Nonpoint Source Control Plan for the

Lake Mendota Priority Watershed Project

This plan was prepared under the provisions of the Wisconsin Nonpoint Source Pollution Abatement Program by the Wisconsin Department of Natural Resources, the Department of Agriculture, Trade and Consumer Protection, the Dane County Land Conservation Department, and the Columbia County Land Conservation Department.

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Nonpoint Source Control Plan for the Lake Mendota Priority Watershed

The Wisconsin Nonpoint Source Water Pollution Abatement Program

Plan Approved, June, 1997

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection
Dane County Land Conservation Department and
Columbia County Land Conservation Department

Publication WT-536-00-REV
April, 2000

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JUN 3 0 1997

June 3, 1997

Mr. Kevin Kesterson, Chair
Dane County Land Conservation Committee
6115 S. Court
McFarland, WI 53558

Kevin

Dear Mr. Kesterson:

I am pleased to approve the Lake Mendota Priority Watershed Plan. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection. This plan went before the Land and Water Conservation Board on June 3, 1997 and was approved at that time. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program. I am also approving the plan as an amendment to the Lower Rock River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Dane County staff that participated in preparing the plan. We look forward to assisting Dane County and other units of government in the watershed in implementing the plan.

Sincerely,

George

Good luck on your project

George E. Meyer
Secretary

cc: Kevin Connors - Dane County LCD
Sue Porter - DATCP
Andy Morton - DNR, SCR
Steve Fix - DNR, SCR
Cindy Hoffland - CA/8
Carolyn Betz - WT/2

RES. 305, 1996-97

ADOPTION OF THE LAKE MENDOTA WATERSHED PLAN

The Dane County Board of Supervisors adopted Res. 292, 1993-94 that accepted designation of the Lake Mendota Watershed as a Wisconsin Nonpoint Source Priority Watershed Project. In both Dane and Columbia Counties, this 230 sq. mi. watershed includes the Pheasant Branch, Dorn, Six-Mile, Yahara and Token Creeks which all flow into Lake Mendota, a 9,842 acre lake. Over 55% of the watershed is cropland and 21% is developed or undergoing urbanization. The remainder is devoted to woodland, grassland, and wetland.

A land resource inventory has been conducted to identify and quantify sources of nonpoint pollution. This inventory included the survey of feedlots for manure runoff, cropland erosion, rural private well sampling, and streambank erosion. In urban/transition areas (conversion of existing agricultural land to developed urban), the inventory addressed construction site erosion and stormwater runoff from established urban areas. A water resources appraisal was also conducted to evaluate each body of water in the watershed for its current use and potential use if nonpoint source pollution control measures were instituted. The watershed team has identified a 50% reduction goal for phosphorus entering Lake Mendota. This reduction goal would result in non-algae blooms on 4 out of 5 days in the summer.

A watershed plan has been drafted which will provide guidance on implementation and cost-share rates for conservation practices and structures. The watershed plan will form the basic foundation from which to build partnerships for this water quality project. The plan, in addition to identifying potential solutions, outlines an aggressive information and education strategy which will involve all of those within the Lake Mendota Priority Watershed.

NOW, THEREFORE, BE IT RESOLVED that the Dane County Board of Supervisors approve the Lake Mendota Watershed Plan.

Adopted Dane County Board of Supervisors 4/3/97.
Signed by County Executive 4/16/97.

WISCONSIN
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George E. Meyer
Secretary

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June 3, 1997

Mr. Robert Stoltenberg, Chair
Columbia County Land Conservation Committee
W6252 Kampen Rd.
Arlington, WI 53911

Dear Mr. Stoltenberg:

I am pleased to approve the Lake Mendota Priority Watershed Plan. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection. This plan went before the Land and Water Conservation Board on June 3, 1997 and was approved at that time. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program. I am also approving the plan as an amendment to the Lower Rock River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Columbia County staff that participated in preparing the plan. We look forward to assisting Columbia County and other units of government in the watershed in implementing the plan.

Sincerely,

George

Good luck on your project

George E. Meyer
Secretary

cc: Kyle Kidney - Dane County LCD
Sue Porter - DATCP
Andy Morton - DNR, SCR
Steve Fix - DNR, SCR
Cindy Hoffland - CA/8
Carolyn Betz - WT/2

RESOLUTION NO. 18-97

SYNOPSIS: APPROVE NONPOINT SOURCE CONTROL PLAN FOR LAKE MENDOTA PRIORITY WATERSHED PROJECT
INTRODUCED BY: LAND CONSERVATION COMMITTEE

TO THE HONORABLE BOARD OF SUPERVISORS OF COLUMBIA COUNTY:

WHEREAS, the Lake Mendota Watershed has been selected by the State Department of Natural Resources for priority funding to control nonpoint sources of water pollution, and

WHEREAS, Dane County and Columbia County Land Conservation Departments have inventoried the Lake Mendota Watershed for animal waste and soil erosion pollution sources, and

WHEREAS, using the inventory results, an implementation plan has been developed in cooperation with the Wisconsin Department of Natural Sources (DNR) and the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP), and

WHEREAS, the watershed plan sets procedures for providing technical and financial assistance to eligible landowners who install various best management practices that reduce nonpoint sources of pollution in the Lake Mendota Watershed, and

WHEREAS, Columbia County, through its Land Conservation Committee (LCC), is responsible for implementation of control strategies in the unincorporated areas, which would include providing technical assistance to landowners who volunteer to participate and administering cost sharing agreements with rural landowners, and

WHEREAS, the draft watershed summary has been reviewed by the public during a public information hearing which was held on March 25, 1997, and

WHEREAS, the Land Conservation Committee has reviewed the Lake Mendota Priority Watershed Project draft summary and recommends approval of the plan by the Board.

NOW, THEREFORE, BE IT RESOLVED that the Columbia County Board of Supervisors hereby approves the Nonpoint Source Control Plan for the Lake Mendota Priority Watershed Project.

BE IT FURTHER RESOLVED that the Land Conservation Committee is hereby authorized to enter into a Nonpoint Source Grant Agreement with the DNR for the purpose of administering cost sharing dollars to rural landowners with the understanding that there be no direct costs for cost-sharing funding to the county.

BE IT FURTHER RESOLVED that Columbia County reserves the right to request further amendments to the watershed plan in order to incorporate new cost sharing opportunities for landowners, to facilitate needed changes in technical standards and

specifications, to extend sign-up periods, or to include other changes that may occur in future revisions to Administrative Rule NR-120.

FISCAL NOTE: No County funding necessary.

Reuben Damm

Reuben Damm

Donald P. Nelson

Donald P. Nelson

James R. Humphrey

James R. Humphrey

Charles M. Johnson

Charles M. Johnson

Robert J. Stoltenberg

Robert J. Stoltenberg

LAND CONSERVATION COMMITTEE

STATE OF WISCONSIN

ss

COUNTY OF COLUMBIA

I, Cathleen M. Lathrop, County Clerk in and for said County, do HEREBY CERTIFY that the above and foregoing is a true and correct copy of a Resolution adopted by the Columbia County Board of Supervisors at the meeting held on April 15, 1997.

Dated at Portage, Wisconsin, this 16th day of April, 1997.

ix

County Clerk

List of Acronyms

ACP	Agricultural Conservation Program
BARNY	Barnyard nutrient analysis model
BIM-GEO	DNR Bureau of Information Management-Geographical Unit
BMP	Best Management Practice
CAC	Citizen Advisory Committee
CFSA	Consolidated Farm Services Agency (United States Department of Agriculture)
COD	Chemical Oxygen Demand
CRP	federal Cropland Reserve Program
CSA	Cost share agreement
DATCP	Wisconsin Department of Agriculture, Trade, and Consumer Protection
DILHR	Department of Industry, Labor, and Human Relations
DNR	Wisconsin Department of Natural Resources
FFA	Future Farmers of America
FOCS	Field Offices Computing System
FPP	Wisconsin Farmland Protection Program
FSA	Food Security Act
GW	groundwater
I&E	Information and Education
LCC	Land Conservation Committee
LCD	Land Conservation Department
LWCB	Land and Water Conservation Board
NPM	Nutrient and Pest Management
NRCS	Natural Resource Conservation Service
SHS	Wisconsin State Historical Society
SIP	Stewardship Incentive Program
SOS	Signs of Success monitoring program
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWEX	University of Wisconsin-Extension
WGNHS	Wisconsin Geological and Natural History Survey
WINHUSLE	sediment transfer model based on the Universal Soil Loss Equation
WPDES	Wisconsin Pollutant Discharge Elimination System [permit system]
WUWN	Wisconsin Unique Well Number assigned to well sample sites

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Lake Mendota Priority Watershed Project Summary

Introduction

The purpose of this watershed plan is to assess the nonpoint pollutants in the Lake Mendota watershed and to guide the implementation of control measures. Implementation of best management practices to control polluted runoff and education are needed to meet very specific water resource objectives designed to protect and enhance Lake Mendota and other lakes, streams, groundwater, and wetlands in the watershed.

Nonpoint source pollution, also called polluted runoff, cannot be easily traced to a single point of origin such as an effluent discharge from a wastewater treatment plant or industrial plant. Nonpoint source pollution occurs when rainwater or snowmelt flows across the land and picks up soil particles, organic wastes, fertilizers, or other pollutants and carries them to surface and/or groundwater. These soil particles and organic wastes contain phosphorus and nitrogen, the same compounds found in commercial fertilizers. Sediment, and its associated nutrients, are deposited in streams, marshes, Lake Mendota, and other small lakes in the watershed. Nonpoint source pollution in the Lake Mendota watershed has led to a general decrease in the quality of the lake and its tributaries. The decrease over time in the number of wetlands, through ditching and conversion to cropland or development, has contributed to decreased water quality and unstable base flow fluctuations.

Other sources of nonpoint pollutants in a watershed originate from streambank erosion and some gully erosion resulting in sediment deposition in the stream or lake.

The *Nonpoint Source Pollution Control Plan for the Lake Mendota Priority Watershed* was prepared by the Department of Natural Resources (DNR), the Department of Agriculture, Trade & Consumer Protection (DATCP), the Dane County Land Conservation Department (LCD) and the Columbia County LCD. The DNR selected the Lake Mendota watershed as a priority watershed project in October, 1993. The Lake Mendota project joins approximately 86 similar watershed projects statewide in which runoff control measures are being planned and implemented. The DNR's Nonpoint Source Water Pollution Abatement Program was created in 1978 by the state Legislature. The program provides financial and technical assistance to landowners and local governments to reduce nonpoint source pollution.

The project is administered at the state level by the DNR and DATCP. The Dane and Columbia County LCDs will administer the project at the local level with assistance from the University of Wisconsin-Extension and the U.S.D.A. Natural Resources Conservation Service. This plan is primarily used by and written for the county LCDs, DNR, DATCP, other local units of government, legislators, external program evaluators and the interested public.

General Characteristics

The Lake Mendota watershed is a 232-square-mile drainage basin located in south central Wisconsin (Map S-1). The Lake Mendota Watershed is within the Lower Rock River Basin. It includes most of the city of Madison, some of the city of Sun Prairie, all of the city of Middleton, the villages of Arlington, Dane, DeForest, Maple Bluff, Shorewood Hills, and Waunakee, and the towns of Arlington, Bristol, Burke, Dane, Leeds, Lowville, Middleton, Morrisonville, Springfield, Vienna, Westport and Windsor. About 88% (205 sq. miles) of the watershed is in Dane County, and 12% (28 sq. miles) is in Columbia County. The watershed is largely agricultural while 20% of the land area is urban, or experiencing rapid urbanization. Approximately 4% of the watershed is wetlands. Land use characteristics ofthe watershed are shown in Table S-1.

Table S-1. Land Uses in the Lake Mendota Watershed

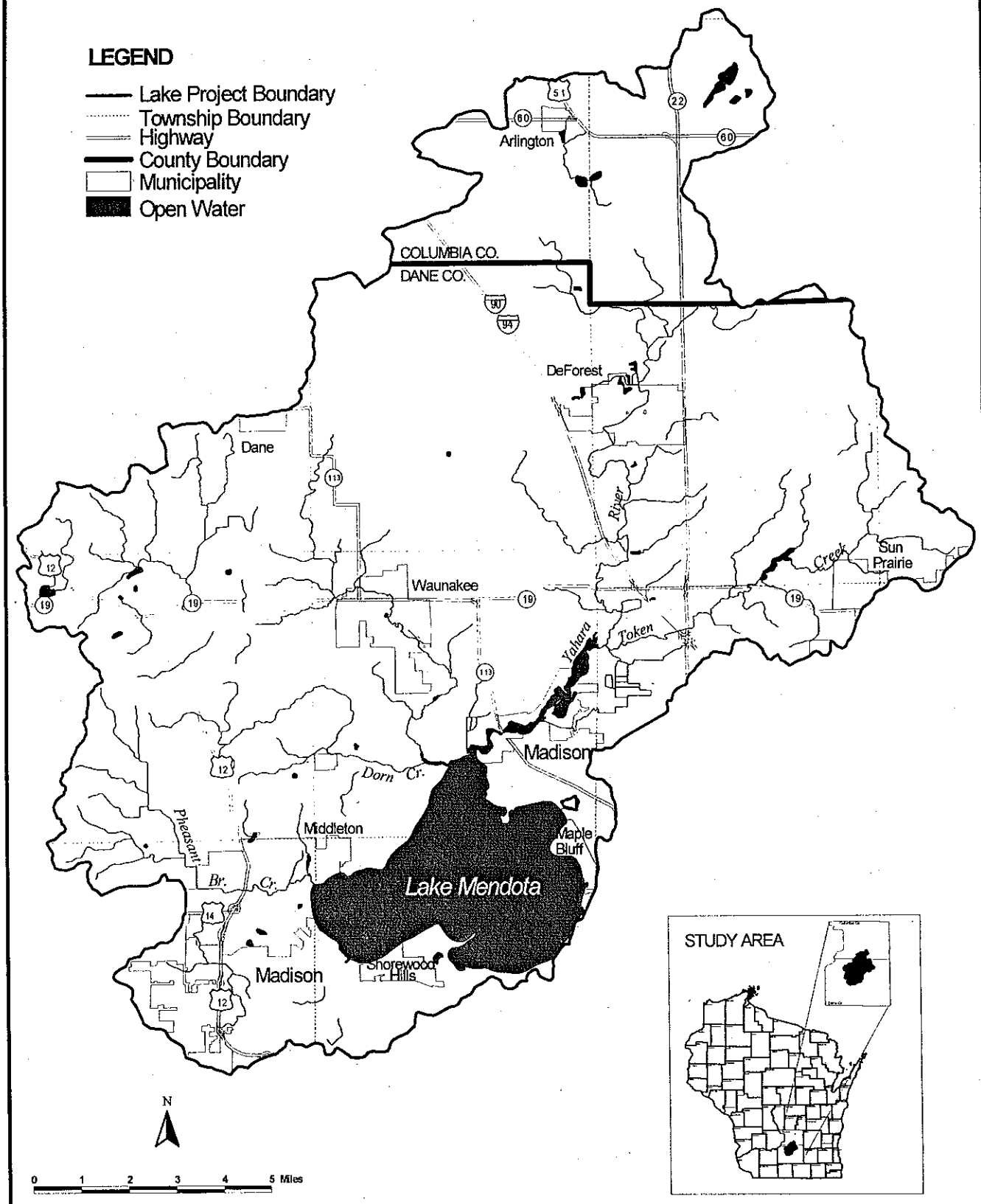
	Dane Co. Acres	Columbia Co. Acres	Total Acres	Percent
Cropland	66,105	14,190	80,295	54.0
Grassland/Wildlife/Pasture	13,960	1,420	15,383	10.3
Woodland	1,800	198	1,998	1.3
Wetland[1]	5,915	412	6,327	4.2
Open Water	11,108	60	11,168	7.5
Developed[2]	29,304	117	29,421	19.8
Internally Drained	2,806	1,353	4,159	2.8
	130,998	17,753	148,751	100

[1] Wetland acreage for Columbia County are included in categories called cropland, or natural and wildlife areas. Wetland acres for Dane County were estimated using digitized NRCS wetland maps combined with hydric soils maps.

[2] Developed acreages include 22,088 acres for the detailed analysis of Sun Prairie, Madison, DeForest, Waunakee, Middleton, and data for Dane, Morrisonville, Windsor, and Westport, 4405 acres of roads outside detailed analysis area, and 125 acres of homesteads.

Source: Dane County LCD: Data used to run WINHUSLE computer model was used
Columbia County LCD: WDNR WISCLAND data used

Map S-1. Lake Mendota Priority Lake Project



Mapscale 1:185,000

Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1999

Dairy farming accounts for the large majority of income to farmers in this watershed. The average farmer manages 229 dairy animals including heifers and young stock, 358 acres of corn, and 142 acres of alfalfa. Farming in the Lake Mendota watershed is predicted to experience only moderate growth in the near future.

The rural population of the watershed has remained relatively stable over the past 20 years. However, Dane County's population is increasing at a rate significantly higher than the state average. The overall population of Dane County has risen from 290,272 in 1970 to 325,545 in 1980 and 367,085 in 1990. Projected population for the year 2020 is 488,515.

Lake Mendota, a 10,000-acre glacial lake, is intensively used for recreational purposes including fishing and water contact sports. Excessive phosphorus loading results in noxious blue-green algae blooms and excessive weed growth. Most of the lake's water quality problems are linked to current and past rural and urban runoff carrying sediment, nutrients, and possibly toxins to the lake. About 50% of the original wetlands in the watershed have been drained or filled. A reduction in nutrient and sediment loading to Lake Mendota will likely result in improvement in the three downstream lakes in the Yahara Lake Chain--Lakes Monona, Waubesa, and Kegonsa.

There are five major tributaries that drain directly into Lake Mendota: Pheasant Branch Creek, Dorn Creek, Sixmile Creek, the Yahara River, and Token Creek. Each of these tributaries is degraded from runoff pollution. Segments of the Pheasant Branch Creek, Token Creek, and the Yahara River have restoration potential if excessive sedimentation and nutrient inputs are controlled.

Sources of Nonpoint Pollution and Inventory Process

The Dane and Columbia County LCDs collected data from 1994 through 1996 on agricultural lands, barnyards, and urban areas in the watershed. The data were used to estimate the pollutant loads from these nonpoint sources. The following is a summary of the inventory results.

Barnyard Runoff Inventory

* There were 344 barnyards that were inventoried in the watershed: 40 lots are internally drained, and 304 drain to receiving water bodies;

* An estimated 20,000 pounds of phosphorus are generated from animals in the watershed annually. Approximately 75% of that is delivered to Lake Mendota, or 15,000 pounds annually.

Nutrient Management Inventory

* Nutrient management plans were prepared for approximately 36% of all cropped acres in Dane County, or 30,691 acres, and 40% of all cropped acres in Columbia Counties, or about 5,500 acres.

* According to the Farm Practices Inventory survey completed, 50% of the farmers were applying nitrogen above levels recommended by the University of Wisconsin. 70% of farmers were applying phosphorus in excess of crop removal rates.

* Due to differences of scientific opinion, there was no determination available for phosphorus loading estimates from fields where winterspreading of manure takes place. However, some studies have put the amounts as high as 30% to 40% of the total cropland phosphorus loading coming solely from runoff of field-spread manure, whereas the remainder would come from phosphorus tied up in eroding soils.

Streambank Erosion Inventory

* Estimation of eroding streambanks was calculated using the streambank and gully erosion model from the Natural Resources Conservation Service, using air photos, maps, and field investigations.

* An estimated 728 tons of sediment erodes from streambanks annually, or about 8% of the watershed's total sediment load. About 4,608 pounds of phosphorus are delivered annually with the eroding soils to surface waters from streambank erosion.

Upland Sediment Inventory

* About 146,000 acres, or 95%, of the watershed land area was inventoried in both Columbia and Dane Counties. Updated farm plans were used as the basis of the upland inventory, and for Dane County, digital orthophotography was used.

* Almost 90,000 acres of upland (primarily cropland) drain to Lake Mendota. An estimated 35,197 tons of sediment is delivered to streams from cropland on an annual basis--2,305 tons from Columbia County and 32,892 tons from Dane County. Approximately 5,600 tons of that sediment are delivered to Lake Mendota on a annual basis or about 58% of the total load. About 35,000 pounds of phosphorus are delivered to Lake Mendota from uplands annually.

Wetlands Inventory

* A broad inventory was conducted using maps, field investigations, and aerial photographs to document existing acreage for potential wetland restoration. Between one-third to one-half of all original wetland acres has been lost in the watershed. An estimated 4,300 acres were determined to be either prior converted wetland or another potentially restorable wetland type.

Groundwater Inventory

* Samples were taken from 157 private wells in the watershed and tested for nitrates. Only 10% of the samples taken were less than the state Preventive Action Limit (PAL) of 2 mg/L for nitrates, the level at which human activity impacts groundwater. Another 26% of the samples were between 2 and 10

mg/L. An alarming 65% of the wells were above 10 mg/L, the Enforcement Standard (ES) Health Advisory Level. The sample results indicate overall very poor groundwater quality in the Lake Mendota watershed, and the health advisory recommends that certain individuals not drink their well water. When contamination is as widespread as it appears to be in the Lake Mendota watershed, runoff from excess manure and fertilizer is a likely source of nitrates in groundwater.

