Little Green Lake Watershed Assessment 2004

Green Lake County Land Conservation Department

Table of Contents

Little Green Lake Watershed Assessment 2004

Purpose:

The purpose of this document is to identify the major sources of sediment and phosphorus delivery to Little Green Lake. This report is not intended to be all inclusive, and should not be used as such.

Treatment recommendations have been included in this report, along with preliminary design data. Further design, analysis, and engineering approval is required before any of the recommendations may be implemented.

A variety of funding options are available to implement the recommended projects and programs. Two of these grants are described at the end of this document.

All these recommendations are contingent on the cooperation of private landowners. Participation is completely voluntary. Some landowners have already been approached regarding the projects proposed in this report, and are open to the idea of participating, but are not committed at this time.

Any questions regarding this document should be directed to:

Green Lake County Land Conservation Department
492 Hill Street
PO Box 3188
Green Lake WI 54941-3188
Phone: (920) 294-4051
Fax (920) 294-4056

Document Prepared by:

Derek R Kavanaugh
Soil Conservationist
Green Lake County Land Conservation Department

Little Green Lake is prone to large algal blooms due to high levels of phosphorus. Sources of phosphorus include increased shoreline development, agricultural production, and in-lake recycling.

The Little Green Lake Protection and Rehabilitation District was formed in 1991 to plan and implement lake protection strategies.

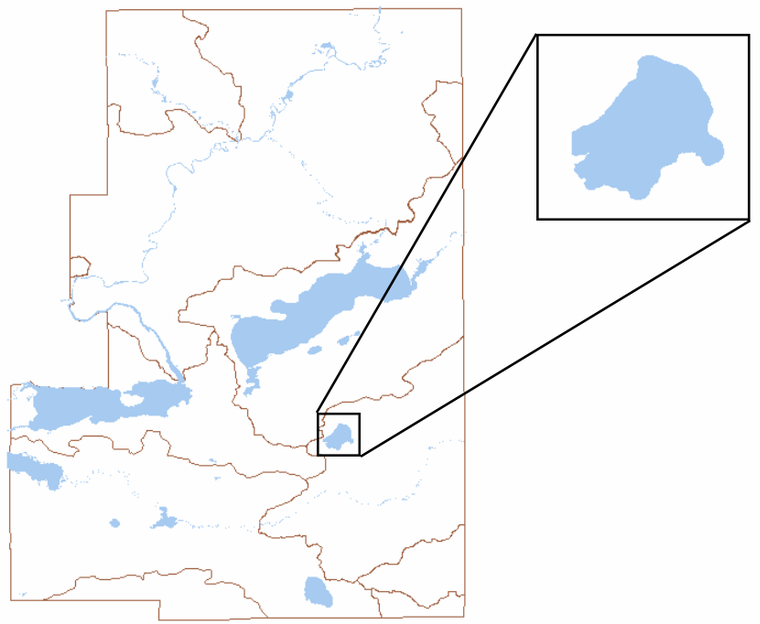
A lake management plan was developed in 1997 by Ramaker and Associates.

In 1999, Ramaker and Associates performed a limited phosphorus budget analysis. The result of the analysis indicated that 70% of the phosphorus budget was attributed to in-lake recycling. It was determined that eliminating the external sources of phosphorus would not eliminate the excessive weed growth. In 2002, a lake aeration system was installed to prevent the release of sediment-stored phosphorus in the lake's bottom.

In 2000, a water and sediment storage basin was installed north of Hwy 44 to reduce the overland movement of sediment attached phosphorus reaching the lake from 450 acres of agricultural cropland.

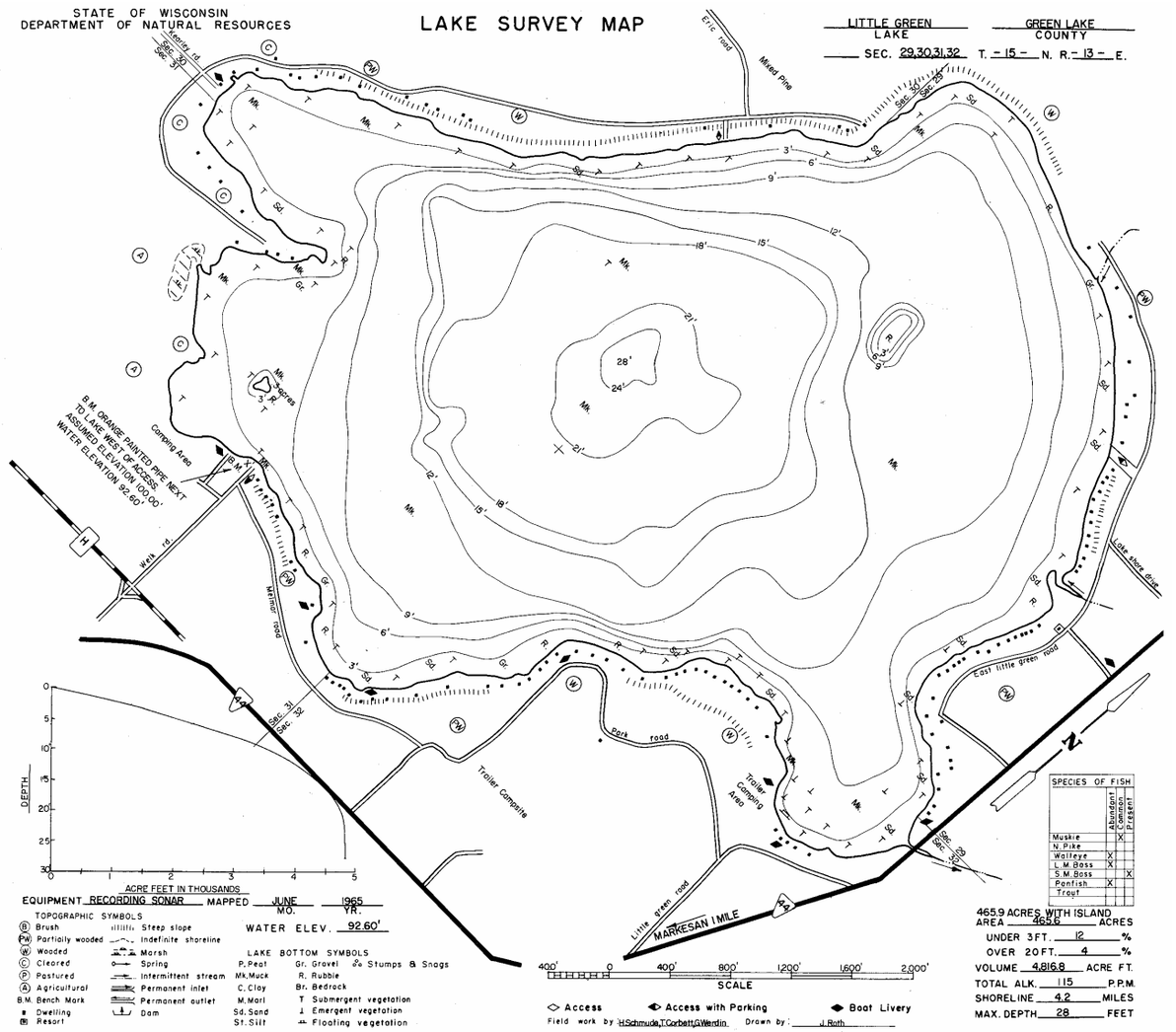
In accordance with the lake management plan, the Lake District is currently addressing the issues of in-lake nutrient recycling and harvesting of nuisance aquatic plants. External nutrient loading is currently being addressed with the assistance of the Green Lake County Land Conservation Department, by working with local landowners to install Best Management Practices (BMPs).

