Green Lake County Land & Water Resource Management Plan



April 2011

ACKNOWLEDGEMENTS

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PREFACE

The Green Lake County Land and Water Resource Management Plan concept evolved from a long-stated need to establish a locally driven process that ensured local decision making and increased program delivery mechanisms. It also ensures the utilization of local, state and federal funds for greater effectiveness toward the protection of land and water resources. The first Land and Water Resource Management Plan was developed in 1999.

The Land and Water Resource Management Plan is empowered by Chapter 92.10 of the Wisconsin Statutes. The basic concepts of this statute is meant to:

- Drive a locally led process for plan development and implementation,
- Provide flexibility in granting programs,
- Drive a comprehensive watershed based conservation effort without excessive planning,
- Reward innovation and cost effectiveness,
- Seamlessly integrate programs and funding sources, making use of a wide variety of implementation tools, and
- Be evaluated in a meaningful manner.

Chapter 92 is the enabling legislation that provides counties, through the Land Conservation Committee, the formal authority to develop a plan that provides structured means that will integrate and leverage available programs, funds, and other resources to:

- Guide the process for resource management planning and decision making,
- Compile information for evaluating land and water resource conditions,
- Develop a multi-year work plan to address land and water resource problems by watershed,
- Strengthen partnerships with landowners, other agencies, municipalities, and organizations,
- Integrate efforts with other county and basin level Natural Resource Management Plans,
- Assist with Township and County comprehensive land use planning efforts,
- Develop effective information and education strategies that will strengthen and maintain community support for the planned Land and Water Resource Management Plan goals and objectives, and
- Track progress toward the achievement of the plan's goals and objectives.

The driving force behind the development of the Green Lake County Land and Water Resource Management Plan is the opportunity to establish a true locally driven process. That means individual citizens, units of government, and local, state, and federal agency representatives must work together to develop a framework which positively integrates natural resource management programs and funding sources, and provides the necessary flexibility to allocate staff and financial resources where they will do the most toward accomplishing resource management objectives.

PLAN SUMMARY

INTRODUCTION

Over the past 15 years, the focus of conservation has changed from a county approach to an ecosystem approach. Basin boundaries have become the level of concern because they have relatively natural boundaries, encompassing many ecosystem components. Still, political boundaries have not disappeared from resource management. Natural resources within the relatively natural boundary of the basin are still protected and managed by many programs implemented at the county level. Therefore, part of the purpose for the Green Lake County Land and Water Resource Management Plan (LWRMP) is to try to coordinate county activities with basin-wide management.

A comprehensive analysis of land and water resource issues and needs within a basin stem from the involvement of many different actors focused on many different scales--from backyards to basins. Therefore, the LWRMP incorporates the concerns and activities of local organizations, basins, watersheds and various levels of government.

In cooperation with the above groups and organizations, the Green Lake County Land and Water Resource Management Plan is focused on restoring, improving, and protecting ecological diversity and quality, and promoting beneficial land, water, and related resource uses. The initial stated goal in 1999 was to achieve a 35% reduction in phosphorus and sediment delivery to waterways over the next 10 years. Cropland soil erosion had been reduced by 10% in 2005 according to the county transect survey. Since that time erosion reduction has remained stagnant.

To meet further goals, the updated LWRMP has defined a set of objectives and action steps, and defined priority areas within the county. It has also identified local, county, state, and federal programs available to landowners and land users for implementing conservation practices. In addition, the LWRMP tries to calculate the costs for meeting the set goals.

Green Lake County considers this LWRMP to be a process that further focuses on more effective solutions to water quality problems caused by nonpoint source pollution. The LWRMP is an opportunity to strengthen landowner participation, improve program effectiveness and increase coordination with other cooperating partners' involved in natural resources. The long-term vision is to implement dynamic, effective nonpoint source programs designed to achieve and maintain beneficial uses of water.

Abbreviated table of contents

- <u>Chapter 1</u>: County Setting, Natural Resources and Trends.
- <u>Chapter 2</u>: Plan Development Process. Including citizen participation, related resource management plans, public opinion, citizen advisory committee, basin team coordination, county coordination, and coordinating agencies and organizations.
- <u>Chapter 3</u>: Land & Water Resource Conditions by watershed.
- <u>Chapter 4</u>: Estimated Rural Nonpoint Source Pollutant Loading. Includes sediment loading, phosphorus loading, urban pollutant loading, and ground water pollutants.
- <u>Chapter 5</u>: Reduction Goals.
- <u>Chapter 6</u>: Plan Implementation Strategy. Includes minimum performance standards, identifying priority sites, implementation budget, program integration, work plan, and budget.
- <u>Chapter 7</u>: Information and Education Strategy.
- <u>Chapter 8</u>: Progress Measurement and Evaluation.

<u>Chapter 1</u>: County Setting, Natural Resources and Trends.

<u>General Characteristics</u>: Green Lake County is located in the southeastern part of central Wisconsin mostly in the Upper Fox River Basin with a total of 226,816 acres. The county is named after the deepest natural inland lake in Wisconsin, Green Lake.

<u>Geology & Topography</u>: Green Lake County lies within two of Wisconsin's geographical provinces—the central plains on the northwest, and the eastern ridges and lowlands on the southeast half of the county.

<u>Surface Water Resources</u>: Green Lake County lies within two of the country's major watersheds. The majority of the county lies within the Upper Fox River Basin and contributes to the Great Lakes Watershed. A very small portion of the southeastern corner of Green Lake County drains into the Upper Rock River Basin, which contributes to the Mississippi Watershed.

Wetland Resources: Green Lake County has gone from 59,000 acres of wetlands in 1938 to 44,000 acres today.

<u>Woodland Resources</u>: Eleven percent of Green Lake County is covered with forests composed of a variety of hardwoods and softwoods with a few conifer plantations.

<u>Wildlife Resources</u>: The wildlife resources of Green Lake County provide significant recreational opportunities.

<u>Fishery Resources</u>: Ten of Green Lake's named lakes support significant fisheries including walleyes, largemouth bass, northern pike, bluegill, cisco, and perch. Big Green Lake has excellent lake trout fishing.

Soils: The majority of the County soils are silt loam and well drained.

<u>Mineral Resources</u>: Sandstone underlies approximately 70 percent of the county. Prairie du Chien dolomite forms a fairly wide band of bedrock from Berlin south to Green Lake then through Markesan to the county line. To the East lies a band of Galena-Platteville limestone and dolomite. Outcrops of granite are found in a few areas.

<u>Ground Water Resources</u>: Ground water is available in the county from glacial deposits and bedrock aquifers. Water from these aquifers is hard, and iron is a problem in some places.

Land Use Trends: Agriculture has and will continue to dominate the land use of Green Lake County. Fragmentation of these agricultural lands is a concern.

<u>Agriculture Trends</u>: Dairy farming is still deceasing in the County and being replaced by grain and vegetable crop farming.

Chapter 2: Plan Development Process

<u>Citizen Participation</u>: A variety of citizens, organizations and government units have contributed insight and guidance to the County Land and Water Conservation Department and the County Land Conservation Committee. A public hearing to accept comments on the 2011 revision of the Land and Water Resource Management Plan was held on April 14, 2011 at the Green Lake Government Center.

<u>Related Resource Management Plan</u>: Over 12 resource management plan documents were integrated into the Land & Water Resource Management Plan.

<u>Public Opinion</u>: No new surveys were conducted for this Land & Water Resource Management Plan update. Information from the 1997 Lake Management Land Use Survey is still believed to accurately reflect public opinion.

<u>Citizen Advisory Committee</u>: A Citizen Advisory Committee provided input for the updated Land and Water Resource Management plan.

<u>Cooperating Agencies and Organizations</u>: Cooperating agencies and organizations provided input in the development of this plan. The Land Conservation Committee recognizes the importance of cooperation to carry out the objectives of this plan.

Chapter 3: Land & Water Resource Conditions

Basin Geography: Approximately 95% of lands drain to the Fox River Basin and 5% drain to the Upper Rock River Basin.

Exceptional Resource and 303(d) Waters: As of 2011, Green Lake County has two water bodies listed as exceptional resource waters: Snake Creek and White River. There are six water bodies listed as 303(d) waters: Harrington Creek, Hill Creek, Roy Creek, Silver Creek, South Branch of the Rock River, and Wuerchs Creek.

Chapter 4: Estimated Rural Nonpoint Source Pollutant Loading

<u>Pollutant Loading from Sediment and Phosphorus</u>: It is estimated that 82% of the phosphorus and sediment loading that leads to water degradation is due to land management practices. The Transect Survey data from 2010 estimates soil loss to be at 2.2 tons/acre. Seventy-eight percent of the phosphorus loading in Green Lake County comes from soil erosion and sediment delivery. Thirteen percent comes from livestock operations with the remaining amount coming from streambank and shoreline sediment and phosphorus delivery.

<u>Urban Pollutant Loading</u>: Since Green Lake County is a rural county, urban pollution is less of a problem in comparison to sediment and phosphorus delivery from agricultural cropland. The concentration of pollutants from urban areas can have substantial negative impacts to local water bodies.

<u>Ground Water Issues</u>: Threats to groundwater include nitrates, volatile organic carbons, pesticides, and bacteria. These potential contaminants originate mainly from agricultural, waste disposal, and materials storage and handling. Two major contaminants in Green Lake County are Nitrogen and Atrazine.

Chapter 5: Reduction Goals

<u>Nonpoint Source Pollution Goals</u>: The long-term reduction goal stated in 1999 was 35% reduction in sediment and phosphorus to surface waters in Green Lake County.

<u>Sediment Reduction Goals</u>: Sediment reduction has been reduced 10% since 1999. The 35% reduction is still our long term goal.

<u>Phosphorus Reduction Goals</u>: Implementing phosphorus based 590 nutrient management plans is our best strategy towards meeting the long term 35% reduction goal for phosphorus. The

2011-2015 phosphorus reduction goals are 3-4%. Nutrient Management Plans (NMPs) offer a multi-dimensional benefit because soil erosion must also be below -".

Chapter 6: Plan Implementation Strategy

<u>Non-Point Pollution Performance Standards</u>: NR 151 agricultural performance standards have been in place for almost 10 years. The purpose of the rules is to control polluted runoff from farms and other sources. Green Lake County will use the following implementation strategy and compliance procedures in assisting with the administration of these rules:

<u>Working Lands Initiative/Farmland Preservation Program Conservation Compliance</u> Green Lake County is aggressively requiring conservation compliance with the Farmland Preservation Program conservation standards. All participating farms in Green Lake County will be in full compliance by 2012 with Nutrient Management Plan components of their overall farm conservation plan.

<u>Agricultural Shoreland Management</u>: In 2005 five additional towns were added to the Conservation Reserve Enhancement Program eligible area. This program has struggled in the county due to explosive land rents and commodity prices.

Other Programs: The Manure Storage Ordinance will be revised in late 2011.

<u>New Program Initiatives</u>: A new initiative will be a Green Lake County Lakes Planning Project to develop a Green Lake County Lake Management Plan. The plan is normally directed to address lake projects or a series of projects that restore and maintain area lakes. The LWCD will apply for DNR Lake Protection grant funds to implement these initiatives.

<u>Identifying Priority Sites</u>: The priority breakdown of Land and Water Funds by Practice (structural practices) for 2011-2015 is as follows:

Cropland Erosion Control -	50%
Livestock Waste Management Facilities -	35%
Streambank/Shoreline Erosion -	10%
Well Abandonment -	5%

Priority Farm/Area Strategy:

Priority Area 1: Green Lake Watershed

Green Lake Watershed is chosen due to its extreme importance as a high quality water resource. Extensive monitoring and research has been conducted with the assumption that dramatic changes in the adoption of conservation systems will show documented changes from the monitoring stations. The financial support of the Green Lake Sanitary District also creates a program that will keep implementation momentum if state funding becomes less available in the coming years.

Priority Area 2: *Agricultural Shoreland Management Area* Fields that intersect the Agricultural Shoreland Management Area retain high priority.

Priority Area 3: 303(d) Watershed & Outstanding and Exceptional Resource Waters Currently in Green Lake County Hill Creek, Roy Creek, Silver Creek, and Wuerchs Creek in the Green Lake Watershed are 303(d) impaired waters. Upper Rock Rick River and Harrington Creek are also 303(d) impaired waters. Snake Creek and White River are exceptional resource waters. These lists can change from year to year.

Priority Farm/Area Conservation Practice Strategy

Priority 1: Nutrient Management

This Best Management Practice when properly implemented and followed can provide substantial water quality improvement as well as positive income creation for farmers. The LWCD now requires farmers who are preparing 590 Nutrient Management Plans to use the most recent phosphorus management standards. Additional measures could be required within the Big Green Lake Watershed if 590 Nutrient Management Plans are unable to prevent manure runoff events from cropland.

Priority 2: Soil Erosion Control Practices

No-till planting is a practice that still creates tremendous soil saving benefits. Other structural practices are still needed to address ephemeral and rill erosion.

Priority 3: Livestock Waste Management

Due to limited funds, livestock waste management is the third priority.

Work Plan - 2015 Goals

The lead agency is the first agency listed below under the -who" column. High priority items are listed in bold.

GOAL 1: Work toward meeting the long term goal of a 35% sediment deliver reduction with the following work plan objectives for the 2011-2015 period yielding a 3-4% sediment delivery reduction.

OBJECTIVE	ACTIONS	WHO	WHEN
Reduce rural sediment loading	Approximately 12,000 acres of Green Lake	LWCD	2011-
through further adoption of	County cropland is still eroding greater than the		2015
residue management	tolerable loss. Get 20% or 2,400 acres (480		
accomplished through better	acres annually) of the remaining acres to adopt		
farm conservation plans.	residue management to get the soil loss on		
	these acres below "T".		0011
Reduce rural sediment loading	Install structural BMPs that are the most cost-	LWCD	2011-
through the installation of	effective. Leverage federal EQIP, CREP funding	NRCS	2015
structural BMPs and the	and LWRM funding to accomplish this.		
encouragement of buffers.			0011
Reduce unrestricted grazing	Inventory pastureland, and build fences and	LWCD	2011-
along streams and rivers.	crossings on shoreline grazing areas.		2015
Reduce urban sediment loading	Enforce Construction Site Erosion Control and	LWCD	2011-
through construction site and	Stormwater Management – Green Lake County		2015
storm water management.	Code Chapter 284 on applicable areas. Revise		
	ordinance.		
Rely on the partnerships	Continue to move forward on projects with the Lake	LWCD	2011-
between agencies and	and Sanitary Districts, and other lake and		2015
organizations, and their tools.	environmental organizations.		
Estimated cost to meet this goal: 6,000 hours annually, \$67,200 for cost-sharing no-till practice,			
\$600,000 for structural BMPs or which \$300,000 will come from LWRM bonding funds and the			
remaining funds from other agend	cies.		

GOAL 2: Work toward meeting the long term goal of a 35% phosphorus delivery reduction with the following work plan objectives for the 2011-2015 period yielding a 3-4% phosphorus reduction. (Phosphorus reduction is most dependent on goal 1 listed above.)

OBJECTIVE	ACTIONS	WHO	WHEN
Reduce nitrogen and phosphorus	Enroll 2,500 acres/year of cropland for nutrient	LWCD	2011-
loading through nutrient	management planning. Monitor FPP	NRCS	2015
management planning and	participants through status reviews on 25% of	GLSD	
manure management BMPS.	participants each year.		
Reduce phosphorus runoff from	Enforce Construction Site Erosion Control and	LWCD	2011-
urban sources through storm	Stormwater Management – Green Lake County		2015
water management.	Code Chapter 284 on applicable areas. Revise		
-	ordinance.		
Rely on the partnerships	Continue to move forward on projects with the Lake	LWCD	2011-
between agencies and and Sanitary Districts, and other lake and		2015	
organizations, and their tools.	environmental organizations.		
Estimated cost to meet this goal: 5	,880 hours annually, \$35,000 cost-share annually for n	utrient	
management planning and \$105,0	00 for manure management structural BMPs.		

GOAL 3: Preserve and Restore Habitat

ACTIONS	WHO	WHEN
Encourage and prioritize the planting of native	LWCD GLA	2011-
vegetation along streambanks/shorelines	NRCS GLSD	2015
	WDNR	
Enforce the Comprehensive Plan for Green Lake	Zoning	ongoing
County		
Enforce the Comprehensive Plan for Green Lake	Zoning	ongoing
County		
Estimated cost to meet this goal: 200 hours annually, \$6,000 cost-share annually from LWRM with the		
remaining funding to come from CREP program.		
	Encourage and prioritize the planting of native vegetation along streambanks/shorelines Enforce the Comprehensive Plan for Green Lake County Enforce the Comprehensive Plan for Green Lake County 00 hours annually, \$6,000 cost-share annually from	Encourage and prioritize the planting of native vegetation along streambanks/shorelines LWCD GLA NRCS GLSD WDNR Enforce the Comprehensive Plan for Green Lake County Zoning Enforce the Comprehensive Plan for Green Lake County Zoning 00 hours annually, \$6,000 cost-share annually from LWRM with the

GOAL 4: Utilize Existing Land Use Patterns

OBJECTIVE	ACTIONS	WHO	WH	IEN
Reduce urban land from	Develop a Purchase of Development Rights	LWCD	200	-0(
encroaching on farmland.	on farmland. program for county farmland.		201	5
Protect natural areas.	Purchase land and/or easements. WDNR,		ong	oing
GLC, GLSD				
Estimated cost to meet this goal: 100 hours annually. Will be seeking funds from the Purchase of				
Agricultural Conservation Easements (PACE) Program under the Working Lands Initiative.				

GOAL 5: Address Immediate Environmental Problems

OBJECTIVE	ACTIONS	WHO	WHEN
Properly abandon wells.	Target 5% of LWRM allocation funds to properly abandon wells.	LWCD	ongoing
Reduce runoff from winter	Encourage long term manure storage facilities.	LWCD,	2011-
manure application.		GLSD	2015
Conservation developments.	Maintain a committee of advisors to assist with	LWCD,	2011-
	conservation planning to developments to	GLA,	2015
	encourage the application of land conservation	GLSD,	
	measures.	DNR	
Estimated cost to meet this goal:	300 hours annually, \$22,500 cost-share annually.		

<u>Budget</u>

PLAN IMPLEMENTATION (LWRM FUNDS)

CATEGORY	2000-2010	2000-2010	2011-2015
	Projection	Actual	Projection ****
Upland Sediment Delivery Control*			
	\$ 2,000,000	\$ 380,822	\$ 150,000
Shoreline Erosion Control**			
	\$ 1,268,800	\$ 220,921	\$ 30,000
Animal Waste Management***			
5	\$ 1,400,000	\$ 64,516	\$ 105,000
Well Abandonment			
	\$ 25,000	\$ 10,731	\$ 15,000
Total			
	\$ 4,693,800	\$ 676,990	\$ 300,000

* Assuming \$65/Ton of sediment reduced. Based on the Green Lake County LWCD conservation practices

implemented between 1994 and 1998.

** Taken from Agricultural Shoreline Management Data using 120' buffers.

*** Includes nutrient management and structural practices.

**** \$60,000 is the estimated LWRM cost-share funds we expect per year times 5 years.

GREEN LAKE COUNTY LWCD -STAFF COSTS			
YEAR	2006 (available hrs)	2011* (available hrs)	
LWCD staff	\$400,512 (12,480)	\$471,664 (12480)	
Contracted Professionals and LTE	\$ 6,000	\$ 6,000	
Total	\$406,512	\$477,664	

GREEN LAKE COUNTY LWCD -STAFF COSTS

Staff costs from 2006 to 2011 have gone from \$406,512 to \$477,664. Green Lake County will receive \$144,420 from DATCP for staff in 2011. Green Lake County Government has remained very dedicated towards funding the Land and Water Conservation Department.

Chapter 7: Information and Education Strategy

An information and education program implemented by all local, state, and federal cooperating agencies will be used to inform the public about pollution problems, rules and regulations, and programs and resources available to address problems. Working Lands Initiative, Farmland Preservation Program will be our highest priority.

Chapter 8: Progress Measurement and Evaluation

Green Lake County will prepare annual financial and accomplishment reports as required by administrative rule. A database tracking systems developed by the LWCD is being refined to track compliance of NR 151. An additional report will be prepared and shared with the Green Lake Sanitary District to determine the progress of pollution reduction in the Green Lake Watershed.

County Setting, Natural Resources, and Trends

General Characteristics

Named after the deepest natural inland lake in Wisconsin, Green Lake is located in the southeastern part of central Wisconsin mostly in the Upper Fox River Basin. The county is one of the smallest in the state with a total of 226,816 acres. There are ten townships that are predominantly agricultural in nature, and one large municipality--the city of Berlin. A population density of about 52 persons per square mile is higher than one finds in a typical agricultural county. This is a reflection of the county's recreational importance, and an indication of the growing influence of manufacturing and service industries. Part of Green Lake County's recreational importance stems from the 19,630 acres of open water in lakes and rivers, which among other things supports large game fish populations. Dairy farming accounts for the majority of the county's agricultural revenue, but vegetable crops and livestock produce many cash receipts as well.

History

Long before Europeans even dreamed of a —New World" the region now known as Green Lake County was home to the American Indians. The large number of antiquities: burial mounds, effigy mounds, garden plots, and food caches, clearly indicate that the county was one of the Native American's favorite gathering and hunting grounds. (Titus, 1930) Green Lake's fertile soils provided natural foods and abundant habitat for migratory waterfowl, deer, turkey, and other game animals.

Green Lake's water resources played an important role in developing the county. The Fox River brought the first explorers, traders, and missionaries into the area, including such famed explorers as Perrot, Joliet, and Marquette. The large, navigable river soon brought permanent settlers into the region, and consequently was used to bring their produce to market. Smaller waterways were harnessed for their power, and as a result the county grew. Nearly every modern day city or village developed around sawmills or gristmills. For example, the Village of Dartford, later named Green Lake, began to develop in 1845 after Anson Dart partially raised the level of the lake with the dam he built for his sawmill. The village of Marquette grew around the sawmill Hiram McDonald built on the Grand River in 1836. The water resource brought permanent settlers, but it also brought tourists. The recreational aspects of Green Lake's water resources have been pivotal for the development of the area ever since David Greenway opened a summer resort in 1867. Even today tourism is a leading factor in the economy.

Early settlers stayed in Green Lake County partially because of the rich soil and partially because of the vast system of marshes, prairies, and savannas. This landscape meant that plowing could begin with very little eradication of timber. Through extensive use of the plow and dredge they soon converted the landscape into one of the more productive agricultural regions of the state. Agriculture in the county did not develop along specialized lines, and the landowners cultivated a vast array of crops. In fact, Wisconsin's first commercial cranberry production began in the marsh near Berlin in 1860. Today, dairy farming is the major producer of cash receipts, but the county also raises fine quality livestock and ranks relatively high among Wisconsin's production of vegetable crops.

Green Lake County Original (Pre-Settlement) Vegetation Cover

1999

Vegetation Cover

Water Boreal Fo est - White spruce, balsam fir, tamarack, white cedar, w Mixed Conifer - Deciduous Forest - Beech, hemlock, sugar maple, yellow birch, white pine, re-Mixed Conifer - Deciduous Forest - Hemlock, sugar maple, vellow birch, white pine, red pine Mixed Conifer - Deciduous Forest - Sugar maple, yellow birch, white pine, red pine Mixed Conifer - Deciduous Forest - White pine, red pine Mixed Conifer - Deciduous Forest - Jack pine, scrub (hill's), oak forest and barrens Mixed Conifer - Deciduous Forest - Aspen, white birch, pine Deciduous Forest - Beech, sugar maple, basswood red oak, white oak, black oak Deciduous Forest - Sugar maple, basswood, red oak, white oak, black oak Deciduous Forest - Oak - white oak, black oak, bur oak Deciduous Forest - Oak openings - bur oak, white oak, black oak Grassland and Brush - Prairie Grassland and Brush - Brush Wetland Vegetation - Swamp conifers Wetland Vegetation - Lowland hardwoods Wetland Vegetation - Marsh and sedge meadow, wet prairie, lowland shrubs Other

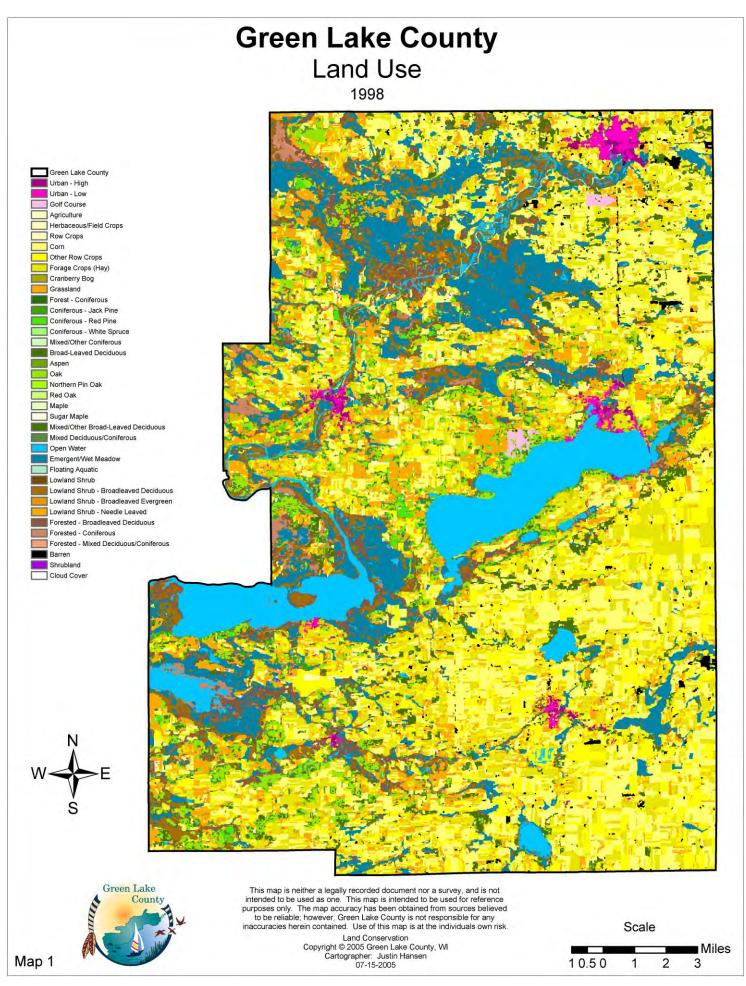




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	Scale			
	-	-	Miles	
1 0.5 0	1	2	3	



Natural Resources

The natural resources of Green Lake County produce part of the ecological services that are critical to the functioning of the life-support system within the basin and beyond. These life supporting ecosystem services include erosion control and sediment retention, habitat for resident and transient populations of animals, nutrient cycling, disturbance regulation, waste treatment, and opportunities for recreation. These services contribute to human welfare and therefore represent part of the total economic value of the county as well as the Upper Fox and Upper Rock River Basins. The only ecosystem service consistently measured in monetary terms is opportunities for recreation, and that brings in tens of millions of dollars in revenue each year. We should rely on straight-line logic to tell us that we absolutely cannot afford to waste resources. Efficient use and protection of our natural resources will ensure that healthy ecosystem functions continue for present and future generations.

Geology & Topography

Green Lake County lies within two of Wisconsin's geographical provinces—the central plains on the northwest, and the eastern ridges and lowlands on the southeast half of the county.

The central plain area lies in an extinct glacial lakebed. It is characterized by a flat to gently rolling topography and averages an elevation of 760 to 800 feet above sea level. It has sandy soils or marsh underlain by sandstone bedrock. This area has a large number of wetland complexes, which makes it difficult to farm unless drained and managed. Except for Lake Puckaway and a few potholes, the region is devoid of lakes. The Fox River flows through the area from southwest to northeast, and tributary streams enter it at right angles from northeast and southwest.

The eastern ridges and lowlands to the southeast are characterized by a relatively rough topography consisting of a series of ridges separated by wide valleys. The entire area is covered by an unpitted glacial outwash plain, and has well drained soils underlain by dolomite and sandstone bedrock. This makes it some of the best land for agriculture. Wetlands are present but far more scattered than those of the central plain region. Eleven of the twelve named lakes found in Green Lake County are located in this region. Primary stream flow is from east to west with the Grand River being the major stream present.

Surface Water Resources

Green Lake County lies within two of the country's major watersheds. The majority of the county lies within the Upper Fox River Basin and contributes to the Great Lakes watershed. A very small portion of the southeastern corner of Green Lake County drains into the Upper Rock River Basin, which contributes to the Mississippi watershed. Precipitation is the principal source of water, most of which percolates downward to groundwater aquifers. Locally, groundwater moves toward nearby rivers and streams, with an overall general movement toward the northwest. It flows into the Fox River, then through the large wetlands in the northwestern part of the county, then through the Winnebago pools, and eventually into Green Bay.

Surface waters make up approximately 7.5 percent of the total area of the county. There are 36 lakes, which make up 17,488 of the 19,630 acres of water. Almost all of the lakes are very fertile, shallow eutrophic or hyper-eutrophic lakes that suffer from excessive aquatic plant growth or algae blooms. Green Lake is an exception. Partly because it is one of the deeper natural inland lake between New York's Finger Lakes and the Rocky Mountains, it has comparatively better water quality and lower nutrient levels in the water column and bottom sediments.

The county has 58 streams, which have a surface area of 1,070 acres and cover 217 miles. The Fox River with an average width of 160 feet and an area of 806 acres is the largest stream present, accounting for 75% of the total stream area. Snake Creek and White River are the only viable trout streams remaining in the county and are designated Exceptional Resource Waters (ERW). At the other end of the spectrum, Wuerchs Creek, Hill Creek, Roy Creek and Silver

Creek, which all discharge into Green Lake are listed on the 303(d) list as waterways not currently meeting water quality standards. Wuerchs Creek is listed as a high priority 303(d) water. Harrington Creek and the south branch of the Rock River are also 303(d) waters.