Urban Inventory

* A complete inventory was conducted of the five largest municipalities in the watershed using maps that were digitized to various land use types (low-density residential, institutional, commercial, industrial, open space, and freeway). The municipalities were Madison, Middleton, Sun Prairie, Waunakee and DeForest. Subwatershed boundaries were drawn based on outfalls from sewer pipes. Pollutant load coefficients, based on those derived from the Source Loading and Management Model (SLAMM), were used to determine contributions of suspended solids and phosphorus for the specified land uses within those municipalities. Projected growth was estimated for the 2020 build-out areas based on maps provided by the Dane County Regional Planning Commission and each of the municipalities.

* The number of building permits issued in recent years was used to calculate the amount of land in transition. Sediment and phosphorus loads were calculated based on the physical characteristics of the site and use of the Universal Soil Loss Equation. Future sediment loads from construction sites were based on the projected growth in the year 2020 build-out areas, and a sediment loss of 7.5 tons per acre, which assumes adoption of uniform construction site erosion control ordinances across Dane County.

* Model results show that for existing and transitional areas, 8,626 tons of sediment are delivered to streams from these municipalities, 4,675 tons of sediment are delivered to the Pheasant Branch and Cherokee Marshes. About 3,281 tons of sediment are delivered to Lake Mendota on an annual basis, or 33% of the total load. 46,530 pounds of phosphorus are delivered to streams from these municipalities, 25,813 pounds of phosphorus are delivered to the Pheasant Branch and Cherokee Marshes, and 17,651 pounds of phosphorus are delivered to Lake Mendota on an annual basis from existing urban areas and areas undergoing construction.

Lake Modeling

* Watershed modeling conducted at the University of Wisconsin Center for Limnology was used to estimate phosphorus loadings based on short-term and long-term monitoring data (1975-1996) conducted on the Pheasant Branch (Hwy 12) and Yahara River (Windsor) stations. Average total phosphorus loading to the lake was calculated to be 75,000 pounds per year of which approximately 66,000 pounds comes via surface water inputs from the watershed. The other

sources are dust and dry fallout, precipitation in the form of snow and rain, and groundwater. In-lake models were then used to predict how much the phosphorus loading should be reduced to improve the water quality of the lake. Improved water quality was expressed in terms of frequency of nuisance algae blooms. The monitored data that had been conducted by the Dane County LCD proved to be consistent with the modeled data.

Project Goals

The overall goal of the Lake Mendota Priority Watershed project is to protect, enhance, and restore the water quality of the streams, lakes, groundwater and wetlands in the 232-square mile drainage area.

Lake Mendota Objective

The water quality goal for Lake Mendota is to reduce the concentration of spring total phosphorus in the lake to less than 0.074 mg/L. Modeling results indicate that this concentration will result in a decrease in the concentration of blue-green algae to less than 2 mg/L during the summer months. This algal concentration generally represents the point at which algae form nuisance blooms (unsightly green water or surface scums). To achieve this goal, phosphorus input loading to the lake from its watershed must be reduced by about 50%, or 37,000 pounds annually. Given the current annual phosphorus loading, the likelihood on any given summer day of a nuisance algae bloom occurring is 50% of the time, or 1 out of every 2 days on average over a number of summers. With a 50% reduction in annual phosphorus loads to the lake, the likelihood of a nuisance algae bloom occurring is reduced to 20% of the time, which translates to no nuisance algae blooms 4 out of 5 days on average over a number of summers. In a year with high precipitation and hence high runoff into the lake, nuisance algal blooms would be more likely that summer, even with the implementation of recommended best management practices (BMPs).

Sediment Objective

To reduce overall sediment delivered to Lake Mendota from all sources by 50 percent. The following will need to be achieved:

* Reduce sediment delivered to the lake from agricultural uplands by at least 2,242 tons, or 40% of the existing contribution from uplands--from 5,600 tons per year to no more than 3,362 tons per year. At a minimum, all landowners should reduce or maintain soil erosion on all cropland to tolerable ("T") soil loss rates, as calculated by the Universal Soil Loss Equation (USLE). All fields that are already at "T" may initiate a water management system to further reduce erosion rates.

* Reduce streambank erosion by 50%--from about 730 tons per year to no more than 365 tons per year through the implementation of streambank protection practices such as riprap, fencing, and shaping and seeding. In addition, efforts

will be used to maintain or develop stream woodland and grassland corridors by developing buffers that provide wildlife habitat, canopy, bank stabilization, and sediment reduction.

* Reduce sedimentation contributions from existing urban areas by 40%, from transitional areas by 80%, and from future urban areas by 80%. These reductions will be achieved by increased good housekeeping practices, such as street sweeping, and through the adoption of uniform construction site erosion control ordinances across all municipalities in Dane County.

Phosphorus Objective

To reduce overall phosphorus delivered to Lake Mendota by 50%, the following will need to be achieved:

* Reduce the phosphorus delivered to streams and ultimately the lake in the watershed from soil erosion in agricultural uplands by at least 40%, from about 35,000 pounds per year going into Lake Mendota, to no more than 21,000 pounds per year. This can be achieved by reaching the sediment reduction objective.

* Reduce phosphorus loading from eroding streambanks by 50%, from about 4,600 pounds per year to no more than 2,300 pounds per year.

* Reduce phosphorus runoff from barnyards in the watershed by about 75%, from about 15,000 pounds per year to no more than 3,737 pounds per year. This can be achieved through clean water diversions and/or complete system improvement.

* Promote nutrient management as an economically and environmentally sound practice within the watershed.

* Reduce phosphorus from existing urban areas by 20%, from transitional areas by 60%, and from future urban areas by 50% through practices used to reduce sediment loads to the lake.

Groundwater Objective

To protect and enhance the groundwater resource in the Lake Mendota watershed, the following objectives will need to be achieved:

* Use nutrient management plans to reduce the over-application of commercial fertilizer and manure and the application of winterspread manure on unsuitable cropland.

* Implement BMPs as appropriate to protect and enhance groundwater quality. The highest priorities for protecting groundwater resources from runoff pollutants are where wells exceed the nitrogen standard of 10 mg/L.

* Encourage proper abandonment of unused wells per NR 120 and NR 812, Wis. Admin Code.

* Reduce over-application of pesticides.

* Provide landowners with extensive informational and educational materials to promote awareness and to instill responsibility for the groundwater resource.

* Use water conservation techniques to help decrease the flow of water out of the deeper aquifer and over-use of the upper aquifer which may be more susceptible to contamination.

Restoration Objective

To restore or enhance streams and wetlands for fish and wildlife, the following have been identified as highest priorities in the watershed:

* The wetland complex in the Pheasant Branch Creek Resource Protection Area. This resource should be enhanced as a northern pike spawning and rearing area.

* The unnamed tributary of Token Creek that originates in Windsor Township and enters into Token Creek in Burke Township. This tributary has the potential of being restored from a Class III to Class II cold water fishery.

* The reach of the Yahara River from Windsor Road upstream to the Village of DeForest. This section of the Yahara River is a priority for enhancement and protection of a warm water sport fishery.

* Goose Pond, which should be enhanced and restored as a shallow lake and wetland system.

* Token Creek which currently has a dam which will be removed by the DNR. The objective will be to restore the wetlands around the old lake bed to ensure a water view for of the all adjacent riparian landowners, to trap sediment, and to provide habitat for nesting waterfowl and other wetland species. The numerous springs in the area should be protected to preserve the wetland complex. Native brook trout of a local genetic strain could be stocked which should thrive in the restored stream with its large amount of cold spring water. A minnow species that would originally have been found in the creek and would have been associated with the brook trout population could also be re-introduced.

* Establish or restore wetlands in 27 other priority areas as delineated in the inventory.

Community Education and Action Objective

To foster understanding of runoff pollution problems and promote participation in resource protection within the Lake Mendota watershed, the following will need to be achieved:

* Translate the project goals into action items by identifying target audiences and designing a program to meet those goals by working with that audience. Target audiences are: the general audience--those who must act, those who can support, and future actors and supporters. The urban transition and established urban audiences are those involved directly in planning and developing the site, those involved during implementation of the plan, and those that can support the development of the erosion control/stormwater management plans. The rural audiences are those involved directly with land management, those involved directly with livestock animals and manure management, those who work with landowners/operators and livestock operators, and those involved in conservation courses/activities.

Table S-2. Sources of Sediment to Lake Mendota and Reduction Goals

Source	Sediment Delivered to Lake Mendota	Percent of Total	Reduction Goal (tons per year and percent)	Estimated Future Sediment Delivery (tons per year)
Uplands	5,604	58%	2,242 tons 40%	3,362
Streambanks	728	8%	364 tons 50%	364
Transitional Areas	2,198	23%	1,758 80%	440
Existing Urban	1,083	11%	433 40%	650
Total	9,613	100%	4,797 50%	4,816

Table S-3. Phosphorus Delivery to Lake Mendota and Reduction Goals

Source	Phosphorus Delivered to Lake Mendota	% of Total	Reduction Goal (pounds per year and percent)	Estimated Future Load (pounds per year)
Uplands	35,030	48%	14,012 (40%)	21,018
Streambanks	4,608	6%	2,304 (50%)	2,304
Barnyards	14,986	21%	11,240 (75%)	3,747
Transitional Areas	13,911	19%	8,347 (60%)	5,564
Existing Urban	3,740	5%	748 (20%)	2,992
Total	72,275	100%	36,650 (51%)	35,625

Critical Sites

Nonpoint source pollutant load reduction in the Lake Mendota Priority Watershed project will be achieved mainly through voluntary participation. However, state statutes require that this plan contain the necessary language to ensure the reasonable likelihood of achieving water quality goals and objectives. Landowners with sites that meet the established critical site criteria are required by law to address those specific sites by reducing the runoff pollutant load to an acceptable level. Pollutant reduction can occur solely through the action of the landowner with guidance from county staff or through watershed cost-sharing participation. Each identified site will be field-verified before receiving notification as a critical site, with the findings sent to the DNR. Landowners interested in receiving cost-share assistance for installing best management practices will need to sign a cost-share agreement with either the Dane or Columbia County LCDs, depending where they reside.

Notification of landowners with critical sites will begin when Dane and Columbia County LCD staff have the ability to identify individual fields for specific management categories on the FOCS/WINHUSLE database or through the BARNY computer model for barnyard sites. Urban critical sites will be identified by Dane County or by the municipality through appropriate modeling. The highest ranked sites will be notified first until all landowners or land operators with critical sites are notified. The notification will include the following information:

* The 36-month period in which landowners are eligible for the maximum cost-share rate of 70% of the total eligible cost, after which the cost-share rate decreases by 50 percent.

* The potential consequences of either Wisconsin Administrative Code Chapter NR 243 for animal waste, or s. 281.20(1)(3)(5), (or current code) for sediment delivery and groundwater protection, that landowners may face if no action is taken. Some of these include a notice of discharge, requiring of a WPDES permit, or issuing a notice of intent.

* The right to appeal the critical site designation through written request to the county Land Conservation Committee (LCC) within 60 days of receiving the notification letter. The LCC shall limit its appeal consideration to whether the critical site designation is consistent with critical site criteria established in the nonpoint source control plan.

Impact and Scope of Critical Sites

* Of the 344 inventoried barnyards that drain to surface waters, 10 are designated as critical sites for control which will result in a minimum reduction of 25% of the barnyard phosphorus objective. At a minimum, land owners must implement clean water diversion practices, but they are eligible for cost sharing to install full systems.

* Of the 89,000 estimated acres of cropland in the watershed that drain to Lake Mendota, 1,670 acres are designated as critical for sediment control which will achieve 25% of the pollution reduction objective for sediment.

* In the urban areas, all transitional areas as identified in the year 2020 build-out plan that exceed 7.5 tons/acre/year in soil loss are identified as critical sites. Correction of these sites will be through enforcement of uniform construction site erosion control standards throughout Dane County.

* Other critical sites in urban areas are identified as those that directly discharge into Lake Mendota or other surface waters and deliver pollutants to that water body according to the following formula: outfalls with a ratio of sediment (tons) to land area (acres) that is greater or equal to 0.2 and where best management practices are identified through a feasibility study. The inventory should be completed during the first three years of the implementation period.

Management Actions

The Dane County and Columbia County LCD staff will contact all landowners who are eligible to receive cost sharing during the project's 10-year implementation period. Management categories are determined based on the level of pollution control needed to achieve water quality objectives in the watershed. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that specific source is necessary if the pollutant reduction goals for the project are to be met. Nonpoint sources which are eligible, but not critical, contribute less of the pollutant load, but are included in cost sharing eligibility to further ensure that water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost-share assistance.

The Dane County and Columbia County LCDs will assist landowners in applying BMPs. Practices range from alterations in farm management (such as changes in manure spreading and crop rotations) to engineered structures (such as clean water diversions, or sediment basins), and are tailored to specific landowner situations. Municipalities are eligible to apply for and receive grants for nonstuctural practices, such as ordinance development and enforcement, and structural practices, such as wet detention basins.

Barnyard Runoff

To maintain cost effectiveness, only those landowners with barnyard sites delivering more than 50 pounds but less than 260 pounds of phosphorus to surface water on an annual basis will be eligible for a complete barnyard runoff management system (102 yards). Barnyard runoff management is the use of structural measures such as gutters, downspouts and diversions to intercept and redirect surface runoff around the barnyard, feeding area or farmstead, and collect convey and temporarily store runoff from the barnyard, feeding area or farmstead. Landowners with barnyards delivering more than 15 pounds but less than 50 pounds of phosphorus annually will be eligible to receive barnyard runoff management systems for clean water diversion work only (120 yards). Landowners with barnyards delivering less than 15 pounds of phosphorus annually are not eligible to participate.

Table S-4. Barnyard Runoff Objective: To Reduce Pollution by 75%

Management Category	Phosphorus (lbs./year)	Number of Barnyards	P Controlled (lbs./year)
Critical	> 260	10	3,344[1]
Eligible for full systems	> 50 but <260	102	11,136[2]
Eligible: Clean Water Diversion only	>15 and <50	120	
Not Eligible	< 15	72	-

[1] This reduction represents clean water diversion work only.
[2] This reduction represents full system installation.

Cropland Erosion

Erosion from upland areas accounts for about 58% of the overall sediment loading to Lake Mendota. The large majority of all cropped acres are eroding at "T." Thus, priority will be placed on bringing all fields eroding at levels greater than "T" down to "T". Water management systems will be initiated on some fields that are eroding at "T" or less. These water management systems would provide extra protection during times when weather conditions reduce residue remaining after planting. Additionally, new technologies, such as the use of polyacrilamides (PAMs), may be used to complement existing conservation practices.

All fields that are eroding at levels greater than "T" and that are delivering sediment to Lake Mendota at a rate greater than 1.3 tons/acre/year will be targeted as critical sites.

Table S-5. Cropland Sediment Objective: To Reduce Sediment Loading by 40%

Management Category	USLE/Sediment Delivery (tons/acre/yr.)	Acres	Tons of Sediment Reduced
Critical	> T soil loss and > 1.3 delivered	1,670	470
Eligible	> T or > 0.2 delivered	50,630	2,788

Streambank and Gully Erosion

Because gully and streambank erosion have not been determined to be significant nonpoint sources in the Lake Mendota watershed, critical site designation will not be a component of control for these areas. However, all active gullies and all trampled streambanks will be eligible to receive cost-share assistance to abate the runoff of sediment into intermittent or continuous streams.

Project Implementation

Project implementation is scheduled to begin in June 1997 and continue for a period of 10 years. Implementation will consist of continuous educational programs for watershed residents, individual farm conservation planning, the signing of cost-share agreements, and practice installation.

Project Implementation Costs

The DNR will award grants to Dane County and Columbia County and to all eligible municipalities or other eligible grantee, such as lake districts, for the cost sharing of BMPs, staff support, and educational activities. Tables S-4 and S-5 present estimates of the financial assistance needed to implement nonpoint pollution controls in the Lake Mendota watershed, assuming a 75-percent participation rate of eligible landowners and a 100-percent participation rate on critical sites. Table S-6 shows the total estimated budget for the entire watershed management project.

An economic evaluation of the potential benefits of water quality improvements to Lake Mendota was conducted.. Results show that there will be an economic benefit of $2,604,800 annually to the watershed community from having implemented BMPs in urban and rural areas.

Table S-6. Project Costs: Lake Mendota Watershed - Rural only at 75% Participation

Activity	State Share		Local Share		Total Cost
	Dane County	Columbia County	Dane	Columbia	
Cost-Share Funds: Practices	$4,016,681	$366,938	1,768,256	160,388	6,312,263
Cost-Share Funds: Easements	187,500	0	0	0	187,500
Land Acquisition	281,250	0	281,250	0	562,500
Local Assistance Staff Support	1,470,892	245,340	0	0	1,716,232
Information/Education Activities (staff not incl.)	50,500	8,000	0	0	58,500
Other (travel, supplies, etc.)	187,200	20,800	0	0	208,000
Engineering Assistance	0	0	0	0	0
Sub-Total	$6,194,023	$641,078	$2,049,506	$160,388	$9,044,995
Total	$6,835,101		$2,209,894		$9,044,995

Table S-7. Project Costs - Lake Mendota Priority Watershed - Urban Only at 75% Participation

Project Element	State Share	Local Share	Total Cost
Developing Urban Areas			
Construction Site BMPs	$0	$1,875,000	$1,875,000
Planned Urban Areas			
Storm Water Management Plans	25,200	10,800	36,000
Storm Water Management BMPs	0	$3,750,000	3,750,000
Existing Urban Areas			
Feasibility Studies	78,750	33,750	112,500
Structural BMPs	1,575,000	675,000	2,250,000
Information & Education			
Urban Staffing	178,500	571,500	750,000
TOTAL	$1,857,450	$6,916,050	$8,773,500

Table S-8. Total Budget - Lake Mendota Priority Watershed - 75% Participation

	State Share	Local Share	Total
Rural Total	$6,835,101	$2,209,892	$9,044,995
Urban Total	$1,857,450	$6,916,050	$8,773,500
Total	$8,692,551	$9,125,944	$17,818,495

Project Evaluation and Monitoring

The evaluation strategy for the project involves collecting, analyzing and reporting information to track progress in four areas:

1. *Administrative:* This category includes the progress in providing technical and financial assistance to eligible landowners, and carrying out education activities identified in the plan. The Dane County and Columbia County LCDs will track progress in this area and report to the DNR and DATCP annually.

2. *Pollutant Reduction Levels:* The Dane County and Columbia County LCDs will calculate the reductions in the nonpoint source pollutant loadings resulting from changes in land use practices and report to the DNR and DATCP during the annual watershed review meeting.

3. *Water Resources:* The DNR may monitor changes in water quality, habitat, and water resource characteristics periodically during the project and at the end of the project period.

4. *LTER*: Lake Mendota will continue to be monitored on a regular basis through the University of Wisconsin, Center for Limnology, as part of the Long Term Ecological Research (LTER) Program.

CHAPTER ONE
Purpose, Legal Status and General Description

Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources. The 230-square-mile Lake Mendota watershed, located in Dane and Columbia Counties, was designated a "priority watershed" in October 1993. The primary objective of this project is to reduce sediment and phosphorus loads to Lake Mendota and to enhance and protect the water quality of the streams, groundwater, wetlands and other lakes in the watershed. The Lake Mendota Priority Watershed is part of the Lower Rock River Basin.

Nonpoint sources of pollution in the watershed include: eroding agricultural lands, eroding streambanks, runoff from livestock wastes, agricultural practices, erosion from construction sites, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through rainfall runoff or seepage, and snowmelt.

The Department of Natural Resources (DNR) administers the Nonpoint Source Priority Watershed Program in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP). Wisconsin is divided into 333 discrete hydrologic units called watersheds. These watersheds are assessed for water quality concerns as part of a comprehensive basin planning program. Watersheds with a high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Since 1978, 87 priority watersheds have been selected. A total of 24 watersheds (large and small-scale) have been completed, and 63 are underway in either the planning or implementation phase. Designation as a priority watershed project enables special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution.

A priority watershed project is guided by a plan such as this one, prepared cooperatively by the DNR, DATCP and local units of government, with input from a local citizen's advisory committee. Project staff evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed.

The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to meet specific water resource objectives. The plan guides implementation of these practices in an effort to improve water quality.

Upon approval by state and local authorities, local units of government implement the plan. Water quality improvement is achieved through mandatory and voluntary implementation of nonpoint source controls (BMPs) and the adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, sanitary districts, lake districts and regional planning commissions are eligible to participate.

Technical assistance is provided to aid in the design of BMPs. State level cost-share assistance is available to help offset the cost of installing these practices. Eligible landowners and local units of government are contacted by the local staff to determine their interest in installing the BMPs identified in the plan. Signed cost-share agreements list the practices, costs, cost-share amounts and a schedule to install management practices. Municipal governments are also assisted in developing and installing BMPs to reduce urban pollutants.

Informational and educational activities are developed to encourage participation.