BMPs being planned and implemented include nutrient management planning, conservation tillage, contour farming, and sedimentation basins.



Lake Statistics

County:	Green Lake County
State:	Wisconsin
Legal Descript:	T15N R13E S29-32
Latitude:	43.73639º
Longitude:	-88.98194º
Size:	466 Acres
Mean Depth:	10 feet
Max Depth:	28 feet
Elevation:	927 feet
Lake Volume:	4,816 Ac-Ft
Shoreline Length:	4.2 miles
Lake Type:	Seepage Lake
Access:	Boat Ramp
Fish Species:	Bluegill, Largemouth Bass, Muskie, Smallmouth Bass, Walleye, Crappie
Exotic/Invasive Species:	Eurasian Milfoil

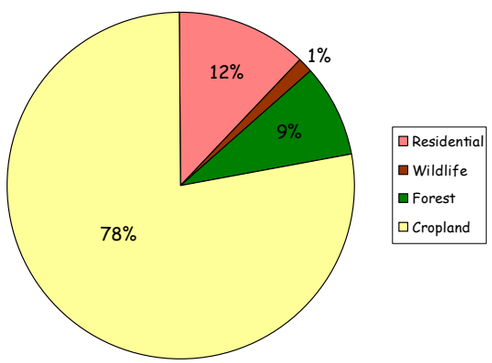


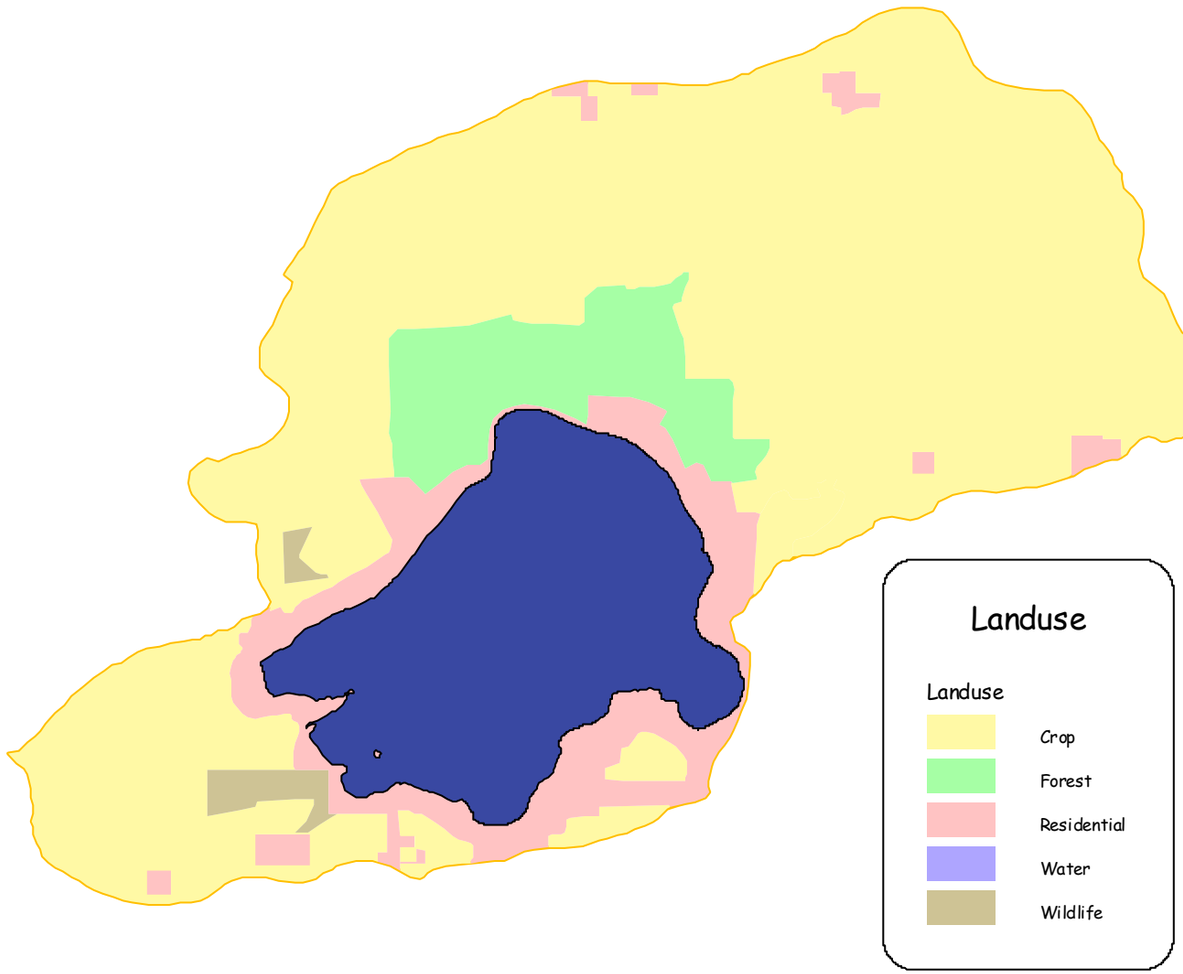
Land Use

The Little Green Lake watershed is primarily agricultural land, used for grain and vegetable production. There are few dairies located within the watershed, resulting in low acreages of hay land.