Wetland Resources

In 1938, there was an estimated 59,000 acres of wetlands in Green Lake County. Many of these were diverted to agriculture and housing, and in 1976 approximately 32,000 acres remained. Today 44,000 acres are classified as wetlands; although, this increase may be misleading due to the change in definition of wetland. The 44,000-wetland acres are classified as both shrub and wooded swamps or bogs, or shallow or deep fresh marshes. The county is also fortunate enough to have a calcareous fen near Berlin, a rare groundwater driven wetland type of regional importance.

Green Lake contains portions of two of the five larger wetland complexes in the Upper Fox River Basin: the White-Puchyan wetland complex of 9,828 acres, and the Grand River Marsh of 5,526 acres. Large un-fragmented wetland areas are relatively uncommon. They are extremely important because they create a habitat for animal populations that cannot survive in such small, fragmented areas that have come to dominate our humanized landscape.

In addition to providing habitat and food for game fish, waterfowl and other species of wildlife, wetlands perform many of the ecosystem services that we can not perform, or perhaps only with great cost. Wetlands are important buffers that maintain water quality--trapping sediments and retaining and removing nutrient runoff. They absorb or hold vast quantities of water and thereby regulate fluctuations in the water supply on which we depend. Wetlands minimize flood hazards by storing excess runoff and reducing the speed at which water moves through the watershed. In addition, wetlands recharge aquifers, anchor shorelines, retain heavy metals, provide recreation, education and research, and maintain biodiversity, open space and aesthetic values.

Wetlands' natural functions are a critical part of the ecological mosaic, and they are a great value to society. Nevertheless, Green Lake County is faced with the loss of this precious resource due to agriculture drainage and urban development. Wetland loss caused by agricultural drainage has been reduced due to the 1985 Swampbuster provision of the Farm Bill. Still, there is continuing nationwide pressure from development interests to weaken wetland legislation. Wetland filling will continue to be an increasing threat to wetland areas as the pressures of non-agricultural land use becomes more intensive.

Woodland Resources

Prior to the growth of agricultural importance, the county contained a mixture of white pine, maple, basswood, oak and hickory forest. Today, 11% of Green Lake County is covered with forests. They are composed of a wide variety of hardwoods and softwoods, with a few conifer plantations. Most forests contain exotic -weed" species such as honeysuckle and buckthorn, and most are small, privately owned tracts used mainly for farm woodlots. The woodlands are important in terms of providing habitat for various species of wildlife, and providing some soil conservation through wind protection. Unfortunately, poor management practices, such as grazing by cattle and deer, have resulted in the destruction of their ecosystem functions. Poorly managed forests have low wood production, greater erosion, and elimination of natural reproduction cycles of native forest species. In order to maintain the benefits of programs such as the CRP, better timber management and proper utilization of the county's woodlands will be necessary.

Wildlife Resources

Wildlife resources have played an important role in the history and development of the county. Before and during early settlement, hunting, fishing, and trapping were essential to human survival and the growth of the area. Today, they provide significant recreational opportunities. Although much of the wildlife's habitat has been reduced or degraded, the county still has an abundance of fish and wildlife. This relative abundance is due to the large contiguous area of forest and wetlands that are essential to preserving high levels of biodiversity.

Nearly all streams and lakes in Green Lake County contribute directly to the welfare of some type of wildlife. Muskrats are the most common aquatic fur-bearing animals, followed in abundance by mink and beaver. A few otter may be present as well. Deer are also common and have become problematic because of overgrazing of forest lands and damage to agricultural crops. Pheasant are present, and turkeys have been successfully reintroduced to the area. In the spring significant numbers of Canada geese concentrate around marshlands and shallow lakes while in the fall they concentrate around the Grand River Marsh and Green Lake.

Decreasing wildlife habitat (both in quantity and quality) is a wildlife management problem. Some of the culprits responsible for habitat destruction include; intensive cultivation, wetland drainage, early spring hay mowing, roadside brush cutting, streambank pasturing, invasion of exotic species, and urban development. An increase in hunting pressure also contributes to wildlife management problems. Through sound educational programs and economic assistance programs some of these problems may be overcome. Conrol of invasive exotic species has been addressed for some problems (purple loosestrife) but much more work will need to be done in the future.

Fishery Resources

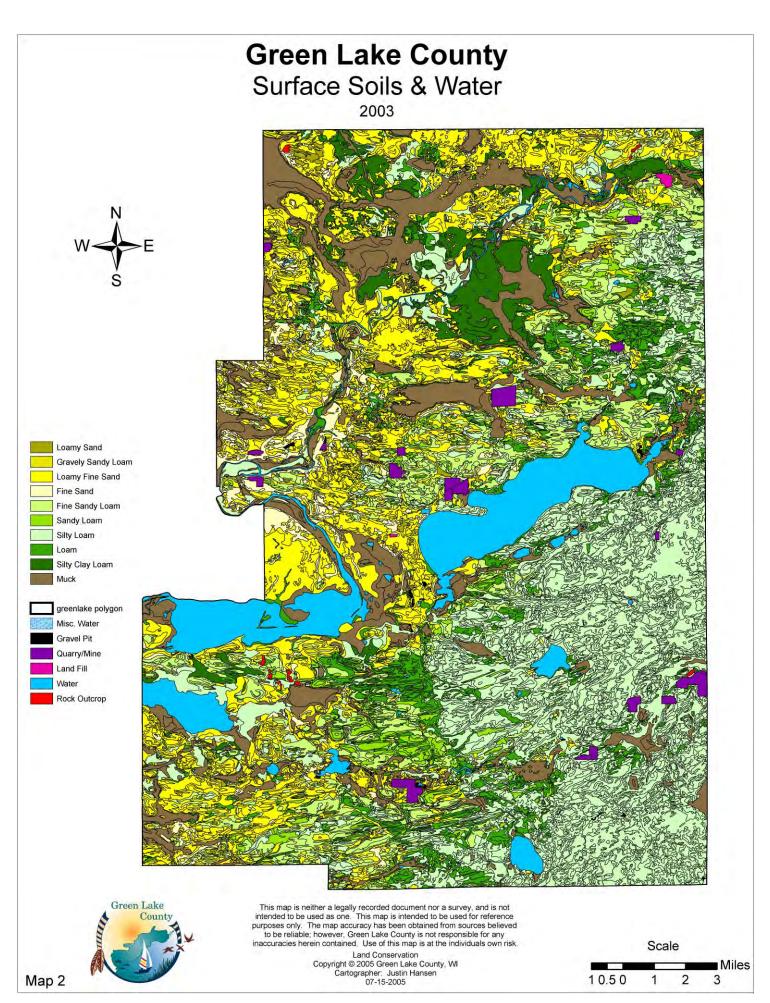
Green Lake attracts hundreds of residents and non-residents a year due to its excellent fishery resources. Ten of Green Lake's named lakes support significant fisheries; including walleye, largemouth bass, northern pike, bluegill, cisco, and perch. Green Lake is famous throughout the Midwest for excellent lake trout fishing. In addition to the species found in the county's lakes, most of the county's streams contain smallmouth bass, channel catfish, crappie, pumpkinseed, and perch. Unfortunately, the problematic exotic carp are found in many of the lakes and streams. Some positive developments have been the GLSD removing approximately 100,000 pounds of carp per year from Green Lake, along with the development of an air pressurized carp barrier on the lake inlet.

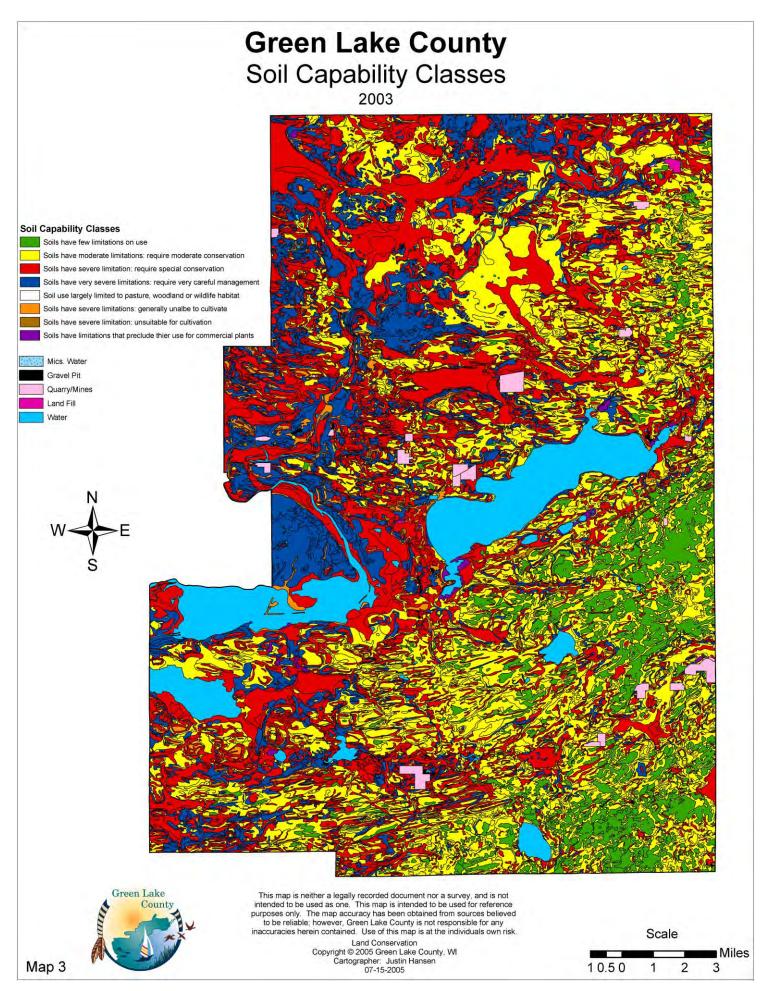
As with wildlife, the loss of habitat is the greatest threat to Green Lake County's fish species. Among other factors, erosion, siltation and high turbidity are combining to make the system uninhabitable for finer game fish. The disturbance of spawning areas through silt dredging has reduced fish numbers as well. Carp also contribute to the overall degradation of available game fish habitat.

The Green Lake County Fish Rearing Facility Hatchery was taken over by the Green Lake Sanitary District in 2007. In April 2011 the District released 8,000 lake trout and 5,000 brown trout into Big Green Lake. This has turned into a great story of local involvement for resource promotion.

Soils

Individual soil types directly influence land uses and management, and therefore, significantly impact other natural resources and ecosystem services. The Green Lake Land and Water Conservation Department uses detailed descriptions of each soil type, including soil patterns, relief and drainage features to determine cropland erosion estimates and sediment load calculations. This in turn, determines the type and extent of agricultural practices and management techniques to recommend.





(SOILS continued)

(Maps 2 and 3)

Plano-Mednota-St. Charles Association

Ranging from well drained and moderately well drained soils, having nearly level to gentle slopes. A silt loam and silt clay loam comprise the upper subsoil, and a heavy sandy loam form the lower subsoil, all layered over calcareous gravelly or very gravelly sandy loam glacial till. The association is on glaciated uplands where the soils formed in wind blown silts and the underlying glacial till. This association covers about 30 percent of the county. Sheet and rill erosion is prevalent on these soils due to intensive farming. Erosion control practices include contour farming, strip cropping, and reduced tillage.

Kidder-Rotamer-Grellton Association

Well-drained soils, ranging from nearly level to steep slopes. Soils contain loam, clay loam or sandy clay loam in the upper subsoil and a loam subsoil over calcareous, gravelly sandy loam glacial till. This association is on glaciated upland consisting of ground moraine made up of swales, rounded hills and drumlins. Throughout these areas, stones and boulders are common on the surface and in the soils. This association covers about 27 percent of the county. Erosion can be severe on these soils if not properly managed and gullies form on areas with rolling land. Conservation practices for controlling gullying include water and sediment control basins.

Lapeer-Mecan-Okee Association

Well drained to somewhat excessively drained soils with gentle to steep slopes containing a surface layer of loamy fine sand over a sandy loam subsoil. Calcareous, gravelly sandy loam or gravelly loamy sand glacial till lies beneath. This association is on glaciated uplands consisting of ground moraine made up of swales, rounded hills and drumlins. Throughout the association, stones and boulders are common on the surface and in the soil. This association covers about 7 percent of the county. Wind erosion is common on these soils where clean tillage is used. Conservation practices used to control wind erosion include windbreaks, conservation tillage and strip cropping.

Oakville-Brems-Granby Association

Including well-drained, moderately well drained, and poorly drained soils with nearly level to steep slopes that have fine sand subsoil underlain by fine and medium sand. This association is on outwash plains and terraces. It consists of low hills and swales. It covers about 9 percent of the county.

Boyer-Oshtemo-Gotham Association

Includes well drained and somewhat excessively drained, nearly level to steep soils with a subsoil mainly of loamy fine sand, sandy loam, and loamy sand underlain by sand or stratified sand and gravel outwash. It is on outwash plains and terraces and consists of low hills and swales and occasional kettle holes. It covers about 6 percent of the county. Wind erosion is common on these soils when clean tillage is used. Windbreaks and conservation tillage are conservation practices that are used to control erosion on these soils.

Willette-Poy-Poygan Association

Ranging from poorly and very poorly drained, nearly level soils that have a silty clay or clay subsoil over sand or calcareous clay or silty clay. It is in drainage ways, old lake basins and flood plains. They have an organic layer of well-decomposed muck about 30 inches thick. This makes up 11 percent of the county.

Adrian-Houghton Association

Very poorly drained, nearly level organic soils underlain by sandy, or clayey material or marl. It is in drainage ways, depressions, and old lake basins and on flood plains. They have an organic layer of highly decomposed muck about 4 feet thick. It makes up 10 percent of the county.

Mineral Resources

Sandstone underlies approximately 70 percent of the county. Prairie du Chien dolomite forms a fairly wide band of bedrock from Berlin south to Green Lake then through Markesan to the county line. To the East lies a band of Galena-Platteville limestone and dolomite. Outcrops of granite are found near Berlin, Kingston, and north of Princeton.

Ground Water Resources

Ground water is available in the county from glacial deposits and bedrock aquifers. Water from these aquifers is hard, and iron is a problem in some places. While no major groundwater pollution problems exist, some wells have detected Atrazine levels above the health advisory standards. Therefore Atrazine prohibition areas within the county have been established and care must be taken to maintain the quality of this abundant resource. (The availability of water from glacial deposits is estimated at 5 to 10 gallons per minute. Availability is estimated at 10 to 100 gallons per minute northwest of a line that extends generally from the City of Berlin to the City of Princeton and a small area that runs northeast form Lake Puckaway through and beyond Green Lake.) Nitrate pollution is also a concern. UWEX has tested for well nitrate levels over the past several years documenting areas where the problems exist. Other potential problems include the decline of water levels between areas of closely spaced wells or areas of heavy industrial or municipal pumping, and the pollution of water in bedrock aquifers. Potential for groundwater contamination is greatest where dolomite bedrock is close to the surface or in areas where water percolates very quickly.

Trends

Land Use Trends

Agriculture dominated land use during the past century and will continue to dominate in the years to come. During the latter part of the 19th century and the early part of the 20th century, the amount of land committed to farming varied between 90 and 95 percent of the total land area. It reached its highest point in 1945 when 216,568 acres of land was in production. The amount of land devoted to agriculture has steadily declined, and today only 66% or 142,757 acres of land remains in production (Ag. Stats. 2007). Of this, 116,464 acres are cropland.

An increasing amount of land in Green Lake County is being used for nonagricultural use. The county's population growth rate is not exceptional, but due to its lakes, streams, woodlands, and wetlands, the number of summer homes is increasing. Green Lake County, which has traditionally been a popular vacation ground, is gaining popularity for home sites and recreational areas for expanding population of southeastern Wisconsin and northern Illinois. Sprawling developments without controls, especially in the riparian zone of streams and lakes, contribute to the loss of habitat and degradation of our natural resources.

The LWCD along with the GLSD have been promoting conservation based developments in land that is being developed in close proximity to Green Lake. It is the intent by providing the assistance that developers are made aware of various practices that can be implemented to minimize the negative impacts from development. The LWCD staff time required to provide this assistance is limited and considerations may need to be made if future assistance is to continue.

Land use planning to control urban development is recommended to help communities develop within their natural and financial limits. Some planning measures include:

- Preservation of farmland, open spaces, and wooded areas,
- Preservation of wetlands and similar wildlife habitat,
- · Preservation of open vegetated drainage ways for filtration and stormwater management,
- Establishment of vegetated buffers along stream corridors to filter surface water; and
- Establishment of green belts' between ecosystems.
- Promotion of conservation developments

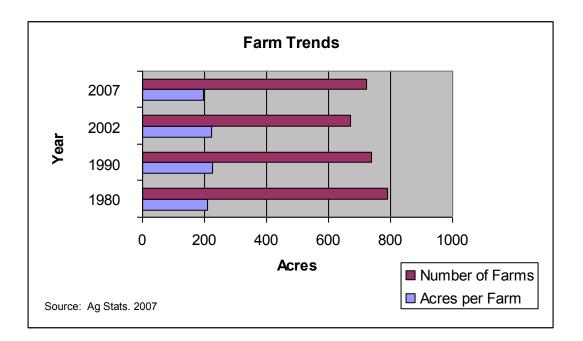
Agricultural Trends

Green Lake County has a diverse agricultural economy. Dairy still accounts for the largest portion of total farm receipts and grain production takes a close second. Vegetable receipts continue to grow in importance. (Ag. Stats. 2007)

According to the Wisconsin Department Agriculture, Trade and Consumer Protection (DATCP) agricultural statistics, the past 5 years have seen some potential trends changing in Green Lake County:

- An increase in the number of farms, from 670 to 723.
- A decrease in average farm size from 221 acres in 2002 to 197 acres in 2007.
- A decrease in all cattle from 25,000 in 2002 to 22,791 in 2007.
- A decrease in alfalfa and hay fields, which coincides with the decrease in cattle numbers.
- An increase in row crops.

Fragmentation of rural areas has slowed recently due to a slower overall economy and a strong agricultural economy.



The Green Lake County Land and Water Resource Management Plan was compiled from information that included local programs, county programs, basin programs, state programs and federal programs.

Citizen Participation

The County Land and Water Resource Management Plan was placed on the Green Lake County website for public review. Public participation in the conservation of Green Lake County's natural resources has been a long-standing trend. A variety of citizens, organizations and government units have contributed insight and guidance to the County Land and Water Conservation Department and the County Land Conservation Committee. The LWCD has worked closely with the Natural Resource Conservation Service (NRCS), Wisconsin Department of Natural Resources (WDNR), Green Lake Sanitary District (GLSD), Lake Puckaway Protection & Rehabilitation District, Little Green Lake Protection and Rehabilitation District, the Green Lake Area Isaac Walton League, Green Lake Association (GLA), Green Lake Conservancy and many other important groups in order to address major areas of concern.

A public hearing to accept comments on the 2011 revision of the Land and Water Resource Management Plan was held on April 14, 2011 at the Green Lake County Courthouse in Green Lake. See Appendix eleven for a copy of the Class II public hearing notice.

Related Resource Management Plans

In developing this Land and Water Resource Management Plan, issues, concerns, needs, goals and objectives from previous natural resource management plan documents were reviewed. All of those documents are listed in the reference section of this plan; however, there were some key documents with specific data, observations and objectives that served a larger role. These include:

- Surface Water Resources of Green Lake County (1971)
- Green Lake County Resource Conservation Program (1976)
- Green Lake County Farmland Preservation Plan (1983)
- Big Green Lake Priority Watershed Project (1992)
- Beaver Dam River Priority Watershed Project (1993)
- Upper Rock River Water Quality Management Plan (1995)
- The State of the Rock River Basin (2002)
- Upper Rock River Watershed Management Plan-Upper Rock River Watershed Appendix (2002)
- Little Green Lake Lake Management Plan (1997)
- The Upper Fox River Basin's Analysis of Demographic, Composition, Public Goods and Natural Resources (1997)
- Winnebago Land and Water Resource Management Plan (1998)
- The State of the Upper Fox River Basin (2001)
- Fox River Basin Headwaters Ecosystem An Ecological Assessment for Conservation Planning (2002)
- Lake Puckaway Lake Management Plan (2010)

It is important to recognize that these documents were developed with a great deal of public participation. Many of the concerns, ideas, and recommendations voiced by those people are incorporated in this document.

Public Opinion

As a precursor to developing a county funded water quality improvement program, the Land & Water Conservation Department, with assistance from the Development Guide Citizen's Advisory Committee conducted a Lake Management and Land Use Survey in 1997. The information from this survey is still relevant in 2011. The survey attempted to measure attitudes and perceptions regarding lake-use and management in the county. The summarization of the Total Survey Results demonstrate that:

- Most people feel that water clarity is satisfactory and water quality is good.
- Although no significant problems exist because of the usage of the lakes, there is a substantial concern that traffic congestion, litter and noise have all increased, and that water quality and boating safety have declined. Some concern is evident that fish/wildlife habitat is suffering.
- Although most people are not very knowledgeable on land use issues, they feel land use planning is very important and that land uses need to be regulated by the government.
- Most people agree that the government should provide for adequate green-space surrounding the lakes. Conservation developments can provide the opportunity for greenspace and lessen the burden for local government to provide the green-space.
- They strongly agree that the county needs a development plan/guide to manage growth and minimize the negative effects of various uses.

Citizen Advisory Committee

The Citizen Advisory Committee that helped develop this document in 2011 was composed of members of a variety of other committees and organizations along with interested citizens that have been involved in natural resource issues in the past. The Land and Water Plan was available on the Green Lake County website and advisory members were asked to review the plan and forward comments as to concerns and changes that should be made. This information was then passed on to staff and committee members.

The Citizens Advisory Committee consisted of:

- Members of the Land and Water Conservation Committee
- Cooperating local, state and federal agencies
- Farmers
- Educators
- Concerned and active citizens.

The purpose of the Citizen Advisory Committee was to provide advisement to the LWCD to identify and prioritize land conservation issues, and to provide recommendations for administering the county programs. The Citizen Advisory Committee provided input to the development of the plan. They looked at the goals from the old work plan and made of list of which goals to continue working toward. New goals were also set. The Citizen Advisory Committee reviewed and commented on the plan draft.

Basin Team Coordination

Green Lake County is a strong proponent of addressing natural resource issues at the basin level. Staff in the Land and Water Conservation Department is involved in the Upper Fox River and Upper Rock River WDNR Geographic Management Units (GMU). It is anticipated that Green Lake's plan will address many of the same issues as these two basins. By factoring in their goals with the goals of the community, the Land and Water Resource Management Plan will succeed in developing a plan that integrates the ecosystem components of a natural boundary with grassroots planning and implementation.

Upper Fox River Basin Priorities: The Department of Natural Resources, *The State of the Upper Fox Basin Plan,* was completed in 2001. The Basin Plan and the LWRM plan share similar water quality goals and objectives. In consultation with the DNR Staff in writing the LWRM plan

common water quality priorities were identified. The Department of Natural Resources water quality priorities from the State of the *Upper Fox Basin Plan* include:

- Continued implementation of the Winnebago Comprehensive Management Plan.
- Limit nutrient, sediment, and organic loading to waterways from point and nonpoint sources.
- Update formal stream classifications (NR104).
- Provide information and education on animal waste management to the agriculture industry.
- Conduct habitat evaluation on dredged streams.
- Participate in the Smart Growth Initiative with local governments.
- Properly regulate land spreading of septage.
- Reduce the discharge of untreated stormwater to waters of the state.
- Provide information and education to the construction industry on sediment control techniques and requirements.
- Provide information and education on aquatic exotic species that currently exist in the basin as well as those that may be introduced to the basin.

Upper Rock River Basin Priorities (2002): Surface and groundwater, land use/planning, environmental protection, and natural area preservation.

County Coordination

Green Lake County LWCD works together with neighboring counties when landowners' properties lie within two counties. Continued efforts will be made to further increase cooperation and communication between Counties.

Cooperating Agencies and Organizations (Programs explained on pp. 67-69.)

- Farm Service Agency The FSA administers farm commodity, crop insurance, credit, environmental, conservation, and emergency assistance programs for farmers and ranchers. Their programs relevant to this plan include Conservation Reserve Enhancement Program, Continuous Conservation Reserve Program, Crop Loss Disaster Assistance Program, Agricultural Market Transition Act Program, Crop Loan Deficiency Payments, and CRP General Signups.
- Green Lake Area Izaak Walton League The Izaak Walton League purses a broad range of conservation and preservation goals. The Green Lake Chapter established the *Snake Creek Wetlands Trail*, established a prairie restoration project, and acquired nearly 100 acres of wetlands on the Fox River through a conservation easement. In addition they acquired rare fen habitat in the Snake Creek Corridor.
- **Green Lake Association** The GLA is a private nonprofit organization committed to conservation and preservation of Green Lake's natural resources. GLA's mission is to ensure that Green Lake remains one of the premier lakes in the Midwest by actively promoting the conservation of the area's natural scenic beauty and intrinsic character. The GLA is also a large participant in public hearings regarding land and water issues, and monitor agencies and committees to ensure their decisions protect Green Lake's character.
- **Green Lake Conservancy** The GLC is a community-based nonprofit, tax exempt land trust whose mission is to preserve, protect, and enhance the aesthetic, ecological, and recreational qualities of the greater Green Lake Watershed. Work is done in partnership with the GLSD, WDNR, GLA, and Green Lake County. They have purchased a number of critical parcels of land valuable for ecosystem functions. They continue to look for additional sites, easements, and donations.

- **Green Lake County Farm Bureau** The Green Lake County Farm Bureau, with over 700 members, is involved in local, state and national affairs making it a true grassroots organization. The purpose of the Farm Bureau is to improve net income of farmers, improve public understanding of agriculture, develop farm leaders, and improve rural life.
- **Green Lake Sanitary District** The GLSD has received numerous lake protection grants in the past 5 years. Grants implementing BMP installations including structural BMPs along with nutrient management planning have helped the LWCD to meet additional CMP installation goals.

The GLSD in conjunction with the Land and Water Conservation Department and other lake organizations plan to continue to pursue funds through the lake planning and protection grant programs to protect Big Green Lake. The future grant funds will be used to continue to implement BMPs that maintain, protect, and improve the water quality of Big Green Lake.

The GLSD's definition of BMPs include: normally understood practices (i.e. high residue management, grassed waterways, scrapes, etc), acquisition of conservancy properties strategically located or designated as sensitive areas/endangered areas, water quality monitoring work and other projects specified in more detail within this document (i.e. Winter Manure Runoff Project, Conservation Development Work, etc).

- Lake Puckaway Protection & Rehabilitation District The Lake Puckaway Protection & Rehabilitation District recently received a Wisconsin Waterways Commission grant to help protect important waterfowl concentration sites. They are also working on dam reconstruction on the Fox River, and are involved in a large fish-stocking program. A Lake Management Plan was completed in 2010.
- Land Use Planning and Zoning The Land Development Office oversees all offices and activities within the Land Use Planning and Zoning Department. The office provides coordination and assistance to the Planning and Zoning Committee and the Board of Adjustment, as well as other County committees and departments. This office provides assistance to the public, which includes review and assistance with requests for land division and analysis of development proposals. Additionally, the Land Development Office reviews and recommends updates to land use ordinances, such as the Zoning Ordinance, Shoreland Ordinance, Floodplain Ordinance, Land Division Ordinance, Nonmetallic Mining Reclamation Ordinance, and Sanitary Ordinance
- Little Green Lake Protection and Rehabilitation District The Little Green Lake Protection and Rehabilitation District have provided much support to the land conservation program in the county. They provided piggyback cost-share funds for various nonpoint projects in the watershed. A lake aeration system was installed in 2002 and an aquatic plant survey was conducted in 2005. The most recent large water and sediment basin for the lake was installed in 2009.
- Natural Resources Conservation Service The NRCS provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. Some of the NRCS responsibilities that relate to this plan include WHIP, WRP, EQIP, and technical assistance for CRP, Continuous CRP and CREP.
- Rock River Watershed Coalition The mission of the Rock River Watershed Coalition is to educate and provide opportunities for people of diverse interests to work together to improve the environmental, recreational, cultural and economic resources of the Rock River Basin. It is an opportunity for farmers, businesses, local governments, sporting clubs, conservation groups, and communities to work together on water quality problems in the basin.

- Town and Country Resource Conservation & Development, Inc The mission of the Town and Country RC&D is to enhance the quality of life in the thirteen-county area (which includes Green Lake County) of South Eastern Wisconsin by promoting healthy communities, a healthy environment and sustainable economic growth. The purpose is to look for ways to initiate and support projects that fill needed gaps, and ensure that efforts are optimized rather than duplicated. The RC&D especially seeks to fill a niche of service to underserved populations in the cities and in the countryside helping urban and rural citizens work together toward their common goals.
- **Twin Lakes Association** The Association is a group of approximately 50 individuals and businesses who have an interest in maintaining the quality of Twin Lakes as a recreational resource as well as an amazing habitat for wildlife. The purpose of the Association is to preserve and protect Twin Lakes and its surroundings, and to enhance the water quality, fishery, boating safety, and aesthetic values of Twin Lakes, as a public recreational facility for today and for future generations.
- U.S. Army Corps of Engineers This is the Federal Government's largest water resources development agency. A prime mission of the Corps of Engineers is to strive for environmental sustainability. The corps recognizes the interdependence of life and the physical environment. The Corps proactively considers environmental consequences of its programs and acts accordingly. The Corps seeks balance and synergy among human development and natural systems by designing economic and environmental solutions that reinforce one another.
- **UW Extension** The Green Lake County University of Wisconsin Extension Office provides educational programs and assistance to all people in Green Lake County. It is an integral part of the university's knowledge based delivery system to the people of the State of Wisconsin. Extension's mission is to focus university knowledge and expertise upon human needs and problems. The extension office agents teach using many methods. These include home and farm visits, telephone calls, seminars, workshops, tours, newsletters, news releases, radio, television, satellite and the educational telephone network (ETN).
- WDNR The Wisconsin Department of Natural Resources is dedicated to the preservation, protection, effective management, and maintenance of Wisconsin's natural resources. It is responsible for implementing the laws of the state and, where applicable, the laws of the federal government that protect and enhance the natural resources of our state. It is the one agency charged with full responsibility for coordinating the many disciplines and programs necessary to provide a clean environment and a full range of outdoor recreational opportunities for Wisconsin citizens and visitors.
- Wings Over Wisconsin Wings Over Wisconsin is a nonprofit organization dedicated to natural resource restoration, preservation & education. They work with private landowners, developing cooperative habitat and cost-sharing agreements. They help restore grasslands, woodlands, and wetlands, and acquire land.