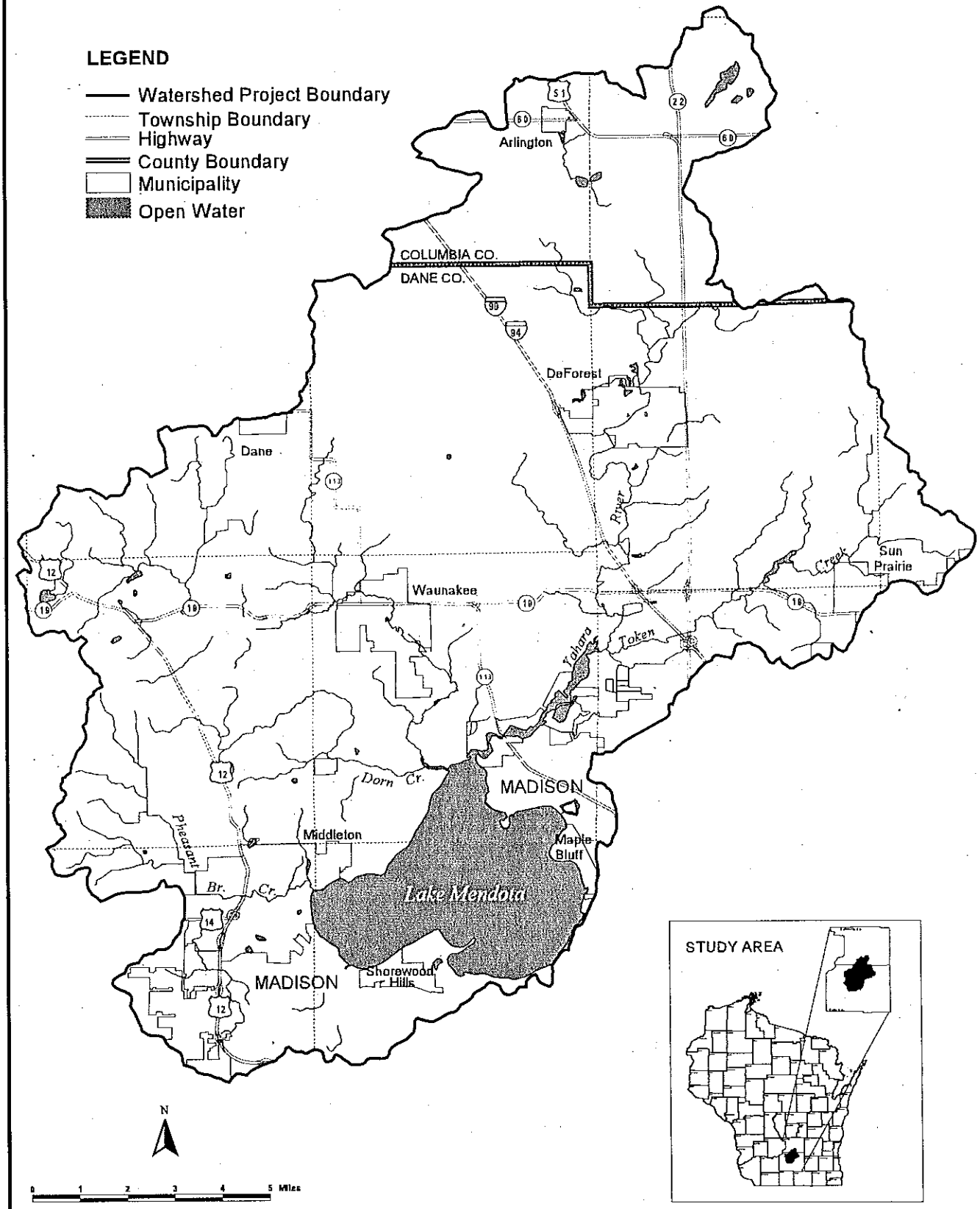
The DNR and DATCP review the progress of the counties and other implementing units of government, and provide assistance throughout the ten-year project. The DNR monitors improvements in water quality resulting from control of nonpoint sources in the watershed.

Legal Status of the Nonpoint Source Control Plan

The Lake Mendota Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 281.20 and 281.65 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared through the cooperative efforts of the DNR, DATCP, the Land Conservation Departments for Dane and Columbia Counties, the major municipalities, and the Lake Mendota Citizen Advisory Committee.

This watershed plan is the basis for the DNR to enter into cost-share agreements and local assistance grants with agencies responsible for project implementation and will be used as a guide to implement measures to achieve desired water quality conditions. If a discrepancy occurs between this plan and the statutes or the administrative rules, or if statutes or rules change during implementation, the statutes and rules will supersede the plan. This watershed plan does not in any way preclude the use of normal regulatory procedures developed to protect the environment by local, state or federal governments. All local, state and federal permit procedures must be followed. In addition, this plan does not preclude the DNR from using its authority under chapters 281, 283, 285, 289, 291, 292, 293, 295 and 299 of the state statutes to regulate significant nonpoint pollution sources in the project area.

Map 1-1. Lake Mendota Priority Watershed Project



Mapscale 1:185,000

Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1999

This priority watershed plan was approved by DNR in June 1997, following approvals by the Land and Water Conservation Board, and the Dane County Board of Supervisors and the Columbia County Board of Supervisors.

Amendments to the Plan

This plan is subject to the amendment process under NR120.08(4) for substantive changes. The Department of Natural Resources will make the determination with the local sponsors if a proposed change will require a formal plan amendment.

Relationship of the Nonpoint Source Control Plan to the Stormwater Discharge Permit Program

Wisconsin's Pollution Discharge Elimination System (WPDES) Storm Water Permit Program is administered by DNR's Bureau of Wastewater Management under Chapter 147 of the Wisconsin Statutes and Chapter NR 216, Wisc. Admin. Code. This program is regulatory in nature and not grant dependent. It applies to certain classes of dischargers statewide as identified in NR 216. However, in some cases permit activities are similar to activities identified in the watershed plan. If this is true, then nonpoint source implementation grants can be used to fund permit activities. Examples include: construction site erosion control, stormwater ordinance development and stormwater management plans. Practices to control construction site erosion and storm water runoff from new development are not eligible for cost sharing. In industrial areas, cost sharing is available as specified in NR 120.17 — only in the non-industrial parts of facilities where a problem has also been identified in the priority watershed plan.

The City of Madison and the University of Wisconsin are currently permit holders under the municipal WPDES program. It is anticipated that suburban communities around Madison, and perhaps Dane County itself, will also be named as permitees at some point during the implementation phase of the Lake Mendota Priority Watershed Program.

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the Lake Mendota project began in 1994. The following information gathering and evaluation activities were completed during this stage:

- Determine the conditions and uses of groundwater, streams and lakes,
- Inventory types of land uses and severity of nonpoint sources affecting groundwater, streams and lakes,

- Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions. (This has been completed through the ongoing integrated resource management planning efforts in the Lower Rock River Basin.),

- Determine nonpoint source controls and other measures necessary to improve and/or protect water quality,

- Determine the economic benefit of improving the water quality of Lake Mendota, and

- Prepare and gain approval of a program for local implementation of the project so that plan recommendations would be carried out.

Implementation Phase

The implementation phase of the Lake Mendota Priority Watershed Project began following review of the draft priority watershed plan, a public hearing and approval by the Board of Supervisors for Dane County and Columbia County, by the LWCB, and finally, the DNR . Public review during plan development occurred primarily through the efforts of the Lake Mendota Citizen Advisory Committee. The counties were awarded their first nonpoint source grants allowing them to sign cost-share agreements in January 1998.

During the implementation phase:

- DNR enters into local assistance agreements with local units of government that have implementation responsibilities identified in the plan. These agreements provide funds necessary to maintain the resources and staff required for plan implementation,

- In the rural portions of the watershed, the Dane County LCD and the Columbia County LCD contact eligible landowners to determine their interest in installing best management practices identified in the plan,

- In the urban portions of the watershed, the DNR, the local project manager or another designee contacts local units of government to discuss in detail the required actions for implementing the plan recommendations,

- In rural areas, the landowner signs a cost-share agreement with the county that outlines the practices, costs, cost-share amounts and a schedule for installation of management practices. Practices are scheduled for installation after an agreement is signed. Practices must be maintained for at least 10 years. Easements purchased by the county must be for a period of at lease 20 years. Easements purchased by the DNR must be perpetual, and

- In urban areas, similar processes are used. In some cases, the local units of government and the DNR sign agreements for urban practices. In other cases the agreements will be between local units of government and their private landowners.

Location, Land Use and Community Information

The Lake Mendota watershed is a 232-square-mile drainage basin located in south central Wisconsin (see Map 1-1). The Lake Mendota Watershed is within the Lower Rock River Basin. About 88% (205 sq. miles) of the watershed is in Dane County, and 12% (28 sq. miles) is in Columbia County. The watershed is largely agricultural--most of the agricultural land is cropland while 20% of the land area is urban or experiencing rapid urbanization. Approximately 4.4 percent of the watershed is wetlands. There is much public land within the watershed. Lake Mendota itself is almost 10,000 acres, or 15-square miles.

Map 1-2 and Table 1-1 illustrate the various land uses in the Lake Mendota watershed. The Dane County land use/land cover information was derived from data used to run the WINHUSLE computer model. Columbia County land use/land cover data are from the DNR WISCLAND project, the Wisconsin Iniative for Statewide Cooperation on Landscape Analysis and Data, a partnership of public and private organizations seeking to facilitate landscape GIS data development and analysis.

Agricultural Characteristics

Dairy farming accounts for the large majority of income to farmers in this watershed. The average farmer manages 229 dairy animals including heifers and young stock, 358 acres of corn, and 142 acres of alfalfa (Nowak, et. al 1996a). Farming in the Lake Mendota watershed is predicted to experience only moderate growth in the near future.

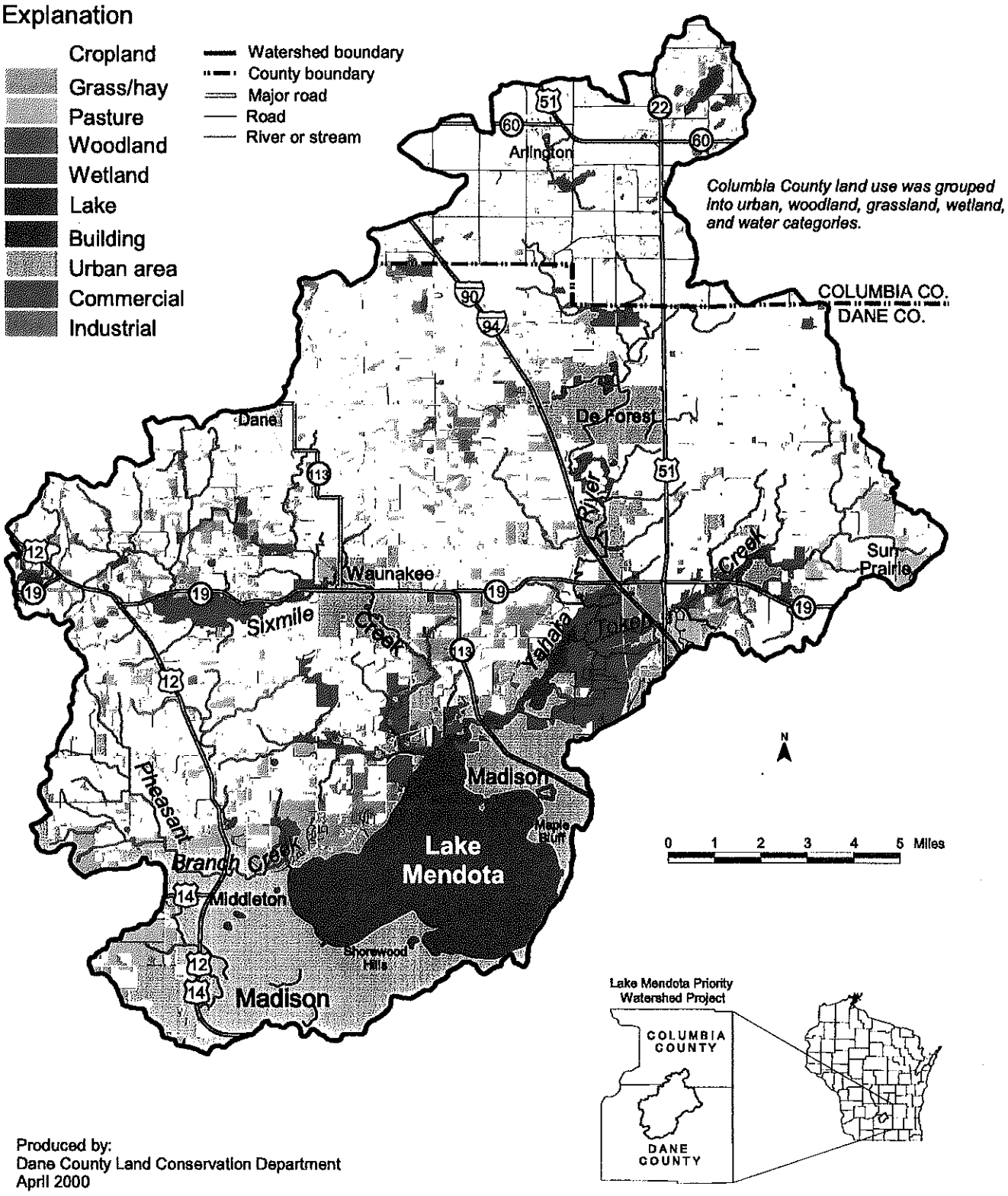
Civil Divisions

The Lake Mendota Watershed lies within Dane and Columbia Counties. Incorporated areas in the watershed include the cities of Madison, Middleton, and Sun Prairie, and the villages of Arlington, Dane, DeForest, Maple Bluff, Morrisonville, Shorewood Hills, and Waunakee. Also included in the watershed boundaries are the towns of Arlington, Bristol, Burke, Dane, Leeds, Lowville, Middleton, Springfield, Vienna, Westport and Windsor.

Population Size and Distribution

The rural population of the watershed has remained relatively stable over the past 20 years. However, Dane County's population currently is increasing at a rate significantly higher than the state average. The overall population of Dane County has risen from 290,272 in 1970 to 325,545 in 1980 and 367,085 in 1990; projected population for the year 2020 is 488,515 (Dane Co. RPC, 1997). The population growth has significant environmental impacts

Map 1-2. Land Use in the Lake Mendota Priority Watershed Project



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April 2000

Table 1-1. Land Uses in the Lake Mendota Watershed

	Dane County Acres	Columbia Co. Acres	Total Acres	Percent
Cropland	66,105	14,190	80,295	54.0
Grassland/ Wildlife/Pasture	13,960	1,420	15,383	10.3
Woodland	1,800	198	1,998	1.3
Wetland[1]	5,915	412	6,327	4.2
Open Water	11,108	60	11,168	7.5
Developed[2]	29,304	117	29,421	19.8
Internally Drained	2,806	1,353	4,159	2.8
	130,998	17,753	148,751	100

[1] Wetland acreage for Columbia County are included in categories called cropland, or natural and wildlife areas. Wetland acres for Dane County were estimated using digitized NRCS wetland maps combined with hydric soils maps.

[2] Developed acreages include 22,088 acres for the detailed analysis of Sun Prairie, Madison, DeForest, Waunakee, Middleton, and data for Dane, Morrisonville, Windsor, and Westport, 4405 acres of roads outside detailed analysis area, and 125 acres of homesteads.

Source: Dane County --LCD: Data used to run WINHUSLE computer model was used
Columbia County LCD: WDNR WISCLAND data used

including the loss of agricultural land, increased sedimentation to waterbodies during construction periods and often major changes in land use patterns.

The largest residential populations are in Madison and Middleton. Residental areas in the surrounding communities are growing rapidly. The largest concentration of industrial land is in the City of Middleton. Detailed information about the municipalities and their land uses is presented in Table 1-2. It is anticipated that there will be increases in all developed land uses over the next 20 years, particularly for industrial, commercial, and residential land uses. This is shown in both Table 1-3 and Map 1-3.

Table 1-2. Urban Land Uses for Specific Subwatersheds in Dane County in the Lake Mendota Watershed - 1996

Sub-watershed	Municip-ality	Land Use in Acres						
		Resid-ential	Comm	Ind	Hwy	Inst	Urban Open Space	Total Acres
Yahara River	DeForest	956	83	159	139	75	469	1881
Pheasant Branch Creek	Middleton	3992	660	298	309	16	2568	7842
Token Creek	Sun Prairie	927	101	16	29	10		1083
Sixmile Creek	Waunakee	945	252	123	33	106	304	1762
	Madison	4818	804	56	727	318	2796	9520
	Total	11,638	1900	652	1236	525	6137	22089

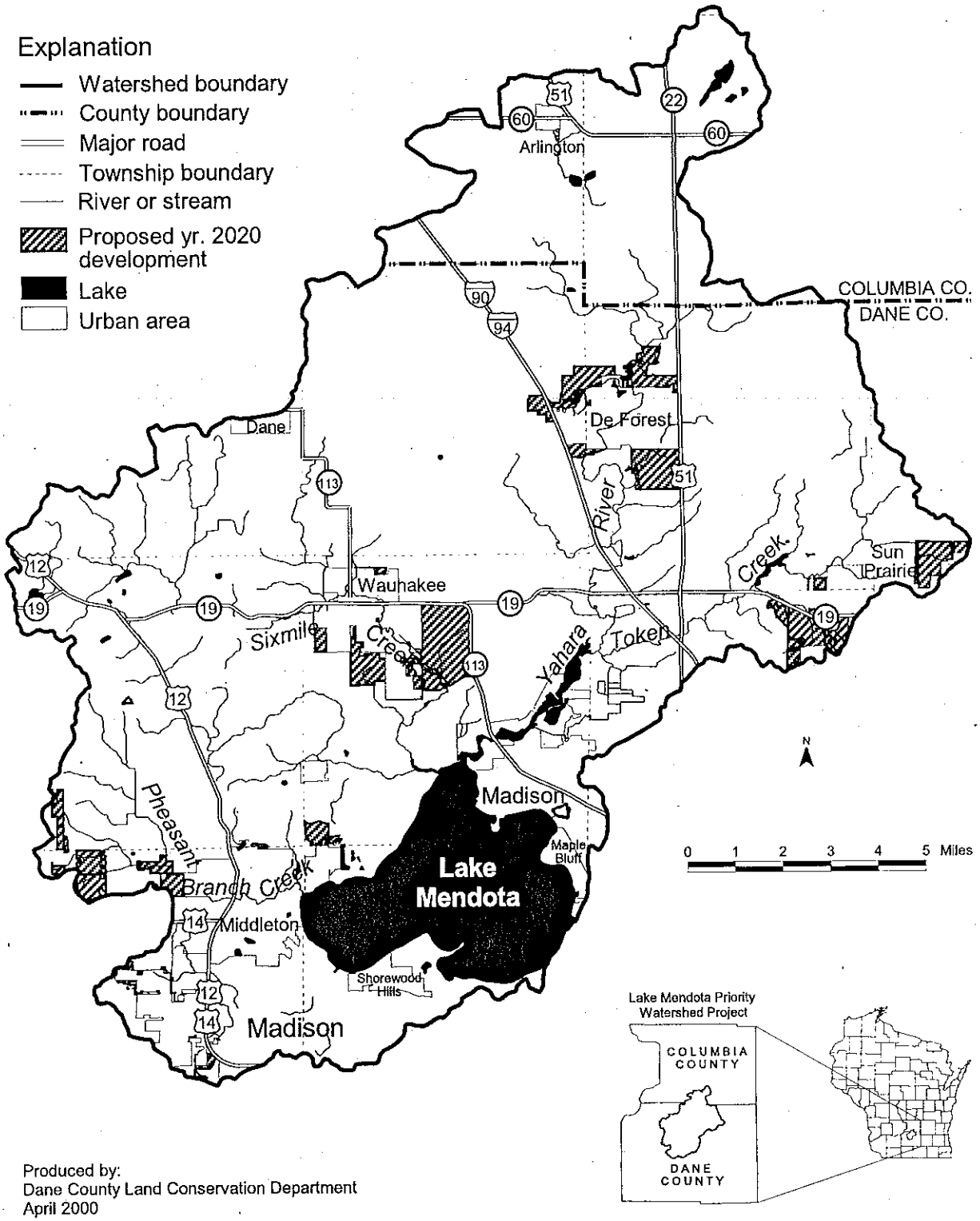
Residential = Low, medium and high densitiy
Hwy = Highway
Inst = Institutional (e.g. schools, hospitals etc.)
Urban Open Space = Urban parks residential
Comm = Commercial
Ind = Industrial

Table 1-3. Increases in Urban Land Use in Specific Subwatershed in Dane County in the Lake Mendota Watershed - 1996 - 2020

Land Use Category	1996		Planned Increase		Year 2020	
	Acres	% of Total	Acres	% Change	Acres	% of Total
Residential	11,637	53%	5,701	+49%	17,338	54%
Commercial	1,900	9%	1,818	+96%	3,717	12%
Industrial	652	3%	1,136	+174%	1,788	6%
Governmental, Institutional	525	2%	228	+43%	753	2%
Transportation, Communication, Utilities	1,236	6%	206	+17%	1,443	4%
Open Space	6,137	28%	959	+16%	7,097	22%
Totals	22,087		10,048		32,136	

Source for Table 1-2 and 1-3: Dane Co. LCD

Map 1-3. Proposed Development by Year 2020 in the Lake Mendota Priority Watershed Project



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CHAPTER TWO
Watershed Conditions and Nonpoint Sources of Pollution

The Lake Mendota watershed was ranked "high" in the DNR's Lower Rock River Basin Plan (1991), indicating that Lake Mendota was capable of responding positively to reduced pollutant loadings. As such, the watershed was selected as a "priority" watershed and was able to receive technical and financial assistance from the state. The first step was to conduct a thorough inventory of all the water resources within the 233-square mile area. This included lakes, streams, groundwater, and wetlands. The water resources appraisal work presented in this chapter was conducted during the planning phase of this project. The purpose of the appraisal was to characterize existing and potential conditions of water resources, identify causes of surface water use impairments, and provide preliminary goals and objectives for these water resources. There are five major tributaries that drain directly into Lake Mendota: Pheasant Branch Creek, Dorn Creek, Sixmile Creek, the Yahara River and Token Creek. There are four lakes: Lake Mendota, Brandenburg Lake, Goose Lake, and Lake Windsor. Schoenberg Marsh, while technically a deep water marsh, is also considered a navigable waterway.