The lakeshore is moderately developed with a mixture of seasonal and year-round homes, along with two trailer courts, a campground and a town park.

Little Green Lake Watershed Land Use





Watershed Soils

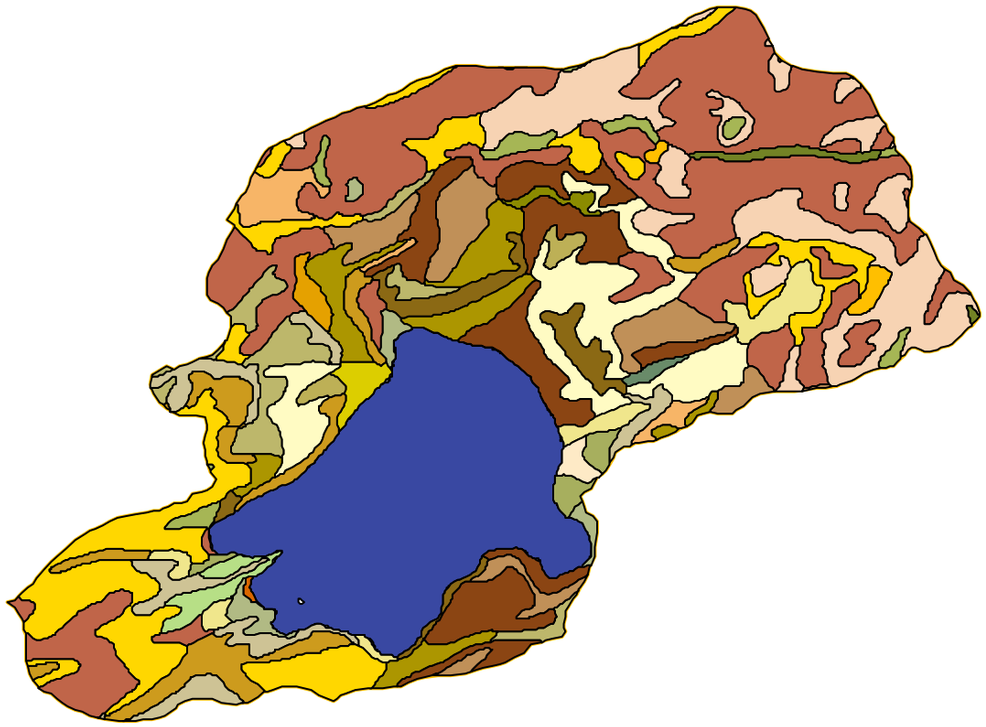
Plano-Mendota-St. Charles association

Well drained and moderately well drained, nearly level to sloping soils that have a subsoil mainly of silt loam and silty clay loam underlain by calcareous, gravelly or very gravelly sandy loam glacial till.

This association consists of a high plain or plateau of ground moraine that has broad ridge tops and gentle swales. It is on glaciated uplands where the soils formed in windblown silts an the underlying glacial till. The coils are mostly nearly level and gently sloping but are steeper along drainage ways and escarpments.
This association makes up about 30 percent of the county. It is about 28 percent Plano soils, 11 percent Mendota soils, 7 percent St. Charles soils and 54 percent minor soils.

The Plano soils are nearly level and gently sloping and well drained and moderately well drained. They are on broad, slightly convex plains. They have a surface layer of silt loam. Their subsoil is silt loam and silty clay loam in the upper part and heavy silt loam in the lower part. The substratum is gravelly sandy loam glacial till that begins at a depth of about 58 inches.

The Mendota soils are nearly level to sloping and well drained. They are mostly on low knolls. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and very gravelly loam in the lower part. The substratum is a very gravelly sandy loam glacial till that beings at a depth of about 33 inches.



* Refer to Green Lake County Soil Survey for mapping unit names and descriptions.

The St. Charles soils are nearly level to sloping and well drained and moderately well drained. They are chiefly on broad ridge tops. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and heavy sandy loam in the lower art. The substratum is gravelly sandy loam glacial till that beings at a depth of about 54 inches.

Of minor extent in this association are the Knowles, LeRoy, Ritchey, Colwood, Joy, Kibbie, Ossian, and Palms soils. LeRoy soils are intermingled with the St Charles soils where the high plain breaks into major drainage ways. Knowles and Ritchey soils are along escarpments where the glacial till is thin over dolomite. Colwood, Joy, Kibbie, Ossian, and Palms soils are in swales and wet drainage ways.

The soils of this association have a high potential for all of the cultivated crops commonly grown in the county. Most of the acreage is used for cultivated crops such as corn, small grains, and legumes, and some in used for canning crops such as sweet corn and peas. A large acreage is also used for dairy farming. A few steeper areas and undrained wet areas are used for pasture or wildlife habitat. A few areas are in woodland.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, and fertility. The wet soils need to be drained if they are to be used for crops.