Chapter 3 Land & Water Resource Conditions

To efficiently and effectively address nonpoint source pollution, it is necessary to establish priorities and define a course of actions. This is not possible unless the water and land resource conditions are assessed. The following summaries provide descriptive characteristics and quantitative assessments of the type and extent of the water resource.

Although these assessments are based on water resource conditions that are unique to Green Lake County, it must also be noted that there are strong communications and working relationships with neighboring counties to foster common goals and objectives for resource improvements throughout the entire basin.

Upper Fox River Basin: Most of the County is located in the Upper Fox. Green Lake County Watersheds include:

- Fox River-Berlin Watershed
- Green Lake previously a DNR funded priority watershed
- Upper Grand River Watershed previously a USDA-EQIP funded priority watershed
- Lower Grand River Watershed
- Buffalo and Puckaway Lakes Watershed
- Fox River-Rush Lake Watershed
- White River Watershed
- Mecan River Watershed
- Swan Lake Watershed

<u>Upper Rock River Basin</u>: Approximately 10 square miles of the County are located in the Upper Rock. Green Lake County Watersheds include:

- Beaver Dam River Watershed previously a DNR funded priority watershed
- Upper Rock River Watershed

A map of each watershed within Green Lake County is provided and is submarized below.

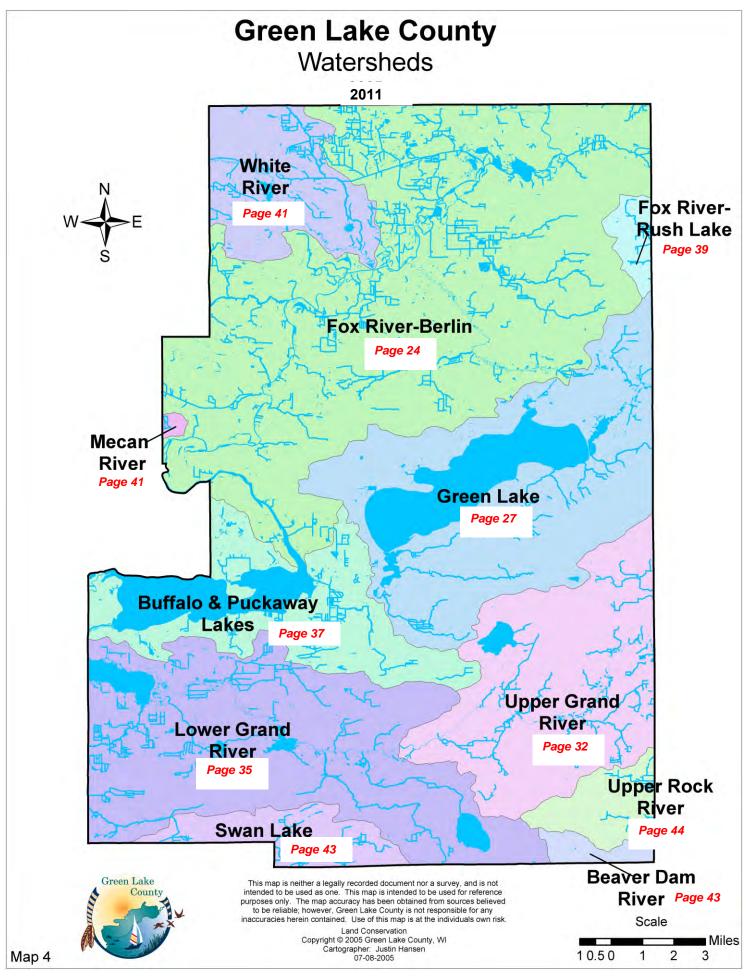
TABLE 3.1: SUMMARY OF WATERSHED TABLES						
Watershed	Cropland (acres within Green Lake County)	Streambank/ Shoreline (miles within Green Lake County)	Area in 300 ft Buffer (acres within Green Lake County)	Cropped Area in 300 ft Buffer (acres within Green Lake County)		
Fox River-Berlin	29,747	321	16,450	3,935		
Green Lake	12,690	122	6,554	2,352		
Upper Grand	16,647	67	4,357	1,949		
Lower Grand	14,328	138	8,032	2,340		
Buffalo/Puckaway	8,187	80	4,145	984		
Fox River-Rush Lake	3,002	5	367	184		
White River	2,593	69	4,344	447		
Mecan River	200	<1	55	29		
Swan Lake	4,502	14	1,042	495		
Beaver Dam	2,456	1.3	11	11		
Upper Rock	3,547	8	558	446		
TOTAL	99,700	825	41,904	13,162		

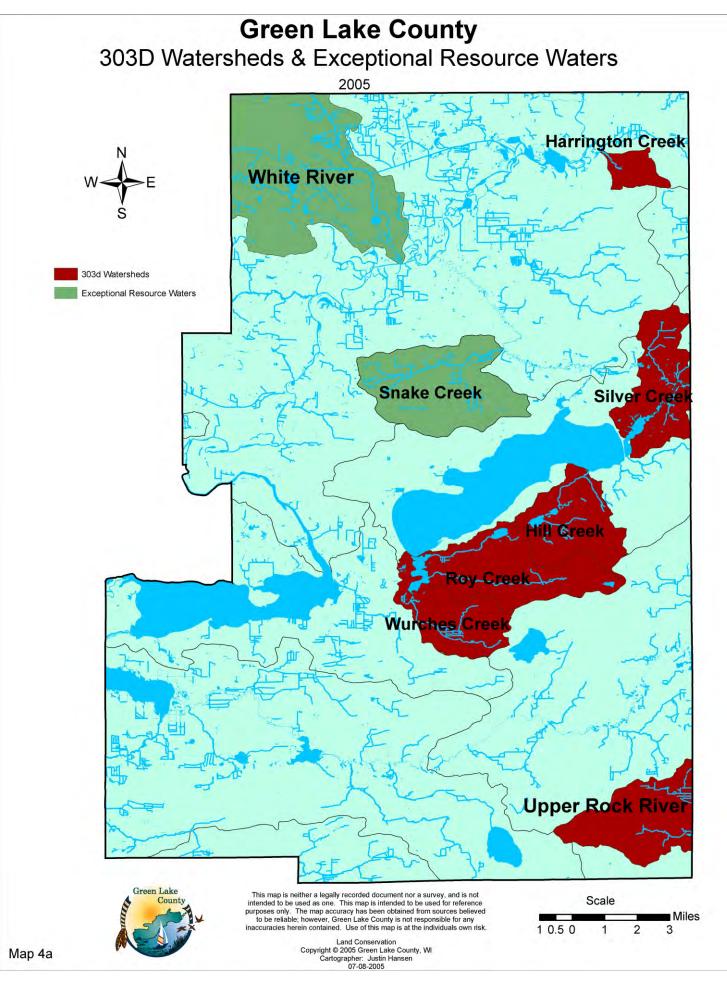
Exceptional Resource Waters:

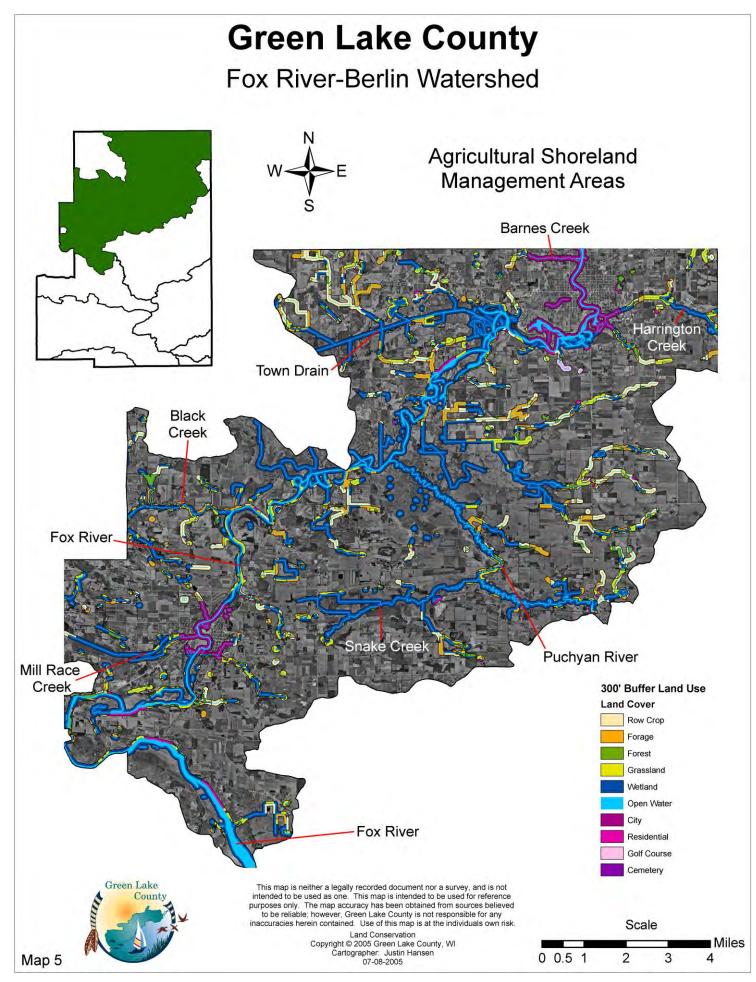
- Snake Creek in the Fox-Berlin Watershed
- White River in the White River Watershed

303(d) Waters – Water not currently meeting water quality standards

- Harrington Creek in the Fox River-Berlin Watershed
- Hill Creek in the Green Lake Watershed
- Roy Creek in the Green Lake Watershed
- Silver Creek in the Green Lake Watershed
- South Branch Rock River in the Upper Rock River Watershed
- Wuerchs Creek in the Green Lake Watershed







UPPER FOX RIVER WATERSHED

The following descriptions have been taken from the 1995 <u>Upper Fox River Basin's Water Resources</u> draft. A few references were made to <u>Green Lake County's Water Resources (1971)</u> when no other data was available.

Fox River-Berlin Watershed - UF06 (Map 5)

This large watershed lies in northern Green Lake County, southeastern Waushara and southwestern Winnebago counties. The total drainage is 199.2 square miles with 129.5 square miles located in Green Lake County. (Only Green Lake County's portion is shown on map 5.) It is Green Lake's biggest watershed, and a major contributor of phosphorus to Lake Winnebago. (The Fox River-Berlin Watershed and the Fond du Lac River watershed account for 30% of the phosphorus that enters Lake Winnebago.) Field reconnaissance did not locate bad nonpoint source pollution sources and there are not the intense agricultural practices immediately adjacent to streams. Therefore, bad nonpoint source sites may be located uplands away from surface water, though there appears to be a significant amount of acreage in the federal Conservation Reserve Program (CRP). Many wetland complexes exist within the watershed, particularly adjacent streams. A calcareous fen is located near Berlin.

Berlin with an estimated population of 5242, is the largest city in the Fox-Berlin watershed, as well as in Green Lake County. Berlin operates an activated sludge wastewater treatment facility, which discharges into the Fox River. It contributes an estimated 1000 pounds of phosphorus per year. While the population is not growing rapidly, there is construction activity, and on site erosion may be a problem. There is a USGS river flow station in Berlin on the Fox River.

Puchyan River (15 miles) is a major tributary of the Fox River and the outlet of Green Lake. A small impoundment is located on this stream just below Green Lake. The Puchyan contains turbid, hard water. Carp, redhorse, suckers and forage fish are the most common fish species present. Smallmouth bass, northern pike and trout are occasionally found in small numbers, while walleyes are present during spring spawning runs. Large numbers of Canada geese use this river during spring and fall migrations. Muskrats are common near marshy areas and a few puddle ducks nest along the stream. Open marsh, upland hardwood, and farm pasture are primary shoreland types, and bank erosion is light. The wastewater treatment plant (WWTP) of the City of Green Lake (480 lbs./yr. phosphorus load) enters the Puchyan River.

Snake Creek (7 miles) is a small tributary to the Puchyan River. The upper 1.3 miles is a class I trout stream (WDNR, 1980) and is an Exceptional Resource Water (ERW). An in stream habitat assessment indicated habitat conditions as being <u>fair</u> (WDNR, 1995). Trout and smallmouth bass are present. Shrub marsh, open meadow, and cultivated crops are common shoreline types. The stream goes through a wetland complex that provides it with good protection from agricultural nonpoint source impacts, although there is grazing in the wetlands at one location.

Barnes Creek (13 miles) is a medium brown, hard water stream that enters the Fox River just below Berlin. Little is know about existing water quality or fisheries. Streambank pasturing and poor storm water management has caused heavy erosion with an estimated 3.5 T/A/YR. A number of barnyard/feedlots may be contributing sediment and nutrients to surface water. The upper reaches have been ditched in many places.

Black Creek (13 miles) contains very dark brown water that is relatively infertile when compared to other streams in the county. Most wildlife and fish are relatively scarce, but geese are common. Streambank vegetation consists primarily of cultivated crops, pasture, and upland hardwood forest.

<u>Harrington Creek</u> (3 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is a small tributary to the Fox River on the south

edge of Berlin. The stream flows through a larger wetland complex that includes a calcareous fen--a unique type of wetland complex. Fens are dependent on upwelling of groundwater rich in calcium and Magnesium bicarbonates; often having plants that are uncommon or rare. Regrettably, this marsh has been filled with some foundry wastes and has recently been partially developed. Harrington Creek is also rated a Limited Forage Fishery stream, and it receives wastewater discharge from National By Products animal processing plant (WDNR SCR-Files, 1995).

Fox River (31 miles) is characterized as a larger stream with a low gradient. An 1855 account of the Fox River in what is now Green Lake County states that the clear flowing water supported small-mouth bass and wild rice, an indicator of good water quality. Today, the water is turbid due to erosion from farm fields and the drainage of wetlands. Ducks and geese while still present along the river no longer blacken the sky as they did a hundred years ago. The river still has an impressive warm water sport fishery, but the abundance of carp indicates a water quality problem. The WDNR is doing long term trends monitoring along the river in Berlin. The City of Princeton's WWTP enters the Fox. (960 lbs./yr. phosphorus load)

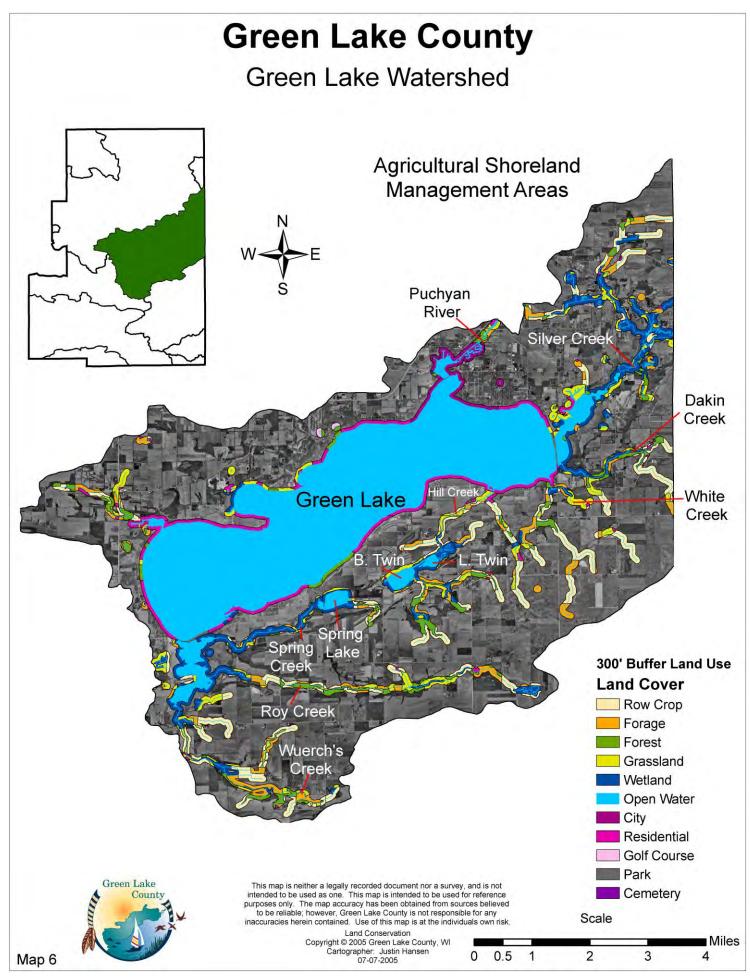
Soil erosion is a major contributor to habitat and water quality deterioration. In spite of this, the Fox is still probably the most important recreational stream in the county. Fishing pressure is very heavy especially near the abandoned lock sites. Boating pressure and hunting pressure is also heavy. Citizens are concerned about the impacts of boating pressures on streambank erosion. It has been suggested that no wake zone ordinances be established on certain portions of the river, for example near Oxbow Trail in Princeton.

TABLE 3.2 a: Land Use

land use	estimated total	percent*
Cropland	29,747 Acres	36%
Grassland	14,253 Acres	17%
Urban/barren	2,600 Acres	3%
Wetland	21,000 Acres	25%
Woodland	8,400 Acres	10%

TABLE 3.2 b: Agricultural Shoreland Management Areas		
Streambank/shoreline	321 miles	
Area in 300' Buffer	16,450.2 acres	
Cropped Area in 300' Buffer	3,934.5 acres	

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.



Green Lake Watershed – UF07

(Map 6)

The Green Lake Watershed is located in Green Lake and Fond du Lac Counties (Fond du Lac portion omitted from map). The total drainage is approximately 114 square miles with 71.4 square miles located in Green Lake County.

The watershed was a priority watershed from 1981 until 1992 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Traditionally, Green Lake was considered to have good water quality. However, long term trend monitoring indicated the lake was moving toward a more nutrient rich tropic state. The eutrophic trend was traced to high annual sediment loading from direct runoff and surrounding tributaries. The primary objective of the project was to reduce sediment and nutrient loading to Green Lake by installing and implementing Best Management Practices (BMPs). These practices helped reduce agricultural impacts, though dense forests with abnormally high concentrations of Buckthorn and other invasive vegetation along with roadside gullies continue to significantly impact Green Lake. The program did not attain all of its goals, but it did result in a significant improvement in the level of nonpoint source control. It is an excellent example of how state, local, and federal agencies along with partners from the private sector, can work together to achieve common goals.

The GLSD is conducting Biotic Indexing for all of Green Lake's tributaries with a number of years worth of data on stream health. This information will need to be analyzed and prepared into a report for future use.

Dakin Creek (3.4 miles) Historically a spring fed class II trout stream (WDNR, 1980) located on the southeast end of Green Lake. It had a good aquatic macroinvertebrate population that supported a native brook trout population (Fassbender et.al., 1971). Today, it is not identified as a trout stream in the state's 1996-7 trout fishing regulations (WDNR, 1996). The water is clear, hard, and highly productive. Watercress and other aquatic plants are common near the source. Mitchell's Glen, a small gorge some 60 feet deep is located on a small tributary of the creek. This area is unique because it contains some uncommon alpine plant species and a 40-foot waterfall. (It is also a historic Native American village site.) Much of the creek is in a near wilderness condition, a unique resource that is presently found in Green Lake County. It is designated an Environmentally Sensitive Area by the Upper Fox River Basin's Analysis of Demographic Composition, Public Goods and Natural Resources.

Hill Creek (2 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is an outlet of Little Twin Lake that flows in a northeasterly direction into Green Lake. The stream contains clear, hard water often polluted with barnyard drainage. Bank erosion is responsible for serious fish and game habitat destruction. Hill Creek, while containing no permanent fishery, allows fish to occasionally enter Green Lake from the Twin Lake system. The 1992, WDNR stream analysis listed this creek as having -fair" water quality (Appendix Two). DNR plans to study this stream in the 2012 - 2013 time period.

Roy Creek (8 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is a tributary to Green Lake containing clear, hard water. The stream contains no fish other than a few forage minnows. The streambank consists of upland hardwoods, farm pasture, and cultivated crops. The stream supports little in the way of wildlife. Many Native America antiquities are located near the creek indicating its importance to the pre-white era inhabitants of the region. The WDNR rated Roy Creek as having -Poor" water quality in 1992. (Appendix Two)

Silver Creek (14 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It rises in northwestern Fond du Lac County and flows west to Green Lake. It drains the largest of Green Lake watershed's sub-watershed, which happens to be heavily agricultural and includes an urban area: Ripon. The creek contains turbid, hard water and a bottom consisting of silt and sand. Phosphorus and Suspended Sediment monitoring done since the completion of the priority watershed project in 1992 indicates that significant loads are carried into Green Lake (WDNR, 1995-6). Ripon's Wastewater Treatment Plant (WWTP) opened their updated treatment plan in 2004 discharging approximately 2074 lbs of phosphorus. Prior to 2004, Ripon's

Wastewater Treatment Plant discharged approximately 3000 lbs of phosphorus per year. It has been listed in the 303(d) list as water not currently meeting water quality standards.

Spring Creek (3 miles) originates at Spring Lake and flows through the County Park marshland before it empties into the southwest end of Green Lake. Canada geese use the area as a rest stop during spring and fall migration. Spring Creek is 2.2 miles long and receives water from open meadows, gullies and agricultural croplands. In 1992, the WDNR reported the water quality as -poor" upstream of highway K. (Appendix Two) A steep gradient in the reach downstream of highway K allows for swift sediment transport to Green Lake.

<u>White Creek</u> (one mile) is a spring fed creek and is classified as a class I trout stream. The stream flows northwest into Green Lake at a gradient of 114.4 feet per mile from a watershed of 3.05 square miles. Indian burial mounds, effigy mounds, and ancient food caches are common along the streambank. Watercress is also present. The creek receives drainage from woodland, cash cropping and barnyard/feedlots. Some agricultural BMPs have been implemented in portions of the White Creek sub-watershed.

USGS data shows White Creek as having one of the highest rates of sedimentation for monitored rural streams in southeast Wisconsin. The monitoring station near the outlet of the creek has recorded mean sediment delivery rates of 338 tons per square mile. This may be due to an intermittent tributary that enters White Creek from the South near the lower reaches. Siltation has been a problem in the lake near the outlet of White Creek and dredging has been conducted in 1988 and 1998-99. Dredging was also conducted in 2002 and 2005. The WDNR classified White Creek as -fair" in their 1992 water quality analysis. (Appendix Two) Since the installation of a sediment basin in 2005 dredging has not occurred on White Creek.

<u>Wuerchs Creek</u> (6 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). It is also listed as a high priority 303(d) stream. It is a continually flowing stream that enters the Green Lake County Park marsh area. A small number of cattle are pastured in the immediate stream area and row cropping occurs near the stream course in some upstream areas. The upstream impacts of nutrient input and streambank degradation caused the WDNR to classify this creek as -Poor" in its 1992 stream system habitat report. (Appendix Two)

Green Lake has an area of 7346 acres and it is the deepest natural inland lake in Wisconsin with a maximum depth of 236 feet. The lake varies from mesotrophic to eutrophic and supports both cold and warm water fisheries (two-story fishery). The water has a residence time of 21 years (Donahue study, 1978), though a recent study by Panuska (1999) estimates it to be 17 years. Various individuals throughout the years have monitored Green Lake, so fortunately, a good source of historical data exists.

Green Lake is situated in a large pre-glacial valley formed by the action of some forgotten river. The Cary glacier scoured this valley depositing a large recessional moraine across its western end and was successful in damming a glacial river causing it to flood. A dam built in the late 1890's on the outlet maintains the water level about five feet higher than the natural lake basin. The installation of the dam on the lake still continues to wreak havoc on the natural ecosystem functions of the lake.

The watershed of Green Lake is mostly in agriculture. Habitat assessments indicate that BMPs have substantially reduced sediment and nutrient loading to the lake. The Green Lake Priority Watershed Project resulted in control of cropland soil erosion and a high reduction of nutrient runoff from barnyards. By 1988, five sub-watersheds had fully achieved or exceeded their nonpoint source pollution reduction goals. The habitat assessment and soil analysis revealed additional sources of nutrients and sediments, including bare forest floors resulting from dense forest canopies, extensive intermittent gully systems, and down-cutting through the rich silt loam topsoil causing streambank erosion. In addition, observation of geese made from 1967 to 1994 have ranged from an estimated few to 275,000 (waste from 200,000 geese is estimated to equal 1000 cattle). They too contribute to phosphorus loading. These problems should be addressed in the future.

Nearly half of the watershed is located in Fond du Lac County. The City of Ripon is located along Silver Creek, the main tributary to the lake. The City's waste treatment plant discharges to Silver Creek, along with many of the City's storm sewers. Cooperation with Fond du Lac County and the City of Ripon should be pursued to reduce impacts to Green Lake. Monitoring programs should be

established on many of the tributaries to Green Lake to further determine where major sources of pollutants are coming from. Several of the tributaries are located on the EPA's Impaired Waters" list (aka 303d List) and are likely contributing to the degradation of Green Lake's water quality.

Land use is a problem around Green Lake. Estimates of over 800 dwellings directly along the lakeshore, plus several resorts contribute to the eutrophication or enrichment of the water. Erosion control, particularly from developments may add excessive sediments and nutrients to the lake. Much of the shoreline is already developed and the remaining undeveloped areas are under extreme development pressure. One of the last parcels with a good expanse of undeveloped shoreline was recently sold to developers. Continued protection of the undeveloped shoreline should be pursued via conservation easement, purchase, or other means. A concern is that continued urban growth around the lake will result in other problems, including a significant increase in piers and boat slips, resuspension of sediments and shoreline erosion due to boat motors, and possible use conflicts.

The Green Lake Sanitary District and Green Lake Conservancy have made exceptional progress in obtaining 15 key parcels of land in the watershed. 200 acres has been purchased by the conservancy since its inception.

Green Lake Conservancy Highlights	
Properties Purchased	15
Acreage of Properties Purchased	200
Feet of Water Frontage	17,500
Grants Received	\$736,250
Citizen Donations	\$446,000
Green Lake Sanitary District Contribution	\$165,375
Green Lake Conservancy Contribution	\$167,375
Green Lake Association Contribution	\$20,000
Actual Purchase Price	\$1,535,000
2010 Fair Market Value	\$4,657,000

The Big Green Lake Shoreline Restoration Program (RSVP) started in 1998 has restored over 100 properties on Big Green Lake (10% of properties on the lake) which include over 12,000 feet of water frontage. Projects have included privately owned residential frontage as well as publicly owned municipal frontage. In addition to the actual shoreline projects completed, RSVP has certified over 15 businesses to understand and complete shoreline restoration projects. Certification workshops are scheduled as needed. At this point, RSVP is self-sustaining (certified businesses) and the program originator, GLA and GLSD, continue to provide partial cost-sharing for projects meeting program requirements (i.e. native plants, minimum sized buffers, etc).

Sensitive areas, particularly areas important to fish spawning and rearing or having significant plant diversity, have been identified. The shore area of Norwegian Bay, with its stand of Hardstem Bulrushes, is one of those areas. The Green Lake Sanitary District, along with 3 of the 4 surrounding townships has established an Ordinance that regulates use, equipment, and operation of boats and activities near this area.

The Green Lake Sanitary District aggressively attacked the Purple Loosestrife problem in the Green Lake Watershed. The Green Lake Sanitary District coordinates the efforts of local high school biology students to aggressively control the spread of Purple Loosestrife and the monitoring of the waters of Green Lake and its tributaries. Further success of this program may encourage expanding the Purple Loosestrife control to other areas in Green Lake County. An extensive amount of biotic indexing is done on the local Green Lake tributaries by student lake volunteers that are part of the Green Lake Sanitary District's *P*artners in Education" program.

The lake should develop an updated Lake Management Plan. In addition, and comprehensive AIS plan should be developed and implemented. Green Lake is the destination of many transient boaters arriving from out of state, or other large waters, such as the Winnebago Pool Lakes or Lake Michigan, and are more likely to transport AIS from these waters. The lake also attracts thousands of boats each year, further increasing the likelihood of the introduction of new AIS species. Many AIS species are already present in the lake, including Eurasian Watermilfoil (EWM), Curlyleaf Pondweed (CLP), Asian Jellyfish, and Zebra Mussels. Species likely to be of concerns may be Rusty Crayfish, Spiny

Waterflea, VHS, and others. The potential impact of these species warrants additional resources to be utilized on this lake.

Other issues of concern include manure spreading within the watershed, carp management, nuisance aquatic plant management, shoreline erosion, and nutrient loading. The Sanitary District owns and operates a mechanical weed harvester to maintain navigation channels within the bays of the lake. Much of the main body of the lake is too deep to support rooted aquatic plants.

Big Twin Lake is one of three small lakes located one mile south of Green Lake. An intermittent inlet connects it with Little Twin Lake. Big Twin Lake supports a sport fishery of largemouth bass. walleye, northern pike, perch, bluegill, crappie, and white sucker. Many ducks use the lake for nesting and as a resting area during migration. The lake is a popular fishing destination year-round, and receives mild duck hunting pressure in the fall. The lake has a current Lake Management Plan and an Aquatic Plant Management Plan. The lake is mildly infested with Eurasian Watermilfoil (EWM) and Curlyleaf Pondweed (CLP). The LWCD received an AIS grant in 2008, and have actively been managing EWM and CLP via chemical treatment. There has also been an on-going educational effort to prevent other AIS species from entering the lake. Twin Lakes is a popular lake for transient boaters coming directly from Big Green Lake, one mile to the north, which contains many invasive species. Twin Lakes has also been the subject of several AIS studies. The Land Conservation Committee supports the continuation of AIS related work. Big Twin Lake has comprehensive plant surveys completed. The lake has a good diversity of plant species, however the frequency of occurrence is low for many species. An evaluation of the lakes fishery is recommended. About a third of the lake shore is moderately developed, with the remaining two-thirds being mostly natural. Continued protection of the undeveloped shoreline is recommended. A complete watershed evaluation should be conducted to locate potential sources of sediment into the lake.