Physical Setting

Climate and Precipitation

The frequency, duration and amount of precipitation influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics and the physical condition of waterways. The Lake Mendota watershed lies in the continental zone which is characterized by winters that are long and relatively cold and snowy, and summers which are mostly warm with periods of hot humid conditions. Mean annual precipitation for the region is about 33 inches of rain and melted snow; the majority falls in the form of thunderstorms during the growing season (May-September). Most runoff occurs in February, March and April when the land surface is frozen and soil moisture is highest.

Physiography

The relief in the region is largely controlled by moraines. Sometimes called "The Yahara River Valley," the area represents the far western edge of the last glacier advancement. The last ice age left glacial deposits up to 350 feet deep. These deposits ultimately dammed up the existing, larger preglacial valleys, forming the Yahara chain of lakes. The resulting glacial retreat also left small ponds or wetland areas within the watershed. This region is

typically flat with gentle undulating hills throughout. The gentle relief resulted in slower moving streams and rivers than those which lie in the Driftless Area. The watershed area has rich soils and constitutes one of the country's major agricultural districts.

Soils

Soils in the Lake Mendota watershed formed in Late Wisconsin Age deposits. They developed in lacustrine silt and clay, fluvial sand and gravel and gravelly sandy loam till of the Horicon formation in an area covered with ice of the Green Bay lobe. The soils are mostly well- to moderately-well drained, with the exception of the Houghton series which are poorly drained muck soils.

The watershed is comprised primarily of three soil associations: the Dodge-St. Charles-McHenry association, the Plano-Ringwood-Griswold association, and the Batavia-Houghton-Dresden association. The Dodge-St. Charles-McHenry association and the Plano-Ringwood-Griswold association consist of soils formed mainly in wind-blown deposits of silt loam underlain by gravelly sandy loam till. The Dodge-St. Charles-McHenry association formed under forested or savanna vegetation and generally has steeper slopes than the soils of the Plano-Ringwood-Griswold association which formed under prairie vegetation. Erosion is a hazard on soils of these associations.

The Batavia-Houghton-Dresden association consists of soils developed in silty deposits or organic material underlain with sand and gravel outwash or silty or clayey lacustrine deposits. Erosion is a hazard on the Batavia and Dresden soils. Houghton is a hydric soil.

Water Resource Conditions and Goals

Water resource specialists from the DNR divided the water resources of the watershed into four categories: Lake Mendota itself, streams and other surface waters, groundwater and wetlands. This section presents the results of the water resources inventory, including the general conditions of the surface water, groundwater and wetland resources. It describes the classifications used for Wisconsin's waters, then describes the surface water and recreational resources in the watershed. Descriptions of subwatersheds are also included and several tables provide summaries of the watershed's resources. A detailed report entitled "Lake Mendota Priority Watershed Surface Water Resource Appraisal Report" is available from the DNR (Sorge, 1996). This report provided the background materials presented in this section. Table 2-2, on page 2-32, summarized the information that follows on the next 30 pages in a tabular format.

Subwatershed Discussions[1]

There are eleven subwatersheds in the Lake Mendota watershed (Map 2-1). Table 2-1 shows the size of these subwatersheds, and shows internally drained acreages. There are seven "pockets" or areas that are internally drained in the northern third of the Lake Mendota watershed. The total land area is 4,145 and the primary land use is agriculture. Most of these areas are cash cropped with some dairy farms mixed in. Some of the acres were once wetlands that have been since converted to cropland. During wet years these areas are unable to be farmed due to the nature of the soils and the high water table. Waterfowl use these areas during their spring and fall migrations. Brood rearing occurs in these areas during wet periods.

A detailed survey was conducted on all the water resources of all eleven subwatersheds and Lake Mendota. Table 2-1 shows the size of the land areas per subwatershed. The results of the water resources survey are presented in the following section.

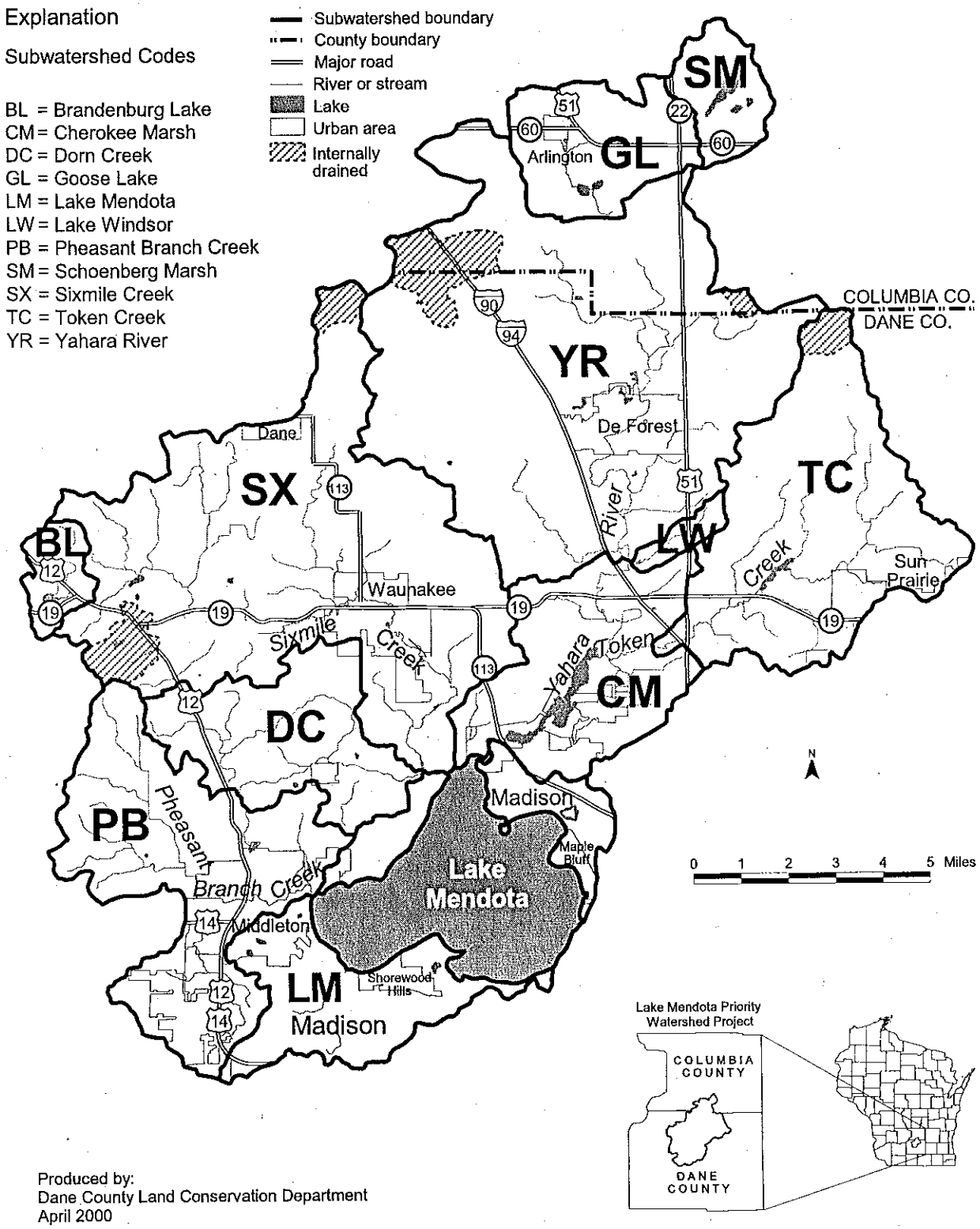
Table 2-1. Subwatershed Size in the Lake Mendota Watershed

Subwateshed	Non-Internally Drained Acres	Internally Drained/Lake Mendota	Total	Percent of Total Watershed
Lake Windsor	778	0	778	0.5
Token Creek	15,629	543	16,172	10.9
Yahara River	34,133	2045	36,178	24.3
Cherokee Marsh	10,307	0	10,307	6.9
Brandenburg Lake	1,690	0	1,690	1.1
Sixmile Creek	29,075	1,571	30,646	20.6
Dorn Creek	8,289	0	8,289	5.6
Pheasant Branch Creek	14,963	0	14,963	10.0
Lake Mendota	11,231	9,842	21,073	14.2
Schoenberg Marsh	0	2800	2800	1.9
Goose Lake	0	5,855	5,855	3.9
Total	126,095	22,656	148,751	

Source: Dane County Land Conservation Department

[1]This section was prepared by Mike Sorge, DNR.

Map 2-1. Subwatersheds in the Lake Mendota Priority Watershed Project



Schoenberg Marsh Subwatershed (SM)

Description

Schoenberg Marsh is located in south-central Columbia County (Map 2-2) in the township of Leeds. The Schoenberg Marsh Subwatershed is 4.4 square miles which is 7.6% of the total watershed. Since the marsh is internally drained, it does not impair water quality of adjacent subwatersheds. Land use is primarily agricultural, followed by wetlands, pasture and residential development. The actual wetland of Schoenberg Marsh is classified as a deep water marsh and is considered to be a navigable waterway with an open water area of roughly 120 acres and a maximum depth of 3 feet. The U.S. Fish and Wildlife Service owns 350.5 acres of land that are open for public access.

Water Quality Conditions

The major loading source of sediment and nutrients is from agricultural activities. U.S. Fish and Wildlife Service management has concentrated on establishing grasslands and legume grass cover around the perimeter of the wetland. Studies have shown that spring breeding pair numbers of waterfowl have increased since cover was improved. This area is designated as a Waterfowl Production Area. The main source of nutrient loading is coming from the northwest corner of the wetland via a narrow grassed waterway. The rest of the perimeter is considered to be well buffered and stable.

The main wetland plant species include cattail, bulrush, and sedges. The open water area of this wetland is approximately 120 acres and has a maximum depth of 3 feet. The fishery of this wetland consists of brown bullhead and fathead minnow. Historically, the open water area has experienced winterkills due in part to its shallow depth, heavy ice cover and the high oxygen demand from decomposing plant and organic materials. The main concern with this subwatershed will be to maintain and enhance this large wetland.

Nonpoint Source Pollutants

- The Schoenberg Marsh Subwatershed contains 3 animal lots which generate 103 pounds of phosphorus annually. All of these are internally drained.
- Although it is estimated that uplands in the Schoenberg Marsh Subwatershed erode at a rate of 113 tons annually, none of that soil reaches Lake Mendota. The watershed is internally drained.

Water Resource Objectives

The following objectives are recommended for the surface water resources for the Schoenberg Marsh Subwatershed:

1. Reduce sediment and nutrient loading by a **medium** level from agricultural fields. Specifically, stabilize the NW corner of the wetland, by improving the grass waterway and practice soil loss prevention through conservation tillage.

2. Continue to maintain and enhance the wetlands and surrounding uplands. Restore native grasslands and legume cover to increase habitat for waterfowl and other species of wildlife.

Goose Lake Subwatershed (GL)

Description

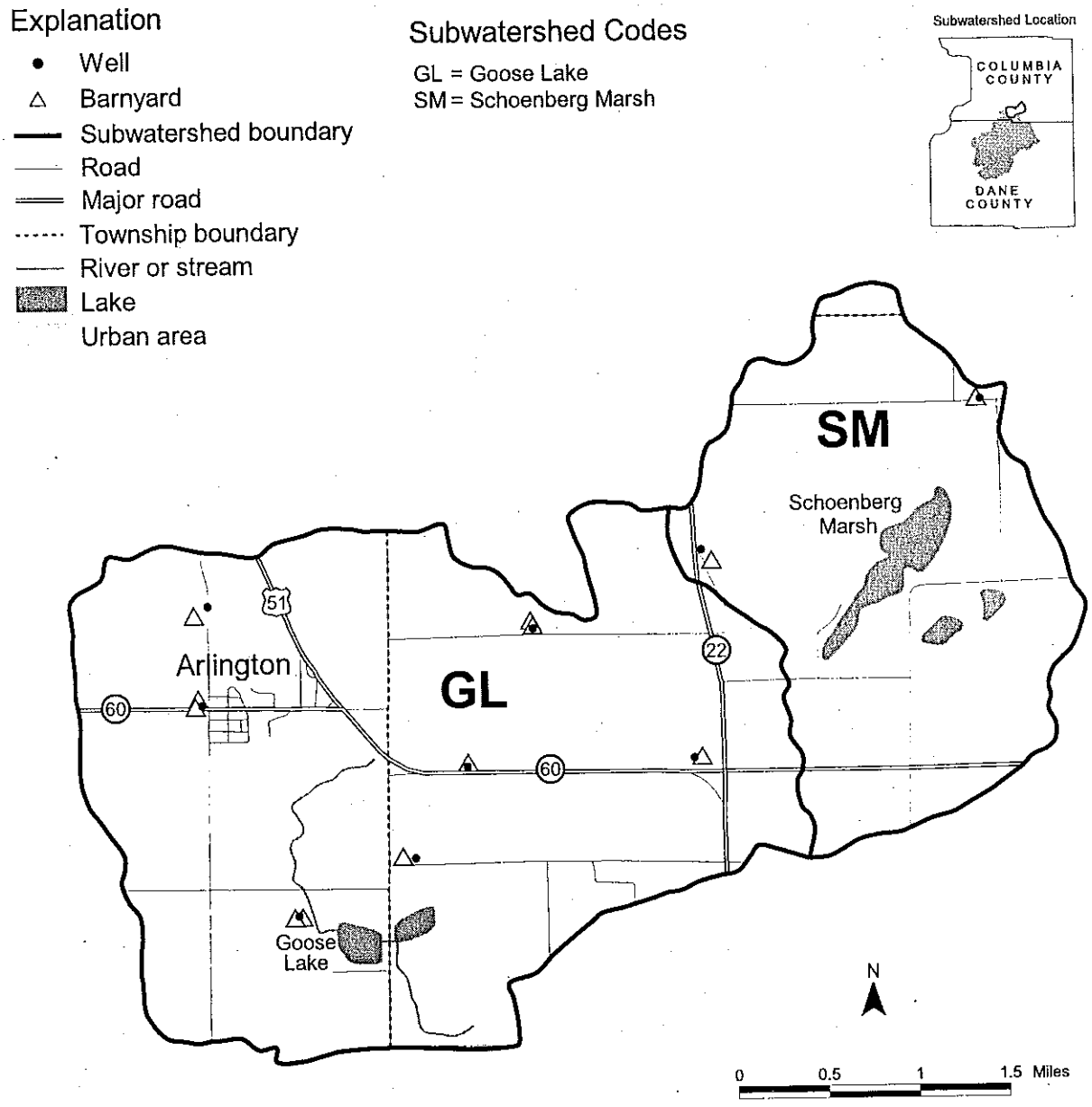
Goose Lake, better known as Goose Pond, is a eutrophic lake located along the southern border of Columbia County (Map 2-2), in the townships of Arlington and Leeds. Goose Lake subwatershed drains just over 9.1 square miles and is internally drained. The Goose Lake subwatershed represents 3.9% of the total watershed area. Because it is internally drained, it does not impact the water quality of the other adjacent subwatersheds. Goose Lake itself is 73 acres in size and is currently divided into two basins by Goose Pond Road which runs north and south. The area of open water is approximately 60 acres: 40 acres in one basin and 20 in the other. Goose Lake is a seepage lake with a maximum depth of 3 feet. The Madison Audubon Society owns 174 acres of land that are immediately adjacent to the pond, and the lake is a wildlife sanctuary.

Water Quality Conditions

For years Goose Lake has received the treated effluent from the town of Arlington, along with the canning wastewater from Del Monte. Several other factors also impact water quality including destruction of wetlands for agricultural benefits, sediment and nutrient loading from agricultural cropland, abundant macrophyte growth and historical winterkills of fish species. The current fishery of Goose Lake is composed of two tolerant species the brown bullhead and fathead minnow. Historically, this lake has experienced winterkills due to its shallow depth, heavy ice cover and an increased oxygen demand from decaying plant and organic materials.

A reduction of sediment and nutrient loading to this subwatershed will have a positive impact on Goose Lake and its surrounding wetlands. Wetland and other upland stabilization play a critical role in the overall quality of the lake and the existing wetlands, as well as providing valuable habitat for a wide range of wildlife species. The Audubon Society has converted 19 acres of agricultural land back into valuable wetland through the construction of a series of berms. Renovation activities have been supported by a wide variety of organizations including Wisconsin Waterfowl Association (WWA), Pheasants Forever, DNR, Prairie Enthusiasts, and Wisconsin Society of Ornithology, to name a few. The local chapter of the Audubon Society is responsible for an 80-acre tall grass prairie restoration, which is the largest of its kind in Wisconsin. Prairie restoration has provided nesting habitat for species of grassland birds such as sedge wrens and bobolinks. Ring-necked pheasants are making a strong come back, due to the increase in prairie habitat. The Goose Pond Sanctuary is one of only 70 Wisconsin

Map 2-2. Schoenberg Marsh and Goose Lake Subwatersheds



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April 2000

Watchable Wildlife Sites with public access. The Audubon Society has created a series of trails that the public can use to view the diverse species of wildlife. Large populations of waterfowl use this area during the fall and spring migrations. It is not unusual to see 200-250 tundra swans, thousands of Canada geese and a wide variety of duck species during these periods.

The main concern of this subwatershed is to continue to enhance and maintain this valuable shallow lake and wetland system. A cooperative effort is planned among the Audubon Society, Del Monte, Dane and Columbia County LCDs, WWA and the DNR to create a 4.5-acre wetland restoration site as a part of the watershed project.

Nonpoint Source Pollutants

- The Goose Lake Subwatershed contains 12 animal lots which generate 321 pounds of phosphorus annually. All 12 of these lots are internally drained.

- The upland sediment delivery in the Goose Lake Subwatershed is 519 tons, annually, but since it is internally drained, it does not effect the total watershed loading to Lake Mendota.

Water Resource Objectives

The following objectives are recommended for the surface water resources of the Goose Lake Subwatershed:

1. Protect and enhance wildlife and aquatic habitat by:
- Reducing sediment loading by a **medium** level to Goose Lake and the wetlands that surround it.
- Reducing phosphorus and nutrient loading by a **medium** level to Goose Lake and the adjacent wetlands.
- Enhancing existing wetlands and creating new wetland areas to help filter runoff and to provide habitat for wildlife.
- Reducing soil loss from wind erosion and runoff events by using conservation tillage practices.

2. Protect and maintain grassed waterways and upland grasslands by:
- Reseeding waterways to aid in the reduction of sediment-nutrient transport.
- Stabilizing upland areas by restoring with prairie plant species, which would reduce soil loss and provide excellent wildlife habitat, such as Tall Grass Prairie.

Yahara River & Cherokee Marsh Subwatersheds (YR & CM)

Description

The Yahara River originates in south central Columbia County and flows southward toward the village of DeForest where it continues through the village of Windsor and then enters the

Cherokee wetland complex before discharging into Lake Mendota. A tributary to the Rock River, the Yahara River is 127 miles long (20 miles of which is within the Lake Mendota Watershed including the headwaters of the Cherokee Marsh.). The Yahara River Subwatershed drains an area of 56.5 square miles, or 24.3% of the total Lake Mendota watershed area. The river's total drainage area of 466 square miles or about one third of Dane County. Most of this is agricultural land, followed by residential, transportation and wetlands. This river connects the county's four largest lakes, often called the "Yahara lakes:" Mendota, Monona, Waubesa and Kegonsa.

Cherokee Marsh is also a subwatershed. It is 16.1 square miles or 6.9% of the total Lake Mendota watershed. The DNR, Dane County, and the City of Madison own parcels of land surrounding Cherokee Lake and its wetlands that offer public access for recreational activities. The problems affecting the Yahara River are many and include destruction of valuable wetlands, sediment and phosphorus loading from farm runoff, construction site and streambank erosion, urban storm water runoff, straightening and channelizing headwater areas for agriculture, discharge from impoundments, areas of heavy aquatic plant growth, high water temperatures and periods of low dissolved oxygen. Historically, treated wastewater effluent from the Madison area was discharged into the Yahara River until this practice ended in the 1950s. Wastewater effluent is now diverted around the chain of lakes, and discharged into Badfish Creek. Map 2-3 shows both of these subwatersheds.