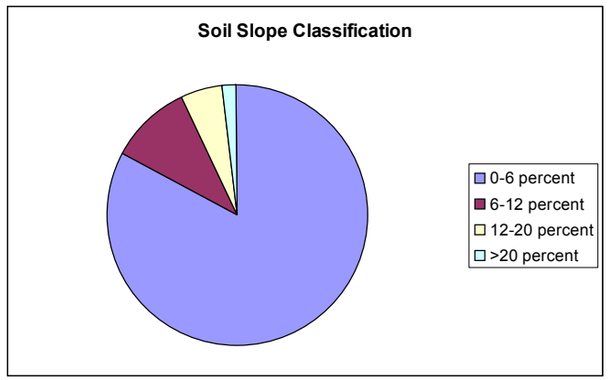
The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

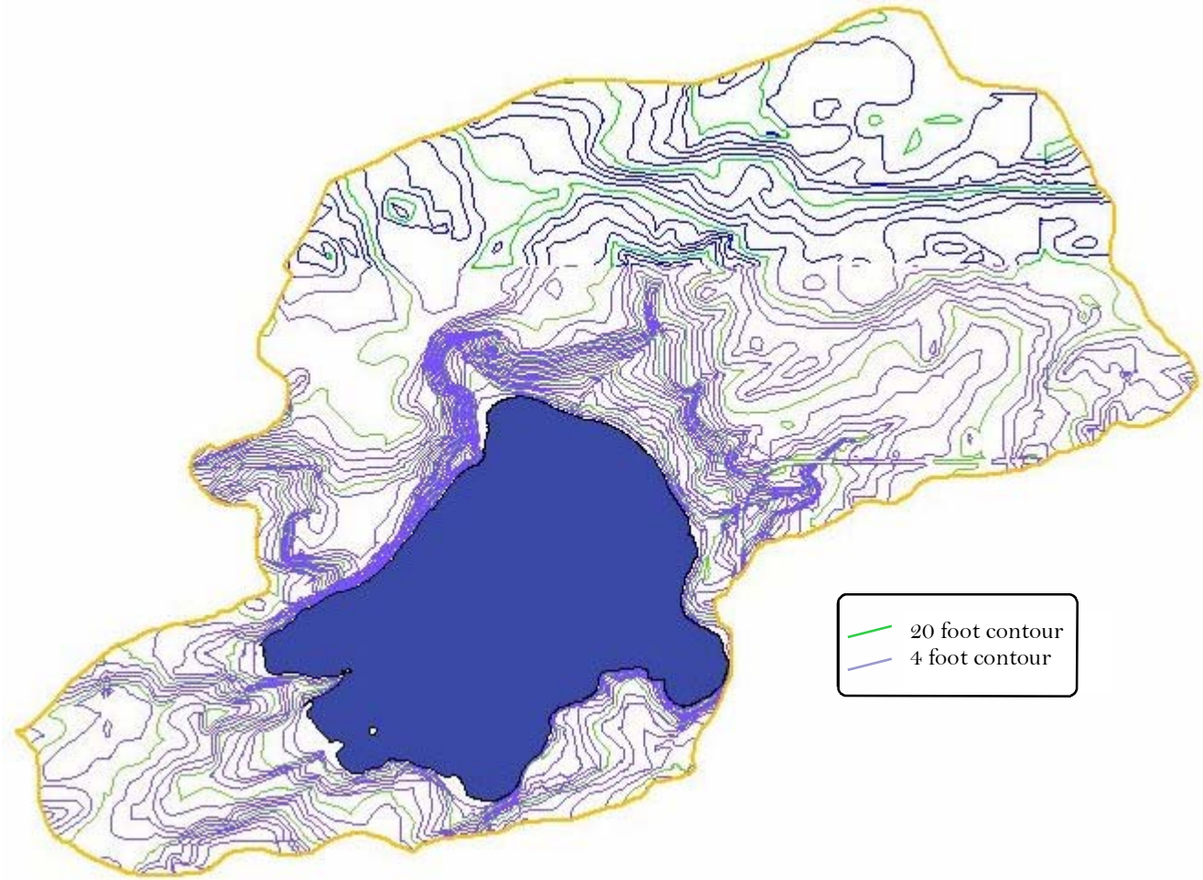
Watershed Slope Classification

Average Watershed Slope: 3.95%

Slope Class		Area	
A/B	(0-6%)	1726	Acres
C	(6-12%)	215	Acres
D	(12-20%)	109	Acres
E	(>20%)	36	Acres

Of the 360 acres of 6% or greater slopes, only 115 acres (30%) is present on cropland.