Little Twin Lake is located a short distance east of Big Twin and connected to it by a channel through a cattail stand. The lake level in both lakes is affected by the presence of a small dam at the outlet. Hill Creek drains both lakes during peak runoff periods but may dry up in late summer on low precipitation years. A small dam and fish barrier is constructed on the outlet to prevent carp from returning from Green Lake. The major importance of this lake is the spawning habitat provided for the fish from Big Twin. The Twin Lakes Association is working with the Department of Natural Resources and biologists to formulate a long-range plan for improving the lakes. The lakeshore is mostly undeveloped, and consists mainly of riparian wetland. The lake receives light fishing pressure and moderate duck hunting pressure.

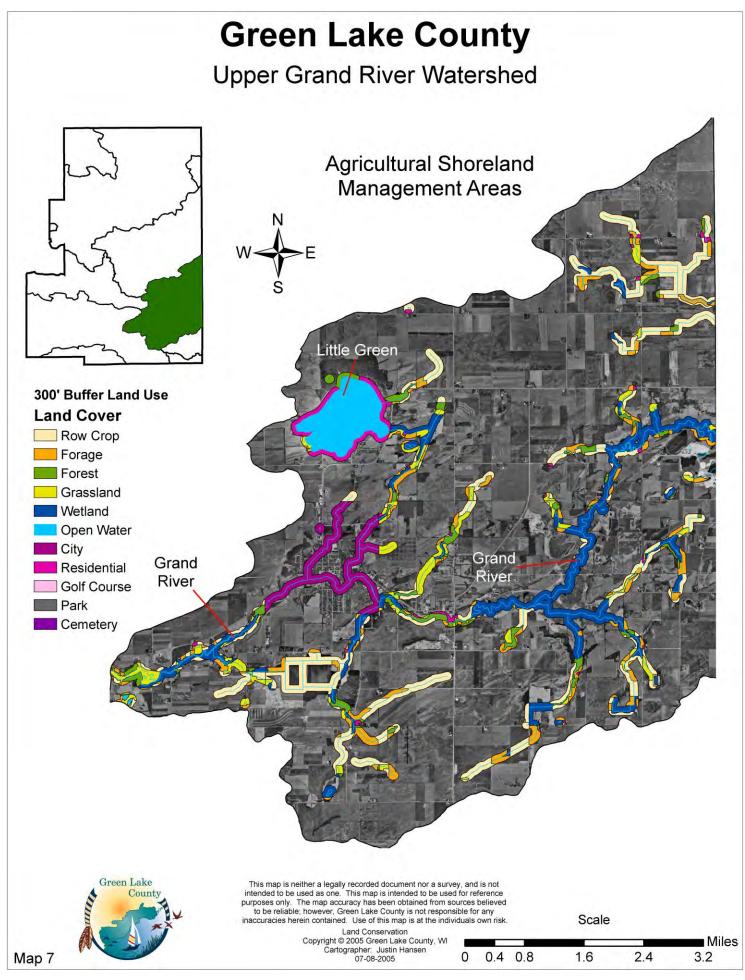
Spring (Spirit) Lake is one of three small lakes located one mile south of Green Lake. Spring Lake is a 62 acre lake. It has a maximum depth of 42 ft. Fish in the lake include panfish, largemouth bass, northern pike, walleye. The shoreline is mostly undeveloped and has a marl bottom. Continued protection of the undeveloped shoreline should be pursued via conservation easement, purchase, or other means. Spring Lake is a unique lake, in that is maintains an almost unaltered shoreline, even though it is in close proximity to other highly developed areas. The outlet to this lake is Spring Creek, which drains west to the inlet of Green Lake. Additional studies are recommended for this lake. There is little water guality data available and presence of AIS should be determined.

estimated total	percent*
12,690 Acres	28%
12,310 Acres	27%
1,430 Acres	3%
2,000 Acres	4%
5,500 Acres	12%
	12,690 Acres 12,310 Acres 1,430 Acres 2,000 Acres

TABLE 3.3 a: Land Use

TABLE 3.3 b: Agricultural Shoreland	Management Areas
Streambank/shoreline	121.6 miles
Area in 300' Buffers	6553.7 acres
Cropped Area in 300' Buffers	2351.7 acres
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Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area



Upper Grand River Watershed – UF12

(Map 7)

The Upper Grand River watershed includes all water draining to the Grand River above Manchester dam in southeast Green Lake County and a part of western Fond du Lac County. The watershed is 62 square miles with 44 square miles located in Green Lake County. (Green Lake County portion shown on Map 7.) The Upper Grand River Watershed in Green Lake County was one of 21 watersheds selected in 1998 as an EQIP watershed project. The 5-year signup period for the project (1998-2002) allocated funding of over \$680,000 for BMP installation.

Grand River (22 miles) Biotic index information taken below Markesan indicates only <u>-fair</u>" water quality. (Burbach, 1998) The Markesan Wastewater Treatment Plant (WWTP) discharges an estimated 1320 pounds of phosphorus per year. Observations made by the WDNR staff indicate that the stream may have reaches of good water quality and habitat; (WDNR, 1995) however, agricultural practices may be affecting the river.

The nature of the shoreline varies according to adjacent land use. Most common shoreline types are open marsh, farm pasture, cultivated cropland, and upland hardwood.

Little Green Lake is a 466-acre lake with a maximum depth of 28 feet. It has a drainage area of about 3.33 square miles. The watershed surrounding the lake is primarily agricultural and there are some severe nonpoint sources of pollution. The shoreline is heavily developed and there is a danger of valuable fish spawning areas and riparian wetlands being destroyed. This could cause severe and permanent damage to the quality of the lake, which already has a history of excessive algae and/or aquatic weed growth resulting in summer fish kills and navigation problems.

Chemical treatment and mechanized plant harvesting have historically been used to manage Aquatic Invasive Species (AIS) and nuisance native species for the purpose of navigation. Further treatments to control AIS are recommended. The Little Green Lake Protection and Rehabilitation District started a plant harvesting program in 2004 and own their own harvesting equipment. The Aquatic Plant Management (APM) Plan is being updated in 2011 to address long term goals for plant management in the lake, while taking into consideration impacts to habitat and plant nutrients availability. Current AIS species of concern include Eurasian Watermilfoil and Curlyleaf Pondweed. A comprehensive AIS Plan should be adopted to address other AIS threats. Other plant management tools should be evaluated for feasibility. One of these is a seasonal draw down to effect sediment consolidation and emergent aquatic plant renewal. A comprehensive lake management plan should be developed. The protection of natural wooded areas surrounding the lake should be pursued, either through conservation easement, purchase, or other methods. Some of these forests and riparian wetland contain unique plant communities, which should be preserved.

According to past phosphorus loading studies (Ramaker, 1999, etal), large amounts of phosphorus are released from bottom sediments and possibly littoral zones during the summer. The effectiveness of the lake destratification project should continue to be evaluated and modified as necessary. Appraisal of phosphorus release from the littoral zone is needed. The lake is borderline hyper-eutrophic and has a history of poor water quality. However, recent observations indicate fluctuating changes in water clarity. Although this might be temporary, a continuation of long range water quality appraisals is recommended.

Little Green Lake Watershed has seen several major projects implemented since 1999 including the installation of large retention basins in 2000 and 2008, a lake aeration in 2003, and a sewer project that was completed in 2000. The lakeshore is highly developed in many areas, with hard armament at the water's edge and little natural vegetation along the shoreline. Shoreline restoration and buffer installation are recommended.

Little Green Lake Protection and Rehabilitation district developed a watershed land use plan with a stormwater management component in 1998 with the help of a lake management grant. The implementation of the plan should be pursued via all grant funding opportunities. The plan should be reviewed and updated as necessary. The DNR and LWCD staff should work together to ensure a comprehensive approach that has good grant funding potential.

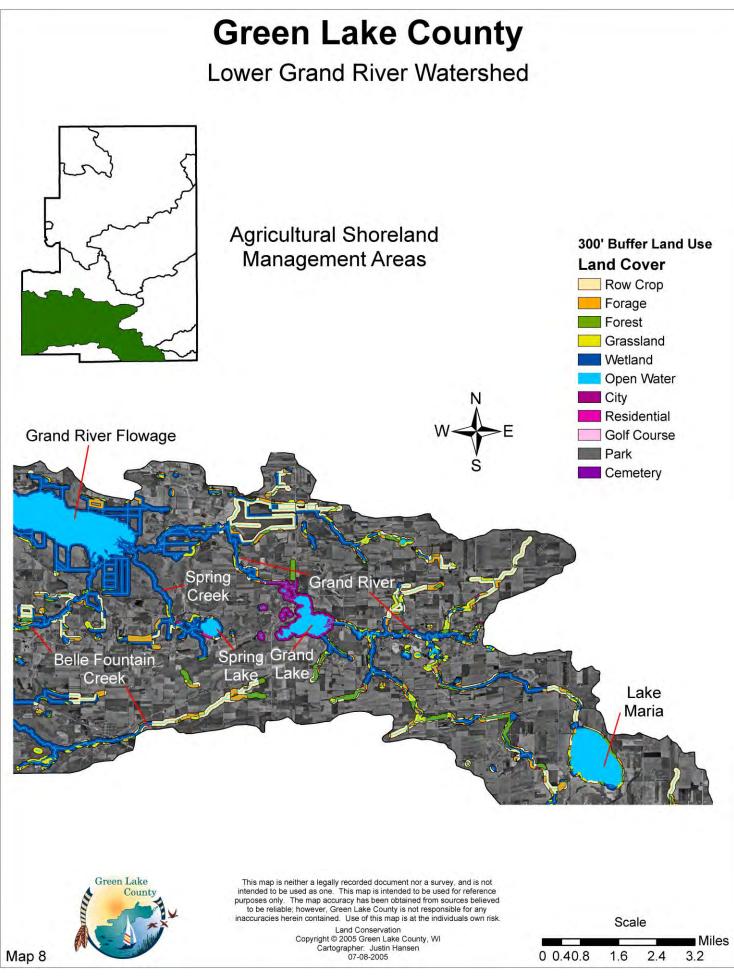
TABLE 3.4 a: Land use

land use	estimated total	percent*
Cropland	16,647 Acres	59%
Grassland	2353 Acres	8%
Urban/barren	860 Acres	3%
Wetland	2500 Acres	9%
Woodland	950 Acres	3%

TABLE 3.4 b: Agricultural Shoreland Management Areas

Streambank/shoreline	67 miles
Area in 300' Buffers	4356.6 acres
Cropped Area in 300' Buffers	1948.7 acres
Estimate using Arguing USCS mana with a 1:24,000 and	*100% includes water area

Estimate using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.



Lower Grand River Watershed – UF11

(Map 8)

The Lower Grand River includes the Grand River and its tributaries from its confluence with the Fox River in Marquette County to where the old dam was in Manchester. The watershed's total drainage is 109 square miles with 65 located in Green Lake County. (Green Lake County portion shown on Map 8.)

Belle Fountain Creek (8 miles) is a tributary to the Grand River. The stream is clear with little sediment build up and provides habitat for northern pike and walleye during spring spawning movements. Much of the stream bank is pastured, though part of the stream lies within the Grand River Marsh Wildlife area. Cattle watering along the stream's tributaries have created erosion problems.

Grand River (21 miles) The 1991 version of the Upper Fox River Basin plan identified problems as wetland drainage, agricultural nonpoint source pollution and an over abundance of carp. (Fix and Eagan, 1990) The entire river system above the Kingston dam was chemically treated to remove carp. This reach of the Grand River has a dam forming the Grand Lake at Kingston.

Spring Creek is a clear hard water outlet of Spring Lake located just west of Kingston. The stream is a tributary of the Grand River. Sand, silt, detritus, and muck are common bottom materials while open marsh is the predominant shoreline type. Apparently only forage fish are present. Caddisfly larvae are common. About two and one-half miles of stream are located in the Grand River Marsh Wildlife Area.

Grand Lake is an impoundment of the Grand River. The lake at one time had a good fishery, but it has been degraded due to sediment accumulation and the presence of carp. The pond has been drained and chemically treated to remove rough fish and undesirable panfish populations. It has improved the situation but not solved it. The majority of the shoreline is marsh and pasture, with some dwellings and a few resorts. The lake is heavily used by mallards, teal, and other dabblers as well as great blue herons and other wading birds.

Lake Maria is a landlocked hard water lake, except that during very wet years there is an outlet flow into the Grand River system. Due to the shallowness, the lake is subject to winterkills and thus few sport fish survive. The lake is used heavily by many species of waterfowl, especially in the spring when an estimated 5,000 migrants stop here. Active management for waterfowl should be explored. Water levels have historically been artificially altered by a make-shift rock dam at the outlet, which may be impacting emergent plant growth throughout the lake. The lake is located in an agricultural watershed, and agricultural runoff may affect water quality. Most of the shore is natural, with very little shoreland development.

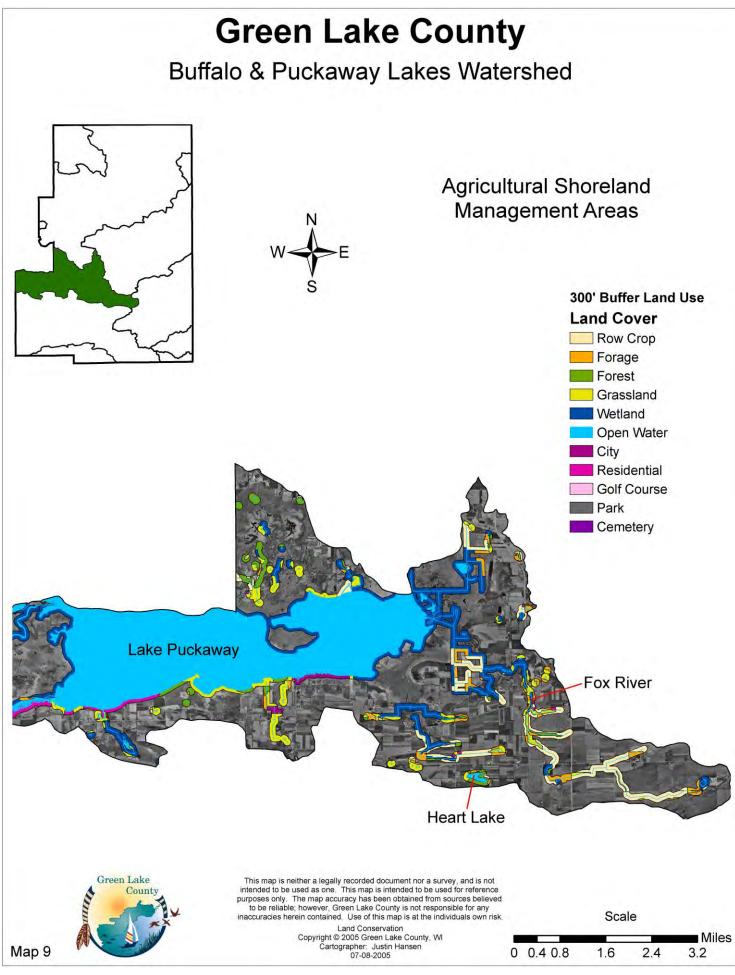
Spring Lake is a hard water, spring fed lake that outlets into the Grand River. It supports the most diversified fisheries of any lake in the county. Common species include northern pike, perch, largemouth bass, bluegill, rock bass, white bass, yellow bass, rainbow trout, carp, and white sucker, not to mention other less common species. Carp and sucker activity has caused a problem by keeping the water turbid and uprooting plants. Marsh birds, and migrating ducks are common game species that also use the lake.

TADLE 3.5 a. Lanu USe		
land use	estimated total	percent*
Cropland	14,328 Acres	34%
Grassland	10,672 Acres	26%
Urban/barren	220 Acres	0.5%
Wetland	5500 Acres	13%
Woodland	5300 Acres	13%

TABLE 3.5 b: Agricultural Shoreland Management Areas		
Streambank/shoreline	138.4 miles	
Area in 300' Buffer	8031.7 acres	
Cropped Area in 300' Buffer	2339.9 acres	

Estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

April 2011



Buffalo & Puckaway Lakes Watershed – UF10

(Map 9)

This watershed is 232 square miles and covers parts of Columbia, Marquette and Green Lake Counties. 33.7 square miles are located in Green Lake County. (Green Lake County portion shown on Map 9.)

Fox River (45 miles) is the principle stream in the watershed. The river and the impoundment that are located in Green Lake have a diverse warm water sport fishery. The river also flows through two important state wildlife areas. (See Fox River-Berlin watershed data for downstream information.)

<u>Heart Lake</u> is a small soft water lake located about four miles northeast of Kingston. The water is clear but is subject to severe alga blooms. Seepage and runoff provide the water supply. A major problem is severe water level fluctuations. The shoreline is about 50 percent agricultural and used for cattle watering. Most of the lakeshore is owned by the state.

Lake Puckaway is a shallow drainage lake of the Fox River. It has an area of 5039 acres and a maximum depth of 5 feet. Wild rice, an indicator of good water quality, once was the dominant plant. The long term impacts of agriculture in the basin, and stabilized water levels have altered the lake, making it eutrophic with elevated phosphorus levels, leading to algal blooms during the summer. Water quality is poor, though the lake still has a healthy diverse aquatic plant community. However, recent studies have shown a steady decline in emergent and floating leaf aquatic plants, and important habitat component for many fish and bird species. Methods should be explored how to stabilize and reestablish these historic plant beds. Lake Puckaway also has a rookery of Great Blue Herons, Egrets, Common Terns, Fosters Terns, Pelicans, and Double-Crested Cormorants, many cranes and other waterfowl also exist in this area. Cormorants have been managed by the USFWS since 2008 due to their increasing numbers and damage to island vegetation. Both species of terns found on this lake are threatened species, and methods should be developed to provide adequate habitat to retain the viability of these species on Lake Puckaway.

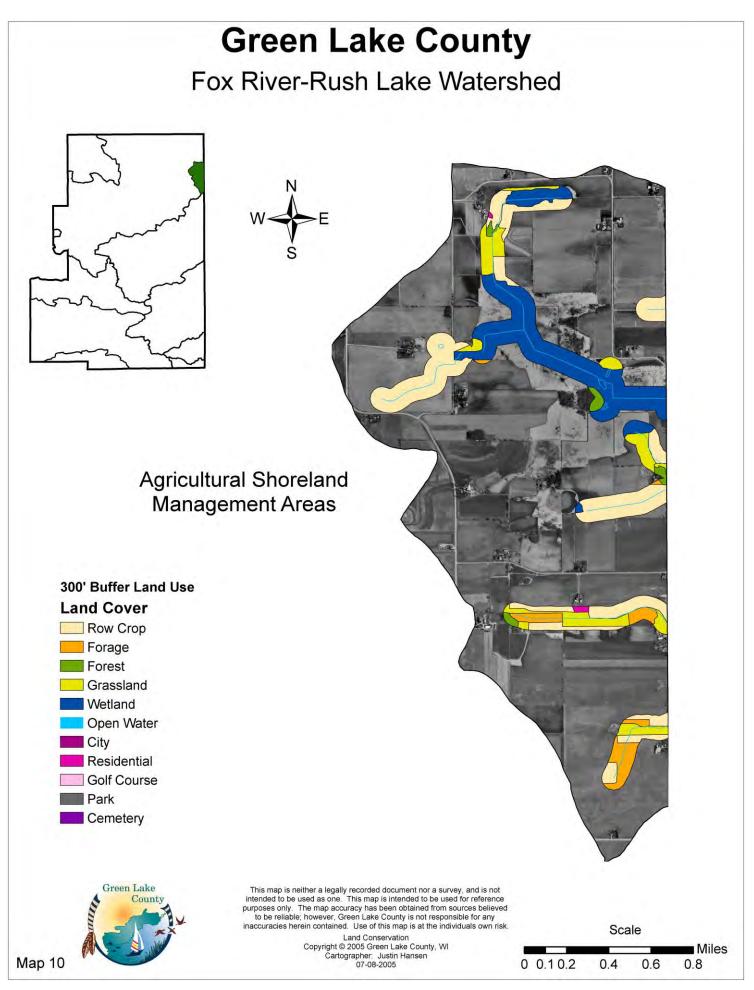
In 2004 the Lake Puckaway Protection and Rehabilitation District (LPPRD) completed a lake management plan. Eight major goals along with fourteen additional goals were formed by the District, its residents, and citizens from the surrounding area. The eight major goals are: monitoring and decision-making, water quality, aquatic plants, carp reduction, water levels, fish populations, shorelines and breakwaters, and watershed management. The Land and Water Conservation Department attended the public outreach meetings and also served as an advisor to the process. These goals and concerns of the Lake Puckaway Protection and Rehabilitation District are likewise shared by the Land Conservation Committee. Please refer to Appendix Twelve for short descriptions of the eight major and additional goals of the District.

The LPPRD has actively been working on the lake management plan via it's Adaptive Management Committee. The committee consists of District Commissioners, lake residents, Wisconsin Department of Natural Resources Lakes Staff, and Land Conservation staff. In 2011, the District hired a Lake Coordinator to continue the implementation of the plan. The LCC continues to support the goals outlined in the 2004 management plan.

TABLE 3.6 a: Land Use		
land use	estimated total	percent*
Cropland	8187 Acres	38%
Grassland	200 Acres	1%
Urban/barren	100 Acres	0.5%
Wetland	5300 Acres	25%
Woodland	1000 Acres	5%

TABLE 3.6 b: Agricultural Shoreland Management Areas		
Streambank/shoreline	80 miles	
Area in 300' Buffer	4145.4 acres	
Cropped Area in 300' Buffer	984.2 acres	

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.



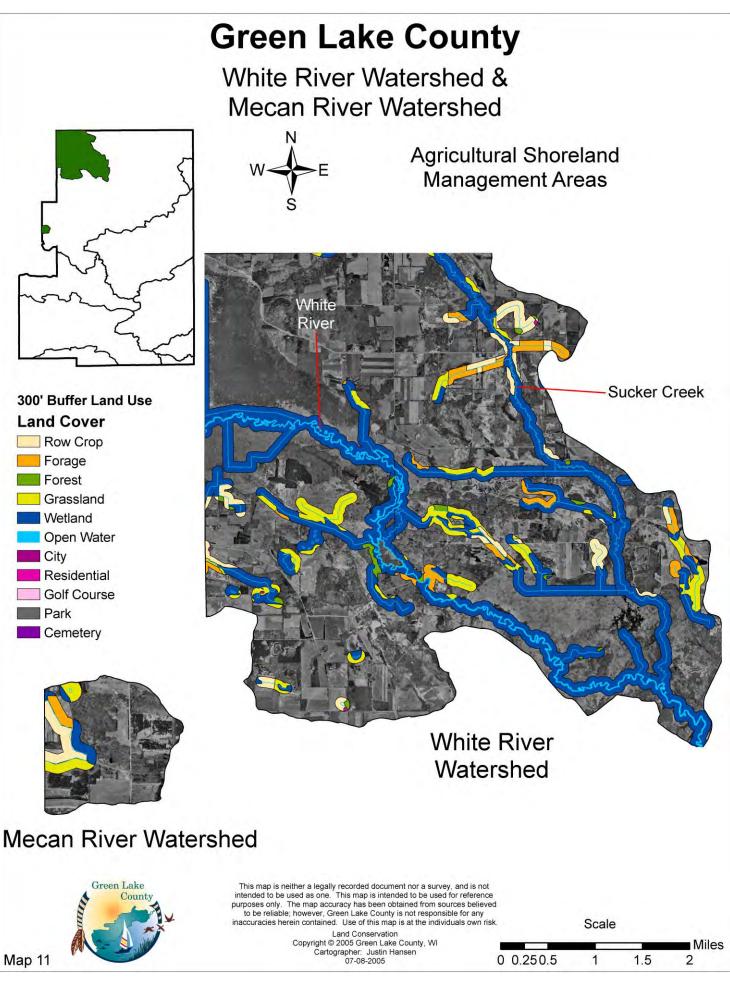
Fox River-Rush Lake Watershed – UF05

(Map 10)

Most of this watershed lies in Winnebago County but Green Lake County overlies a small section of this large watershed, making up about 5 of the 125 square miles. (Green Lake County portion shown on Map 10.) Many wetland complexes lie in this watershed, with the Rush Lake complex being the largest and most important. The Rush Lake/Waukau Creek sub-watershed was listed as a Nonpoint Source priority area in the Lake Winnebago Comprehensive Management Plan of 1998. This was based on high critical soil erosion rates in excess of 5.2 ton/acre/year. Land use in this watershed, including the section in Green Lake County is primarily agricultural in nature with small dairy operations and cash grain farms as the primary means.

TABLE 3.7 a: Land Use		
Land Use	Estimated Total (acres)	Percent*
Cropland	3002	85%
Grassland	0	0%
Urban/barren	60	2%
Wetland	230	7%
Woodland	200	6%

TABLE 3.7 b: Agricultura	I Shoreland Management Areas
Streambank/shoreline	4.7 miles
Area in 300' Buffers	366.7 acres
Cropped Area in 300' Buffers	183.8 acres



White River Watershed – UF08

(Map 11)

This watershed is located in the northwest corner of Green Lake, northeast Marquette and southern Waushara counties with 21 of the 160.5 square miles located in Green Lake. (Green Lake County portion shown on Map 11.)

<u>White River</u> (32 miles) Above the White River Flowage is a class I trout stream (WDNR, 1980) and it is an Exceptional Resource Waters. Some potential nonpoint source threats exist to the stream from agricultural practices near the stream. Below the flowage the river is considered a warm water fishery (Poff and Threinen, 1963). The river flows through a large wetland complex below the Neshkoro Millpond, including the White River Marsh State Wildlife area. The wetland complex seems to assimilate the discharge of the Silver Lake Sanitary District, with estimated phosphorus loads of 900-lbs./yr. without any noticeable adverse impacts.

Sucker Creek (20 miles) is a dark brown hard water stream that drains a large portion of the White River Marsh. The stream contains a limited fishery consisting of forage minnows. Bank vegetation is mostly open marsh and shrub, and muskrats, geese, and ducks are common.

TABLE 3.8 a: Land Use				
Land Use	Estimated Total (acres)	Percent*		
Cropland	2,593	22%		
Grassland	1,307	11%		
Urban/barren	0	0%		
Wetland	6,500	48%		
Woodland	1,400	10%		

TABLE 3.8 b: Agricultural Shoreland Management Area		
Streambank/shoreline	69.3 miles	
Area in 300' Buffer	4343.9 acres	
Cropped Area in 300' Buffer	446.9 acres	

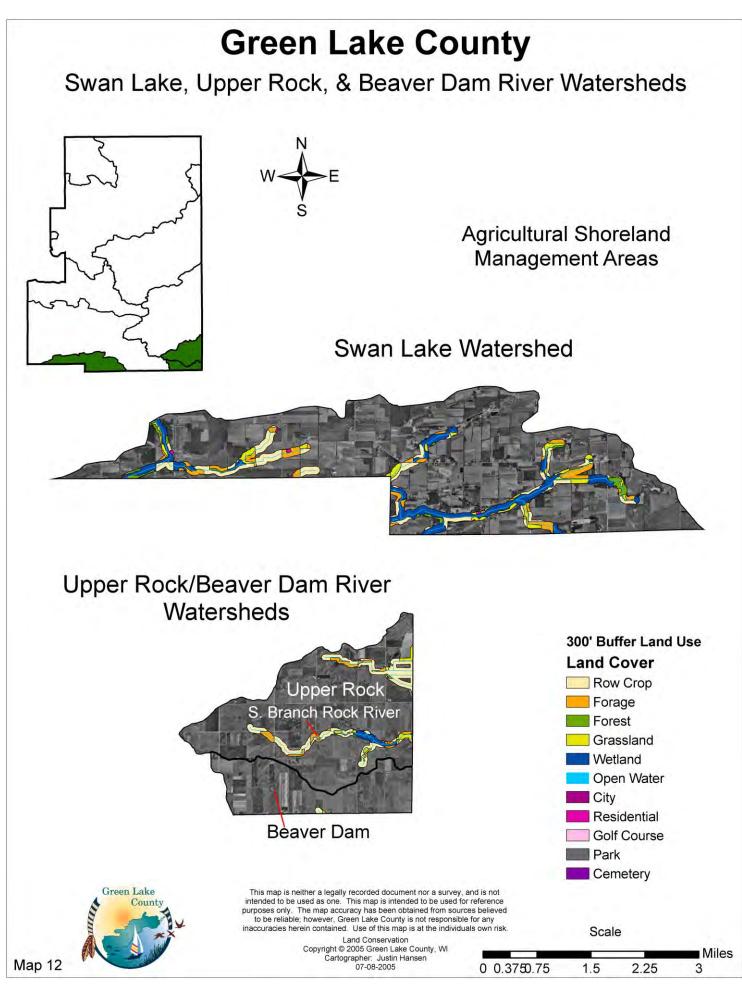
Mecan River Watershed – UF09

(Map 11)

A small portion of this watershed, about a half a square mile, lies in Green Lake County (Green Lake County portion shown on Map 11.) Many of the streams in the watershed that tributary to the Mecan support high quality cold water fisheries.

Black (Millrace) Creek is a man-made ditch running from the Mecan River, an Exceptional Water Resource to the Fox River at Princeton. It was originally constructed in 1857 and was used to provide waterpower for a gristmill. Shoreline vegetation consists of shrub marsh, open meadow, cultivated crops, and lawns.