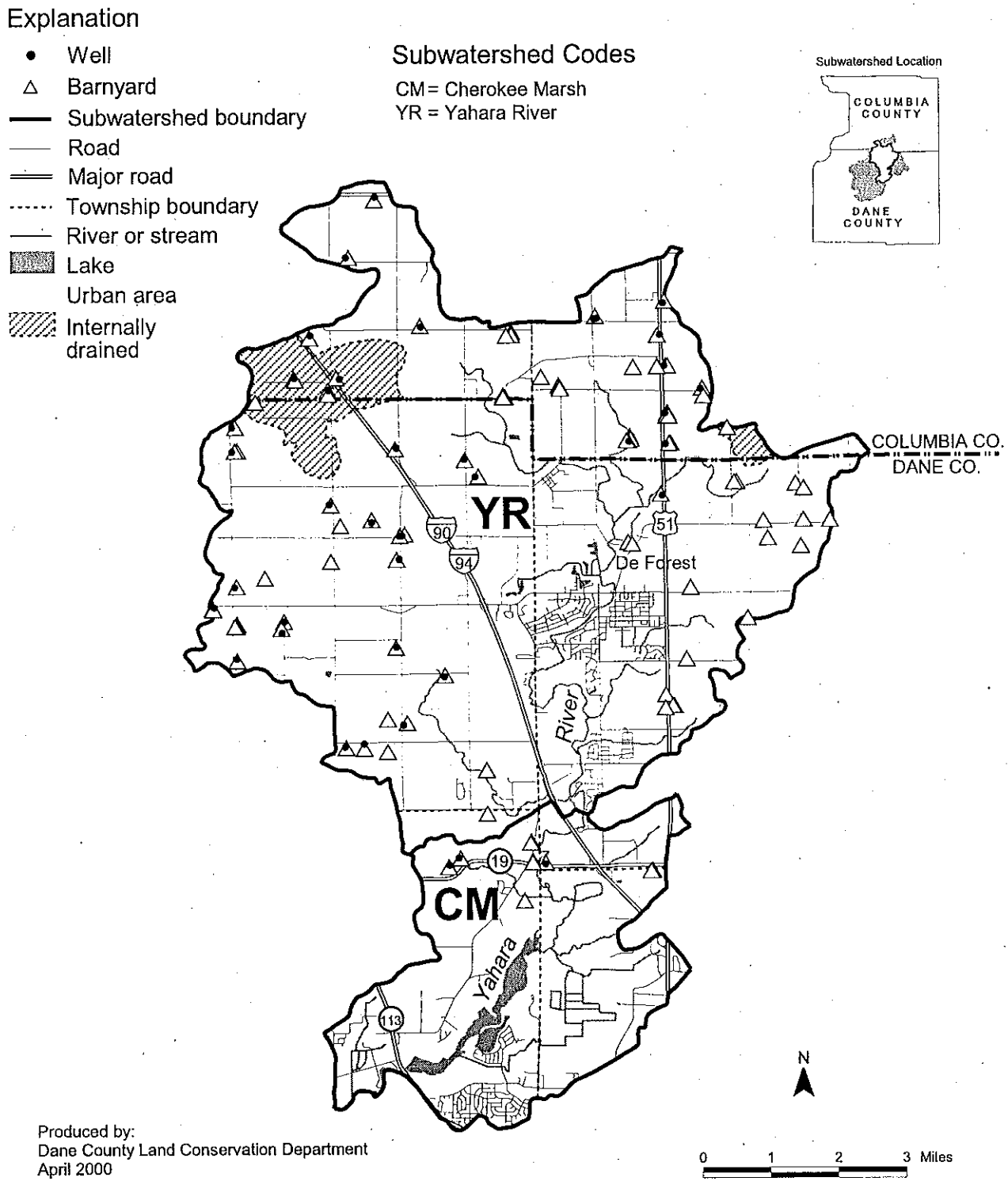
Water Quality Conditions

The Yahara River was divided into three different reaches for the purposes of the watershed project: the first reach is the segment from the headwaters downstream to county Highway V; the second is from Highway V downstream to Windsor Road; and the third reach is from Windsor Road downstream to the Cherokee Marsh. In all three reaches, the river experiences sediment and nutrient loading from agricultural fields and barnyards, hydrologic manipulation, turbidity and bank erosion.

In the first reach, the problems affecting water quality are related to a landscape dominated by agriculture, both cash cropping and dairy farming, followed by residential development. In addition to the other water quality problems, this reach experiences channelizing of the headwater areas, low flows, lack of suitable habitat for aquatic organisms, unstable and narrow stream corridors, wetland destruction and heavy in-stream sedimentation. Storm water runoff from the urban area is also a concern due to the increasing growth of the village of DeForest. The current biological use of the fishery in this reach is warmwater sportfishery. However, it is probably more reflective of a warmwater *forage* fishery due to its low flows, elevated water temperatures, low dissolved oxygen levels, and the lack of diverse habitat. Macroinvertebrate samples indicate "fair" water quality. This reach has very pooravailable habitat for aquatic organisms, because most of the desirable substrate is embedded in fine sediments. Increasing buffered corridors adjacent to the stream would reduce the amount of sediment entering this reach of the Yahara River.

The second reach shows more effects of adjacent residential development. This reach flows through the village of DeForest and the town of Windsor, both of which are expanding their developed areas. In addition to the other water quality problems, this reach experiences large

Map 2-3. Yahara River and Cherokee Marsh Subwatersheds



volumes of storm water runoff from urban areas, construction site disturbance, loss of infiltration areas, discharge from impoundments and the loss of valuable wetlands. The current biological use of the fishery for this reach of river is warmwater sport fishery. This reach of river has the greatest potential for sustaining valuable populations of sport fish. The amount of available aquatic habitat in this reach is very good. Macroinvertebrate samples indicate "good" to "fair" water quality. The gradient and flow in this reach are also very good. There are a couple of large areas of eroding, raw streambanks north of Windsor Road that contribute sediment to this reach of river.

The third reach (from Windsor Road downstream to the Cherokee Marsh) of the Yahara River is dominated by agriculture, residential development, wetland and grassland. In addition to the other water quality problems described above, this reach experiences debris jams, discharge from impoundments, elevated water temperatures, periods of low dissolved oxygen, loadings associated with storm water runoff from urban areas, heavy in-stream aquatic plant growth, large populations of common carp, and sediment loading from construction site erosion. There are several areas downstream of Windsor Road where streambank erosion is a problem. In some cases sediment loading is so great that it has caused the channel to become braided. The current biological use of the fishery in this reach is a warmwater sport fishery. This reach plays an important role in providing spawning habitat for a wide variety of sport fish. Species such as northern pike, walleye and white bass use the lower reaches of the Yahara River and Cherokee Marsh yearly. A wide range of wildlife species also use the lower reaches of the river along with the Cherokee Marsh. Macroinvertebrate samples were not collected in this reach, due to the lack of suitable substrate and overall depth.

Cherokee Lake is 57 acres and 20 feet deep. The lake was formed when part of Cherokee Marsh was dredged in the 1960s. The lake functions as a deep-water sedimentation basin for the Yahara River and is a popular recreation area. Cherokee Marsh is the major estuarine wetland of the Mendota watershed and includes at least 4 major springs and high quality fens designated as a State Natural Area. Some of the marsh has been altered considerably by ditching, filling, golf course development and farming.

Nonpoint Source Pollutants

- The Columbia County portion of the Yahara River subwatershed contains 37 animal lots which contribute 1,088 pounds of phosphorus, annually. This represents an estimated 6% of the phosphorus for the entire watershed. This portion delivers 369 tons of sediment to Lake Mendota annually, or 6.5% of the total load. The Dane County portion of the Yahara River subwatershed contains 50 animal lots (8 are internally drained) which contribute 2,340 pounds of phosphorus, annually. This represents an estimated 12% of the phosphorus for the entire watershed.

- The upland sediment delivery in the Dane County portion of the Yahara River subwatershed is 710 tons, annually, or 12% of the entire watershed load.The Cherokee Marsh subwatershed contains 9 barnyards (1 is internally drained) which contribute 580 pounds of phosphorus annually. This represents an estimated 3% of

the phosphorus for the entire watershed. About 424 tons of sediment are delivered to the lake each year from this subwatershed, or 7.5% of the total load.

Water Resource Objectives

The following objectives are recommended for the surface water resources of the Yahara River and Cherokee Marsh subwatersheds:

1. Reduce sediment and nutrient loading from agricultural and barnyard runoff by a **high** level to enhance the overall water quality.

2. Maintain proper native grassland buffers along river corridors, grassed waterways, and other buffer areas to aid in streambank stabilization and nutrient and sediment retention.

3. Maintain proper construction site erosion control practices on any areas where the soil has been disturbed (residential, commerical or highways).

4. Emphasize proper soil conservation tillage practices to reduce soil and nutrient loss.

5. Continue to address storm water runoff and its associated problems through proper planning for future growth areas, educational workshops and installing control structures.

6. Protect, enhance and create new wetlands to improve spawning areas for sport fish and provide additional wildlife habitat.

7. Stabilize streambanks where banks are eroding due to bank failures, especially the reach from Windsor Road to Interstate 90-94.

8. Further recommendations about the Cherokee Marsh subwatershed are found in the wetland section at the end of this chapter.

Token Creek Subwatershed (TC)

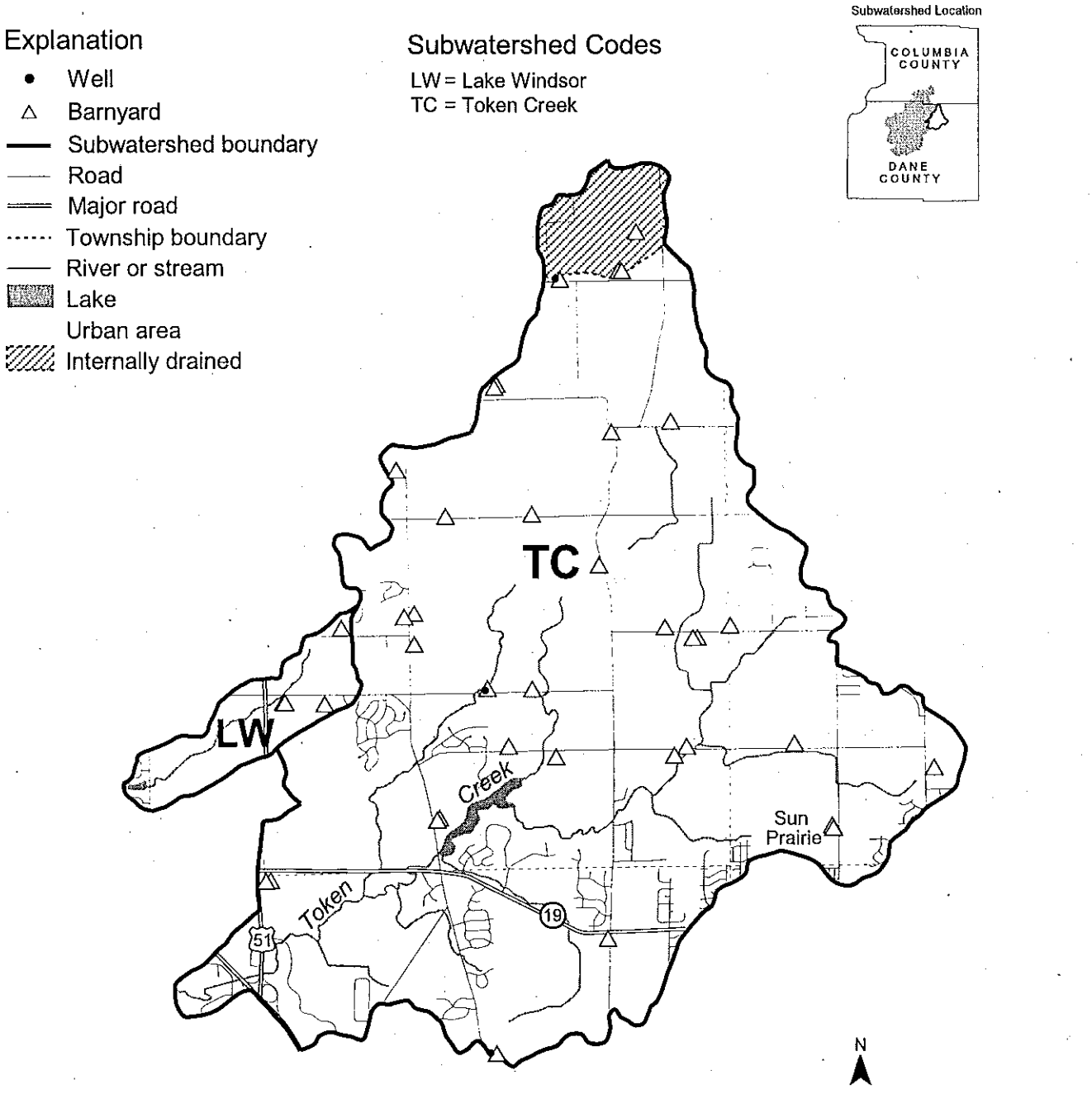
Description

Token Creek is a tributary to the Yahara River that originates in north central Dane County (Map 2-4). It originates in Windsor Township (T9N, R10E, Section 24). Token Creek is10 miles long with a drainage area of 25.3 square miles, or 10.9% of the total watershed area. The primary land use for this subwatershed is agricultural.

Water Quality Conditions

The problems affecting the water quality of Token Creek include destruction of valuable wetlands, sediment and phosphorus loading from agricultural fields and barnyards, sediment

Map 2-4. Lake Windsor and Token Creek Subwatersheds



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loading from construction site and streambank erosion, storm water runoff from urban areas, discharge from several impoundments, areas of heavy in-stream plant growth, periods of low dissolved oxygen and a lack of habitat for aquatic organisms due to heavy sedimentation. Large populations of common carp along with high turbidity also impair water quality. Token Creek has a diverse fishery, containing warmwater, coldwater, and rough fish species. The first two miles of stream upstream from its confluence with the Yahara River is currently classified as warmwater sport fishery consisting of bluegill, largemouth bass, walleye, green sunfish, and some rough fish species (common carp and freshwater drum). This section of stream is characterized by low gradient, high turbidity, heavy sedimentation and overall channel widening. Urban development along with hydrologic modification have all had impacts on Token Creek.

The portion of stream from mileage marker 2 to 4 is currently classified as coldwater fishery. This includes the section of stream from the Token Creek County Park upstream to the Token Creek millpond dam. The summer electrofishing surveys showed low numbers of brown trout and brook trout, which are probably escapees from DNR rearing ponds. Other fish species were dominated primarily by tolerant forage species (white sucker, creek chub, johnny darter and bluntnose minnow). Two sport fish and large numbers of common carp (both young of the year and adults) were also found. Carp are visible at road crossings throughout the year. This segment of stream is characterized by moderate velocities, high turbidity, heavy sedimentation, naturally occurring log jams, overall channel widening and heavy in-stream aquatic plant growth.

An unnamed tributary to Token Creek flows southward before entering this section. The current fish classification for "Creek 4-1" is coldwater, and includes brown trout, mottled sculpin and white sucker. This portion of creek has the highest water quality within the subwatershed. Creek 4-1 is characterized by good spring activity, healthy macroinvertebrate communities, well buffered streambanks, stable substrate and good in-stream cover. There are large areas of watercress here indicating groundwater upwelling or spring activity and good water quality.

The last six miles of Token Creek upstream from the millpond dam to its headwaters was classified in 1996 as limited forage fishery. Summer electrofishing found bluntnose minnow, fathead minnow, brook stickleback, common carp, green sunfish and white sucker. This portion of stream is characterized by low flows, increased rates of sedimentation, high turbidity, elevated temperatures and lack of habitat.

In 1998, the DNR purchased the dam and the land upstream of the dam which had long ago formed the 50-acre Token Creek Millpond. In 1993, the dam had failed and significant springs were uncovered. The DNR has made it a priority to remove the dam and to restore the stream to its original condition prior to having had a dam in place. This will be a multi-year effort involving finding and rehabilitating the original stream corridor, improving the fisheries habitat and protecting the springs. The springs flow at a rate of 4,000 gallons per minute, at 50° and provide 50% of the base flow to Lake Mendota. The ultimate goal is to restore the stream to a naturally reproducing brook trout fishery.

Nonpoint Source Pollutants

- The Token Creek Subwatershed contains 33 animal lots (5 are internally drained) which contribute 2,383 pounds of phosphorus annually. This represents and estimated 12% of the phosphorus for the entire watershed.

- The upland sediment delivery in the Token Creek Subwatershed is 752 tons, annually, or 13.4 percent of the entire watershed load.

Water Resource Objectives

The following objectives are recommended for improving the surface water resources of Token Creek Subwatershed:

1. Reduce sediment and nutrient loading from agricultural and barnyard runoff by a **high** level to enhance overall water quality.

2. Remove the dam that creates the millpond. This would allow the stream to find its original natural channel, improve the coldwater fishery and provide a valuable wetland complex.

3. Maintain proper native grassland buffers, grassed waterways and other buffer areas to aid nutrient and sediment retention.

4. Maintain proper construction site erosion control practices on any areas where the soil has been disturbed (residential, commercial or highways), through proper planning, educational workshops and proper control structure installation.

5. Maintain and enhance the overall integrity of water quality for the coldwater unnamed tributary located in Windsor Township (T9N, R10E, Section 34). This could be accomplished through the above objectives plus habitat improvement for coldwater fish and providing well-vegetated buffers along the stream corridor.

6. Emphasize proper soil conservation tillage practices to reduce soil and nutrient loss.

7. Continue to address storm water runoff and its associated problems through proper planning for future growth areas and installation of control structures.

Lake Windsor Subwatershed (LW)

Description

Lake Windsor is located in the township of Windsor (T9N, R10E, Sections 31 and 32) Dane County. This lake is a drainage lake created by building a dam on an intermittent tributary to the Yahara River. The resulting Windsor impoundment is 9 acres in size and has a maximum depth of 6 feet, and a drainage area of 1.2 square miles. The ratio of the drainage basin to

lake area is 86:1. Land use in this subwatershed is dominated by agriculture. The Lake Windsor Subwatershed area (Map 2-4) represents about 0.5% of the total watershed area.

Water Quality Conditions

Lake Windsor is extremely fertile and turbid due to the tremendous amount of runoff generated by its surrounding agricultural lands. Problems affecting water quality are sediment and phosphorus loading from surrounding agricultural lands, phosphorus resuspension from lake sediments, possible winterkills, turbidity, algal blooms, carp sediment suspension, storm water runoff from developed areas and impervious surfaces (roads and highways). Overall water clarity of this impoundment is poor, with an average Secchi depth of 1.71 feet. Historically the impoundment was managed for trout, but survival of fish was poor due to high summer temperatures and low oxygen conditions during ice cover periods. An electrofishing survey in the fall of 1985 found seven species of fish: bluegill, black bullhead, green sunfish, hybrid muskie, freshwater drum, common carp and fathead minnows. The numbers of fish were low. Records show hybrid muskies that migrated up the Yahara River from Lake Mendota were caught by anglers and transplanted into Lake Windsor.

Nonpoint Source Pollutants

- The Lake Windsor Subwatershed contains 3 animal lots which contribute 178 pounds of phosphorus annually. This represents and estimated less than 1% of the phosphorus for the entire watershed.

- The upland sediment delivery in the Lake Windsor Subwatershed is 127 tons, annually, or 2.2% of the entire watershed load.

Water Resource Objectives

1. Reduce sediment and nutrient loading by a medium level during runoff events to enhance overall water quality.

2. Maintain proper grassland buffers, grassed waterways and other buffer areas to aid in nutrient and sediment retention.

3. Maintain proper construction site erosion control practices on any area where the soil has been disturbed (residential, commercial or highways).

4. Maintain proper lawn management techniques for lake front property owners (low nutrient/phosphorus fertilizers, proper disposal of grass clippings etc.).

5. Emphasize proper soil conservation tillage practices to reduce soil and nutrient loss.

Brandenburg Lake Subwatershed (BL)

Description

The Brandenburg Lake subwatershed (Map 2-5) includes the lake itself plus the surrounding 2.6 square mile drainage area, representing roughly 1.1% of the total watershed area. Also known as Lake Katrine, Brandenburg Lake is located along the northwestern edge of the Lake Mendota Watershed boundary in the terminal moraine of Springfield Township. This is a seepage lake that is 38 acres, has a mean depth of 6 feet, and a maximum depth of 9 feet. Land use in this subwatershed is primarily agricultural followed by some grassland, wetland, and a small amount of residential land use. Most of the surrounding shoreline is owned by the Blackhawk Council of Girl Scouts.

Water Quality Conditions

The fishery of the lake consists of forage fish and minimal sport fish: minnows, green sunfish, brown bullheads, and walleyes that are possibly carryovers from the fingerling rearing years. From the early 1960s to the mid-1980s, the DNR has used Brandenburg Lake as a rearing pond for walleyes (*Stizostedian vitreum*). This lake has produced as many as 800,000 walleye fingerlings annually. The rearing process is quite lengthy starting with chemical eradication using Rotenone (fish pesticide) every fall. This eradication removes fish predators preventing the predation on the walleye fry when they are stocked in late April. Walleye fry use the lake until late July or early August, when they were seined for transporting in southern Wisconsin lakes. A fingerling's diet during this 3- to 4-month period consists primarily of plankton. In 1987 through 1993 stocking efforts were focused primarily on Lake Mendota as part of an ongoing "Biomanipulation Study." Brandenburg Lake could play a beneficial role in sustaining healthy walleye populations in the future. Brandenburg Lake is also used by various species of waterfowl for brood rearing and spring and fall migrations.

