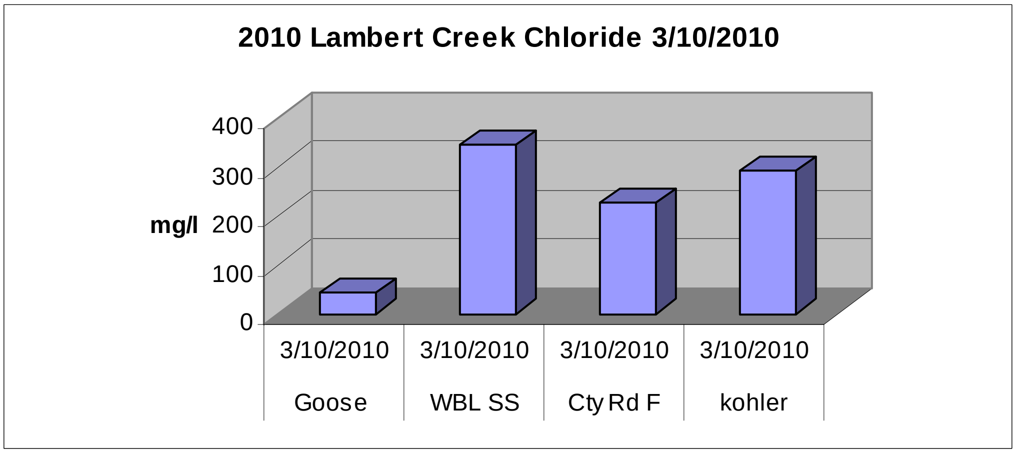
SITE	DATE	TP (mg/L)	TKN (mg/L)	NH3 (mg/L)	NO3 mg/L	TSS (mg/L)
kohler	5/3/2010	0.091	3.26	1.22	0.513	5.7
kohler	5/10/2010	0.065				2.8
kohler	5/11/2010	0.096	1.57	0.201	0.113	5.3
kohler	5/17/2010	0.098	1.72	0.246	0.216	2.9
Kohler	5/24/2010	0.131				7.3
Kohler	5/26/2010	0.182	2.15	0.592	0.139	10.0
Kohler	6/1/2010	0.144	2.83	1.55	0.631	14.8
Kohler	6/7/2010	0.105				3.0
Kohler	6/14/2010	0.260	1.32	0.074	0.055	6.5
Kohler	6/21/2010	0.254				3.0
Kohler	6/28/2010	0.267	1.54	0.062	0.044	3.6
Kohler	7/6/2010	0.221				4.6
Kohler	7/12/2010	0.283	1.51	0.146	0.269	31.5
Kohler	7/19/2010	0.195				12.1
Kohler	7/26/2010	0.251	0.339	0.302	0.568	17.9
Kohler	8/2/2010	0.220				16.4
Kohler	8/9/2010	0.188	1.53	0.190	0.314	14.1
Kohler	8/11/2010	0.332		0.044	0.106	30.1
Kohler	8/16/2010	0.212				24.0
Kohler	8/23/2010	0.248	1.59	0.337	0.201	6.4
Kohler	8/30/2010	0.153				3.2
Kohler	8/31/2010	0.291	2.10	0.465	0.247	8.9
Kohler	9/7/2010	0.250				12.2
Kohler	9/13/2010	0.152	1.11	0.205	0.193	2.0
Kohler	9/20/2010	0.171				5.2
Kohler	9/23/2010	0.232	1.42	0.02	0.037	18.3
Kohler	9/27/2010	0.151	1.14	0.02	0.022	1.8
	average	**0.194**	**1.675**	**0.355**	**0.229**	**10.1**

* VLAWMO, with the help of Wenck Associates, the Minnesota Conservation Corps and a grant from the PCA, restored approximately 1600 feet of creek just upstream of the Kohler flume. Project will be completed in spring of 2011.

Lambert Creek Chloride Data – 2010







* WBL SS has the highest concentration of chloride on all three sampling days. Much of the runoff going through the storm sewer is coming from hwy 96.

Lambert Creek YSI Data – 2010

Reading Location	Date	DO (mg/l)	Temp C	pH	Conductivity
Cty Rd F	5/11/2010	10.64	8.99	7.74	0.582
Cty Rd F	5/25/2010	5.62	16.99	7.82	0.886
Cty Rd F	7/8/2010	5.17	20.21	9.11	0.524
Cty Rd F	8/4/2010	5.58	21.32	10.33	0.583
Cty Rd F	9/22/2010	6.11	14.24	-0.24	0.488
Goose	5/11/2010	10.15	11.07	8.79	0.303
Goose	7/8/2010	4.3	24.76	7.52	0.287
Goose	8/4/2010	3.37	27.16	9.68	0.298
Goose	9/22/2010	5.12	16.21	5.37	0.327
Kohler	5/11/2010	9.51	6.52	7.62	1.007
Kohler	5/24/2010	5.26	22.3	7.85	0.784
Kohler	7/8/2010	5.56	20.29	9.2	0.754
Kohler	8/4/2010	4.93	23.58	10.13	0.762
Kohler	9/22/2010	6.6	12.9	-0.57	0.484
Oakmede	5/11/2010	10.98	7.96	7.98	0.199
Oakmede	5/24/2010	3.8	20.9	7.9	0.468
Oakmede	7/8/2010	4.6	25.99	8.76	0.43
Oakmede	8/4/2010	3.36	27.85	9.75	0.416
Oakmede	9/22/2010	5.52	16.71	1.37	0.355
WBL SS	5/25/2010			7.26	0.855
Whitaker	5/11/2010	7.79	10.2	8.14	0.255
Whitaker	7/8/2010	3.03	24.93	8.35	0.213
Whitaker	8/4/2010	2.02	24.44	9.97	0.218
Whitaker	9/22/2010	5.78	15.82	3.31	0.235