TABLE 3.9	a: Land Use				
Land Use	Estimated Tota	al (acres)	Percent*		
Cropland	-		-		
Grassland	200		63%		
Urban/barren	16		0.5%		
Wetland	110		34%		
Woodland	40		1%		
All tables estimation	ted using ArcView U	ISGS maps	with a 1:24,00	0 scale. *100% inclu	des water area.
TABLE 3.8	b: Agricultura	I Shorel	and Mana	agement Areas	
Streambank/s	shoreline	69.3 mile	s		
Area in 300' E	Buffer	4343.9 ad	cres		
Cropped Area	a in 300' Buffer	446.9 acr	es		



Swan Lake Watershed – UF15

(Map 12)

This watershed is 81 square miles and includes the headwaters of the Fox River. A small part of it lies within southern Green Lake County—about 19 square miles. (Green Lake County portion shown on Map 12.) Agricultural nonpoint source pollution problems are present with animal waste management, stream bank trampling, and farm field runoff. The watershed had wetland complexes but no public wildlife areas.

Fox River (34 miles) The headwaters of the Fox start in Green Lake County. A Fox-Wolf Basin study indicates that phosphorus loading from the Fox River to Park Lake is six times the threshold amount considered excessive.

TABLE 3.10 a: Land use

land use	estimated total	percent*
Cropland	4503	37%
Grassland	100 Acres	1%
Urban/barren	30 Acres	0.3%
Wetland	650 Acres	5%
Woodland	1100 Acres	9%

TABLE 3.10 b: Agricultural Shoreland Management Areas		
Streambank/shoreline	13.6 miles	
Area in 300' Buffer	1041.7 acres	
Cropped Area in 300' Buffer	495.2 acres	

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

UPPER ROCK RIVER WATERSHED

The following descriptions were taken from the 1995, <u>Upper Rock River Basin's Water Quality Management Plan.</u> For further updates refer to the 2002, <u>The State of the Rock River Basin</u> publication #WT-668-2002.

Beaver Dam River Watershed – UR03

(Map 12)

The Beaver Dam River Watershed has a small segment lying in Green Lake County. Three square miles of the Drew Creek watershed is located in Green Lake County. (Green Lake County portion shown on Map 12.) Land use is primarily agricultural, with dairy farming and cash grain cropping predominating. 95% is comprised of cropland. Pollution runoff effects are severe on most streams and lakes, and this sub-watershed flows primarily to Fox Lake. The Beaver Dam Watershed was selected for a priority watershed project in 1990.

TABLE 3.11 a: Land Use		
land use	estimated total	percent*
Cropland	2456 Acres	95%
Grassland	0 Acres	0%
Urban/barren	0 Acres	0%
Wetland	0 Acres	0%
Woodland	37 Acres	2%

TABLE 3.11 b: Agricultural Shoreland Management Areas		
Streambank/shoreline	< 1 mile	
Area in 300' Buffers	11.3 acres	
Cropped Area in 300' Buffers	11.3 acres	

Both tables estimated using Arcview USGS maps with a 1:24,000 scale. *100% includes water area.

Upper Rock River Watershed – UR12 South Branch of Rock River

(Map 12)

A bit more than seven square miles of this watershed lies in Green Lake County. (Green Lake County portion shown on Map 12.) As in most other watersheds in this basin, the streams have low gradients. The primary land use is agricultural. The Horicon Marsh and many sizeable wetland complexes exist within this watershed. The Upper Rock River Basin's Water Quality Management plan recommends that this watershed is a high-priority candidate for future pollution abatement programs.

South Branch Rock River (3 miles) is listed as a 303(d) water not currently meeting water quality standards (Wisc. Dept. of Natural Resources). A small part of this river lies in Green Lake County. It then flows east for 17 miles through Fond du Lac County, and eventually through the Horicon Marsh—a wildlife refuge of State, National, and International importance. Only the lower three miles of the river have been classified, but the samples upstream indicate that the water supports tolerant forage fish. Cropland erosion, wetland loss, streambank and riparian zone erosion and livestock access to streambanks are responsible for the water quality, and hence the life forms present. Waterfowl heavily impacts this river.

TABLE 3.12 a: Land Use

land use	estimated total	percent*
Cropland	3548 Acres	79%
Cropland	752 Acres	17%
Urban/barren	0 Acres	0%
Wetland	70 Acres	1.5%
Woodland	20 Acres	0.5%

TABLE 3.12 b: Agricultural Shoreland Management Areas

Streambank/shoreline	7.8 miles
Acres in 300' Buffers	558.2 acres
Cropped Acres in 300' Buffers	445.5 acres

Estimated using Arcview USGS maps with a 1:24,000 scale *100% includes water area.

Chapter 4

Estimated Rural Nonpoint Source Pollutant Loading

POLLUTANT LOADING

The ecological balance of waterways in Green Lake County and the entire Fox-Wolf Basin and Upper Rock River Basin are significantly degraded by nonpoint source pollution. Currently, about 82% of the phosphorus and sediment loading that leads to degradation is due to land management practices. The principal nonpoint sources include:

- Phosphorus runoff from farm fields and livestock operations.
- Sediment delivery from cropland and construction sites.
- Sediment eroded from shorelines, streambanks, and drainage ditches.

Sediment Loading

Sediment adversely impacts water resources in a number of ways. Sediment influences light penetration, and therefore reduces the amount of photosynthetic activity. The decrease in water clarity also makes it difficult for predators to locate prey. Sediment also degrades habitat by causing water temperatures to rise—warm water cannot hold as much oxygen as cold water and therefore cannot support as much fauna—and sediment eliminates bottom habitat critical for aquatic insects and fish spawning. In addition, high sediment concentrations abrade fish gills making the fish more susceptible to disease. Finally, sediment serves as the transport mechanism for a large portion of the total phosphorus loading.

Cropland Sediment Loading

In Green Lake County intensive agricultural practices, mainly tilling, but also confined dairy herds, create a considerable amount of soil loss. This is due to the fact that anytime soil is left unprotected by sod cover or crop residue the opportunity for erosion exists. Sheet, rill, and gully cropland erosion are the primary source of sediments that are carried down stream. Still, not all soil loss is carried into our waterways.

T, Soil Loss and Sediment Delivery

The relationship between these three factors is sometimes misunderstood, both -T" value and soil loss have been greatly misused over the years. Below are the definitions of each followed by an explanation of how these values were considered in this document.

<u>– T" Value</u>

 \pm ", or Tolerable Soil Loss, is an estimate of the amount of soil that can be lost from a cropped field on a continual basis and still retain an adequate level of soil productivity. This value is strictly based on soil type.

Soil Loss

This is the estimated amount of soil that is moving from one place to another on the landscape. It is calculated using the Revised Universal Soil Loss Equation 2 (RUSLE 2) and it provides a value that can be compared to -T It tells us how much soil is moving around the landscape but it does not tell how much sediment is actually being delivered to surface water.

Sediment Delivery

This is the estimated amount of soil that is actually being delivered to surface water; therefore, it is the most relevant in terms of water quality. It is the only measurement that estimates actual amounts of soil reaching surface water.

→" has been used as the standard for a number of state and federal programs. Green Lake County's 1988 Soil Erosion Plan estimates the average —"Trate to be 3.8 tons/acre/year. Approximately 22,900 acres were estimated to erode at or above that tolerable rate. (See Appendix Three) The 2010 Transect Survey data estimated the average to be 2.2 tons/acre. (Appendix Four) Unfortunately, —"Tis not the most appropriate measurement for this plan. In order to achieve the water quality goals in this plan it is necessary to think in terms of less than \pm " even at the reduced \pm " level of 2.2 tons/acre. The important factor is the trend of reduced soil erosion rates. It would appear that farmers are maintaining sound land management principles. The progressive farmers are masking the negative impacts of farmers who still have erosion levels above \pm

Green Lake County's Land and Water Conservation Department has conducted a Geographic Information Systems (GIS) Transect Survey each year since 1999. (Appendix Four). This analyzes slope, soil type, residue management, crop, and conservation practices of 820 sites within the county. The data has been calculated to determine an estimated soil loss of cropland. This estimate is used to calculate sediment delivery, based on the Green Lake watershed's data that an estimated 19% of soil loss reaches surface water.

Source 2 – Shoreline Sediment Loading

Green Lake County contains 824 miles of shorelines and streambanks; therefore, erosion from these sources continues to be important. Erosion of these areas is caused by high water levels, wave action, boating pressure, and ice shoves. There have been improvements made to shoreline and streambank erosion control but statistically these changes have not been significant enough to document any change from the 1999 figures.

TABLE 4.1: SEDIMENT I	DELIVERY* IN G	REEN LAKE COUNTY tons	s/yr 2005
		STREAMBANK/	
	UPLAND**	SHORELINE***	TOTAL
Green Lake	7,641	2,189	9,830
Fox River-Berlin	8,726	4,622	13,348
Upper Grand River	10,116	1,206	11,322
Lower Grand River	4,440	1,840	6,280
Buffalo & Puckaway Lakes	2,996	861	3,857
White River	608	748	1,356
Swan Lake	1,243	245	1,488
Fox River	2,153	97	2,250
Mecan River	-	8	8
Beaver Dam River	1,035	0	1,035
Upper Rock	1,279	85	1,364
TOTAL	40,237	11,901	52,138

It is estimated that shoreland erodes at 10.8 ton/mile/year in the glacial till soils and 18 tons/mile/year in outwash plain soils.

* Does not include urban sources. **Land use areas were estimated using Arcview data. ***Included all streambank/shoreline on USGS quadrangle maps with a 1:24,000 scale.

Phosphorus Loading

Phosphorus is one of the essential nutrients for plant growth. When phosphorus concentrations rise, water bodies experience nuisance plant growth. Excessive growth causes severe oxygen fluctuations--aquatic plants produce oxygen as they photosynthesize in the daylight, but consume oxygen at night as they respire. Large swings in these daily levels of dissolved oxygen can stress fish and other aquatic life. Also, excessive plant growth in the streams can restrict water flow and increase sedimentation rates, which impacts oxygen and temperature levels. As stated above, oxygen and temperature levels impact the aquatic environment.

High phosphorus concentrations can cause dense algae populations (blooms) and can therefore be a major cause of eutrophication in lakes. The densities of these blooms vary according to the amount of nutrient loading, temperature, and wave action. The blooms affect aesthetics interfere with boating, swimming, and other recreational use of the waters, and further impact water quality and aquatic life. The blooms reduce sun light penetration, which prevents more desirable rooted aquatic plants from growing. Aquatic insects, fish, waterfowl, and wildlife all depend on these rooted aquatic plants for survival. In addition, when the algae and aquatic plants die they consume oxygen during decomposition that can contribute to fish kills. (Weed harvesting does not significantly impact oxygen consumption or phosphorus levels.)

Source 1 - Phosphorus Loading from Cropland Sediment

It is important to note that the majority of phosphorus reaches waterways through soil erosion and dissolved phosphorous. Phosphorous from manure, sludge, and other fertilizer application attaches to soil particles and wash into waterways. If soil erosion is reduced then phosphorus loading is less of a problem. To be consistent with other counties in the basin, Green Lake County estimates its phosphorus load to be 1.5 pounds per ton of sediment.

Source 2 - Phosphorus Loading from Streambank and Shoreline Sediment

For consistency within the Upper Fox River Basin, Green Lake County will use a value of .75 pounds of phosphorus per ton of sediment. The logic for this reduction is based on the fact that much of the sediment in streambank erosion originates in the subsoil layer of the soil profile. The subsoil generally has significantly less particulate phosphorus than the topsoil.

Source 3 - Phosphorus Loading from Animal Lot Runoff/Manure and Sludge Spreading

Manure contains several components that adversely affect the water quality and aquatic life, mainly phosphorus. The major sources of manure in a watershed are runoff from barnyards that have inadequate or non-existing runoff systems, and runoff from improperly field-spread manure. Spreading sludge from wastewater treatment plants also contributes to phosphorus loading.

Green Lake County's LWCD and the GLSD have compiled data on the number of barnyards in the Green Lake Watershed. A GIS data layer of livestock facilities was assembled. From this information, phosphorus levels for each livestock facility can be produced. In early 2011 the Green Lake Association has started a project to list and detail all BMPs that have been installed in the Big Green Lake Watershed. This information will be in a GIS format and placed on the Green Lake County and Green Lake Association websites. This information will be used to track and monitor barnyards progress in meeting and maintaining compliance for NR 151 performance standards.

TABLE 4.2: PHOSPHOF	RUS LOAD	ING* IN GREEI	N LAKE COL	JNTY lbs./yr - 200
STREAMBANK				
PHOSPHORUS.	CROP	SHORELINE	BARNYARD	TOTAL
Fox River-Berlin	13,089	1,668	2,441	17,198
Green Lake	11,462	1,642	1,795	14,899
Upper Grand River	15,174	904	2,449	18,527
Lower Grand River	6,660	1,380	1,281	9,321
Buffalo & Puckaway Lakes	4,494	646	959	6,099
Fox River-Rush Lake	3,230	73	413	3,716
White River	912	561	248	1,721
Mecan River	0	6	1	7
Swan	1,865	184	295	2,344
Beaver Dam	1,553	0	192	1,745
Upper Rock	1,919	64	307	2,290
Total	60,358	7,128	10,381	77,867

*Does not include urban sources or point pollution.

URBAN POLLUTANT LOADING

The urban area in Green Lake County is considerably less than the rural area, but the urban pollutant load is still significant. Urban water pollution begins when development alters natural processes. Removing vegetation and replacing it with streets, rooftops and driveways greatly decrease the amount of water soaking into the soil. Storm sewers are used to carry the water directly into nearby waterways. Storm sewer systems are designed to remove water from developed areas quickly during storms, which thereby allows pollutants, such as sediment, phosphorus, heavy metals, pet wastes, street wastes and road salt, to reach streams and lakes at a *—*apid transit" pace.

TABLE 4.3: AVERAGE URBAN LOADS FOR WISCONSIN lbs./acre/year

POLLUTANT	LAND USE					
	residential	institutional	commercial	industrial	Open	freeway
					space	
Solids	400	650	1,900	1,750	46	3,000
Phosphorus	0.326	0.266	1.256	0.756	0.156	1.5165

Table by Wisconsin Department of Natural Resources Water Resource Management.

Sediment Loading from Construction Sites

Eroding construction sites are a leading urban cause of water quality problems in Wisconsin. For every acre under construction, about a dump truck and a half (approximately 25 tons) of soil washes into a nearby lake or stream, unless the builder properly uses erosion controls.

Road Salt

Salt used for highway deicing is composed of more than 95 percent sodium chloride (NaCl). Storm water can dislodge or dissolve salt and carry it into surface waters or infiltrate into groundwater. Snow piles dumped into waterways or piled near surface waters also deliver sodium chloride and the associated deicing materials. Once delivered to waters, chlorides form a saline layer along the bottom that prevents normal mixing. This can lead to reduced oxygen levels in bottom waters and increase nutrient release from sediments. Increased chloride levels may also release mercury from contaminated sediments. On land, high concentrations of sodium and chloride lead to deterioration of soil structures, resulting in decreased permeability, loss of vegetation, and increased erosion.

The 1999 Land & Water Resource Management plan advisory committee addressed road salt as a county concern. As of 2011 few methods if any have come along to encourage the replacement of road salt that is used on public roads.

Pollutants from Lawn and Garden Care

The pressure to have a perfectly manicured lawn has clouded a number of issues and contributed to the problems in local streams and lakes. For example, nutrient applications containing phosphorus has become a widespread practice even though many soils already contain enough phosphorus for a healthy lawn. Lawn fertilizer containing phosphorus can no longer be applied to lawns as of April 1, 2010 unless it is for a new lawn or the soil test results show a phosphorus deficiency. Routine insecticide and herbicide applications are common though they should only be used as the very last resort. These unneeded pesticides and nutrients can be expensive, and ultimately runoff directly into nearby waterways.

Pollutants from Poor Auto Maintenance

Good auto maintenance pays in the long run, but poor auto maintenance can seriously harm our waters. Anything that drips from a motor vehicle-oil, gas, antifreeze-can wash into storm sewers. These materials are toxic to aquatic life. Dumping them into a storm sewer has almost unthinkable consequences. Education efforts such as storm sewer stenciling is an easy way to educate the public.

Municipal and Industrial Discharge

The urban population also contributes to phosphorus loading through industrial and municipal phosphorus discharge. Much of this point source pollution has been addressed throughout the years yet locally can still be a major source problem but still ranks small in comparison to nonpoint pollution—especially in Green Lake County. According to the Fox-Wolf Basin Resource Strategies 1998 report the entire Fox-Wolf Basin's industrial and municipal point sources contribute an estimated 307,300 pounds of phosphorus per year. Green Lake County produces an estimated 6720 pounds of that total. (From Fox-Wolf Basin Resource Strategies, 1998) Cost effective nutrient trading strategies between point and nonpoint pollution are a part of an overall way to reduce nutrient loadings to the waters of Green Lake County.

GROUND WATER ISSUES

Ground water is available in the county from glacial deposits and bedrock aquifers. The availability of water from glacial deposits is estimated at 5 to 10 gallons per minute. Northwest of a line that extends generally from the City of Berlin to the City Of Princeton: and a small area that runs northeast from Lake Puckaway through, and beyond Green Lake, availability is estimated at 10 to 100 gallons per minute. Most groundwater in the county is drawn from sedimentary bedrock aquifers. Yields from properly constructed wells range from 10 to over 500 gallons per minute. Quality of the water is generally adequate for domestic, municipal, and industrial use.

Unused and improperly abandoned wells are a significant threat to groundwater quality. If not properly filled with impermeable material, abandoned wells can directly channel contaminated surface water or soil into groundwater. Water that gets into abandoned wells bypass the purifying action that normally takes place in the upper layers of soil. Many improperly abandoned wells are threatening groundwater.

Wells must be properly filled when they are removed from service. They are removed from service for a number of reasons, including construction of a replacement well, destruction of the building being served, failure of the well to produce safe water, failure to meet the State Well Code (NR812) standards, or when a community water system is extended into an area.

After wells are removed from service they are seldom used. They often get forgotten after a property transfer and, in time, may get covered by buildings. Sometimes all traces of old wells disappear. Such wells can cause groundwater contamination. The wells can provide points of entrance, and possible sources of contamination into aquifers. For example, unused wells near animal yards and sewage absorption fields provide direct access for the entrance of contamination into the groundwater.

After a well gets covered, it is very difficult, if not impossible, to find it and determine if it's causing contamination. When new wells are constructed in an area with improperly abandoned wells, they may have to be cased much deeper or to alternate aquifers to provide safe water. These problems can be avoided by the proper closure of wells.

The Wisconsin Geological and Natural History Survey shows that since 1936 approximately more than 2,900 well constructions have been reported in Green Lake County. Not all of those can be located, nor are they all in use.

Nitrates

The presence of nitrate in a water analysis is a danger signal. Large amounts of nitrates are dangerous to infants because it is related to methemoglobinemia, or -blue baby disease". Even small amounts of nitrate make the water supply suspect. Nitrate is an indication that the water supply may also be contaminated with bacteria and pollution. The primary sources of nitrogen are farming/landscaping through excessive or improper use or storage of manure, commercial fertilizer use, land development through inadequate stormwater management and erosion protection, on-lot septic systems through improper siting, design, and maintenance, and airborne sources. These sources enter ground water through improperly abandoned wells, sinkholes, more permeable soils, and high bedrock or ground water.

Atrazine

Atrazine is a herbicide, which is a member of the chemical family of triazines, and used chiefly to control grasses and broadleaf weeds in numerous crops, and to control perennial weeds and grasses in industrial, home and garden settings. It is the most widely used herbicide in the U.S. It enters ground water from direct entry into a well through accidental chemical spills, improper storage near wells, or agricultural land application. The United States Environmental Protection Agency states that no adequate studies are available on the risks to human health, but animal experiments have shown that it adversely effects the heart, lungs, liver, kidney, spleen, adrenal glands, and brain. The Wisconsin State Laboratory of Hygiene states that it may pose a cancer risk if it is present in amounts above the advisory level in drinking water.

Reduction Goals

NONPOINT SOURCE POLLUTION CONTROL GOALS

The long-term goal stated in 1999 plan was a 35% reduction in sediment and phosphorus to surface waters in Green Lake County over the next 10 years. This goal was based on the goals on the *Green Bay Remedial Action Plan* that called for a 50% reduction, and the *Winnebago Comprehensive Management Plan* that called for a 33% reduction. Green Lake County chooses to coordinate the goals of this plan with surrounding counties that share the Upper Fox River Basin.

With the decline of cattle in the county and decline in alfalfa/grass acreage this has had an effect on soil erosion. More row crops are being grown and this has the effect of diminishing our progress with grain farms that have adopted no-till farming systems. It also should be noted that corn silage is very popular with larger dairies and this results in most of the crop residue removed from the field which leaves more bare soil.

With this 2011 plan revision, the Land and Water Conservation Department maintained the goal of a 35% reduction of sediment and phosphorus as a long term goal. Plans are to reduce sediment delivery by an additional 3-4% by 2015. It now is becoming harder to record or determine progress on phosphorus reduction due to budget constraints for water quality monitoring. We are still confident though using the 19% sediment delivery figures from estimated soil loss numbers.

Sediment Reduction Goals

Reducing sediment delivery by 35% over 10 years is a very aggressive goal and requires widespread implementation of residue management practices, and streambank and shoreline buffers. The 2015 sediment reduction goals are 3-4% and will continue to strive towards the 35% reduction goal from the 1999 base year. Buffers are designed to slow water runoff, provide shelter and stabilize riparian areas. They provide a filter system, which can reduce up to 80 percent of sediment, 40 percent of phosphorus, reduce nitrates and remove up to 60 percent of pathogens from runoff. Buffers also result in fish and wildlife habitat. Residue management practices can reduce soil erosion up to 90%. It also increases the health and structure of the soil and thus its productivity. In addition to these practices, structural BMPs will be utilized in areas where their installation will reduce sediment loads substantially.

1999.	

Progress on the 2010 reduction goal of 35% is estimated that a 10% reduction occurred from

SOURCE	1999 LOAD (0% met)	2010 LOAD (10% met)	2015 GOAL (14% goal)	FINAL GOAL (35% met)
CROPLAND	51,254 tons/yr.	46,209	44,361	33,315
SHORELINE	11,901 tons/yr.	11,901	11,901	7,736
TOTAL	63,155	58,110	56,262	41,051

TABLE 5.1 SEDIMENT DELIVERY REDUCTION

Phosphorus Reduction Goals

The 2015 phosphorus reduction goals are 3-4% and will continue to strive towards the 35% reduction goal from the 1999 base year. The dynamic nature of agriculture cropland utilization makes a specific target hard to obtain because progress in one area can be offset by negative changes in another.

This plan continues to stress the importance of reducing sediment and thereby the phosphorus that is attached to it. About 14% of the farms in Green Lake County have nutrient management plans developed using the phosphorus based 590 specification, we will continue to have farmers develop phosphorus based 590 nutrient management plans which should assist in reducing phosphorus delivery to Green Lake County waters.

SOURCE	1999 LOAD	2010 LOAD	2015 LOAD Projection (3-4% Reduction)	FINAL GOAL
CROPLAND	76,881 lbs./yr.	60,335 lbs./yr.	58,244 lbs./yr.	49,972 lbs./yr.
SHORELINE	7,128 lbs./yr.	8,925 lbs./yr.	8,613 lbs./yr.	4,633 lbs./yr.
ANIMAL LOT	10,381 lbs./yr.	7,758 lbs./yr.	7,486 lbs./yr.	6,747 lbs./yr.
TOTAL	94,389	77,018	74,343	61,352

TABLE 5.2: PHOSPHORUS REDUCTION

Soil Erosion and Sediment Delivery from Urban Development

Green Lake County is reducing urban pollutants through the adoption of County Code Chapter 284 – Construction Site Erosion Control and Stormwater Management, as well as through increased educational efforts.

Chapter 6

Plan Implementation Strategy

To meet the goals set forth by this plan, landowners must comply to set standards and implement Conservation Practices or commonly known as Best Management Practices through various cost-share programs. To meet the standards some properties will require installation of structural practices while others will require changes in land management and cropping techniques. NR 151 establishes the requirements to which landowners comply with these standards. The Green Lake County LWCD's role is to assist landowners in planning, designing, installing, and approving management plans and practices to meet NR 151 standards. This plan also acknowledges and will utilize existing programs and ordinances to meet the NR 151 standards.

NON-POINT POLLUTION PERFORMANCE STANDARDS

The Wisconsin Department of Natural Resources (WDNR) has developed performance standards for agricultural and non-agricultural nonpoint sources of pollution. Green Lake County will assist in directing the implementation strategies and evaluating pollution reduction goals set forth in this plan.

Agricultural Standards and Prohibitions

For farmers who grow agricultural crops:

- Meet tolerable soil loss (T) on cropped fields, and
- Follow a nutrient management plan using the phosphorus index strategy designed to limit entry of nutrients into state waters (groundwater and surface water), and
- Allow a tillage setback from surface water of 5 20 feet.

For farmers who raise, feed, or house livestock:

- Divert water from the well when well is located downslope of lot, and
- Prevent direct runoff from feedlots or stored manure into state waters, and
- Limit livestock access to state waters to avoid high concentrations of animals and maintain adequate or self-sustaining sod cover along waterways, and
- Follow a nutrient management plan for manure application using the phosphorus index strategy, and
- Process wastewater performance standards.

For farmers who have, or plan to build, a manure storage structure:

- Maintain structures to prevent overflow,
- Repair or upgrade any failing or leaking structures that pose an imminent health threat or that violate groundwater standards,
- Close abandoned structures not used for a period of 24 months according to accepted standards, and
- Meet technical standards for newly constructed or substantially altered structures.

For farmers with land in a water quality management area (300 feet from a stream, 1000 feet from a lake, or in areas susceptible to groundwater contamination):

- Do not stack manure in unconfined piles, and
- Divert clean water away from feedlots manure storage areas, and barnyards located within this area.

Nutrient Management Plans

To meet the nutrient management standards, farmers may hire an agronomist or prepare their own nutrient management plans if they complete a DATCP-approved training course or otherwise demonstrate that they are qualified. These plans must:

- Rely on soil nutrient tests from a DATCP-certified laboratory,
- Comply with the NRCS Nutrient Management Standard 590 as directed by ATCP 50,
- Follow the recommendations for nutrient applications in the Soil Test Recommendations for Field, Vegetable and Fruit Crops, UWEX publication A-2809, unless there circumstances that justify more than the recommended application, and
- Include additional management practices to reduce runoff of phosphorus.

AGRICULTURAL SHORELAND MANAGEMENT

Conservation Reserve Enhancement Program

This program applies to all land in Green Lake County except land in the Town of Seneca. The program has had a very slow start in Green Lake County due to the fact that only four towns (Berlin, Brooklyn, Green Lake, Mackford) were initially included in the project area. In 2005 five additional towns (Kingston, Manchester, Marquette, Princeton, and St. Marie) were added to the eligible area (see map on page 61).

Signup has been disappointing for this program and the goals of the program have fallen way below expectations. Landowners are encouraged to plant crops to maximize their farm income and that appears to be a direct conflict with the CREP program.

OTHER PROGRAMS

Manure Storage Ordinance

Green Lake County has had a Manure Storage Ordinance since 1985. It addresses all livestock facilities with existing or planned manure storage facilities. This ordinance adopted under s. 92.16, States., shall prohibit any person from constructing a manure storage system unless that person obtains a permit from the county and develops a nutrient management plan that complies with s. ATCP 50.04(3). The system must also comply with NRCS technical guide standards 313 and 634 along with applicable DNR requirements under s 281.65(4)(g)5., Stats. Currently the county only issues 2 - 3 permits per year on average.

Regulations address the location, design, alteration, operation, and maintenance of all animal feedlots and livestock waste storage facilities, including abandonment of storage facilities.

This ordinance will be revised in 2011 to include implementing the new NR 151 performance standards. Like other counties' plans, the new ordinance will provide recommendations for the development of a reasonable, environmentally effective, and enforceable approach to regulating manure storage facilities. The Manure Storage Ordinance can be viewed at the Land and Water Conservation Department.

Shoreland Protection Ordinance

The administration and enforcement of this ordinance is mandated under Chapter 59 of the Wisconsin Statutes. The administration and enforcement is provided through the County Land Use Planning and Zoning Department. The intent and purpose of the ordinance is to further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structure and land use and reserve shore cover and natural beauty. The Shoreland Protection Ordinance applies to those areas as defined in Chapter 59.692 (1)(b) as being the area between the ordinary high water mark of navigable waters for the following distances:

- One thousand feet (1,000⁺) from a lake, pond or flowage. If the navigable water is a glacial pothole lake, this distance shall be measured from the high water mark of the lake.
- Three hundred feet (300') from a river or stream or to the landward side of the floodplain, whichever distance is greater.

The Shoreland Protection Ordinance can be viewed at the Green Lake County Land Use Planning and Zoning Department.

The ordinance is currently in a revision process.

Farmland Preservation Program/Working Lands Initiative

This program is to provide for soil and water conservation standards and procedures to be followed by participants joining in the Wisconsin Farmland Preservation Program (FPP). Conformance with these standards and procedures will be necessary for landowners to establish and maintain eligibility for farmland preservation tax credits under section 71.09 (11) and 92.1015 (6).

This shall apply to:

 Landowners who claim a farmland preservation tax credit for which they are eligible because their land is located in a district zoned exclusively for agricultural use or have a FPP contract in unzoned towns.

Landowners must:

• Meet the soil and water conservation standards.

This is perhaps one of Green Lake County's most influential land conservation programs, because it addresses all cropland not just Highly Erodible Land (HEL). This is important in Green Lake County due to the low amount of HEL and large amount of land with slopes of 2% to 6% which is farmed intensively in some areas.

The new standards with the Working Lands Initiative of the Farmland Preservation Program are being fully implemented in Green Lake County.

The Farmland Preservation Program requirements can be viewed at the Land and Water Conservation Department.