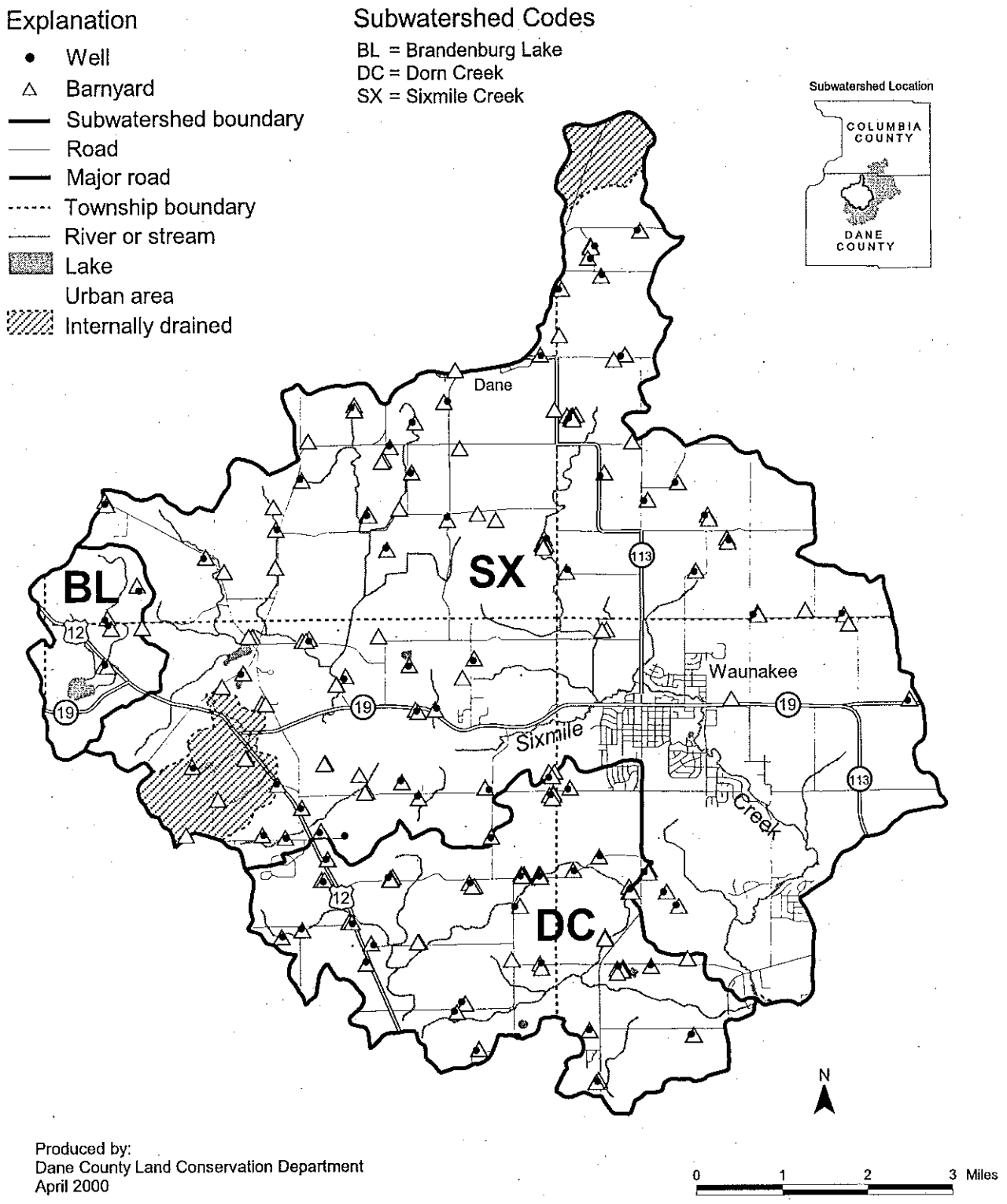
Major water quality problems of this eutrophic lake include sediment and phosphorus loading from surrounding agricultural areas, phosphorus resuspension from lake sediments, periodic winterkills, excessive macrophyte growth and algal blooms and summerkills related to farm chemicals applied to agricultural fields flushed into the lake during runoff periods. Reducing the sediment and nutrient loading would improve overall water quality. Brandenburg Lake could play a critical role in the future fishery of Lake Mendota.

Nonpoint Source Pollutants

- The Brandenburg Lake Subwatershed contains 5 animal lots which generate 144 pounds of phosphorus, annually. This represents less than 1% of the phosphorus for the entire watershed.

- The upland sediment delivery in the Brandenburg Lake Subwatershed is 42 tons, annually, or 0.7% of the entire watershed load.

Map 2-5. Brandenburg Lake, Dorn Creek and Sixmile Creek Subwatersheds



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Water Resource Objectives

The following objectives are recommended for the surface water resources of the Brandenburg Lake Subwatershed:

1. Reduce sediment and nutrient loading by a **medium** level during runoff events. This will result in a reduction in macrophyte (aquatic plant) growth, reduction in algal bloom frequency and reduce the possibility of winterkills and summerkills.

2. Improve the wildlife values of Brandenburg Lake.

3. Maintain and develop waterway corridors and re-establish grasslands in the upland areas to increase the buffering capacity and improve wildlife habitat.

Sixmile Creek Subwatershed (SC)

Description

The riverine portion of this subwatershed (Map 2-5) is actually the 12 miles of the Sixmile Creek, beginning in Springfield Township, flowing south into the Waunakee Marsh then east through the city of Waunakee and south through Governor Nelson State Park where it finally enters the north end of Lake Mendota. In all, it drains 47.9 square miles of land, mostly agricultural and some residential. This is 20.6% of the entire watershed. Sixmile Creek was selected as a priority watershed project in 1979, with work effort completed in 1991.

Water Quality Conditions

The major water quality concerns on Sixmile Creek from land uses include wetland destruction, sediment and phosphorus loading from agricultural fields and barnyards, sediment loading from construction site erosion, sediment loading from streambank erosion, pasturing of horses adjacent to creek in some areas, streambank erosion from trampling of banks by horses, storm water runoff from urban service area, excessive aquatic plant growth in the streams and loss of aquatic habitat due to sedimentation. Impoundments, both man-made and naturally occurring log and debris jams, increase water temperature and impair annual fish migration. Accumulating sediments are an additional problem as are historical fish-kills related to the improper disposal of canning wastewater. For the purposes of the watershed project, Sixmile Creek has been divided into three different reaches in this subwatershed. The first reach is from the headwaters to state Highway 113; the second is from Highway 113 to Woodland Drive; and the third is from Woodland Drive to Lake Mendota.

The first reach contains the large wetland complex called the Waunakee Marsh. This marsh is approximately 600 acres and has a drainage area close to 12,000 acres. From its headwaters, Sixmile Creek runs through this large wetland and the channel is lost. The creek then is re-established just west of Kingsley road. Land use in this portion is dominated by agriculture, followed by grassland. The fishery of Sixmile Creek above Highway 113 is primarily a

limited forage fishery comprised of warmwater species (central mudminnow, creek chub, brook stickleback, white sucker and fathead minnow). Intolerant species found during the survey include pearl dace and northern redbelly dace. Bottom dwelling macroinvertebrate samples ranged from "fair" at Highway 113 to "fairly poor" at Kingsley Road.

Below Highway 113, the stream runs through the city of Waunakee and its outer urban expanses. The fishery also changes to a warmwater sport fishery including bluegill, pumpkinseed, green sunfish, largemouth bass, northern pike, white sucker, common shinner, central mudminnow, brook stickleback and bluntnose minnow. Intolerant forage fish species include brook silverside, central stoneroller and pearl dace. Wisconsin DNR owns 6 acres of controlled wetland to preserve northern pike spawning habitat . When the wetland is drawn down, the pike fingerlings migrate out of the wetland and into Sixmile Creek and downstream into Lake Mendota. Macroinvertebrate samples were "good" at Mill Road and "good" at state Highway 19 at Waunakee Park. This reach has the best stream bottom for aquatic organisms. It also has the best diversity of habitat, and the steeper gradients cause water velocities to increase, improving the streams ability to transport sediment downstream. The streambanks are unstable and have failed in several places, causing collapse and erosion. These sites are located downstream of Division Street and Mill Road. Signs of construction site erosion and in-stream sediment deposition are also visible below Mill Road.

There is a small un-named tributary that originates in Westport township (T8N, R9E, Sec.10), and enters Sixmile Creek in Section 16 in Westport township (T8N-R9E). This tributary is a narrow, coldwater stream and is well buffered above Bong Road all the way to Hogan Road.

The third reach includes Woodland Road downstream to the mouth of Lake Mendota. This reach has characteristics that make it quite different than the two upper sections since its overall width and depth increase, and gradient and velocity decrease. Turbidity increases here, and the stream changes from a variable run-riffle-pool flow characteristics to a continuous run. Stream bottom is mainly fine sediments. There are also areas obstructed due to large wood and debris jams. Macroinvertebrates were not sampled in this section due to the lack of suitable sampling habitat. Electrofishing surveys were not performed in this reach since depth was too great.

The entire 12 miles of Sixmile Creek is classified as Exceptional Resource Water (ERW). NR 102.11 Wisconsin Administrative Code defines an ERW water as: "surface waters which provide valuable fisheries, hydrologically or geologically unique features, outstanding recreational opportunities, unique environmental settings, and which are not significantly impacted by human activities".

Nonpoint Source Pollutants

- The Sixmile Creek Subwatershed contains 105 animal lots (5 are internally drained) which contribute 6,291 pounds of phosphorus annually. This represents and estimated 32 percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Sixmile Creek Subwatershed is 1,019 tons, annually, or 18.2 percent of the entire watershed load.

Water Resource Objectives

The following objectives are recommended for the surface water resources of Sixmile Creek Subwatershed:

1. Reduce sediment and nutrient loading from agricultural and barnyard runoff by a **high** level to enhance the overall water quality.

2. Maintain proper native grassland buffers, grassed waterways, and other buffer areas to aid in streambank stabilization and nutrient and sediment retention.

3. Maintain proper construction site erosion control practices on any areas where the soil has been disturbed (residential, commercial or highways).

4. Emphasize proper soil conservation tillage practices, to reduce soil and nutrient loss.

5. Maintain proper disposal of canning waste water to prevent future fishkills.

6. Continue to address storm water runoff, and the problems that are associated with it, through proper planning for future growth areas and installing control structures.

7. Reduce sediment loading by fencing horses out of creek, this would also reduce streambank erosion. Horses could be provided access to drink by constructing access lanes.

Dorn Creek Subwatershed (DC)

Description

Dorn Creek originates in the town of Springfield and flows southeast through Governor Nelson State Park before entering Sixmile Creek which eventually flows into Lake Mendota. The creek is 6 miles long, and has a drainage area of 13 square miles. The primary land use in this subwatershed is agriculture followed by wetlands. The Dorn Creek Subwatershed (Map 2-5) represents about 5.6% of the total watershed area.

Water Quality Conditions

Wetlands provide a valuable function in this subwatershed from a nutrient and sediment retention ability as well as the role they play in the success of northern pike spawning. The first mile of stream consists of species that are commonly found in Lake Mendota. Species include warmwater forage, sport and rough fish species such as white sucker, creek chub, common shinner, largemouth bass, northern pike, panfish, freshwater drum and common

carp. Historical records identified northern pike in the lower reaches of the stream during the spring spawning period.

Aquatic insect (macroinvertabrate) sampling results ranged from "very good" to "poor." The site that had a very good rating was dominated by the insect *Gammarus* which has a low tolerance value according to the Hilsenhoff Biotic Index (HBI). The HBI gives the lowest tolerance values to the highest quality insects. This site was located near its headwaters where the stream was narrow, clear, cold, has plenty of dissolved oxygen and a stable substrate. The stream characteristics change drastically once Dorn Creek passes under Meffert Road. This segment is heavily degraded by sediment and nutrient loading from barnyard runoff and agricultural fields. The other site located at County Highway Q had very high HBI values indicating "fairly poor" to "poor" water quality, and significant organic pollution. This site is located about 2 miles upstream of Sixmile Creek and is located adjacent to the Cherokee State Wildlife Area.

This subwatershed lies in an area dominated by intense agriculture. Land use is mostly cash cropping. There are also several barnyards that need to be addressed. For the most part the streambanks are well protected, but the section north of county Highway K, running parallel to County Highway Q, has areas of bank erosion. The common characteristics of this stream include low flows, heavy sedimentation, poor substrate, heavy aquatic plant growth, limited fishery and tremendous runoff pollution contributions.

There are many contributing factors to overall undesirable water quality of Dorn Creek including sediment and nutrient loading from agricultural fields and barnyards, excessive in-stream aquatic plant growth, low flow periods, turbidity, periods of dissolved oxygen suppression, heavy in-stream sedimentation which covers stream substrate, destruction of valuable wetlands for agricultural purposes, and the overall absence of stable stream bottom necessary to support aquatic life.

A reduction in sediment and nutrient loading will have a positive impact on Dorn Creek and eventually reducing Dorn Creek's pollution contributions to Sixmile Creek and eventually Lake Mendota. However, there is a tremendous amount of in-stream sediment (more than 3 feet deep) that will continue to be transported downstream. Protecting, enhancing or creating wetlands would provide multiple benefits for northern pike spawning, water quality improvements and provide excellent wildlife habitat. Grassed waterways and upland corridor protection will also enhance loading reduction as well as providing increased wildlife habitat.

Nonpoint Source Pollutants

- The Dorn Creek Subwatershed contains 54 animal lots (2 are internally drained) which contribute 4,720 pounds of phosphorus, annually. This represents and estimated 24% of the phosphorus for the entire watershed.

- The upland sediment delivery in the Dorn Creek Subwatershed is 1008 tons, annually, or 18% of the entire watershed load.

Water Resource Objectives

The following objectives are recommended for improving the surface water resources of Dorn Creek Subwatershed:

1. Reduce the sedimentation rate to Dorn Creek by a **high** level.

2. Reduce nutrient and phosphorus loading to Dorn Creek by a **high** level which will reduce aquatic plant growth, help stabilize dissolved oxygen levels and reduce loadings that enter Lake Mendota.

3. Maintain and enhance existing wetlands, and convert prior converted wetlands back into wetlands.

4. Protect, enhance and create northern pike spawning areas

5. Stabilize areas of streambanks that have failed.

Pheasant Branch Creek Subwatershed: (PB)

Description

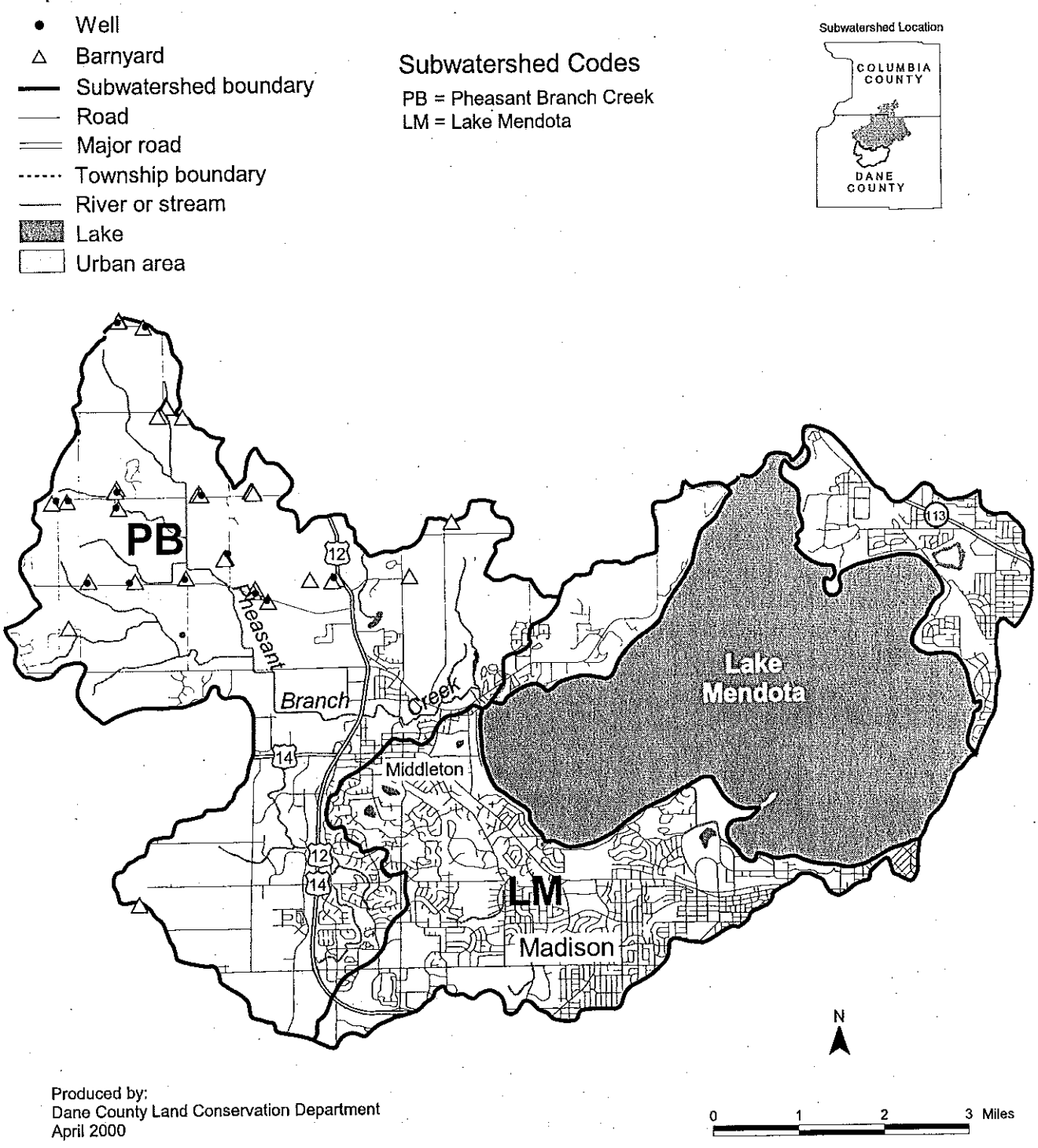
The riverine portion of the Pheasant Branch Creek subwatershed originates out of a glacial moraine located in the township of Springfield. Pheasant Branch Creek then flows southeast through the city of Middleton before entering Lake Mendota for a total stream length of 7 miles. The primary land use in this area is dominated by agriculture, consisting of both cash cropping and dairy farming. The residential component of this subwatershed is also a major concern. Pheasant Branch Creek drains a total of 23.3 square miles, or 10% of the total watershed area (Map 2-6).

Water Quality Conditions

Pheasant Branch Creek and the factors impairing its water quality vary by stream reach. The creek has unique features which have contributed to its degraded water quality.

The portion of the creek upstream of State Highway 12 has several characteristics that cause water quality problems including straightening of the channel, low flows, sediment and nutrient loading from agricultural fields, destruction of nearby wetlands, barnyard runoff, elevated temperatures, fish kills related to manure spills and unstable banks. This area has very little available habitat for fish and aquatic insects to use. Sedimentation is a major problem here; more than one meter of fine materials have covered the river bottom in most areas. The fishery in this reach is comprised primarily of warmwater forage species, with some rough fish and other tolerant species. The fishery is limited due to the factors listed above, as well as hydrologic manipulation such as concrete flood control structures located at State Highway 12 and further downstream. Fish migration has been virtually eliminated due

Map 2-6. Pheasant Branch Creek and Lake Mendota Subwatersheds



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to impassible concrete structures used to control water flow during rains. Organic loading is a major factor impairing overall water quality.

The section of stream from State Highway 12 downstream to Lake Mendota is uniquely different from that described above. This section runs through a large urban service area of the city of Middleton. In this section, the morphology of the stream channel has been altered less by human involvement, and is more sinuous than the upstream section. Factors impairing water quality and habitat in this section include flow problems, high water temperature, lack of dissolved oxygen, severe bank failures, storm water runoff, garbage and debris, construction site erosion, wetland destruction and hydrologic manipulation. Storm water runoff continues to be one of the biggest factors degrading this reach. This runoff increases water temperatures, depletes dissolved oxygen, increases turbidity and deposits in the stream other pollutants associated with streets and concrete or asphalt surfaces. Loss of unpaved areas being replaced by new construction, has decreased the amount of rain and snow infiltration into the soil and has therefore generated large amounts of storm water runoff. Streambanks from where the creek crosses county Hwy. M upstream to Hwy. 12 have areas of severe erosion. Little plant life occurs in the understory due to the inability of sunlight to penetrate through the heavy deciduous foliage. This situation exposes a tremendous amount of unvegetated soil to runoff events.

The fishery in this section is subdivided into two areas: that located upstream of Highway M, and that downstream of Highway M to Lake Mendota. There is a gabion, a large concrete flood control structure, just downstream of the Highway M bridge. This gabion helps reduce erosive energy generated during runoff periods, but it acts as a barrier to fish migration. The fishery above Highway M to Highway 12 consists of young largemouth bass and brook stickleback. The 1995 fish survey of two reaches of stream in this section of Pheasant Branch Creek covering roughly 270 meters of stream length found only two species with a total of five individuals. This was unexpected due to the diverse habitat for fish here, including runs with ample depth, deep pools (4-6'), and nice riffles. However, sediment delivery is a problem in some areas along with elevated temperatures, periods of low flow, storm water runoff and lack of dissolved oxygen. Biotic indices also indicated degraded water quality.

The section of Pheasant Branch Creek from County Highway M downstream to the entrance of Lake Mendota is quite different than the portion above that road. Streambank erosion is minimized the further the stream travels from Highway M because the surrounding landscape changes from a deciduous wooded and highly developed urban landscape to a more naturally occurring groundcover (including the Pheasant Branch Conservancy area) with a series of small wetlands. This area includes segments where the channel width narrows and stream flow velocities increase. There are also some spring fed areas that contribute large volumes of water to Pheasant Branch Creek. One of the largest springs produces more than 900 gallons per minute. The factors impairing water quality here include sediment delivery from upstream, nutrient loading from agriculture and wetlands, construction site erosion and storm water runoff. This section of stream has a diverse warmwater forage and sport fishery along with some rough fish species. The fishery in this section is reflective of that of Lake Mendota because of its proximity. Certain species of lake fish use this creek during different stages of their life cycle, some species for spawning and others for brood rearing.