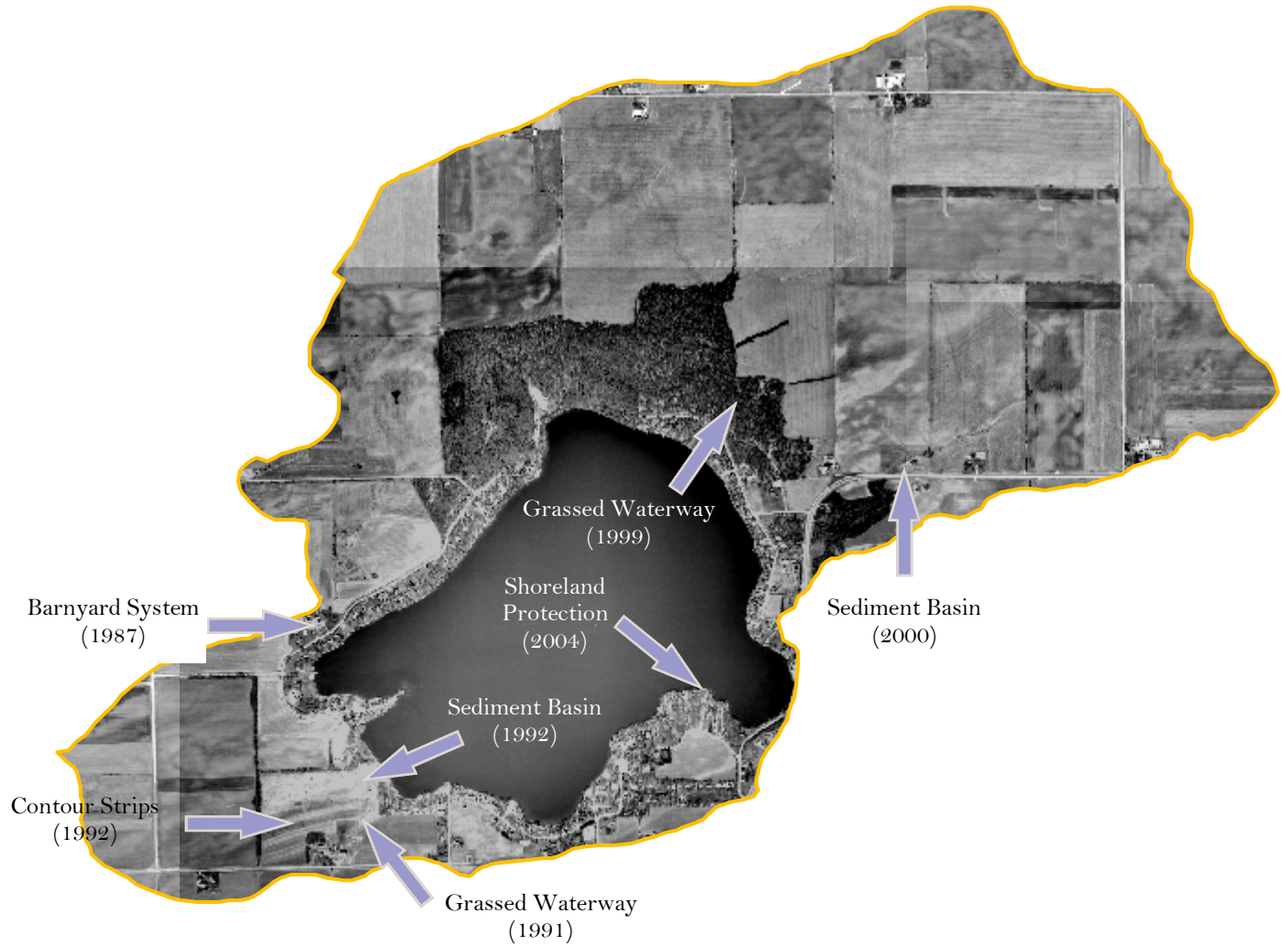
Historical Conservation Practices

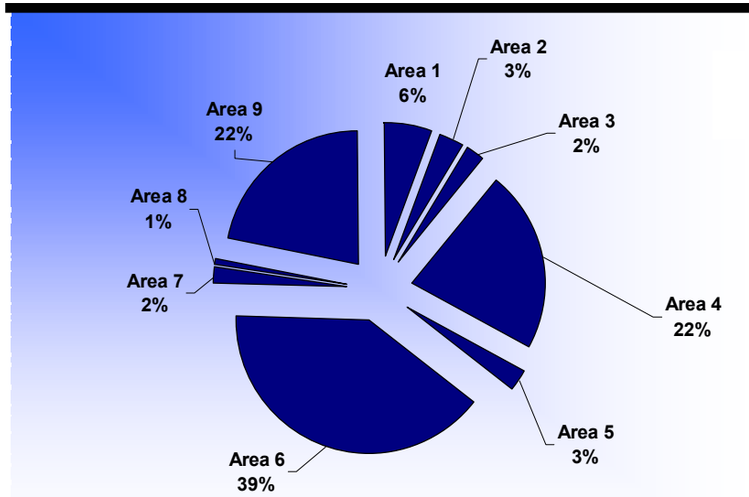
A series of conservation practices have been installed over the past two decades in the Little Green Lake watershed.

Some of the practices installed with the assistance of the Green Lake County Land Conservation Department (LCD), include:

1987	Barnyard System
1991	Grassed Waterway
1992	Contour Strip Cropping
1992	Sediment Basin
1999	Grassed Waterway
2000	Sediment Basin
2004	Seawall Removal / Shoreland Protection and Habitat

The LCD has plans to continue working in the Little Green Lake watershed to continue improving water quality and lake health.