Construction Site Erosion Control and Stormwater Management – Green Lake County Code Chapter 284

This applies to land disturbing and land developing activities within Green Lake County, but it does not pre-empt more stringent storm water management requirements in some municipalities. The purpose of this chapter is to set forth storm water requirements and criteria that will prevent and control water pollution. Its purpose is to diminish the threats to public health, safety, welfare, and aquatic life due to runoff of storm water from development or redevelopment.

Ordinance objectives:

- 1. Control erosion and pollutants during land disturbance and development activities by:
 - Treating turbid water in temporary sediment basins, grit chambers, etc.
 - Properly disposing of all wastes and building materials,
 - Preventing or removing sediment from being tracked on to private or public roads,
 - Protecting drain inlets from turbid water/sediment,
 - Controlling site erosion by diverting channelized and sheet flow runoff, minimizing bare soil area, constructing sediment basins, installing sediment control measures, stabilizing soil storage piles, and protecting storm sewer inlets.
- 2. Manage quantity of storm water discharge by:
 - Controlling peak flow rates of storm water discharge from the site, and
 - Maximizing infiltration of storm water runoff from driveways, sidewalks, rooftops, and landscaped areas.
- 3. Manage quality of storm water discharge by:
 - Trapping, filtering, or otherwise preventing the release of particulate materials,
 - Reducing pollutant loading, protecting stream habitat,
 - Avoiding discharge of urban storm water pollutants to natural wetlands,
 - Pre-treating infiltration storm water to prevent groundwater contamination, and
 - Locating storm water ponds and infiltration devices sufficiently separated from supply wells.

The construction Site Erosion Control and Storm Water Management requirements can be viewed at the Land and Water Conservation Department.

County-Wide Installation of Best Management Practices

While this plan targets priority areas in the county, many landowners outside of the priority areas have resource problems that will require the assistance of the LWCD for the installation of conservation practices also know as Best Management Practices. Best Management Practices control nonpoint sources of pollution and can be used to help landowners meet minimum NR 151 performance standards. Generally these practices use standard specifications included in the

Natural Resources Conservation Service (NRCS) Field Office Technical Guide. In some cases additional specifications may apply.

Appendix Five lists potential Best Management Practices that are most often used to control nonpoint sources of pollution and briefly defines each one. Financial assistance may be available to offset the cost of installing most of the practices listed. Assistance rates and options may vary based on the source of funding for a given project. More detailed descriptions of the practices can be found in USDA NRCS Technical Guide IV.

NEW & CONTINUING PROGRAM INITIATIVES

As a result of the LWRM plan revision process, this plan also includes our future direction for restoring and protecting our lakes. The resource assessment and Advisory Committee both identified that we need to clarify lake objectives. This section of the plan implementation will focus on restoration and protection, monitoring, planning, and the information and educational strategies. The Lake Objectives table identifies the lakes and where the specific implementation components will occur. The workplan, beginning on page 70, clarifies the activity. The LWCD will work in coordinating the objectives. The following lays out some of the new initiatives that should be considered over the next five years.

Restoration and Protection (R&P 1-5)

- 1. <u>In-Lake Phosphorous Reduction</u> Initiate or continue support of in-lake restoration actions on lakes with significant internal P loading. Actions could include replacement/removal of materials/equipment (pumps, aeration lines, etc.), evaluation monitoring, redesign, and engineering.
- 2. <u>Lake Land Easements and Acquisition</u> Develop land acquisition or land easement strategy for county lakes. Factors to consider include: visually sensitive land features, water quality functions, development threat, special value as ORW/ERW, archaeological features, habitat support for threatened or endangered species, access/recreational values, wild condition, and Smart Growth compatibility. Partnerships, outreach strategy, landowner integration, Realtor participation/education, and organizational capacity should be enabled or considered. Establish a program for developer/Realtor integration with resource management agencies.
- <u>Aquatic Invasive Species (AIS)</u> Conduct AIS appraisal, education, protection and restoration. Zebra Mussels, carp, Eurasian watermilfoil, Curly-leaf Pondweed, and Purple loosestrife are either documented within the county or region. New invasives are likely to appear. All lakes are threatened and case by case actions will be supported. Lake AIS Grants and Clean Boats Clean Water's programs should be utilized.
- 4. <u>Shoreline and Shoreline Buffer Restoration</u> Initiate or maintain shoreline protection and restoration actions for county lakes, including appraisals, evaluations, I&E, demonstration projects, grant application, and technical assistance at all levels. Opportunities for restoration on public land should be exhausted.

Planning (Plan 1-3)

- 1. <u>County Lake Plan Integration</u> Update the listing of existing lake management plans and integrate watershed, water quality, and habitat objectives of those plans with GLCLWCP
- 2. <u>303 (d) listed waters</u>- Participate with partners in revisions to surface waters 303 (d) listing.

Monitoring (Mon 1,2)

- <u>Water Quality and Habitat Monitoring</u> Sponsor or support with partners the collection of baseline data to include fish, plants, water quality, water levels, habitat, and watershed conditions. Enable and support the growth of volunteer programs relating to lakes and streams. Build the capacity for locally driven monitoring actions for purposes of evaluation (did it work?) appraisal (existing condition) and response (acute issues needing timely response) action.
- Lake Modeling Lake models for predicting conditions based on response to management actions should be directed to lakes with active sources of nutrient and sediment. Priority should be considered for purposes of evaluation the efficacy of applied BMPs. Development of objectives for total P target levels should be pursued. Support initiatives for the determination of sediment, phosphorous loads and sources, including TMDL's. Integrate where appropriate, available data with lake management unit NPS watershed objectives and strategy.

Information and Education (I&E 1-3)

- 1. <u>School Partnerships</u> Encourage and enable, with all partners, the continuation or initiation of educational objectives relative to a stream or lake's water quality, watershed, habitat, fishery, and wildlife.
- <u>Water Level Management</u> Evaluation water level management on specific lakes. Include water level history, historical plant community condition, cultural implications, benefits and drawbacks. Develop future condition predictions based on various water level scenarios. Little Green Lake and Puckaway Lake are example lakes benefiting from improved understanding of water level effects. A corresponding I&E initiative should be employed to improve the public's awareness.
- Lake Management Capacity Assist local lake management units capacity for effective application of lake management. Sponsor with partners I&E program to build organizational capacity, including linkage with NALMS, Wisconsin's Lake Program (Wisconsin Association of Lakes, UW-Extension, WI DNR), River Alliance, local organizations and conducting lake forums open to lake associations, districts, and volunteers.

Lakes Objectives													
Lake	R&P 1	R&P 2	R&P 3	R&P 4	R&P 5	Mon 1	Mon 2	Plan 1	Plan 2	Plan3	I&E 1	I&E 2	I&E 3
Big Twin	X	Х	Х			Х	Х	X	Х	Х	Х		Х
Dog Lake		X	X			Х		Х		Х			Х
Kingston Millpond		X	X			Х		Х		Х	Х	Х	Х
Grand River Marsh			X					Х		X			Х
Green Lake		X	X	Х		Х	Х	Х	Х	X	Х		Х
Heart Lake		X	X			Х		Х		X			Х
Little Green Lake	Х	Х	X	Х		Х	Х	Х	Х	Х	Х	Х	X
Little Twin Lake		Х	X			Х		Х		Х			Х
Maria Lake		X	X			Х		Х		Х		Х	Х
Puchyan Millpond					Х			Х					
Puckaway Lake		X	X	Х		Х	Х	Х	Х	X	Х	Х	X
Spring Lake		Х	Х			Х		Х		Х			Х
Spring(spirit) Lake		X	X			Х		Х		Х			Х
Unnamed Lk		Х	X			Х		Х		Х			Х

TABLE 6.1 Lakes Objectives

IDENTIFYING PRIORITY SITES

The Green Lake County Land Conservation Committee decided that the following criteria should be established to determine priority sites for Land and Water cost-share funding from DATCP. As other funds are discovered it is likely that they would be distributed using this criteria. Grants that are received for specified watersheds or water bodies from various programs obviously are dedicated to these areas.

Priority Breakdown of Land and Water Funds by Practice (structural practices) for 2011-2015.

Cropland Erosion Control -50%Livestock Waste Management Facilities -35%Streambank/Shoreline Erosion -10%Well Abandonment -5%

A breakdown of Land and Water funds by priority category paid out can be found in Appendix Ten.

PRIORITY FARM/AREA STRATEGY

The following priority farm/area strategy is based on Chapter 3 resource assessment.

Priority Area 1: Green Lake Watershed

Green Lake Watershed is chosen due to its extreme importance as a high quality water resource. Extensive monitoring and research has been conducted with the assumption that dramatic changes in the adoption of conservation systems will show documented changes from the monitoring stations. The financial support of the Green Lake Sanitary District also creates a program that will keep implementation momentum if state funding becomes less available in the coming years.

Priority Area 2: Agricultural Shoreland Management Area

Fields that intersect the Agricultural Shoreland Management Area retain high priority.

Priority Area 3: 303(d) Watershed & Outstanding and Exceptional Resource Waters

Currently in Green Lake County Hill Creek, Roy Creek, Silver Creek, and Wuerchs Creek in the Green Lake Watershed are EPA 303(d) impaired waters. Upper Rock River and Harrington Creek are also 303(d) impaired waters. Snake Creek and White River are exceptional resource waters. These lists can change from year to year due to new waterways nominated for inclusion on the 303(d) list and/or the potential of official delisting of a waterbody due to correction of its impairments. (See map on page 22)

PRIORITY FARM/AREA CONSERVATION PRACTICE STRATEGY

Priority 1: Nutrient Management

This Best Management Practice when properly implemented and followed can provide substantial water quality improvement as well as positive income creation for farmers. The Additional measures may be required within the Big Green Lake Watershed if 590 Nutrient Management Plans are unable to prevent manure runoff events from cropland.

Priority 2: Soil Erosion Control Practices

No-till planting is a practice that still creates tremendous soil saving benefits. Other structural practices are still needed to address ephemeral and rill erosion.

Priority 3: Livestock Waste Management

Due to limited funds, livestock waste management is the third priority. EQIP is a program that we direct landowners to for livestock waste management cost-sharing

The ranking sheet for the county carries out the priorities listed above. (Appendix One). The ranking sheet will rank landowners for cost sharing assistance. It is not meant to evaluate

landowners for the NR 151 agriculture performance standards. The ranking sheet gives the highest priority to one specific area but it does not exclude any area in the county. While the Big Green Lake Watershed has the highest priority, other factors could give a higher ranking to a different geographic area if the applicant scores higher than the other priorities. Two ranking periods will occur annually. The first ranking will be completed by March 15 and the second ranking by July 15.

The Land and Water Conservation Department developed a performance standards tracking database. The database is geo-referenced so that tracking can be reviewed using the GIS functions available to the Land and Water Conservation Department. This database, which has the ability to produce a report for landowners and operators, can also produce forms and reports for the Land and Water Conservation Department to monitor progress toward NR 151 agriculture performance standards and the goals established in the Land and Water Resource Management Plan. We are currently working on fixing some of the problems with this program.

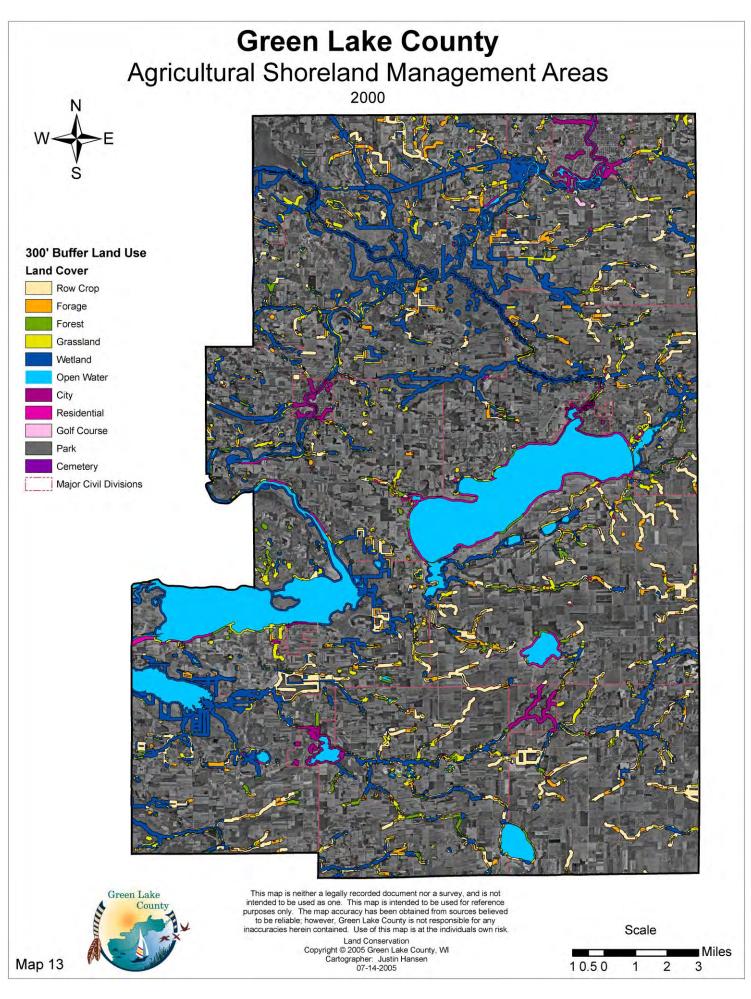
Status reviews, currently, are conducted for farmers participating in the Farmland Preservation Program. They will also be conducted in the Priority Farm Strategy Areas. For landowners not participating in the Farmland Preservation Program or in the Priority Farm Strategy Areas, status reviews will be conducted from complaints or areas that LWCD staff observes possible NR 151 compliance problems.

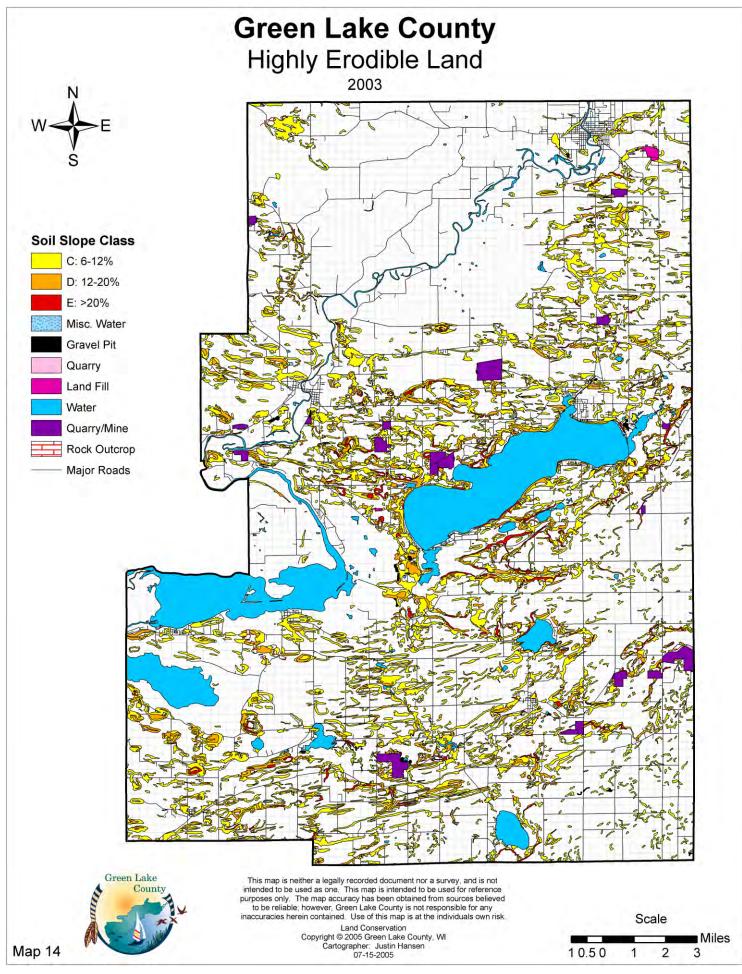
A copy of all status reviews will be sent to landowners and land operators where a status review has been performed for lands that they own or operate. For landowners found to be out of compliance with NR 151 performance standards, contact will be made and the following information will be given in writing:

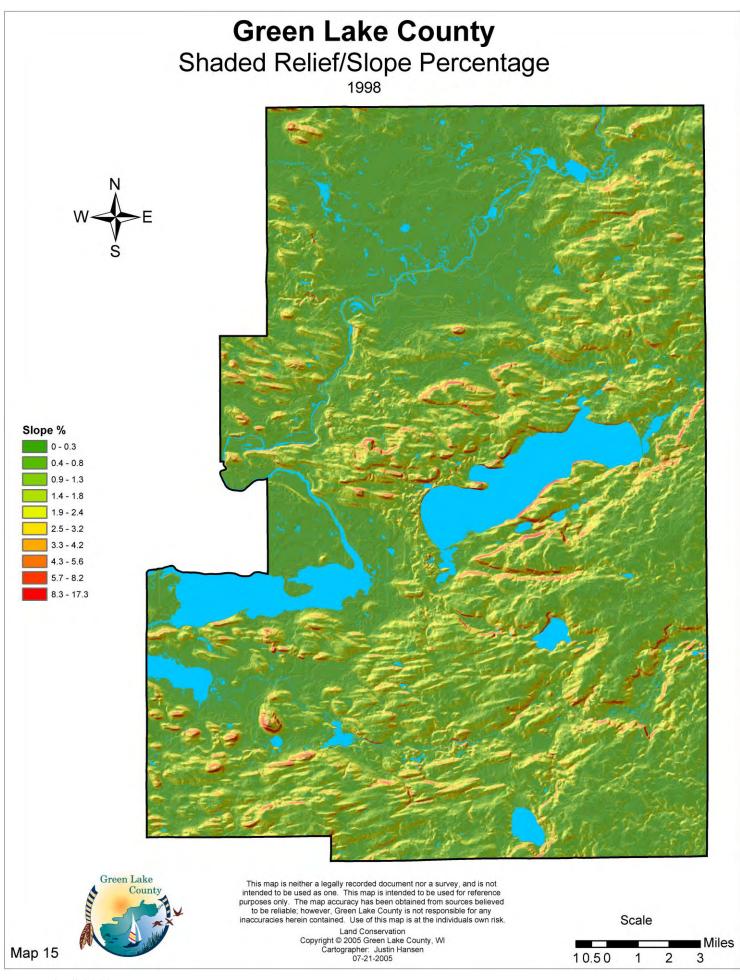
- A statement explaining the compliance issues.
- The corrective measures needed to achieve compliance.
- A timeline for achieving compliance.
- The status of eligibility for cost-share assistance.
- The funding sources available and technical assistance to be received.
- An explanation of technical standards and maintenance requirements.
- A signature page attached to findings report indicating whether the landowner agrees or disagrees with the report.
- A copy of performance standards and prohibitions and any applicable technical standards.
- Landowners disagreeing with the status review report shall be given a notice of process and procedure for appealing the findings of the LWCD.
- Appeals will be directed to the Green Lake County Land Conservation Committee.

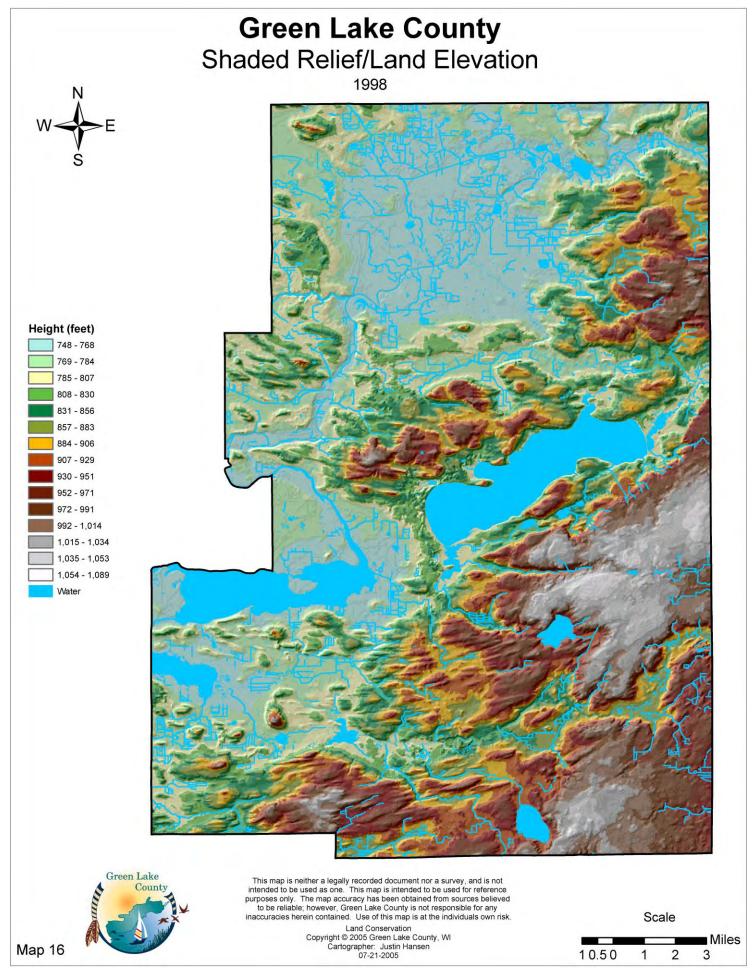
Landowners who are in violation of the agriculture performance standards will be referred to the Wastewater Specialist for the Department of Natural Resources – Northeast Region.











IMPLEMENTATION BUDGET

Financial Assistance Administration

Financial assistance is available to landowners and local units of government with priority sites to help offset the cost of installing BMPs. The Land and Water Conservation Department distributes funding to landowners after practices have been completed and inspected; or in the case of conservation tillage, after residue checks following planting. To qualify for financial assistance, landowners must meet eligibility criteria defined by the program from which they are receiving funds. The Land and Water Conservation Committee will prioritize applications for financial assistance. Two ranking periods will occur each year. The first ranking will be done by March 15 and the second ranking by July 15.

To receive financial assistance, landowners must enter into a cost-share agreement with the Land and Water Conservation Department. Cost-share agreements are binding documents that secure funds for implementing an individual or group of conservation practices. Structural practices with cost-share amounts greater than \$14,000 have the agreement attached to the deed of the property. Non-structural practices such as conservation tillage and nutrient management are not recorded with the deed.

Local, state, or federal permits may be needed prior to the installation of some practices. Areas in which permits are generally required include zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the county program or not. The cost-share recipient is responsible for acquiring the needed permits prior to the installation of practices.

The Land and Water Conservation Department is responsible for enforcing compliance of costshare agreements. The Land and Water Conservation Department will insure that practices installed through the program are maintained in accordance with their operation and maintenance plan for the appropriate length of time.

Cost Containment Procedures

Cost containment procedures are identified in this plan to control the costs of installing BMPs where the cost-share funding is administered by the Land and Water Conservation Department. The County will use cost estimation, bidding, average costs, and flat rates. These procedures and cost lists can be obtained from Land and Water Conservation Department.

Cost Estimation: Projects under \$5,000 will require a cost estimate from the landowner or land user and the cost-share agreement will then be developed based on the estimate and average costs for the practice from previous years.

Bidding: A bidding procedure should be used for constructed practices expected to cost greater than \$5,000. Landowners are required to seek three bid requests. Three bid packets will be supplied by the Land and Water Conservation Department to the landowner or land user. The Land and Water Conservation Department will list an invitation for bids on the county website allowing anyone to request a bid packet for a \$15 fee.

In the event it is impractical to establish competitive bidding procedure for all or some of the practices, the department director will authorize use of one or more of the following containment procedures to substantiate the cost of a practice or practices:

- Average costs for similar practices installed in the region during preceding years.
- Acceptable, regionally established cost range for a practice based on past experience.
- Specified maximum payment for a practice, regardless of cost.

- Use of department employees or agents to design, construct, or install a practice to minimize public costs.
- Other cost containment procedures as determined by the department.

If the landowner or land user is required to obtain bids, the bidding procedure shall meet at least the following minimum standards:

- All bids shall be sealed and delivered by the bid deadline to the Land and Water Conservation Department office.
- A bid opening shall be announced at a specific time. Bids may be reviewed for a period of no longer than one week from opening. The landowner will select the bid and the Land and Water Conservation Department will establish the reimbursable cost-share contract amount.
- The amount of the cost-share grant shall be based on the lowest qualified bid.
- The landowner or land user may select a contractor that submitted a higher bid only if the landowner or land user pays the difference. The landowner or land user may not select a contractor that did not bid on the project.

Average Costs: The department may make cost-share payments based on the average cost of a cost-share practice, regardless of its actual cost. The department shall determine average costs per unit of materials and labor, or average costs of completed components, based on a survey or review of itemized costs for cost-shared practices installed during the preceding years.

Flat Rates: Flat rate payments will be authorized for non-structural conservation practices. Incentive practice rates are also included as a flat rate cost-share practice.

The value of in-kind services provided by the landowner shall be established by bid, maximum payment, or average cost method for a measurable work product.

PROGRAM INTEGRATION

The reduction goals of this plan will be achieved through full implementation of all federal, state, county and local soil and water conservation programs. The following are brief descriptions of each applicable program.

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program is a joint, state-federal land retirement conservation program targeted to address state and nationally significant agriculture-related environmental effects. This voluntary program uses financial incentives to encourage farmers to enroll in contracts of 10 to 15 years in duration to remove lands from agricultural production. All areas in Green Lake County are eligible except for the Town of Seneca. Agricultural Shoreland Management areas are the targeted lands.

Conservation Reserve Program (CRP)

The Conservation Reserve Program was developed to assist landowners in voluntarily converting highly erodible and environmentally sensitive cropland from the production of annual crops to less intensive uses such as permanent grass, legumes, forbs, wildlife cover or trees. Regular sign-ups occur only as announced by the Secretary of Agriculture. Most cases involve offers of entire fields. Applications are available at the Farm Service Agency.

Continuous sign-up is primarily for partial fields and small plots. The sign-up is ongoing and covers priority practices such as filter strips, riparian buffers, shelterbelts, field windbreaks, grassed waterways and shallow water areas for wildlife.

Environmental Quality Incentives Program (EQIP)

The intent of the EQIP program is to provide a voluntary conservation program for farmers who face serious threats to soil, water and related natural resources. The program provides technical, financial and educational assistance primarily in designated priority areas. Currently all land in Green Lake County is eligible for this program.

Exceptional Resource Waters Programs (ERW)

Chapter NR 102 states that these waters deserve special protection because of their water quality, fisheries, wildlife and recreational values. NR 207 restricts the amount of wastewater discharged into them. These waters are targeted for DNR funding.

Lake Management Planning Grant Program

The Wisconsin Lake Management Planning Grant Program was developed to provide financial assistance to qualified lake organizations or local governments to collect and analyze data concerning the physical, chemical and biological health of their lakes. Grant money can also be used to investigate watershed conditions, review ordinances and conduct social surveys to gauge local concerns and perceptions as they relate to lake use and water quality. The end product of most Lake Management planning grants is a comprehensive lake management plan that addresses local concerns and analyzes alternatives for lake and watershed management. The LWCD and county Lake Districts have received grants through this program.

Lake Protection Grant Program

Through the Lake Protection Grant Program qualified lake organizations can apply for funds to carry out a variety of Lake Protection projects. The state-share is 75%. Eligible projects include the purchase of lands critical to a lake ecosystem, restoration of important wetlands, and the development of regulations and ordinances designed to protect and enhance water quality.

River Protection Planning Grant Program

River protection planning grants provide state cost-sharing assistance to eligible sponsors for the collection, assessment and dissemination of information on riverine ecosystems, to assist in developing organizations to help manage rivers, to assist the public in understanding riverine ecosystems and to create management plans for the long term protection and improvement of riverine ecosystems.

River Protection Management Grant Program

River protection management grants provide state cost-sharing assistance to eligible sponsors for implementing a specific activity or set of activities, other than planning activities, to protect or improve a river ecosystem.

Partners for Fish and Wildlife

Partners for Fish and Wildlife restore wetlands, grasslands, and threatened and endangered species habitats. Land that is eligible must be degraded but able to be restored to wetlands or grasslands that provide habitat for endangered and/or threatened species. Up to 100% may be cost-shared.

Purchase of Development Rights (PDR)

The goal of the PDR is to preserve farmland economically. Green Lake County has proposed to buy farmland development rights through a competitive bidding procedure. Eligible land includes 40 acre farmed parcels with no existing buildings. The county has built up the conservation fund account to over \$200,000 to try to get this program running with the Purchase of Agricultural Conservation Easements (PACE) program.

Wetland Reserve Program (WRP)

The Wetland Reserve Program is a voluntary program established to help landowners restore and protect wetlands on their property. To be eligible, land must have been drained for farming or pasture and is possibly restorable to natural wetland conditions. Land adjacent to restorable acreage is also eligible if it contributes to wetland functions and values.

Wildlife Damage Abatement and Claim Program

The Wildlife Damage Abatement and Claim Program provides abatement and claim assistance to landowners receiving wildlife damage. The damage must be caused by deer, bear, or geese to commercial seedlings, orchard trees, crops or agricultural land, nursery

stock, apiaries, or livestock. Landowners are eligible for practices such as fencing, shooting permits, cannons, etc. Green Lake County has a history of deer damage problems that appear to be growing in their complexity.

Wildlife Habitat Incentive Program (WHIP)

The purpose is to develop or improve fish and wildlife habitats on privately owned land. Almost any type of land is eligible, including agricultural and non-agricultural land, woodlots, pastures, and streambanks. Some practices installed include seeding to native grasses, in stream structure, etc. with up to 75% cost sharing for restoration costs.

Wisconsin Farmland Preservation Program (FPP), Working Lands Initiative

The goals of the Farmland Preservation Program are to preserve farmland through local planning and zoning, promote soil and water conservation, and provide tax relief to participating farmers. To be eligible under the new Working Lands Initiative, all cropland and facilities associated with the farm must be in compliance with the Agricultural Performance Standards and meet certain zoning requirements.