In 1994, Dane County purchased 161 acres as a addition to the Pheasant Branch Resource Protection Area. This area is one of the largest undisturbed wetlands in the watershed and provides a great amount of spring flow to Pheasant Branch Creek. The DNR purchased 60.5 acres from Dane County for the protection and enhancement of the wetland area. This wetland is highly valued for fisheries, wildlife and aesthetics. Long range goals include creating a wetland that will allow the northern pike to use the marsh for spawning and fry rearing.

Nonpoint Source Pollutants

- The Pheasant Branch Creek Subwatershed contains 34 (4 are internally drained) animal lots which contribute 1923 pounds of phosphorus annually. This represents and estimated 9% percent of the phosphorus for the entire watershed.

- The upland sediment delivery in the Pheasant Branch Creek Subwatershed is 1070 tons, annually, or 19% of the entire watershed load.

Water Resource Objectives

The following objectives are recommended for the surface waters of the Pheasant Branch Creek subwatershed:

1. Reduce sediment and nutrient loading by a **high** level during runoff events on agricultural lands, barnyards and urban areas to improve overall water quality of Pheasant Branch Creek as well as Lake Mendota.

2. Reduce sediment loading from construction sites through erosion control planning, educational workshops and proper installation of control structures.

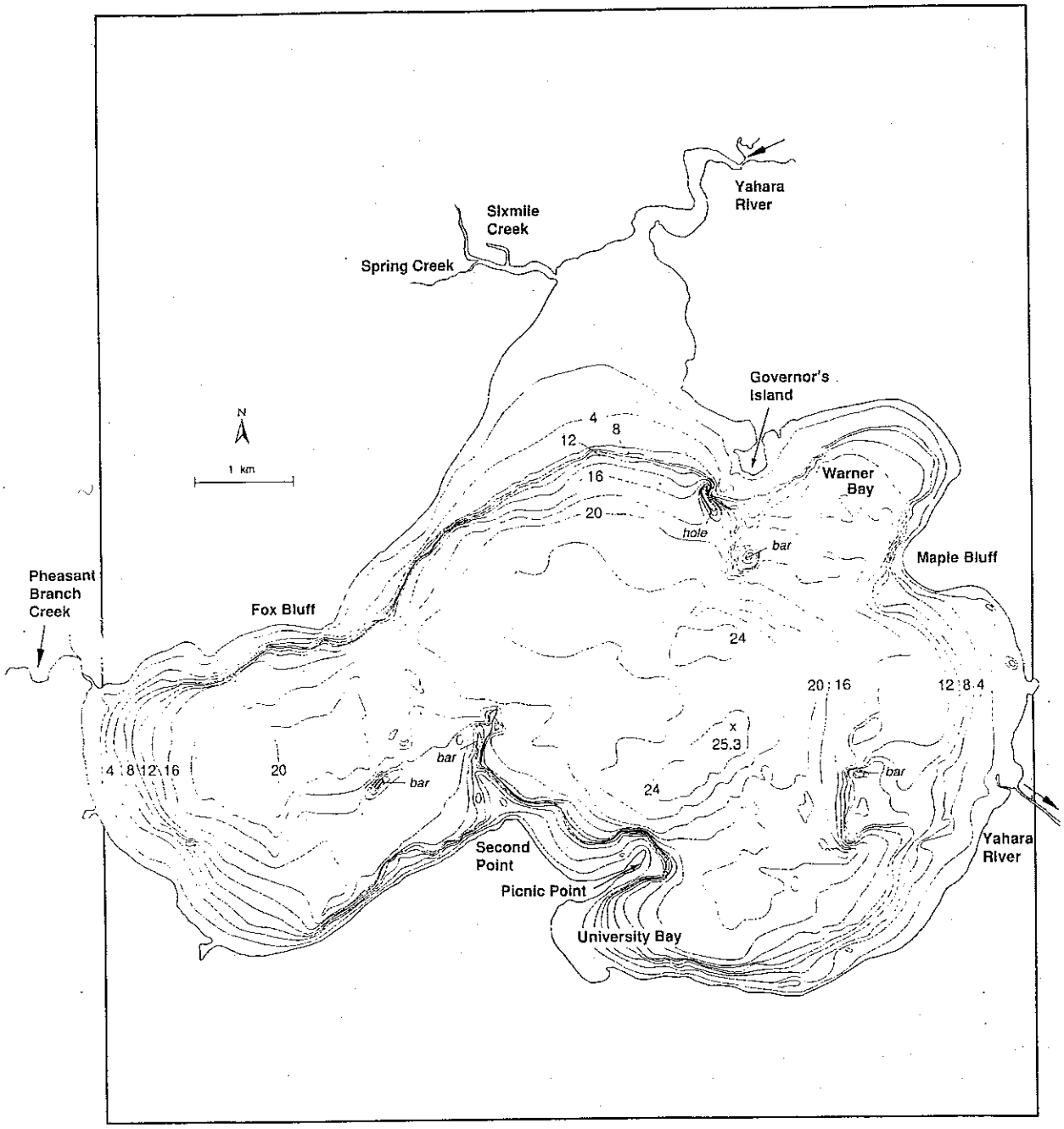
3. Improve the wildlife values to the large wetland complex of the land acquisition by Dane County through wetland enhancement and restoration.

4. Improve fisheries values by providing spawning sites for northern pike.

Lake Mendota

Description

Lake Mendota is located in central Dane County and is surrounded by the cities of Madison and Middleton, the villages of Maple Bluff and Shorewood Hills, and the campus of the University of Wisconsin-Madison. It is the largest and deepest lake of the four lakes in the "Yahara chain." The other lakes are Lake Monona, Lake Waubesa and Lake Kegonsa. Lake Mendota is 9,842 acres in size, has a maximum depth of 82 feet with an average depth of 42 feet (Map 2-7). This lake has a drainage area to lake surface area ratio of 15:1. The water residence time is 6.5 years. In 1847 a dam was built on the Yahara River that caused the



Map 2-7. Hydrographic map of Lake Mendota (depth contours in meters).

water levels of Lake Mendota to rise by 3 to 5 feet. Due to high sulfate concentrations in the lake, Lake Mendota has a high capacity for internally recycling phosphorus. Like the other lakes in the chain, it is classified as eutrophic.

Lake Mendota has been extensively studied for the better part of a century (Lathrop, 1992; Kitchell, ed., 1992). In 1885, the city of Madison began construction of a sanitary sewer system that delivered raw sewage to the two upper lakes in the chain. The effluent was later diverted to just Lake Monona when the first sewage treatment plant was built in 1898. Lake Mendota also received effluent from the three sewage treatment plants from the Villages of DeForest and Waunakee, and the Town of Windsor. These plants' effluent were finally diverted to the Madison Metropolitan Sewerage District in 1971. Excessive algal blooms are further characteristic of these waters, resulting from overloading of nutrient-rich sewage. Data indicate that the water quality has actually improved in the past 25 years due to effluent diversion to the Rock River below Lake Kegonsa. In recent years, phosphorus concentrations in the lakes has been low during years of low flow. In general, the lower the flows to the lakes, the lower the phosphorus and chlorophyll concentrations are. Lake Mendota has even dropped into the mesotrophic category such as in drought year 1988.

Excessive nutrient loading has had a significant influence of the fisheries of the lakes. The fishery of Lake Mendota is diverse, containing both warm and cold water species, rough fish, sport fish and forage fish, with the last accounts showing over 50 species present. Lake Mendota supports an excellent warmwater fishery, including walleye, perch, panfish, bass, northern pike and hybrid musky. Cisco, a coldwater species, are also found in the lake, although a large "die-off" occurred in 1987.

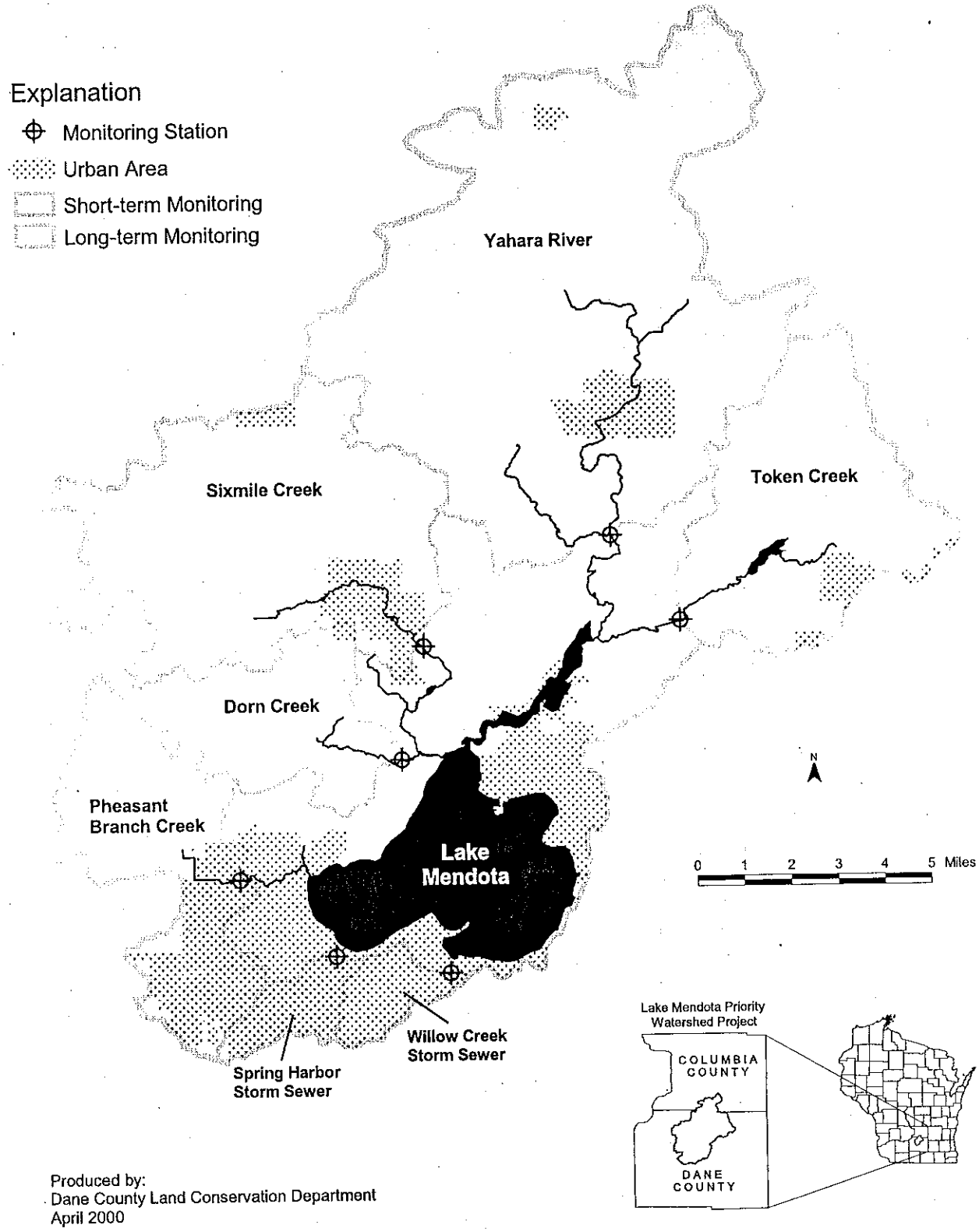
Monitoring[2]

During the planning process of the Lake Mendota Priority Watershed, a thorough analysis of historical monitoring data was conducted by Dick Lathrop as part of his doctoral work in limnology. The following discussion presents a summary of this analysis and lake quality modeling and results. Additional detail on the modeling process can be found in a publication by Lathrop and others, 1998.

One of the principal water quality conditions of concern for Lake Mendota is excessive blue-green algal growth which limits water clarity and negatively impacts recreational use. The primary pollutant supporting algal growth in Lake Mendota and many other natural lakes throughout Wisconsin is the nutrient phosphorus. The vast majority of the phosphorus entering Lake Mendota comes from the surrounding land area and is carried to the lake by tributary streams. It is the land use practices occurring in the lake's tributary drainage area that most greatly influence the amount of phosphorus exported to the lake and in-turn the lake's water quality. The tributaries draining mostly agricultural areas include: Pheasant Branch Creek, Dorn (or Spring) Creek, Sixmile Creek, Yahara River and Token Creek. Inflow from the smaller urban area includes the Spring Harbor and Willow Creek storm sewers. All monitoring stations (Map 2-8) were situated upstream of the lake so as to allow

[2]This section was prepared by Dick Lathrop, DNR and edited by John Panuska, DNR.

Map 2-8. Monitoring Areas in the Lake Mendota Priority Watershed Project



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April 2000

calculation of the flow and loading to the lake. At various times during the past 25 years, continuous flow monitoring stations were maintained on all of these tributaries (except Dorn Creek) by the USGS. The inflow monitoring data in concert with monitored outflow were used in the development of a water and phosphorus mass budget for Lake Mendota from 1975 through 1996 for use in model development. Also included in the water and phosphorus budget were estimates of loads from dry fallout, precipitation and groundwater. This was done using available data for those years where data existed and filling in gaps where data were missing.

Model Development

The first step in setting the phosphorus reduction goal for Lake Mendota was to establish the cause and effect relationship between the phosphorus loading and the lake's water quality response. The watershed loading/lake response relationship is best described using a lake water quality model. The model used in the goal setting process was developed by staff at the UW Center for Limnology and was based on observed flow, phosphorus loading and water column concentration to the greatest extent possible. The model was an empirical model, or one based on mathematical relationships derived from a number of observations. The model application had two components: a lake phosphorus concentration prediction component and an algal response component. The phosphorus concentration component was used to predict mid-April phosphorus water column concentration considering the flow or flushing of the lake, the phosphorus loading to the lake and the amount of phosphorus trapped in the lake via settling to the sediments. The algal response component of the model used the mid-April water column phosphorus concentration to predict the statistical probability of blue-green algal blooms the following summer. The model was formulated to directly evaluate the probability of blue-green algal blooms at various values of reduction in watershed phosphorus loading and was run using 21 years of observations.

Model Results

Average total phosphorus loading to the lake was calculated to be 75,000 pounds per year, of which approximately 66,000 pounds comes via surface water inputs from the watershed (dust, dry fallout, snow and rain and groundwater accounts for the rest). In-lake models were then used to predict how much the phosphorus loading should be reduced to improve the water quality of the lake. Improved water quality was expressed in terms of frequency of nuisance algae blooms. Mid-April P mass changes between successive years indicated that Lake Mendota often responded rapidly to large changes in P loadings. As a basis for evaluation, a threshold chlorophyll a value of greater than 2 mg/l to define a bloom condition. Subsequent evaluations of chlorophyll a probability were therefore tied to the greater than 2 mg/l threshold. Figure 2-1 summarizes the probability of bloom conditions based on two watershed phosphorus load reduction scenarios. For no watershed load reduction the probability of a bloom condition on any summer day is about 60%. If the watershed phosphorus load is reduced by 50%, the bloom probability decreases to 20%. A 50% reduction in watershed phosphorus loading results in a reduction in the April steady state in-lake phosphorus concentration from 0.120 to 0.074 mg/l. The modeling analysis focuses on the frequency of the more noticeable extreme nuisance conditions. The results indicate that the frequency at which these events occur can be reduced by watershed management activities

directed toward reducing watershed phosphorus loading. It is important to realize that nuisance water quality conditions will continue to occur after nutrient reduction but at a lower frequency.

The results obtained by the monitoring data proved to be consistent with the data that the WINHUSLE computer model generated. Those results are presented in Chapter 3.

Water Resource Objectives

The water quality goal for Lake Mendota is to reduce the concentration of spring total phosphorus in the lake to less than 0.074 mg/L. Modeling results indicate that this concentration will result in a decrease in the concentration of blue-green algae to less than 2 mg/L during the summer months. This algal concentration generally represents the point at which algae form nuisance blooms (unsightly green water or surface scums). To achieve this goal, phosphorus input loading to the lake from its watershed must be reduced by about 50%, or 37,000 pounds annually. Given the current annual phosphorus loading, the likelihood on any given summer day of a nuisance algae bloom occurring is 50% of the time, or 1 out of every 2 days on average over a number of summers. With a 50% reduction in annual phosphorus loads to the lake, the likelihood of a nuisance algae bloom occurring is reduced to 20% of the time, which translates to no nuisance algae blooms 4 out of 5 days on average over a number of summers. In a year with high precipitation and hence high runoff into the lake, nuisance algal blooms would be more likely that summer, even with the implementation of recommended best management practices (BMPs).

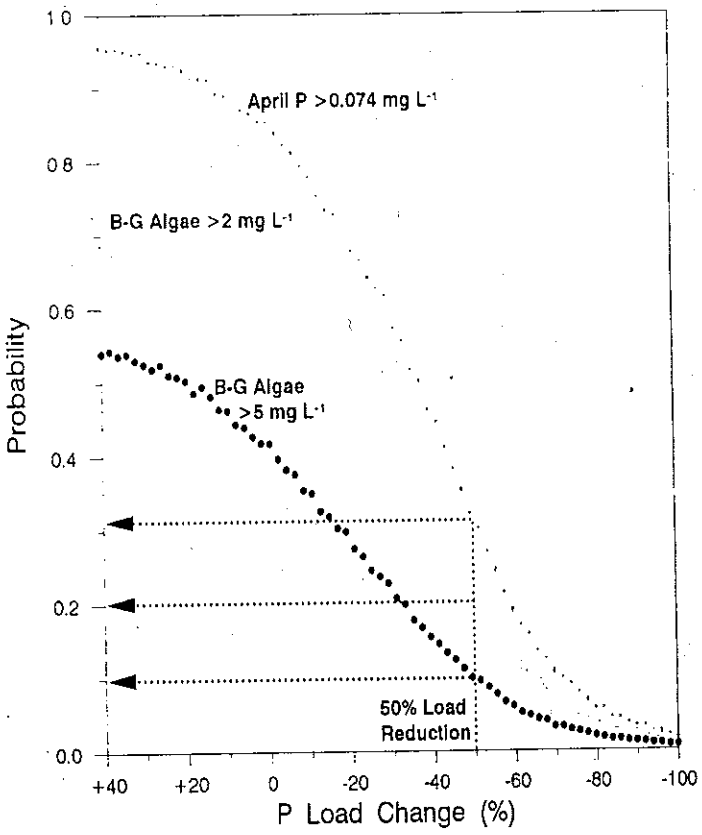

Fig. 2-1. Probabilities of April P concentrations >0.074 mg/L (asterisks), blue-green algal concentrations >2 mg/L (solid circles) versus percentage change of the annual P load. Each point is based on 5000 random samples from a computer model. Probabilities for a 50% load reduction (surface water inputs excluding unalterable sources) are depicted by the dotted lines and arrows.

Source: Lathrop, R.C. et. Al, 1998.

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Table 2-2. Existing and Biological Use and Potential Biological Use for Improvement for the Surface Waters in the Lake Mendota Priority Watershed

Surface Water	Existing Biological Use	Potential Biological Use	Comments
Lake Katrine	Eutrophic	Same	Reduce loadings, public access, walleye rearing
Dorn Creek	0 - 1.0 WWSE	Enhance WWSF	Areas could be enhanced for WWSF spawning
Dorn Creek	1.0-6.0 LFF	Same	Impacted by NPS, Sed, Nutr
Lake Mendota	Eutrophic	Same	Reduce sed and P loadings by 50%
Lake Windsor	Eutrophic	Same	Impoundment; NPS; Reduce loadings
Pheasant Branch Creek	0-1.0 WWSF	Enhance WWSF	Enhance wetlands for northern pike and wildlife
Pheasant Branch Creek	1.0-5.0 LFF	Same	Urban NPS; channelization; hydrologic manipulation
Schoenburg Marsh	Deep water marsh	Enhance deep water marsh	Reduce loading; enhance wildlife values
Goose Lake	Eutrophic	Enhance lake	Native Prairie; wetland restoration, improve wildlife values
Sixmile Creek	0-8.5 WWSF	Enhance WWSF	Enhance wetland; improve northern pike spawning
Sixmile Creek	8.5-12.0	Enhance LFF-WWFF	NPS; Nutr; Sed; Hab; enhance wetlands
Token Creek	0-2.0 WWSF	Same	Enhance wetlands; improve sport fish
Token Creek	2.0-4.0 Cold Class III	WWSF	Cold water species limited by millpond
Token Creek	4.0-10.0 LFF	Same	Nutr, Sed, Hab, Flow, and NPS
Unnamed Trib STH 19	Cold Class III	Cold class III-II	Habitat improvement, enhancement and protection
Yahara River	0-20.0 WWSF	Enhance WWSF	Sed, Nutr, Hab, Urb, CSE, Enhancement/ Protection

Fishery Use Terminology
WWSF = Warm water sport fish
WWFF = Warm water forage fish
LFF = Limited forage fish
FAL = Fish and aquatic life

Cold water class I
Cold water class II
Cold water class III

Use Impairments
NUTR = Nutrient loading
SED = Sediment loading
Hab = Limited by habitat
Urb = Urban Issues

FLOW = Limited by flow
NPS = Nonpoint source
CSE = Construction Site Erosion

Groundwater Resources[3]

Regional Aquifers

Water supplies for domestic, agricultural and industrial uses in the Lake Mendota watershed are obtained from both private groundwater sources and municipal systems. Groundwater is the only source of drinking water in the Lake Mendota Priority watershed. Groundwater is stored underground in pore spaces and cracks in soil and rock layers. Soil and rock layers which hold groundwater are called aquifers. In an aquifer, all the pore spaces and cracks are filled or saturated with groundwater. A well is simply a pipe through which groundwater is pumped from an aquifer to the land surface.