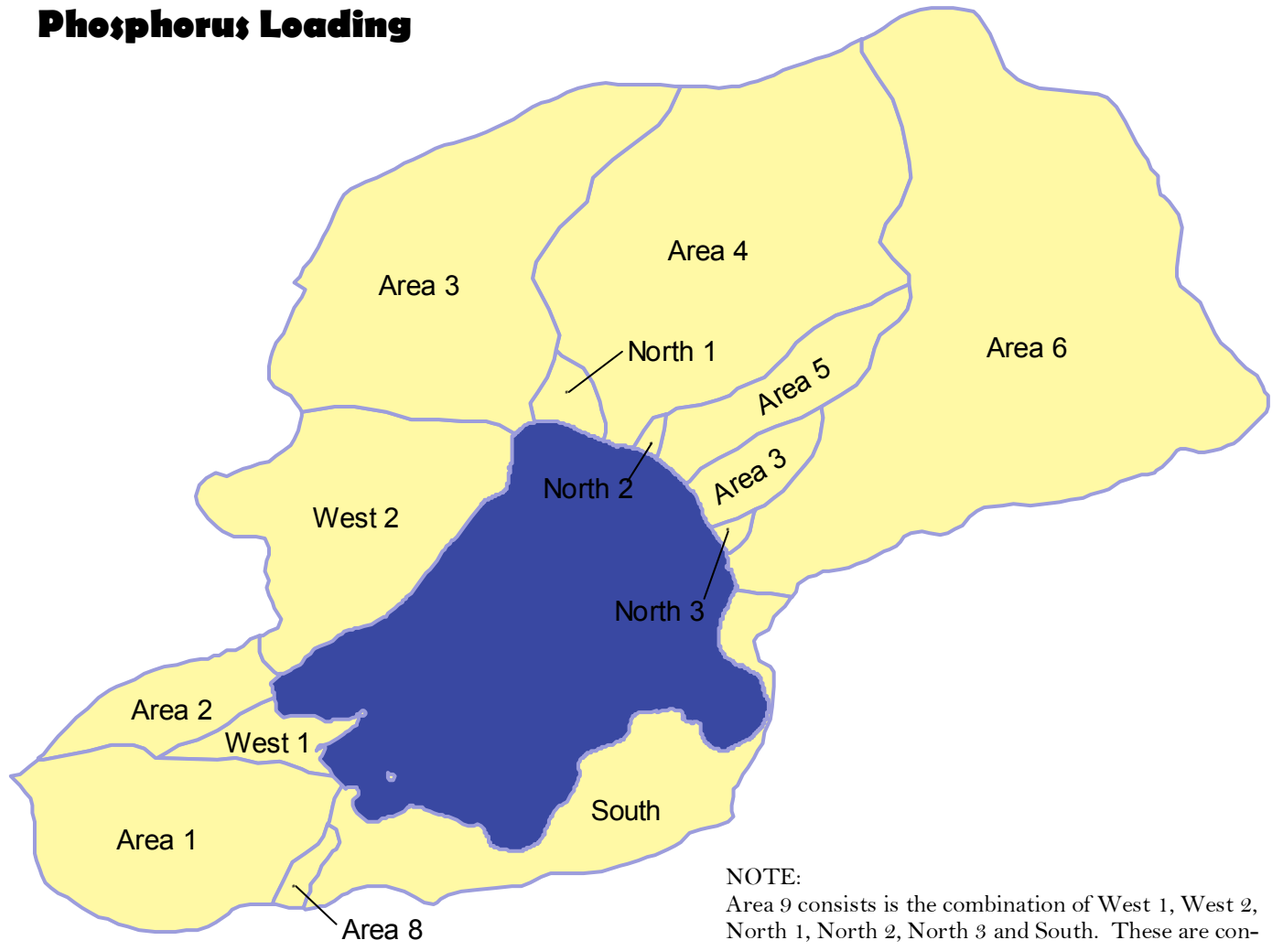


External Phosphorus Loading

According to the 1999 Limited Phosphorus Budget Study performed by Ramaker and Associates the major external sources of Phosphorus are delivered from the following areas (listed in order of significance):

1.	Area 6	NE Watershed
2.	Area 9	Direct (Shore Area)
3.	Area 4	NE Watershed
4.	Area 1	SW Watershed
5.	Area 2	West Watershed
6.	Area 5	NW Watershed
7.	Area 3	NE Watershed
8.	Area 7	West Watershed
9.	Area 8	West Watershed

Phosphorus Loading



NOTE:
Area 9 consists is the combination of West 1, West 2, North 1, North 2, North 3 and South. These are considered "direct runoff" areas

Watershed Treatment Recommendations

Area 1

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Maintain current contour strips
- Encourage use of cover crops

Area 2

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops
- If livestock are reintroduced, barnyard system installed in 1987 must be upgraded.

Area 3

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops

Area 4

- Install 2 sedimentation basins
- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops

Area 5

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops

Area 6

- Maintain sedimentation basin installed in 2000
- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops

Area 7

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops

Area 8

- Implement Nutrient Management Planning on all cropland
- Encourage high residue management
- Encourage use of cover crops
- Maintain grassed waterway installed in 1991

Area 9 (Direct)

- Eliminate use of Phosphorus lawn fertilizer
- Encourage installation of shoreland buffers
- Encourage minimal lawn sizes
- Encourage soil testing for lawn fertilization
- Encourage infiltration practices, such as rain gardens and barrels.
- Conduct fertilizer survey of residents
- Implement soil testing program
- Consider a fertilizer distribution program
- Implement Nutrient Management Planning on all cropland acres
- Encourage high residue management
- Encourage use of cover crops
- Install sedimentation basin (South Area)

Proposed Conservation Practice

Basin #1

Location: T15N R13E S29 NW1/4 NE1/4
Drainage Area 4

Contributing Area: 231 Acres

Storage Capacity: 15.64 Ac-Ft (25yr-24hr)
Sediment Storage Capacity (10yr): 0.752 Ac-Ft

5 yr-24 yr design storm inflow (Qin): 155 cfs
5 yr-24 yr design storm outflow (Qin): 40 cfs
Reduction: 74%

25 yr-24 yr design storm inflow (Qin): 255 cfs
25 yr-24 yr design storm outlflow(Qin): 92.6 cfs
Reduction: 64%

Trapping Efficiency: 65%
Sediment Reduction: 90.5 Tons/Year

Soil Volume: 7140 Cu Yds
Inlet Pipe Diameter: 36”
Outlet Pipe Diameter: 24”

Maintenance Agreement: TBD*

* To be determined

Proposed Project Area

Proposed Conservation Practice

Basin #2

Location: T15N R13E S29 NW1/4 NE1/4
Drainage Area 4

Contributing Area: 408 Acres

Storage Capacity: 13.26 Ac-Ft (25 yr-24hr)
Sediment Storage Capacity (10yr): 1.093 Ac-Ft

5 yr-24 yr design storm inflow (Qin): 131 cfs
5 yr-24 yr design storm outflow (Qin): 40.7 cfs
Reduction: 69%

25 yr-24 yr design storm inflow (Qin): 255 cfs
25 yr-24 yr design storm outlflow(Qin): 97.7 cfs
Reduction: 62%

Trapping Efficiency: 87%
Sediment Reduction: 176 Tons/Year

Soil Volume: 4042 Cu Yds
Inlet Pipe Diameter: 36”
Outlet Pipe Diameter: 24”

Maintenance Agreement: TBD*

* To be determined

Proposed Project Area

NOTE: Basin #2 receives the outflow of basin #1 plus an additional 177 acres

Proposed Conservation Practice

Outlet

Current Condition: Narrow, Deep Gully with eroding banks

Contributing Area: 408 Acres

Current 10 year-24 hour design storm discharge: 332 cfs (25 year-24 hour: 433 cfs)

Design Capacity: 100 cfs (25 year-24 hour design storm event)

Channel Reconstruction:

Reach 1 (Wooded):

Widen channel bottom to reduce velocity and shear stress
Grade banks to maximum slope of 3:1
Install rock check dams to prevent channel incision

Reach 2 (South of woods, north of road):

Widen channel bottom to reduce velocity and shear stress
Grade banks to maximum slope of 3:1
Line channel with Turf Reinforcement Matting (TRM) to hold vegetation

Reach 3 (South of road):

Option 1—Construct retaining walls (may be cost-prohibitive)
Option 2—Grade banks and line with rock (Requires use of additional property)
Option 3—Leave in current condition (Requires yearly maintenance for functionality)

Reach 3

Reach 2

NOTE: Photos of Reach 1 not available at time of publication

PHOSPHORUS

Natural inputs

Phosphorus (P) is relatively sparse in natural soils and exists primarily as the phosphate molecule that tends to stick to soil as water moves through it. Therefore, in the absence of human-caused impacts, P concentrations in the surface and groundwater that flows into lakes tends to be very low and so usually regulates the potential amount of algal growth in the system. In pristine parts of the world, there is also very little phosphorus in precipitation and in the dry portion of atmospheric inputs referred to as dry fallout.