Wisconsin Nonpoint Source Pollution Abatement Program

The new Nonpoint Source Pollution Control Program is entitled Targeted Runoff Management Project (TRMP). Funding is available on a competitive basis for eligible rural or urban Best Management Practices throughout the communities. The goal of the Nonpoint Source Pollution Program is to improve and protect water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources.

Other Programs

Aquatic Ecosystem Restoration

(Section 206, - 1996 Water Resource Development Act of 1996) The U.S. Army Corps of Engineers may provide cost sharing assistance to carry out projects for aquatic ecosystem restoration and protection projects, for purpose of improving the environment.

Emergency Streambank and Shoreline Erosion Protection

(Section 14, of Flood Control Act 1946)

The U.S. Army Corps of Engineers may provide cost sharing in one locality during any fiscal year for the construction repair, restoration and modification of unstable conditions caused by streambank and shoreline erosion which calls for prompt action to eliminate the threat to public health and safety, and to prevent interruption of vital services.

Green Lake County Trails and Paths

There is a desire by local organizations, some of those being the Green Lake Association, the Green Lake Conservancy, the Green Lake Sanitary District, the City of Green Lake, Green Lake Greenways and others, to promote the public's travel to the 15 Conservancy Lands and local parks located on or near the waters of Green Lake. It is desired where possible to make these natural sites accessible by both motorized and non-motorized means of transportation requiring multi use trails for walking and biking to these sites. Many of these Conservancy Lands have been in part funded with WDNR grants and it is envisioned to connect these lands via a multi-use trail.

USDA Farm Service Agency

Stabilizing farm income, helping farmers conserve land and water resources, providing credit to new or disadvantaged farmers and ranchers, and helping farm operations recover from the effects of disaster are the missions of the U.S. Department of Agriculture's Farm Service Agency (FSA).

WORK PLAN – 2015 GOALS - These are a comprehensive list of activities over 5 years.

Goal 1 – WORK TOWARD MEETING THE LONG TERM GOAL A 35% SEDIMENT DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2011-2015 PERIOD YIELDING A 3-4% SEDIMENT DELIVERY REDUCTION.

Objective 1: Reduce rural sediment loading through further adoption of residue management accomplished through better farm conservation plans.

- Of the 12,000 acres with < 15% residue cover, get 20% (2,400 acres:480 acres annually) to adopt residue management.
- Install structural BMPs to reduce soil erosion.
- Educate farmers on the problems of tillage farming and the benefits of residue management while trying to implement residue management and conservation tillage on their properties.
- Present research on no-till, cover crops, and sediment containment.
- Inventory properties, and target landowners that have greatest erosion problems.
- Update farm conservation plans.
- Inform landowners of applicable financial assistance programs.
- Continue with Transect Surveys updating all data.

Objective 2: Reduce rural sediment loading through the installation of structural BMPs and the encouragement of buffers.

- Install structural BMPs that are the most cost effective.
- Increase education efforts on the impacts of sediment loading through streambank and shoreline erosion.
- Notify landowners (Appendix Eight) and land users of problems.
- Install riparian buffers and shoreline/streambank stabilization by cost sharing, and purchasing or renting easements.
- Help plan and install buffers and stabilization by assisting in providing materials and skills.
- Offer demonstration areas.
- Create and use progressive and unique cost sharing programs.

Objective 3: Reduce unrestricted grazing along streams and rivers.

- Inventory pastureland, and build fences and crossings on shoreline grazing areas.
- Promote CREP in the eligible area.
- Educate farmers about restricted grazing benefits in shoreland areas.
- Inventory, target, and notify farmers (Appendix Eight) who graze livestock along waterways.
- Adopt grazing management recommendations and reduce access of livestock from streams and rivers.
- Assist in constructing and financing exclusions, crossings and access ramps.
- Apply for Grazing Management Grants to promote grazing systems.

Objective 4: Reduce urban sediment loading through construction site and storm water management.

- Enforce Construction Site Erosion Control and Stormwater Management Green Lake County Code Chapter 284 on applicable areas. Revise ordinance.
- Continue education of the urban sediment loading problems to contractors, inspectors, and the public.
- Help residents control erosion through education and fact sheets.
- Modify the ordinance to properly reflect UDC provision and target staff resources to larger developments.
- Enforce erosion control and stormwater management ordinance measures.

Objective 5: Rely on the partnerships between agencies and organizations and their tools.

- Continue to move forward on projects with the Lake and Sanitary Districts, and other lake and environmental organizations.
- Work with Lake and Sanitary Districts in the county to protect our lakes.
- Work with any other agencies or organizations that have programs that reflect the goals of the Land and Water Resource Management Plan.

Goal 2 – WORK TOWARD MEETING THE LONG TERM GOAL OF A 35% PHOSPHORUS DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2011-2015 PERIOD YIELDING A 3-4% PHOSPHORUS REDUCTION.

Objective 1: Reduce nitrogen and phosphorous loading through nutrient management planning and manure management BMPs.

- Enroll 2,500 acres/year of cropland for nutrient management planning.
- Raise awareness of producers, local cooperatives, and independent crop consultants of the benefits of nutrient management.
- Inventory and target livestock operations, and assist in planning and building manure storage.
- Develop nutrient management plans for individual farmers.
- Help with implementation of nutrient management practices such as soil testing, alternative weed management, legume and manure crediting.

Objective 2: Reduce phosphorus runoff from developed lakeshore properties.

- Inform all lakeshore owners, landscapers, members of the local government, and others working along riparian boundaries about the problems associated with nonpoint source pollution, especially phosphorous runoff.
- Target landowners contributing to the problem of phosphorus runoff, and offer alternatives.
- Remind citizens that phosphorus cannot be applied to lawns.

Objective 3: Reduce phosphorous runoff from urban sources through storm water management.

- Enforce Construction Site Erosion Control and Stormwater Management Green Lake County Code Chapter 284 on applicable areas. Revise ordinance.
- Enforce Stormwater Management and Erosion Control Ordinance.
- Educate property owners and the public about backyard conservation and methods of reducing stormwater pollutants.

Objective 4: Rely on the partnerships between agencies and organizations, and their tools.

- Continue to move forward on projects with the Lake and Sanitary Districts, and other lake and environmental organizations.
- Work with Lake and Sanitary Districts in the county to protect our lakes.
- Work with any other agency or organizations that have programs that reflect the goals of the Land and Water Resource Management Plan.

Goal 3 – PRESERVE AND RESTORE HABITAT

Objective 1: Restore native plantings and vegetation in eligible areas

- Encourage and prioritize the planting of native vegetation along streambanks/shorelines
- Plant native vegetation when stabilizing shorelines and streambanks or replanting any disturbed areas.
- Restore wetland areas.
- Promote the shoreline vegetation projects with native vegetation.

Objective 2: Decrease present and future fragmentation of natural habitat.

- Enforce the Comprehensive Plan for Green Lake County.
- Prioritize unfragmented parcels and areas near unfragmented parcels.
- Reduce wetland filling.

Objective 3: Protect and Establish Corridors.

- Enforce the Comprehensive Plan for Green Lake County.
- Recommend planting native vegetation in Agricultural Shoreland Management Areas.
- Recommend planting native vegetation in any areas eligible.

Objective 4: Develop a Total Maximum Daily Load (TMDL) for at least one 303(d) impaired waterbody in the county.

- Identify designated use, assess water quality, specify reduction needed, provide basis for taking actions needed to restore waterbody.
- Request the WDNR to approve a TMDL for one of the impaired watersheds.
- Identify appropriate -designated uses" for each waterbody.
- Write a quantitative assessment of water quality problems and contributing pollutant sources.
- Specify the amount of pollution reduction necessary to meet water quality standards.
- Allocate the necessary pollutant limits among various sources in the watershed.
- Provide a basis for taking actions needed to restore a waterbody.

Goal 4 – UTILIZE EXISTING LAND USE PATTERNS

Objective 1: Reduce urban land from encroaching on farmland.

- Promote USDA farm economy programs. Start to develop Purchase Development Rights program for county farmland.
- Continue Farmland Preservation Program.
- Promote the Purchase of Development Rights.
- Promote USDA Farm Economy Programs.

Objective 2: Protect natural areas.

- Purchase land and/or easements.
- Promote programs that help keep farm income strong.
- Implement sound conservation practices.
- Purchase Development Rights.
- Protect Sensitive Areas by purchasing land using various funding sources.

Goal 5: ADDRESS IMMEDIATE ENVIRONMENTAL PROBLEMS

Objective 1: Properly abandon wells.

- Target 5% of LWRM allocation funds to properly abandon wells.
- Locate and identify previously abandoned wells in the county.
- Contact and educate property owners, well constructors, and other citizens about proper well abandonment.
- Cost-share proper closure of abandoned wells.

Objective 2: Reduce runoff from winter manure application.

- Develop short and long term to solutions to substantially reduce this source of runoff.
- Conduct monitoring of land where manure has been winter applied.
- Install manure storage facilities where a nutrient management plan documents the need.

Objective 3: Conservation developments.

- Maintain a committee of advisors to assist with conservation planning to developments to encourage the application of land conservation measures.
- Assist local planning efforts to encourage conservation developments.

BUDGET

FINANCIAL ASSISTANCE BUDGET

Table 5-1 shows the LWRM funds fall short of the needed dollars thus showing the importance of leveraging other program funds to work towards our goals.

5-1: PLAN IMPLEMENTATION

CATEGORY	2000-2010 Projection	2000-2010 Actual	2011-2015 Projection ****
Upland Sediment Delivery Control*	\$ 2,000,000	\$ 380,822	\$ 150,000
Shoreline Erosion Control**	\$ 1,268,800	\$ 220,921	\$ 30,000
Animal Waste Management***	\$ 1,400,000	\$ 64,516	\$ 105,000
Well Abandonment	\$ 25,000	\$ 10,731	\$ 15,000
Total	\$ 4,693,800	\$ 676,990	\$ 300.000

* Assuming \$65/Ton of sediment reduced. Based on the Green Lake County LWCD conservation practices implemented between 1994 and 1998.

** Taken from Agricultural Shoreline Management Data using 120' buffers.

*** Includes nutrient management and structural practices.

*** \$60,000 is the estimated LWRM cost-share funds we expect per year times 5 years.

ADMINISTRATIVE BUDGET

The Land and Water Conservation Department will attempt to use existing staff to achieve the goals of this plan. Currently there are six full-time employees. The department moved to new office facilities in 2011 and room is available for staff expansion if funding became available. At the time of this plan, much discussion is focused on possible staff cuts due to budgetary constraints.

5-2: GREEN LAKE COUNTY LWCD – STAFF COSTS

YEAR	2006 (available hrs)	2011* (available hrs)
LWCD staff	\$400,512 (12,480)	\$471,664 (12480)
Contracted Professionals and LTE	\$ 6,000	\$ 6,000
Total	\$406,512	\$477,664

* Estimated figures.

Staff costs from 2006 to 2011 have gone from \$406,512 to \$477,664. Green Lake County will receive \$144,420 from DATCP for staff in 2011. Green Lake County Government has remained very dedicated towards funding the Land and Water Conservation Department.

OTHER AGENCIES

Many agencies and organizations work towards the same goals as the LWCD. In fact, these agencies and organizations provide funding sources for programs within the county. Some are listed below.

5-3: GREEN LAKE COUNTY - AGENCY FUNDS FOR LISTED PROGRAMS

SOURCE	PROGRAMS	Dollars/year To Green Lake County (approx.)
WDNR	Lake Management Planning Grants & Lake Protection Grants	\$15,000
DATCP	Farmland Preservation Program	\$300,000
DATCP	SWRM	\$85,000
Little Green Lake Protection and Rehabilitation District	Local Cost-Share	\$2,500
Green Lake Sanitary District	Local Cost-Share	\$20,000
USDA	EQIP	\$45,000
USDA	CRP	\$350,000
USDA	Farm Program Assistance	\$4,000,000
USDA	Crop Insurance	\$4,000,000
WDNR	Wildlife Damage Program	\$60,000

Chapter 7

Information and Education Strategy (I&E)

BACKGROUND

Many people are not aware of their own contribution to nonpoint pollution. Building awareness is the first step in adopting the Best Management Practices (BMPs) that reduce nonpoint pollution. Before people adopt BMPs they must first recognize the drawbacks to their current management practices and the impact they have on the resources around them. Then people must feel that implementing BMPs is manageable and worthwhile. Only then will they consider changing their current practices.

Generally speaking, there are three major barriers that prevent landowners from adopting soil and water conservation Best Management Practices (BMP).

Knowledge Barriers	Not having the necessary information to make an informed decision about a new management practice.
Skill Barriers	Not having the management ability to adopt a new practice.
Attitude Barriers	Not supporting either the need to adopt a practice or the belief that the practice will accomplish the goal.

Three tools will be used to overcome these barriers and encourage landowners to adopt new practices:

- **1.** Monetary Assistance (Ch. 6)
- 2. Information and Education
- 3. Ordinances (Ch. 6)

The Information and Education strategy is fundamental for influencing current activities because it provides awareness and helps change attitudes.

INFORMATION AND EDUCATION STRATEGY

Goal 1 – RAISE AWARENESS AND KNOWLEDGE

Objective 1: Inform residents about the new NR 151 pollution agriculture performance standards for Wisconsin and their impact on landowners in Green Lake County.

Objective 2: Inform residents about the ecological, recreational, and economic value of clean streams, wetlands, and lakes with healthy, native plants and animals.

Objective 3: Inform residents about rural and urban sources of runoff pollution.

Objective 4: Inform residents about storm sewers and the effect of their runoff.

Objective 5: Offer solutions for preventing runoff pollution and retaining clean streams, wetlands, and lakes.

Objective 6: Raise awareness of available funding sources for programs, and whom to contact for help.

Objective 7: Notify landowners of their pollution loading determinations.

Landowners must be made aware of existing problems and solutions, and they must gain the ability to implement new strategies. Therefore, the following activities will be utilized on a yearly basis to raise awareness and knowledge.

One on One Contact With Landowners

There is no better way to convince landowner to adopt new practices than having a technician actually spend time with them on their property. This is not always possible due to the lack of staff hours. Landowners on identified critical sites will warrant an individual farm visit from qualified technical staff. At least five critical sites will be visited per year to establish future plans. Status reviews also are a productive way to discuss with landowners farm conservation goals and progress on their farm.

• Media

Newspapers and radio are two important sources for distributing information. Local news releases will describe water resources and impacts of nonpoint source pollutants, and programs targeted at controlling nonpoint source pollutants. News coverage would include current activities and progress.

• Pamphlets

Green Lake County Resource Managers (DNR, NRCS, FSA, UWEX, and LWCD) publish many useful pamphlets. The LWCD has pamphlets on BMPs and conservation programs. Local organizations also put out a wide variety of exceptional resource pamphlets a year. Coordinating these pamphlets, and making them readily available show the commitment the community shares to conserving Green Lake County's natural resources. Also a locally developed handbook was developed by LWCD and UWEX to assist farmers who are writing their Nutrient Management Plan.

• Direct Mailings

Through the Green Lake County Land Information Department, a mailing list of all landowners in the Water Quality Management areas will be generated. Direct mailings will be done each year to specific groups of landowners.

All of the Lake Associations and many other organizations in the county, send out newsletters each year. The LWCD and these organizations cooperate to use the individual newsletters to spread information about relevant programs.

• Workshops

Educational workshops will be conducted to further this plan. Awareness of soil and water conservation issues is critical to implementation of remedial measures. Not only does the LWCD hold workshops, but other organizations in Green Lake County do as well. Workshops get people involved, and give them the skills and information they need to become stewards of the land. Field tours are also an excellent way to reach out to landowners.

• Formal Presentations

Formal presentations to various organizations are an excellent way to raise their awareness on natural resource issues. Some of the targeted audiences include: Farm Bureau, Forage Council, Technical College agricultural classes, lake and river organizations, civic groups, and any other receptive group.

GOAL ACCOMPLISHMENTS

Accomplishing the goals of the I & E strategy will require a collaborative effort between the Green Lake County LWCD, UW-Extension, the University of Wisconsin-Madison, local conservation clubs, and many other agencies and groups.

Evaluation

As part of the annual accomplishment report, the county will prepare a summary of its information and education efforts over the year. The report will address how the I & E strategy was implemented, how residents participated, and how successful the adopters were with their new BMPs.

Evaluating Strategy Implementation

The staff will summarize the I & E activities they accomplished during the year. If the strategy was used to select and plan activities, it can be seen as an indication that the strategy should be working. Whether the activities actually reached their intended audiences and whether they caused participants to successfully change their behavior can be measured by evaluation participation rates and the BMP adoption process.

Evaluation Participation Rates

Since the strategy depends on activities to get people aware and involved, participation at activities can help evaluate the success of the I & E efforts. Participation means more than just attendance at field days and volunteer events, but also includes newsletter readership, requests for information, and signed cost-share agreements. If residents are attending planned I & E events and signing cost share agreements, I & E activities are probably having their desired impact. If residents never call the LWCD office to learn more about the project or attendance at field days and demonstrations are consistently low, this would probably indicate that new activities were needed.

Evaluating I & E success based primarily on participation can be misleading since participation is not an indicator of successful BMP adoption. For example, just because someone attended a demonstration does not mean that they learned what the staff wanted them to and just because a farmer installs a BMP does not mean that they are using it successfully. To determine if the I & E Strategy is causing residents to successfully adopt BMPs involves monitoring the performance of the participants.

Committing all LWRM funds each year also demonstrates that our program is stimulating landowner interest.

Evaluation the BMP Adoption Process

Evaluating the adoption process involves keeping careful records of the successes and failures in the beginning of the projects that participants had with the BMPs along with documentation of their performance with the new BMP. This means that the staff will continue working with participants after a BMP is installed to ensure that the practice has been adopted successfully. Success means that the BMP benefits both the participants operation and water quality.

The first step of monitoring the adoption process involves evaluating I & E activities as they occur. Such techniques include informal discussion with participants, confidential discussion, observations, and polls. The staff will use the information gathered to improve each activity.

The second step of monitoring the adoption process involves determining if the I & E objectives are being achieved. The same techniques described above can be used to evaluate the objectives.

More formal, and time-consuming ways to evaluate include phone surveys, focus groups, and examining performance records.

Chapter 8 Progress Measurement and Evaluation

For this Land & Water Resource Management Plan to be successful, it is imperative to regularly measure and evaluate the extent to which the goals are being achieved. It is through this process that needed adjustments or revisions in the plan goals and objectives can be made. The evaluation process includes checks on pollutant load reduction, administrative reporting, water resource monitoring, and various spot-checking.

POLLUTANT LOAD REDUCTION

Specific rural source, sediment and phosphorus loads are identified in Chapter Four. Chapter Five discusses sediment and phosphorus reduction goals. Achieving these goals requires the installation of all applicable Best Management Practices, regardless of program. It requires close communications with cooperating agencies to accurately track the installation and associated pollutant load reduction of those particular BMPs.

The methods to be used to provide quantitative measurements of pollutant load reduction are:

Cropland Sources – Where and when possible sediment delivery modeling will continue to be used throughout the implementation process. In addition, the Green Lake LWCD will conduct a yearly transect survey, and continue spot-checking conservation plans. The latter two are our most reliable methods to determine progress.

Shoreline and Streambank Sources – The Land and Water Conservation Department tracks the extent and location of shoreline and stream bank protection projects it provides technical and financial assistance on. Detailed figures on sediment and phosphorus load reductions will be obtained from those particular projects.

Livestock Waste Management – The BERT model is accepted as the appropriate method for barnyard runoff systems. BERT provides a one number rating based on a single event assessing phosphorus load reductions from nutrient management practices will be recorded as actual changes in the amount of phosphorous applied. Phosphorus calculations will be tracked using spreadsheet and database programs developed by the LWCD.

MONITORING OF PLANNED ACTIVITY PROGRESS

The most measurable component of each objective will be monitored.

Goal 1 – WORK TOWARD MEETING THE LONG TERM GOAL A 35% SEDIMENT DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2011-2015 PERIOD YIELDING A 3-4% SEDIMENT DELIVERY REDUCTION.

Objective 1: Reduce rural sediment loading through further adoption of residue management accomplished through better farm conservation plans.

Method: One-on-one contact, field days, news articles, and publications to educate landowners to the benefits of residue management on crop production.

Evaluation: Evaluation of annual Transect Survey results and on-site status reviews.

Objective 2: Reduce rural sediment loading through the installation of structural BMPs and the encouragement of buffers.

Method: Report all conservation practice installations into a standard reporting system.

Evaluation: Compare year to year progress and evaluate pollution reduction versus cost of practices installed.

Objective 3: Reduce unrestricted grazing along streams and rivers.

Method: Evaluate one subwatershed per year to determine livestock presence.

Evaluation: Create a report of livestock inventory in the subwatershed.

Objective 4: Reduce urban sediment loading through construction site and storm water management.

Method: Develop a better ordinance and its enforcement.

Evaluation: Compare compliance figures to non-compliance figures on an annual basis.

Objective 5: Rely on the partnerships between agencies and organizations and their tools.

Method: Have a minimum of six meetings with the various lake and sanitary districts.

Evaluation: Count the number of meetings attended and report on the results of the meetings.

Goal 2 – WORK TOWARD MEETING THE LONG TERM GOAL OF A 35% PHOSPHORUS DELIVERY REDUCTION WITH THE FOLLOWING WORK PLAN OBJECTIVES FOR THE 2011-2015 PERIOD YIELDING A 3-4% PHOSPHORUS REDUCTION.

Objective 1: Reduce nitrogen and phosphorous loading through nutrient management planning and manure management BMPs.

Method: Enforcement of Farmland Preservation Program nutrient management planning (NMP) requirements via annual NMP checklists and semi-annual NMP review by LWCD staff. Hosting self-prescribed NMP courses twice per year.

Evaluation: Track acres via farm records to determine the total acreage under current NMP.

Objective 2: Reduce phosphorus runoff from developed lakeshore properties.

Method: One press release each year about the lawn phosphorus fertilizer law.

Evaluation: Through field stops monitor citizens applying fertilizer to their lawns and check for fertilizer analysis.

Objective 3: Reduce phosphorous runoff from urban sources through storm water management.

Method: Report the number of violations of the stormwater management ordinance and methods to obtain compliance.

Evaluation: Create an annual report of the number of violations. Document the impacts of the violations.

Objective 4: Rely on the partnerships between agencies and organizations, and their tools.

Method: Maintain the ability to communicate with our partners.

Evaluation: Record the number of complaints received about the LWCD.

Goal 3 – PRESERVE AND RESTORE HABITAT

Objective 1: Restore native plantings and vegetation in eligible areas

Method: Implement up-to-date average material costs to encourage low cost plantings.

Evaluation: Compare our local costs to other counties.

Objective 2: Decrease present and future fragmentation of natural habitat.

Method: Attend one Land Use Planning and Zoning Committee meeting per year to speak on the importance of comprehensive planning and preventing parcel divisions.

Evaluation: Record meeting attendance and the impact.

Objective 3: Protect and Establish Corridors.

Method: Encourage native vegetation in Agricultural Shoreland Management Areas by informing landowners of the native grass drill.

Evaluation: Record the number of acres seeded to native plantings with the DNR seeder.

Objective 4: Develop a Total Maximum Daily Load (TMDL) for at least one 303(d) impaired waterbody in the county.

Method: Develop the TMDL.

Evaluation: Completion of TMDL with a report to its implementation possibilities.

Goal 4 – UTILIZE EXISTING LAND USE PATTERNS

Objective 1: Reduce urban land from encroaching on farmland.

Method: Develop a Purchase of Develop Rights (PDR) program.

Evaluation: The actual development of the program.

Objective 2: Protect natural areas.

Method: Purchase easement using county conservation funds.

Evaluation: Evaluate the first purchase using county funds.

Goal 5: ADDRESS IMMEDIATE ENVIRONMENTAL PROBLEMS

Objective 1: Properly abandon wells.

Method: Cost-share all properly abandoned wells.

Evaluation: Annually report the number of properly abandoned wells.

Objective 2: Reduce runoff from winter manure application.

Method: Through status reviews view five livestock farms annually to determine winter spreading activities.

Evaluation: Report on the five farms as part of the annual status reviews.

Objective 3: Conservation developments.

Method: Assist local efforts such as the Joint Advisory Committee on Land Use Matters (JACLUM).

Evaluation: Report the activities of the organization to the Land Conservation Committee.

ADMINISTRATIVE REPORTING

Accomplishments – An annual accomplishment report will be completed annually and submitted to DATCP.

Financial reporting (all funds under LWCD responsibility) – The meeting will also evaluate total year-end and cumulative payments for BMP installation, total funds encumbered in project cost-share agreements under LWCD responsibility. Other funds appropriated for the implementation of the Land and Water Resource Management Plan. This includes applicable staff and other related administrative support costs. It is based on the inputs and phosphorus delivered downstream of the concentrated livestock area or buffer.

WATER RESOURCE MONITORING

It is generally agreed that surface and lake water monitoring is needed to adequately determine the extent of progress being made toward meeting specific goals and objectives. Limited funds and a requirement for extensive staff time to properly evaluate water quality changes preclude monitoring each watershed within the County. Green Lake County will rely instead on monitoring that is currently being done. This includes the following categories: Whole Stream Monitoring, Signs of Success, and Single Source Monitoring. The WDNR, the U.S. Geological Survey-Water Division, and the University of Wisconsin have formed a team of experts to develop and direct evaluation of monitoring activities within each category.

Green Lake County will also utilize data from additional Monitoring Programs.

Self-Help Monitoring Program – This program gives citizens an active role in Lake Management activities and assists the WDNR with basic data collection. The Self-Help Monitoring Team consists of volunteers who collect water quality data on a regular basis to track lake health and guide Wisconsin's Lake Management Program. They collect data on phosphorus, potassium, sediment, fecal coliform, Enterococcus, macrophytes, transparency, Chlorophyll, and other lake characteristics. They also help educate lake property owners about lake ecology and water quality while building a long-term information base on a large number of Wisconsin Lakes. Green Lake, Little Green Lake, Lake Puckaway, and the Twin Lakes have Self-Help monitoring programs.

Monitoring Stations – The USGS has a monitoring station on the Fox River in Berlin (Hydrologic unit 04073500) and Princeton (Hydrologic unit 04073365). The GLSD has gauging stations and automatic samplers on White Creek (Hydrologic Unit 04030201), and the Inlet of Green Lake (Hydrologic Unit 04073468), and a gauging station on the outlet of Green Lake. The GLSD also performs manual random samples around Green Lake including Silver Creek (Hydrologic Unit 040734644) near Ripon.

The Upper Rock River Basin has proposed Base-Line monitoring of fisheries, insects and habitat on representative waters. They plan to monitor up to 14 sites per year, repeating each station every five years. It is the goal of both the Basin and the County that these representative water sites overlap priority areas to properly monitor resource management activities.

The WDNR has already started Base-Line monitoring in Green Lake. They measure fish assemblages and water quality in various locations every year, repeating locations every five years.

Appendix One

Ranking Sheet

	Green Lake County Land and Water Plan - Ranking Sheet											
		September 2010										
	Owner's											
	Address	S										
	Farm Nu	lumber Tract										
A		r Farm/Area Strategy										
		the Conservation Treatment Unit located	I	1								
	1a	Within the Green Lake Watershed?	100 pts	_								
	1b	Within the Water Quality Management Area (WQMA)?	[1								
		(300 ft of a USGS delineated stream or 1000 ft of a WDNR identified lake?)	50pts									
-	1c Within a 303d, Outstanding (ORW) or Exceptional Resource Water (ERW) Watershed? 50 pts											
B		It Management										
	2 Nutrient Management Planning											
	2a 2b	Planned acres within the WQMA										
C	2b											
C		osion Control Practices (based on the most recent State approved soil erosion model) eet/Rill Erosion (Average for the Conservation Treatment Unit)										
	3a	Existing Soil Loss										
	3b	Soil Loss After (-)										
	00	(transfer to lines 3d an	nd									
	3c	Soil Savings tons/ac/yr 3e)										
			·									
	3d	i Tons/Ac/Yr x i Acres within the WQMA i = i x i	7									
	3e	i Tons/Ac/Yr x i Acres outside the WQMA i = i x	1 pt									
		Ily and Streambank Erosion (Average Annual Loss)										
	4a	Gully erosion within the WQMA (tons/yr) x 2 pts										
л	4b	Gully erosion outside the WQMA (tons/yr)										
D		ock Waste Management rnyards/Feedlots										
	5 Da n 5a	"BERT" Score (Before)										
	5b	"BERT" Score (After)										
	50 50		4pts									
	00		1910									
	5d	Implementation of planned practices will address:										
	5e	Overflow of storage structures 5	pts									
	5f	Unconfined manure stacking within the WQMA 5	pts									
	5g	Direct runoff from feedlots or stored manure to waters of the state 5	pts									
	5h	Unlimited livestock access to the waters of the state 5	pts									
	5h	Diverting clean water from feedlots/barnyards within the WQMA 5	pts									
	5j	Abandonment of unused manure storage structures 5	pts									
E	Ground	Water Resources		-								
	6a	Well Abandonment 25 pts/each										
	6b	Sink Hole Treatment 10 pts/each										
F		d Wildlife Resources		_								
	7a	Fish/Wildlife Habitat Improvements 20 pts										
G	Total Re	esource Management										
9	8a	Will installation of practices bring farm into NR 151 compliance?										
	Ja			<u> </u>								
Rank	king sheet ma	ay be modified by LCD/LCC, contact for most recent version	TOTAL									

Appendix Two

Stream System Habitat Rating

WDNR 1992 Report WR-312-92

Rating Items: Watershed Erosion Watershed Nonpoint Source Bank Erosion Bank Vegetation Lower Bank Channel Capacity Lower Bank Deposition Embededness Bottom Substrate Available Cover Average Depth Riffles and Runs Average Depth Pools Ration Pool/Riffle/Run Aesthetics

Scoring: <64 = Excellent, 65-112 = Good, 113-176 = Fair, > 177 = Poor

Ratings: White Creek = 166 (Fair) Hill Creek = 168 (Fair) Roy Creek = 177 (Poor) Wuerchs Creek = 201 (Poor) Spring Creek = 195 (Poor)

Many citizens believe that these waters should be included on the 303(d) list of waters not currently meeting water quality standards.