The most important thing you can do for our lakes is to insist on a true phosphorus free fertilizer product. Remember, as golf courses have shown, you can have good turf and protect water quality by using a phosphorus free fertilizer.

Remember, when you're fertilizing the lawn, you MAY NOT just be fertilizing the lawn!

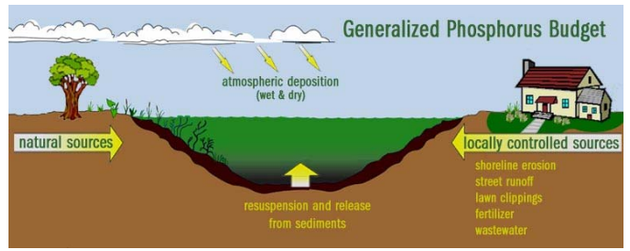
Human inputs

Human activities lead to increased inputs of P in streams and sometimes in groundwater and even in atmospheric inputs. The most obvious sources are from municipal wastewater (sewage) treatment plants and from industry and are called point sources that are regulated by monitoring loads at the ends of their discharge pipes and setting strict limits. Diffuse, or non point sources, are much more difficult to measure and to control. Agricultural fertilizer-P is a major source of phosphorus pollution in streams throughout the US.

Most lawns in Wisconsin (approximately 80 percent) have soils that are saturated with phosphorus, and do not need any more added to them.

The major sources of P to most urban lakes are non-point, and are controllable to a large extent by homeowners and/or local communities. They typically include:

- Soil-P from erosion (construction sites, road banks, shoreline disturbance, lawns & gardens)
- Road runoff
- Roof runoff
- Lawn clippings
- Excess lawn fertilizer runoff
- Sewage from leaky sewer lines or from on-site septic drain fields



Soil Testing and Fertilizer Program

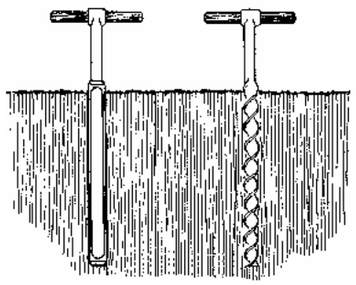
As indicated earlier in this report, lawn fertilizer can be a large source of the Phosphorus loading to Little Green Lake. Often fertilizer is applied without knowing what nutrients a lawn requires. A soil test is the only practical way of telling whether lime and fertilizer are needed.

Therefore, as an educational and research component of this report, it is recommended that a soil testing and fertilizer program be implemented in the Little Green Lake Watershed.

Chapter NR 151 of the Wisconsin Statutes already requires that all cropland have a nutrient management plan in place by January 1, 2008 for any cropland that applies fertilizer or manure.

In order to educate residential landowners around Little Green Lake, it is recommended that a mail survey be distributed to inquire about resident's fertilizer knowledge and use.

As a component of the survey, residents would be able to opt to have a free soil test conducted. The soil sample would be taken by Green Lake County Land Conservation Department (LCD) staff, and analyzed by UW-Madison Soils Lab. Fertilizer and lime recommendations would be given by the LCD staff.



There is no "one size fits all" when it comes to fertilizer. Many commercial blends available at retail stores can be misleading and confusing.

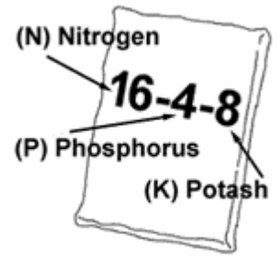
Many factors must be considered when choosing and applying fertilizer, such as:

- Soil Type
- Current Soil Fertility
- Grass Type
- New or Existing Lawn
- Time of Year

Approximately 80% of the soils in Wisconsin are saturated with Phosphorus, and do not require any more. It is commonly found that many people do not understand the chemical composition of fertilizer, and phosphorus-free fertilizer may be difficult to locate.

As part of the soil testing and fertilizer program, residents with lawns requiring fertilizer additions who wish to fertilize may qualify to receive a free year supply of phosphorus free fertilizer from a local Coop by the use of a voucher from the Lake District or County LCD.

This program would serve to educate the public about the types and proper use of fertilizer, as well as local sources of the proper fertilizer. As a secondary effect, it would serve to support the local economy.

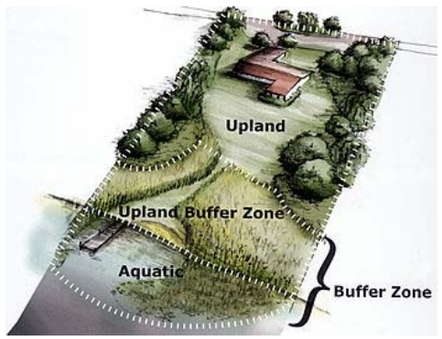


It is important that people understand the numbers on the fertilizer bag, and know when, how, and how much to apply to maintain a healthy lawn and lake.

Shoreland Restoration Program

As Little Green Lake becomes more developed, shoreland habitat continues to decrease. The "riparian zone" is the area of land between the waters' edge and the upland. This is the most diverse habitat of most ecosystems. Many terrestrial and aquatic species rely on this zone for survival. Over 90% of all endangered species in Wisconsin rely on the riparian zone for a least some portion of their life cycle.

As houses are built, lawns are installed, and shorelines are covered in rock, the shoreland habitat is destroyed, and becomes "sterile".