Appendix Three

Soil Erosion Control Plan--1988

<u>Township</u>	Acres eroding above the tolerable rate
Berlin	2,400
Brooklyn	2,200
Green Lake	4,600
Kingston	1,900
Mackford	3,100
Manchester	3,800
Marquette	1,800
Princeton	1,100
Seneca	1,000
St. Marie	1,000

22,900

Appendix Four

Transect Survey – 2010 Data

Acres meeting "T"

CROP	Total Acres	% of Total		
CORN	51,777	53.0%		
SOYBEANS	11,039	11.3%		
SMALL GRAINS	7,229	7.4%		
FORAGE	15,240	15.6%		
IDLE	2,638	2.7%		
OTHER	6,643	6.8%		
CRP	3,126	3.2%		

Relative Soil Loss by Watershed

Watershed	Average Annual Soil Loss <="T"	Average Annual Soil Loss > "T"	% of County Acres <="T"	% of County Acres > "T"	Total Tons <="T"	Total Tons > "T"	Watershed Total Tons			
Requer Dem Diver	1.1	7.1	2.3%	0.10/	2472	604	3165			
Beaver Dam River				0.1%		694				
Big Green Lake	1.5	12.2	15.0%	3.2%	21981	38139	60120			
Buffalo & Puckaway Lakes	1.8	10.1	7.0%	1.0%	12309	9867	22176			
Fox River	1.5	8.7	2.4%	0.6%	3517	5100	8616			
Fox River - Berlin	1.1	9.5	27.0%	1.8%	29015	16705	45720			
Lower Grand River	1.3	9.6	11.9%	1.4%	15113	13130	28243			
Swan Lake	1.6	6	4.2%	0.1%	6565	586	7151			
Upper Grand River	2.2	9.2	12.8%	3.2%	27510	28761	56271			
Upper Rock River	2.2	7.3	3.1%	0.4%	6663	2853	9515			
White River	0.7	6	2.4%	0.1%	1641	586	2227			
Total Acres	97,692		88.1%	11.9%						
*determined by using the 2	*determined by using the 2010 Transect Survey Data for Tillage and Crop Summary									
Took the total acres x the percentage of watershed above or below "T" and multiplied this by the average soil loss for each category										

Appendix Five

Best Management Practices

Agricultural Sediment Basins. A structure designed to reduce the transport of sediment of other pollutants eroded from agricultural fields to surface waters and wetlands.

Barnyard Abandonment or Relocation. Relocation of an animal lot from a critical site such as floodway to suitable site to minimize the amount of pollutants from the lot to surface or groundwater.

Barnyard Runoff Management. Structural measures to redirect surface runoff around the barnyard, and collect, convey or temporarily store runoff from the barnyard.

Buffers. Permanently vegetated areas immediately adjacent to lakes, streams, and wetlands that filter pollutants from nonpoint sources.

Cattle Mounds. Cattle mounds are earthen mounds used in conjunction with feeding and dry lot operations and are intended to provide a dry and stable surface area for cattle.

Closure of Waste Storage Facility. Manure storage systems abandonment is the proper abandonment of leaking and improperly sited manure storage systems, including: a system with bottom at or below groundwater level; a system whose pit fills with groundwater; a system whose pit leads into the bedrock; a system which has documented reports of discharging manure into surface or groundwater due to structural failure; and a system where there is evidence of structural failure. The practice includes proper removal and disposal of wastes, liner materials, and saturated soils as well as shaping, filling, and seeding of the area.

Contour Farming. The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

Contour Strip Cropping. Growing alternating strips of row crops and grasses or legumes on the contour.

Critical Area Stabilization. The Planting of suitable vegetation on non-point source sites and other treatment necessary to stabilize eroding lands.

Cropland Protection Cover (Green Manure). Cropland protection covers are close-growing grasses, legumes or small grain grown for seasonal soil erosion protection and soil improvement.

Easements. Easements are legally binding restrictions on land titles. Easements are purchased to provide permanent vegetative cover.

Field Diversions. A channel constructed across the slop with a supporting ridge on the lower side, to divert excess water to safe outlets in other areas

Grade Stabilization Structure. A structure used to reduce the grade in a channel to protect the channel from erosion or to prevent the formation or advance of gullies.

Grassed Waterways. A natural or constructed channel shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

High Residue Management. A system which leaves at least 30 percent of the ground covered with crop residue after crops are planted.

Intensive Grazing Management (Rotational Grazing). Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a

period of recovery of the vegetative cover. Rotational grazing systems can correct existing pasturing practices that result in degradation and should replace the practice of summer dry-lots when this practice results in water quality degradation.

Lake Sediment Treatment. Lake sediment treatment is a chemical, physical, or biological treatment of polluted lake sediments. Sources of pollution to the lake must be controlled prior to treatment of lake sediments. Treatment does not include dredging.

Land Acquisition. The purchase of land or the interest in land which is contributing or will contribute non-point pollution or for the construction of an urban structural practice.

Livestock Exclusion from Woodlots. The exclusion of livestock from woodlots to protect the woodlots from grazing by fencing or other means.

Manure Storage Facility. A structure for the storage of manure for a period of time that is need to reduce the impact of manure as a non-point source of pollution. Livestock operations where this practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

Milking Center Waste Control System. A milking center waste control system is a piece of equipment, practice or combination of practices installed in a milking center for purposes of reducing the quantity or pollution potential of the wastes.

Nutrient Management. The management and crediting of nutrients from all sources, including legumes, manure, and soil reserves for the application of manure and commercial fertilizers. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface and groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

Pesticide Management. The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning.

Roofs for Barnyard Runoff Management and Manure Storage Facilities. Roofs for barnyard runoff management and manure storage facilities are a roof and supporting structure constructed specifically to prevent rain and snow from contacting manure.

Shoreline and Streambank Stabilization. The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access.

Shoreline Buffers. A permanently vegetated area immediately adjacent to lakes, streams, channels and wetlands designed and constructed to manage critical non-point sources or to filter pollutants from non-point sources.

Structural Urban Best Management Practices. These practices are source area measures, transport systems and end-of-pipe measures designed to control storm water runoff rates, volumes and discharge quality. These practices will reduce the amount of pollutants carried in runoff and flows destructive to stream habitat. These measures include such practices as infiltration trenches, porous pavement, oil water separators, sediment chambers, sand filtration units, grassed swales, infiltration basins and detention/retention basins.

Terraces. A system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent erosion in the channel.

Wetland Restoration. The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

Appendix Six

Rare Species and High-Quality Natural Communities in Green Lake

References made to: <u>Wisconsin Natural Heritage Inventory-</u>1996, and <u>A vascular flora of</u> <u>Green Lake County, Wisconsin</u> - T. Eddy, 1996, and <u>Wisconsin Endangered and</u> <u>Threatened Species-</u>1999 on the WDNR web site

Additional resources include: Thomas R. Schultz's observations, Dr. Eric Ratering's observations, Thomas L. Eddy's observations.

ENDANGERED: continued existence in Wisconsin is in jeopardy. THREATENED: appears likely, within the foreseeable future, to become endangered. SPECIAL CONCERN: species for which some problem of abundance or distribution is suspected by not yet proven.

ANIMALS

ENDANGERED

Forester's Tern (Sterna forsteri) 1994 Red-Necked Grebe (Podiceps grisegena) Western Slender Glass Lizard (Ophisaurus attenuatus attenuatus)* Powesheik Skipperling (Oarisma powesheik) Queen Snake (Regina septembittatta) 1978 Caspian Tern (Sterna caspia) 1990 Blanchard's Cricket Frog (Acris crepitans blanchardi) 1919

THREATENED

Acadian Flycatcher (*Empidonax virescens*) 1988 Bell's Vireo (*Bireo belli*) 1979 Cerulean Warbler (*Dendroica cerulea*) 1988* Great Egret (*Casmerodius albus*) Greater Prairie-Chicken (*Tympanuchus cupido*) 1981 Osprey (*pandion haliaetus*) 1981 Red-Shouldered Hawk (*Buteo lineatus*) 1983 Blanding's Turtle (*Emydoldea blandingii*) 1981*

SPECIAL CONCERN

Black-Crowned Night-Heron (Nycticorax nycticorax) 1988 Merlin (Falco columbarius) 1915 Broad-Winged Skipper (Poanes viator) Karner Blue Butterfly (Lycaeides melissa samuelis) 1993** Two-Spotted Skipper (Euphyes bimacula) Lake Chubsucker (Erimyzon sucetta) Lake Herring (Coregonus artedi) 1909 Lake Sturgeon (Acipenser fulvercens) 1991* Least Darter (Etheostoma microperca) 1925 Redside Dace (Clinostomus elongatus) 1928 Weed Shiner (Notropis texanus) 1925 Black Tern (Chlidonias niger) 1990 Western Grebe (Aechmophorus occidentalis) 1990 Common Moorhen (Gallinula chloropus) 1990 Least Bittern (Ixobrychus exilis) 1990

PLANTS

ENDANGERED

Soft-Leaf Muhly (Muhlenbergia richardsonis) 1989 Lake-Cress (Armoracia lacustis) 1921*

THREATENED

Brittle Prickly-Pear (*Opuntia fragilis*) 1990 Pale Green Orchid (*Platanthera flava var herbiola*) 1980 Prairie Parsley (*Polytaenia nuttallil*) 1986 Small White Lady's-Slipper (*Cypripedium candidum*) 1986 Sticky False-Asphodel (*Tofieldia glutinosa*) 1986 Tussock Bulrush (*Scirpus cespitosus var callosus*) 1986 Wooly Milkweed (*Asciepias lanuginosa*) 1986 ***

SPECIAL CONCERN

Common Bog Arrow-Grass (*Triglochin maritimum*) 1986 Downy Willow-Herb (*Epilobium strictum*) 1975 *** Lesser Fringed Gentian (*Gentianopsis procera*) 1986 Low Nutrush (*Scleria verticillata*) 1989 Virginia Meadow-Beauty (*Rhexia virginica*) 1932 Robbins Spikerush (*Elocharis robbinsii*) 1984 *** Slender Bog Arrow-Grass (*Triglochin palustre*) 1986 Whip Nutrush (*Scleria triglomerata*) 1980 Slim-Stem Small-Reedgrass (*Calamagrostis stricta*) Pale Beardtongue (*Penstemon pallidus*)

NATURAL COMMUNITIES

Springs and Spring Runs, Hard 1979 Wet-Mesic Prairie 1986 Calcareous Fen 1990 Wet Prairie 1986 Emergent Aquatic 1981 Southern Sedge Meadow 1988 Floodplain Forest 1979 Shrub-Carr 1979 Tamarack Fen 1979 Southern Dry Forest 1981 Dry Prairie 1978 Shaded Cliff 1976 Bedrock Glade 1990 Mesic Prairie 1979 Northern Dry-Mesic Forest 1979

* Indicates: a candidate for federal listing.

** Indicates: Federally Endangered or Threatened.

*** Indicates: no known species vouchers in Green Lake County.

The date following the species and natural community names notes the most recent year the occurrence was recorded by the Wisconsin Natural Heritage Inventory

Appendix Seven

USGS Data – Silver Creek/Green Lake Inlet

Water Year	Silver Creek (S Koro Rd)						Green La	ke Inlet (County Rd A)	
(Oct - Sept)	Susper	Suspended Sediment		Phosphorus		Susper	nded Sediment	Pho	osphorus	
	(tons)	(tons/sq. mi)	(lbs)	(lbs/sq mi)	Mean (cfs)	(tons)	(tons/sq. mi)	(lbs)	(lbs/sq mi)	Mean (cfs)
1988	387	11	6,355	176	13.4	358	7	5,990	112	18.7
1989	1,690	47	20,988	580	21.4	2,008	38	23,612	441	30.6
1990	672	19	16,830	465	23.7	1,431	27	17,250	322	33.9
1991	639	18	7,913	219	23.1	603	11	8,370	156	28.2
1992	821	23	7,541	208	26.6	810	15	8,337	156	32.3
1993	1,730	48	24,119	666	62.3	3,573	67	28,178	527	79.9
1994	537	15	10,231	283	19.7	712	13	13,487	252	27.8
1995	445	12	7,581	209	18.5	756	14	9,235	173	26.2
1996	679	19	11,038	306	37.2	942	18	12,728	238	51.3
1997						818	15	9,446	177	32.7
1998						986	18	7,592	142	28.7
1999						1,121	21	8,088	151	28.3
2000			No Data			978	18	7,815	146	25.6
2001						1,683	32	12,877	241	52.0
2002						869	16	8,297	155	39.8
2003						602	11	4,654	87	17.9
2004						2,741	51	22,929	429	75.8
2005						482	9	6588	123	26.0
2006						438	8	4398	82	22.3
2007						398	7	3807	71	24.7
2008						3833	72	20086	375	79.1
2009						883	17	6866	128	39.7
2010						1172	22	8749	164	43.8

Source: Surface Water data for USA: USGS Surface-Water Annual Statistics

URL: http://waterdata.usgs.gov/nwis/annual? (Summarized by Paul Gunderson)

Water Year	Silver Creek (S Koro Rd)							
(Oct - Sept)	Suspend	led Sediment	Pho	sphorus				
	(tons) (tons/mi) (lbs) (lbs/sq mi)		(lbs/sq mi)	Mean (cfs)				
1982	2,997	983	2,168	711	3.4			
1983	964	316	1,397	458	5.5			
1984	1,529	501	1,083	355	4.8			
1985	1,030	338	1,441	472	4.9			
1986	5,220	1,712	4,271	1,400	7.9			
1987	113	37	456	150	3.5			
1988	72*	24*	259*	85*	1.9*			
1989-1996	No Data							
1997	349	115	1,334	437	2.8			
1998	159	52	683	224	3.4			
1999	265	87	798	262	2.8			
2000	250	82	755	247	2.1			
2001	522	171	1,254	411	4.8			
2002	194	64	531	174	2.0			
2003	19	6	244	80	0.8			
2004	2413	791	7,439	2,439	6.2			
2005	158	52	665	218	1.2			
2006	68	22	323	106	2.2			
2007	91	30	492	161	2.2			
2008	6461	2118	8125	2664	7.3			
2009	159	52	606	199	3.1			
2010	223	73	630	207	4.0			

USGS Data – White Creek (Spring Grove Road)

* Oct thru June

Source: Surface Water data for USA: USGS Surface-Water Annual Statistics URL: http://waterdata.usgs.gov/nwis/annual? (Summarized by Paul Gunderson)

Appendix Eight

Landowner Notification

The majority of time that the Land and Water Conservation Department will spend with NR 151 standards will occur through status reviews of Working Lands Initiative, Farmland Preservation Program participants. Landowners are sent a current status report which informs the landowner if they are meeting NR 151 requirements which then allows them to continue to receive the program payments.

For landowners not meeting NR 151 standards or County ordinances, a notice of the problem will be mailed to the landowner stating that the standards have not been met or that they are in violation of the ordinance. The Green Lake County Land & Water Conservation Department shall prepare a conservation plan with the landowner including a schedule of implementation. The Green Lake County Land & Water Conservation Department must provide a notice of availability of funds to the landowner when funds are available to implement or install the necessary practices. A minimum of one year must elapse after the landowner's plan and schedule has been developed before beginning any enforcement action. The one-year deadline for enforcement action may be extended upon agreement between the landowner and the Green Lake County Land & Water Conservation Department.

The Green Lake County Land & Water Conservation Department must provide along with the notice of problem: a list of pertinent best management practices and associated average costs per unit as provided by the Green Lake County Land & Water Conservation Department; a written statement informing the landowner of the right to appeal the decision; and the appeals procedure.

Appendix Nine

Agricultural Shoreland Corridors

Agricultural shoreland corridors are the lands extending 20 feet from; the top of the bank on each side of a perennial stream or river, the centerline of an intermittent stream, or the ordinary high-water mark of any lake or pond shown on a United States Geological Survey quadrangle map with a scale of 1:24,000.

Agricultural shoreland corridors have different regulations than agricultural shoreland management areas. In corridors, landowners shall establish and maintain an adequate vegetative buffer, or equally effective erosion control practice. When a vegetative buffer is established, the plant variety or seed mixture shall be one of those listed in technical guide standard 342, critical area planting. If any activity disturbs a vegetative buffer in the corridor, the landowner must replant or restore the disturbed area to an effective vegetative buffer as soon as practicable. Tillage practices that leave less than 70% vegetation are prohibited in the corridor, except that tillage practices are allowed to establish or reestablish a seedbed. Livestock holding areas, other than pastures, are prohibited within the agricultural shoreland corridor unless a barnyard runoff control system is installed that meets technical guide standard 312. (Existing structures can remain.)

Twenty feet is a designated distance for agricultural shoreland corridors. This is also the minimum dimension for the Agricultural Shoreland Management Ordinance. If funding is limited, then 20-foot corridors will be considered top priority areas within agricultural shoreland management areas, though the areas will still be considered.

Green Lake County has a total of 635.9 cropped acres in the shoreland corridors. The rental price for all 635.9 acres \$51,587 per year. (There are 12,863 acres of 300-foot shoreland areas, at a total cost of \$1,026,882 per year. Though the benefits of the areas outweigh those of the corridors.) The Land Conservation Committee will likewise consider purchasing easements in these corridor areas rather than paying annual rental payments.

Appendix Ten

Land & Water Funds Appropriated

DATCP cost-share for the installation of Best Management Practices has been awarded to Green Lake County since 2000. The amount of funding over these years has varied. Below is a breakdown of how the funding has been awarded according to the four priority categories as listed on page 59 of this plan.

	Cropland Erosion 50%	Livestock Waste Mgt Facilities 35%	Streambank/ Shoreline Erosion 10%	Well Abandonment 5%
2000	64%	36%	0%	0%
2001	39%	25%	35%	1%
2002	47%	42%	10%	1%
2003	81%	18%	0%	1%
2004	38%	48%	12%	2%
2005	86%	0%	12%	2%
2006	19%	66%	12%	3%
2007	54%	44%	1%	1%
2008	81%	0%	17%	2%
2009	62%	29%	7%	2%
2010	45%	46%	6%	3%

Land & Water funds of \$676,990 were paid to county landowners from 2000 – 2010. Below is the breakdown by watershed of where payments were made.

Watershed		
Beaver Dam River	\$1,950	0.3%
Big Green Lake	110,934	16.4%
Buffalo & Puckaway Lakes	91,262	13.5%
Fox River - Berlin	113,173	16.7%
Fox River - Rush Lake	300	0.0%
Lower Grand River	99,925	14.8%
Mecan River	0	0.0%
Swan Lake	5,339	0.8%
Upper Grand River	165,637	24.5%
Upper Rock River	87,866	13.0%
White River	604	0.1%
Total	\$676,990	

Appendix Eleven

Public Hearing Notification

A public hearing was held on April 14, 2011. A Class II public hearing notice was posted in the Berlin Journal Newspapers.

an a	PUBLI	C HEAF	RING NO	FICE	
Governmen sin a Publi Conservati	that on the t Center Room c Hearing will on Committee lanagement P	m #0914 in 11 be held for appro	n the City by the Ga val of the	of Green Lake con Lake Co revised Land	e, Wiscon- unity Land
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Written public comments received are as follows:

From Charlie Marks regarding the Big Green Lake Watershed:

- Create a more detailed/specific Big Green Lake & Watershed Plan
- Detailed study of County K Estuary to determine the impact of the newly installed carp barrier (mid June 2009)
- Determine method to reach a consensus compromise for balance in Silver Creek Estuary between biodiversity and recreational uses
- Do carp surveys (in lake, Silver Creek Estuary and K Estuary) and fish survey on the lake
- Take years of biotic indexing data to evaluate tributary health
- Re-examine lake and watershed goals from 10 years ago for key nutrients (P, TSS, DO, etc)
- Perform updated watershed inventory
- Re-examine phosphorus and suspended sediment loadings in comparison to 10 years ago
- Determine other uses for fish rearing facility and look at unused ponds for other uses
- Create a 5 year plan for conservancy properties (i.e. uses, work to be completed, etc)
- Do pilot/study to determine effect of a EWM No Cutting Zone' and look into raising weevils
- Determine holes (i.e. more grab samples from lake tributaries) in current USGS monitoring and fill them in
- Develop 5 year plan for <u>BMP</u> goals' including funding costs with reduction targets
- Re-evaluate current programs (i.e. RSVP, JACLUM, etc) to determine if these should stay or go
- Work with local schools (grade school through colleges) to strategize and prioritize work, goals and plans (i.e. 5 year?)
- Work to strengthen partnership and cooperation between local lake organizations (i.e. quarterly meeting GLSD, GLA, LCD, etc)
- Continue evolution of green team events which goes <u>hand-in-hand</u> with the whole notion of ongoing Information & Education for all good environmental things

From Thomas Eddy regarding the Big Green Lake Watershed:

- Install aerial lake cams for viewing Green Lake any time of day or night via WWW
- Lake management document specific for Green Lake
- Investigate aquatic macrophytes and emergent at head of lake (marsh across from Dodge County Park). Species? Density? A similar study such as that completed on Silver Creek after the barrier was in place
- Examine biodiversity of lake with soundscaping
- Photograph/video tape underwater locations of lake
- Set rusty crayfish traps to measure lake and inlet populations
- Photograph entire lakeshore for baseline record of buffer area
- Cost-share installation of storm drain filtering equipment
- Plant inventories of properties owned managed by the Sanitary District (completed are Norwegian Bay, Mitchell Glen)

Oral public hearing comments received are as follows:

Land Conservation Committee members Thomas Traxler and Sue McConnell felt that more funding should be allocated to Goal 3 –Preserve and Restore Habitat" for promotion of shoreline stabilization. Also more newspaper articles and workshops needed to educate the public. Shoreline stabilization work should continue.

David Wilke, Green Lake County Farm Bureau President, stated protecting the environment and maintaining family farms is important to their membership of over 600 members.

RESOLUTION NUMBER 07-2011

Relating to: Land and Water Resource Management Plan Approval

The County Board of Supervisors of Green Lake County, Green Lake, Wisconsin, duly assembled at its regular meeting begun on the 17th day of May, 2011, does resolve as follows:

WHEREAS, under s. 92.10(6), Wis., Stats., counties are required to prepare a county land and water resource management plan; and

WHEREAS, this comprehensive plan is an analysis of land and water resource issues and needs within the county; and

WHEREAS, this plan integrates all of the various land and water conservation programs administered by the Green Lake County Land and Water Conservation Department; and

WHEREAS, an official public hearing was conducted on April 14, 2011; and

WHEREAS, pertinent public comments have been incorporated into the plan; and

WHEREAS, this plan will be presented to the Wisconsin Land and Water Conservation Board for their approval on June 7, 2011;

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of Green Lake County that the Green Lake County Land and Water Resource Management Plan be adopted and implementation of the plan begin upon Wisconsin Land and Water Conservation Board approval.

Roll Call on Resolution 07-2011

Ayes 1, Nays 1, Absent 1, Abstain 0

Submitted by: Land Conservation Committee

Michael R. Stoddard, Chairman

Michael I. Cloudard, ona

Passed and Adopted/Bejected this 17th day of May, 2011.

County Board Chairman

ATTEST: County Clerk

Approved as to Form: Corporation Counsel

Thomas W. Traxler, Vice-Chairman

Susan E. McConnell

Maureen Schweder

Maureen Schweder

argafet

Arnold Dahlke. FSA Member Jr.

Appendix Twelve

Lake Puckaway Lake Management Plan Goals

GOAL 1: Monitoring and Decision-Making

Establish an Adaptive Management Committee to a) measure and report on the health of the lake and recommend actions for its protection and restoration and b) help foster an effective partnership between LPPRD, WDNR, and others.

GOAL 2: Water Quality

Monitor, maintain, and improve water quality.

GOAL 3: Aquatic plants

Monitor, maintain, and improve healthy beds of native aquatic plants and coordinate the management of invasive non-native plants.

GOAL 4: Carp Reduction

Integrate carp management as one component of a balanced strategy to improve water quality.

GOAL 5: Water levels

Establish clear and consistent agreements between LPPRD and WDNR to operate and improve the Princeton Dam.

GOAL 6: Fish Populations

Monitor fish populations to help measure the success of habitat protection and restoration and to determine the success of natural reproduction.

(Note: This goal applies to fish population surveys that help measure the health of the lake for the Adaptive Management Committee. All other fish and wildlife management actions are covered in Goals 11-13.)

GOAL 7: Shorelines and Breakwaters

Develop and implement projects to protect in-lake areas from wind and wave erosion, prevent erosion on public and private shorelines, and provide information and incentives for shorelines to be protected all around the lake.

GOAL 8: Watershed Management *

Support local, county, state, and federal policies and practices in the watershed that improve water quality in Lake Puckaway.

Actions :

Category 1: Direct Drainage Area and Shorelines on Lake Puckaway and the Fox River

- Identify and seek resources for implementing appraisals, Information & Education, and Best Management Practices (BMP)
- Develop Information & Education program buffers/restoration as topics
- Identify critical water quality/habitat areas for protection/restoration and prioritize
- Identify priority areas runoff management
- Implement shoreline and habitat restoration demonstration projects
- Integrate Puckaway Comprehensive Management Plan actions with Marquette and Green Lake County Land and Water Plans

Category 2: Lake Puckaway Sub-Watershed

- Appraise watershed and identify:

- Critical areas of water quality functions for protection/restoration
- Non-point sources and prioritize for BMPs
- Identify and seek resources for implementing appraisals and BMPs
- Implement BMPs

Category 3: Upper Fox River Watershed

- Support local, county, state and federal programs and practices where possible
- Advocate for lake management planning and practices for other lake systems in the watershed that affect Lake Puckaway (e.g., Buffalo Lake, Grand River Marsh, etc.)

* Although the LPPRD is not a watershed organization, it has a vested interest in the success of programs that reduce runoff of storm water and its associated sediments and pollutants to the lake from urban and rural sources.

ADDITIONAL GOALS AND ACTIONS

The next fourteen goals follow the foundation of the commitments represented by the first eight goals above and are also extremely important in their own right.

Recreation (Goals 9 and 10). Various forms of recreation and access to Lake Puckaway from public boat landings and private properties are key to people's enjoyment of the lake. Goals 9 and 10 focus on ways to improve the lake's habitat and recreation zones and to improve access and safety during the open water season and during ice cover.

Habitat and Recreation Zones

Use and improve the Habitat and Recreation Zone map (Figure 2) to guide lake users and lake managers in an integrated approach to habitat protection and recreational experience.

Recreational Access and Safety

Develop and implement strategies to improve motorized and non-motorized boating access and safety.

Fish and Wildlife Population Management (Goals 11-13). The protection and restoration of the habitats that are essential to sustain fish and wildlife are thoroughly addressed in the priority goals for Adaptive Management (Goals 1 through 8), fish population surveys are included within these as Goal 6. The following goals cover additional management needs for specific fish and wildlife populations in and around the lake. Public comments indicated that many citizens were not as supportive of Goals 12 and 13 compared to the other goals proposed in the draft plan. Thus, until there is more understanding of the issues, these might be considered the lowest priority goals in the plan.

Fish Management Actions

Set priorities and implement fish management actions to benefit the sport fishery.

Wildlife Population Surveys

Monitor selected wildlife species to help measure the success of habitat protection and restoration and to establish additional management recommendations.

Common Terns

Manage the common tern habitat area on a portion of the dredge bank island.

Information, Education, and Public Involvement (Goals 14-18). The public review process for this Comprehensive Plan identified a very strong desire for improvements in communication between the LPPRD Board and its members, and the general public. Goals 14-18 presented here are an essential aspect of plan implementation and success. The development of

specific actions, assignments, and timelines to accomplish these goals is of extremely high priority.

Outreach Messages

Develop and routinely update -key messages" to implement LPPRD outreach goals and help:

Outreach Schedule

Establish and implement a routine schedule to inform the public and increase the visibility of LPPRD and promote the Puckaway area as a tourism destination and a rural residential area.

Volunteer Activities

Establish and implement a range of activities to engage the public in hands-on projects, increase visibility of LPPRD, and recruit new volunteers and leaders.

Shoreline Demonstration

Develop shoreline demonstration projects and provide incentives for private property owners to protect shorelines. (See Goal 7)

Public Review

Provide opportunities for the public to learn about the Adaptive Management Committee's recommendations (Goal 1), provide feedback on the overall implementation of this Comprehensive Management Plan, and for Lake District members to vote at Annual Meetings.

Economic Inventory (Goal 19). In addition to the ecological inventory that is at the core of this Comprehensive Plan to protect the health of Lake Puckaway (see Goal 1), LPPRD Commissioners and members are interested in maintaining an inventory of the economic indicators as measures of community health. This would include, but not be limited to, information on demographics, employment, property values, taxes, public works, and tourism. This information will help guide the ongoing implementation of this plan.

Economic Inventory

Collect and summarize information on local and regional economic health and make recommendations that help support the Mission and Vision of this Comprehensive Plan.

LPPRD Organizational Development (Goals 20-22). In order to implement this ambitious Comprehensive Management Plan for Lake Puckaway, the structure and function of the Board of Commissioners must be supported. A Board assessment (Goal 20) will help gain perspective on LPPRD developmental needs and challenges, prioritize them, develop a plan of action, and measure their progress. Although more specific goals will grow out of this assessment, Goals 21 and 22 immediately address the funding issues presented by the implementation of this plan.

Board Development

Prepare the LPPRD Board to fully implement the Comprehensive Plan for Lake Puckaway.

Fund Development

Secure short- and long-term funds to implement this Comprehensive Plan.

Lake District Boundaries

Increase the Lake District boundaries and voluntary attachments so that the District represents and is funded by a greater proportion of those who benefit from its services

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