Shoreland buffers serve several purposes, including:

- Erosion prevention
- Pollutant filtering
- Increases infiltration
- Reduces the need for fertilizer near water
- Reduces the need for pesticides near water
- Habitat for many wildlife species
- Travel corridor for wildlife
- Wildlife food sources
- Nuisance species control (geese)
- Sound control
- Privacy barrier
- Provides a natural look to the lake
- Encourages a sustainable, diverse ecosystem

Additional benefits include:

- Less time and money spent on lawn care
- More time to enjoy property
- More wildlife viewing near your home

Lawns extending to the waters' edge not only impact water quality, but have little or no wildlife benefits.

Financial Estimates

Basin #1	
Obstruction Removal	$5,000
Outlet Pipes	$7,500
Earthen Berm	$35,000
Site Stabilization	$2,500
Basin #2	
Obstruction Removal	$5,000
Outlet Pipes	$7,500
Earthen Berm	$35,000
Site Stabilization	$2,500
Outlet Channel	
Earth Work	$2,500
Rock Check Dams	$2,000
TRM Lining	$2,000
SUBTOTAL	$106,500
Land Compensation (Financial Impact, Easements, etc.)	$43,700
Consultants (Failure Analysis)	$2,500
Staff Time (Survey, Design, Engineering, Installation)	$31,200
TOTAL	**$183,900**

Lake Protection Grants

Grant awards may fund up to 75 percent of project costs (maximum grant amount $200,000). Because of the size, complexity, and technical nature of many projects, a pre-application meeting with the DNR is highly recommended, especially if the project requires plan or permit approvals. This will ensure the application will be complete and can be evaluated and considered for funding. Eligible projects include:

- Purchase of land or conservation easements that will significantly contribute to the protection or improvement of the natural ecosystem and water quality of a lake.
- Restoration of wetlands and shorelands that will protect a lake's water quality or its natural ecosystem (these grants are limited to $100,000). Special wetland incentive grants of up to $10,000 are eligible for 100 percent state funding if the project is identified in the sponsor's comprehensive land use plan.
- Development of local regulations or ordinances to protect lakes and the education activities necessary for them to be implemented (these grants are limited to $50,000)
- Lake management plan implementation projects recommended in a plan and approved by DNR. These projects may include watershed management projects, lake restoration, diagnostic feasibility studies, or any other projects that will protect or improve lakes. Sponsors should submit a copy of their lake management plan and the recommendation(s) it wants to fund for DNR approval at least two months in advance of the May 1 deadline. Plans must have been officially adopted by the sponsor and made available for public comment prior to submittal. The DNR will review the plan and advise the sponsor if the plan is approved.

Staff time can be used as an "In-Kind" cost to be applied to the required 30% "Local Contributions"

Targeted Runoff Management (TRM) Grants

TRM grants are provided to control polluted runoff from both urban and rural sites. The grants are targeted at high-priority resource problems. Projects funded by TRM grants are site-specific and serve areas generally smaller in size than a subwatershed. The grant period is 2 years, with a possible 1-year extension. The maximum cost-share rate available to TRM grant recipients is 70 percent of eligible costs, with the total of state funding not to exceed $150,000.

How can TRM grant money be used?

TRM grants can fund the construction of rural and urban BMPs. *For the first time this year, TRM grants can also fund design of BMPs as part of a construction project.* Most work may be reimbursed only when done during the grant period. There are two exceptions: land acquisition and design completed prior to the grant can be reimbursed, provided the design and parcel appraisal are approved by DNR regional staff and the construction project is selected for funding. Some examples of eligible BMPs include stream bank protection projects, wetland construction, detention ponds, some cropland protection, and livestock waste management practices. These and other practices eligible for funding are listed in ch. NR 153 and s. NR 154.04, Wis. Adm. Code.

What projects are not funded by the TRM Grant Program?

TRM grants may not be used to fund the following:

- Projects to control pollution regulated under Wisconsin law as a point source. This includes activities to meet permit requirements for large livestock feeding operations regulated under ch. NR 243, Wis. Adm. Code, and municipal or industrial activities to meet permit requirements under ch. NR 216, Wis. Adm. Code.
- Construction site erosion control and post-construction structural BMPs for new development.
- Projects that are not water quality based (such as projects to solve drainage or flooding problems) or for dredging projects.
- Rural projects within Priority Watershed project areas, unless a showing is made that the Priority Watershed funding is inadequate to cover the entire TRM project.

Total Cost Estimates

Additional Recommended Practices	
Southern Basin	$15,000
Shoreland Restoration	$25,000
Soil Testing/Fertilizer Program	$5,000
Total	**$45,000**

Basin Costs (detailed on pg 16)	$183,900
Additional Practices (from above)	$45,000
Total	**$228,900**
75% Cost-Share Grant	$171,675
Total Local Costs	$57,225

† Estimate only. Amounts and individual project allocations are subject to change.

Summary

Through this report, a number of projects have been identified to improve or maintain the quality of Little Green Lake.

On-going efforts, such as lake aeration and harvesting of nuisance weeds must be continue to address the continuing problems related to in-lake recycling of nutrients.

An on-going education program, such as hands-on seminars, meetings, and newsletters is strongly suggested.

While structures, such as sediment basins do reduce sediment and nutrient loading when properly designed, the largest impact will be achieved through proper land use and land management, including fertilizer management, appropriate crop rotations, reduced tillage and buffer areas.

The Green Lake County Land Conservation Department (LCD) is continuing to work with landowners in the Little Green Lake watershed to improve land use and farming methods.

There must be a consorted effort of every landowner and lake user in order to improve lake health over the long term.

Suggested Time Line

Sediment Basins (Area 4)

- February 2005 Conduct land surveys
- February 2005 Conduct borings/investigation
- March 2005 Complete basic designs for sediment basins
- March 2005 Apply for necessary permits
- May 2005 Apply for TRM and Lake Protection Grant
- July 2005 Complete final basin designs
- July 2005 Finalize land agreement for basins
- June 2005 Begin installation of sediment basins

Soil Testing and Fertilizer Program

- May 2005 Conduct fertilizer use survey
- August 2005 Collect soil samples (Fertilizer Program)
- January 2006 Soil sample interpretations returned
- May 2006 Fertilizer distribution

Shoreland Restoration Program

- Install as projects and funding become available