Three aquifers have been identified in the Lake Mendota watershed. From the ground surface down, these include: 1) a sand and gravel aquifer, composed of glacial and other unlithified materials; 2) an upper bedrock aquifer composed of sandstone and dolomite; and 3) a lower bedrock aquifer composed of sandstone of the Eau Claire formation and the Mt. Simon Sandstone. Between the upper sandstone and dolomite aquifer and the Mt. Simon and Eau Claire sandstones there is a confining unit composed of the shale of the Eau Claire formation. This confining unit is not present under the Yahara lakes nor in the eastern portion of the county where the Lake Mendota watershed is located (Fig. 2-2).

The geology of the watershed was recently updated as part of the Dane County Regional Hydrologic Study commissioned by the Dane County Regional Planning Committee (Bradbury and others, 1997). The purpose of the Dane County Regional Hydrologic Study was to improve the understanding of the groundwater system and its relationship to surface water, update the last comprehensive groundwater resource assessment (Cline, 1965) and to provide a three-dimensional groundwater model to be used for water resource management decision making in the future. Products of the study include:

- A database of hydrogeologic data for 4,000 municipal and private wells;
- Water table elevation maps for the entire county at a scale of 1:24,000;
- Maps showing the level of water in wells drilled in the deep sandstone aquifer (potentiometric surface), depth to bedrock and hydrologic properties of the shallow aquifer at a scale of 1:100,000;
- Maps of groundwater capture zones for municipal wellhead protection areas;
- A three-dimensional model of groundwater flow for the entire county.

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[3] This section prepared by Laura Chern, DNR

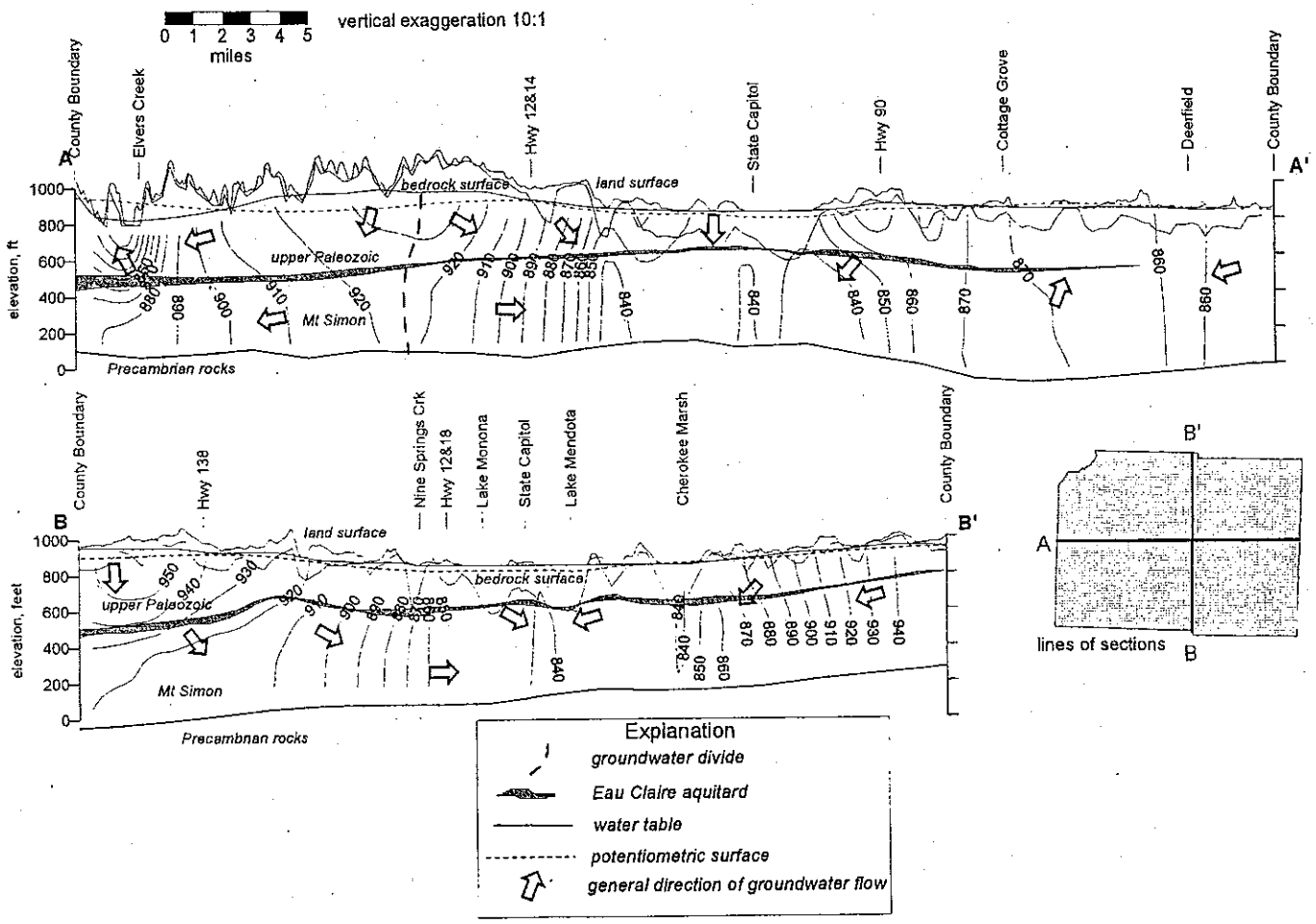


Fig. 2-2. Aquifers in the Lake Mendota Watershed.

Direction of Groundwater Flow

Local groundwater flow in the Lake Mendota Watershed generally follows topography. Groundwater infiltrates (recharges) at topographic highs and is discharged to lakes, streams and wetlands unless it is intercepted by a shallow well. Regional groundwater flow occurs in the deeper Mt. Simon and Eau Claire formations which are also recharged at topographic highs and discharge to the Yahara lakes. In the case of the Lake Mendota watershed, regional groundwater flow is generally to the southwest.

The three-dimensional flow model recently completed as part of the Dane County Regional Hydrologic study compares present groundwater flow to pre-development conditions in order to test research results. The greatest effect of pumping on water levels occurs in and around the city of Madison where water levels in the upper and lower aquifers have declined by more than 60 feet. Similarly, water levels in the Lake Mendota watershed have declined, and the model indicates that groundwater flow direction has been reversed near large cones of depression formed by Madison municipal wells. Groundwater is being recharged from the Yahara lakes, streams and wetlands. By comparing pre-development conditions to 1992 flow at gaging stations, it is apparent that pumping has reduced baseflow.

Groundwater Quality

A total of 157 private well samples were collected for nitrate analysis in the Lake Mendota priority watershed (Table 2-3). An alarming 65% of these samples exceeded the health-based enforcement standard of 10 mg/L. An additional 25% exceeded the preventive action limit of 2 mg/L. The preventive action limit indicates the level at which human actions affect groundwater quality. Most private wells in the watershed draw water from the upper aquifer, and sources of contamination are probably within 1 or 2 miles of affected wells. When contamination is as widespread as it appears to be in the Lake Mendota watershed, runoff from excess manure and fertilizer application is a likely source of nitrate in groundwater.

Concentration for nitrate ranged from not detected to 46.7 mg/L (parts per million). One part per million is comparable to one drop in a 10-gallon fish tank. No specific source of contamination is indicated by the results.

Table 2-3. Well Sampling Results for Nitrates: Lake Mendota Watershed

Subwatershed	Total samples taken	Number of Nitrate Samples and %of samples taken		
		<2 mg/L	(P.A.L.) > 2 and <10 mg/L	(E.S.) >10 mg/L
Lake Windsor	0	0	0	0
Token Creek	3	0	1 (33%)	2 (67%)
Yahara River	22	1 (5%)	3 (14%)	18 (82%)
Cherokee Marsh	3	1 (33%)	0	2 (67%)
Brandenburg Lake	4	0	3 (8%)	1 (25%)
Sixmile Creek	52	6 (12%)	15 (29%)	31 (60%)
Dorn Creek	29	3(10%)	11 (38%)	15 (52%)
Pheasant Branch Creek	16	3 (19%)	4 (25%)	9 (56%)
Lake Mendota	0	0	0	0
Schoenberg Marsh	3	0	0	3 (100%)
Goose Pond	6	0	1 (17%)	5 (83%
N. Yahara River	19	1(5%)	2 (11%)	16 (84%)
Totals	157	15 (9.5%)	39 (25%)	102 (65%)

1999 Well Sampling Program

In 1999, additional groundwater sampling was offered to rural residents in the Lake Mendota watershed (Dane Co. LCD, 1999). Two-hundred and forty-eight residents participated in the sampling. Some wells were found to be free on contamination; however, significant levels of nitrates and triazines were found in 40 percent and 38 percent of the wells, respectively. The levels of nitrates in the goundwater of the Lake Mendota watershed are among the highest in the state. Forty percent of the wells were found to have nitrate levels above the state and federal drinking level standard of 10 milligrams per liter, which is not safe for pregnant women or infants to drink. Seventeen samples (47%) exceeded 20 milligrams per liter and two exceeded 40 milligrams per liter. Sources of nitrates include fertilizer, septic system effluent and animal waste.

Triazines are a group of chemicals related herbicides, the most common of which is atrazine. Triazines are suspected of causing cancer, birth defects, heart and liver damage and skin allergies. Atrazine levels about 0.3 parts per billion is cause for concern. Seventy-two of the samples contained a measurable amount of atrazine and 38% had levels about 0.3 parts

per billion. Atrazine is classified as a possible human carcinogen. Levels of 3.0 parts per billion or more are considered an unacceptable risk for long-term consumption. Public water supplies cannot contain more than these levels and private well owners are advised not to drink their water with readings this high.

Coliform bacteria were detected in 13% of the samples. These bacteria do not usually cause disease by themselves, but indicate that disease-causing bacteria could be present.

Water quality specialists suggested that additional testing be conducted to verify the accuracy of the readings. Depending on the level and type of contamination, various actions are recommended, including well repairs, water treatment devices, or drilling a new well. Education is a key component in groundwater protection, and both Dane County and the state run various programs from well maintenance to pesticide application.

Farm Practices Inventory

The Farm Practices Inventory (FPI) is a formal assessment of land users' nutrient and pest management practices conducted in some priority watershed projects by the University of Wisconsin-Extension. Three reports were completed as a result of the Lake Mendota FPI (See Appendix 2 - Farm Practices Inventory). The second report from this study, "Nitrogen and Phosphorus Management," focuses on the use of farm fertilizers, specifically nitrogen and phosphorus (Nowak and others, 1996b). Each farmer's nitrogen use was assessed independently to determine the total rate of nitrogen application on their most productive corn field. Of farmers surveyed, 50% applied nitrogen fertilizer more than 10 pounds per acre over recommended rates. Of farmers surveyed, 73% either under-credited the amount of nitrogen from manure or didn't credit nitrogen at all from manure application. About 93% of farmers surveyed did not credit enough nitrogen (by 10 percent) contributed by legumes.

The third report from this study, "Farmstead Pollution," focuses on the use of pest management strategies and farmstead pollution prevention (Nowak and others, 1996c). The report documents pesticide storage practices, manure storage, milkhouse waste, fuel storage tanks and farmstead well protection. Improperly abandoned wells present a direct risk to groundwater as they can act as a direct conduit from the surface to the drinking water source. Of farmers surveyed, 26% indicated they have one or more abandoned wells on their farmstead.

Safe Drinking Water Task Force

In the spring of 1996, then Dane County Executive Rick Phelps established the Safe Drinking Water Task Force. The goal of the task force was to recommend specific actions to protect Dane County's groundwater. A final report was completed that fall (Born and others, 1996). In response to the final report, a 5-year plan to ensure safe drinking water was included in Dane County's 1997 budget. The county executive's 1997 Safe Drinking Water Budget Initiative allocated the following for groundwater protection (all of which are related to problems that can be addressed in the Lake Mendota Priority Watershed):

Table 2-4. Safe Drinking Water Task Force Recommendations & Budget

1. A well abandonment program to include : a) an information and education campaign regarding the need to abandon wells properly; b) a 75-percent cost sharing program to properly abandon unsafe, unused and noncomplying wells; c) subdivision review to include well issues. The program will complement a newly created federal program for proper well abandonment in agricultural areas.	$16,000
2. An inventory of all manure storage structures in Dane County to improve regulation of manure storage and insure that old manure pits are properly abandoned.	$6,000
3. Continued support of development of the regional groundwater model.	$2,500
4. Partnership funding to continue flow monitoring of Black Earth Creek. This monitoring will provide critical information on the groundwater-surface water interaction in the western part of Dane County.	$4,650
5. Survey of septic systems in western Dane County, where the risk for septic system failure and groundwater degradation is the highest in the county. A detailed survey will establish how great a problem exists.	$10,000
6. Expansion of the county septic system maintenance program to all septic systems; currently, those installed before 1980 are not covered.	$42,000

The Dane County executive recommended addressing the following over the next four years:

1. Protect wellheads with overlay zoning, appropriate development standards and inter-governmental agreements.

2. Create a partnership with the state to insure that all septage produced in Dane County is properly disposed.

3. Insure that high capacity wells are properly cased and extend into the deep sandstone aquifer.

4. Promote farmer's use of improved pest management techniques so they can reduce their use of pesticides an improve their profitability.

5. Work with state regulators to prevent leaks from underground storage tanks.

Conclusions and Recommendations to Groundwater Contamination Problems

1. The three-dimensional groundwater model completed by the WGNHS and USGS indicates that water conservation is needed in the watershed to maintain baseflow to lakes, rivers, streams and wetlands. Decreased baseflow not only affects water quantity in surface water but also temperature and therefore fish and aquatic habitat.

2. Water conservation is also critical for maintaining a high quality water supply in Dane County. As pumping has increased, water is drawn from the upper aquifer to the deeper aquifer. The shallower aquifer is more vulnerable to contaminant sources due to land use.

Recommendations for 1& 2: The public education plan (known as "information and education," or I&E, plan) for the Lake Mendota Watershed should contain a water conservation element.

3. Zones of contribution for municipal wells in the watershed have been delineated using the three-dimensional groundwater model. Overlay zoning can be used to set up wellhead protection areas for all municipalities.

Recommendation: The watershed staff should work with Dane County and the DNR on wellhead protection ordinances or overlay zoning for municipalities in the watershed.

4. More than 65% of private wells tested for the watershed appraisal had nitrate levels greater than the health based enforcement standard of 10 mg/L. Such wide-spread contamination suggests that nutrient management is needed to preserve and enhance groundwater quality in the watershed.

5. The Farm Practices Inventory showed that 50% of farmers in the watershed are over-applying nitrogen fertilizer and not adequately crediting other sources of nitrogen.

Recommendation: Nutrient management cost sharing to protect and enhance groundwater quality should be available to most farmers in the watershed.

6. Although no well samples were examined for pesticides, information shows that groundwater contamination by Atrazine is fairly widespread in Dane County.

Recommendation: Pest management cost sharing to protect and enhance groundwater quality should be available to most farmers in the watershed.

7. The FPI indicated that some wells in the watershed are improperly abandoned and could act as direct conduits for contaminants to groundwater.

8. The Dane Executive's 1997 Safe Drinking Water Budget Initiative set aside $68,000 for well abandonment and septic system maintenance.

Recommendation: The Dane County Executive's 1997 Safe Drinking Water Budget Initiative should be explored as a source of funding for well abandonment and septic system maintenance for septic systems installed prior to 1980 and located within the watershed.

Wetlands[4]

Introduction

Wetlands are an integral part of the Lake Mendota Watershed and have been an important resource for its wildlife, people and water quality since before recorded history. While the extent of wetlands within the watershed has fluctuated greatly in recent geologic times, modification of wetland communities by human activity in the last 150 years has caused significant changes to the present-day Mendota area landscape. Wetland loss and degradation during this period has contributed to a decline in the water quality of Lake Mendota, and reduced the value of the lake as a fishery and habitat for waterfowl and other wildlife.

Wetland History

Geologic Changes -- The outline of Glacial Lake Yahara, a meltwater lake left behind by the retreating glacier some 13,000 years ago, can still be seen in the organic soils surrounding present-day Lake Mendota. In places, these soils still support sedge-meadow or cattail wetland communities. Lake Yahara, with waters estimated to be 12 feet above current Lake Mendota, would have inundated many familiar local wetlands such as Cherokee Marsh and Pheasant Branch Marsh. Nonetheless, net wetland area within the watershed likely surpassed that of modern times for thousands of years after the glacier departed, until outlets for meltwater and precipitation slowly developed through the glacial outwash. The relative area of Lake Mendota, its littoral zone and upland wetlands within the watershed has likely fluctuated for thousands of years.

Early Settlement -- The Four Lakes region has been continually inhabited since about 10,000 BC, by at least four native cultures. Wetlands were important to these cultures for hunting and gathering, fishing and for the extensive wild rice beds. Native peoples used some of the same techniques later employed by European settlers to manage and manipulate wetlands, such as using fire to rejuvenate marshes and make travel easier, reseeding wild rice beds to ensure a continued supply of this annual grass and constructing small dams and weirs to improve navigation or concentrate fish for harvest. It seems unlikely that such early management significantly altered the wetland area of the watershed.

Similarly, European settlement, beginning in the 1830's, did not immediately bring great changes to the Mendota wetland community. Early settlers' first priorities were with breaking prairie soils, clearing land, and building farmsteads. The first significant wetland changes were apparently due to flooding, not drainage, as dams were built for grist and saw mills. The first grist mill was built on Token Creek in 1849, with a second there in 1860. A third grist mill was built on Sixmile Creek near Waunakee also in 1860. These millponds probably inundated some wetland acreage, while creating wetland conditions on adjacent uplands. The net effect may have been to change wetland type as often as acreage, usually to the detriment of water quality, as formerly free flowing streams were slowed, warmed, and

[4]This section prepared by Mike Foy with field assistance from Cami Peterson.

allowed to acquire silt burdens. But though locally important, these small millponds probably had a minimal effect on the wetlands and water quality of Lake Mendota.

In contrast, construction of the earliest and largest of the milldams, the Farwell Dam at the outlet of Lake Mendota, ranks among the larger human changes to the watershed. Begun in early 1849 by future Governor Leonard Farwell, the dam raised the level of Lake Mendota 3.5 feet to power the grist mills, lathes and saws of Farwell's "Madison Mills" on the present site of Tenney Park. A thriving business for many years, the wood and earth dam washed out in 1866, but was rebuilt only to have the mill burn twice over by 1894. The once marshy slough between the lakes was dredged and straightened in 1849 as well. The dam was eventually rebuilt with locks to allow navigation to Lake Monona. The dam has clearly been a major influence on Lake Mendota wetlands and water quality to this day.

In raising the pool, certain areas of deep-water aquatics were undoubtedly lost, especially as water quality and light penetration declined over the years. Shallow aquatics probably shifted location, while near shore emergents would have been inundated. The lake flooded over the bar in the north bay, fetch increased and the extensive wetlands between the bar and the Yahara River inlet were exposed to destructive wave action. The higher water also floated emergent stands, which became susceptible to calving and loss from the increased wave action, and later, from the increased flood flows as the watershed was ditched and cultivated.

By the turn of the century, calving had apparently removed a large area of emergent wetland in the north bay, resulting in Sixmile Creek emptying directly into the lake, rather than through its former outlet into the Yahara River. Although much of the emergent loss within the lake itself was accomplished by 1900, Cherokee Marsh and the Upper Yahara River have seen steady losses this century, including as recently as 1993, when record precipitation caused large chunks of emergents to break free and float across the lake to rest against the University of Wisconsin shoreline.

Organized and Private Drainage -- By the early 1900's, increasing demand for arable land turned attention to wetland reclamation. University of Wisconsin agricultural research promoted drainage to lengthen growing seasons and improve yields even on only seasonally wet fields, while providing fertilization recommendations to make wetland soils productive. Steam dredges became available, and a 1891 state law authorized the formation of drainage districts and assessments to finance them. At least seven drainage districts were organized in the Mendota watershed since 1916, eventually draining over 3,000 acres through construction of main drains and stream channelization. Of these, four districts are still considered active and will require consideration prior to any wetland restoration projects in the watershed (Table 2-5).

By providing ditch outlets for gravity flow of water within reasonable distance of many farms, the drainage districts (along with improved town road ditches) encouraged additional private drainage. Drainage efforts increased greatly between 1940 and 1970 with swelled demands for providing foodstuffs for two World Wars, growing post-war export markets and improved USDA financial and technical drainage assistance. Nearly all large wetland complexes within the watershed were drained to some extent, and some were lost completely, such the extensive area along Pheasant Branch Creek in the Town of Middleton, known as

Slaughter's Marsh or The Big Marsh. Other significant wetland losses have been to nonagricultural drainage, such as the conversion of wetland into the Cherokee Country Club.

Table 2-5. Active drainage districts within the Lake Mendota watershed.

Drainage District Number	Town or Municipality	Section(s)
11	Windsor	13, 24, 25
22	Vienna Windsor DeForest (Village)	23, 24 18 18
5	Windsor	4, 5, 6, 7, 8
29	Vienna	5,23,26

Dredging and Filling -- Although wetland loss through filling has not equaled that of drainage, these losses are notable because subsequent development makes filled areas virtually irretrievable to any restoration effort, and because they represent a high proportion of former shoreline and near-shore wetlands important to water quality and to fish and wildlife for spawning and nesting.

An estimated 25% of the original City of Madison plat was marshy. These extensive wetlands were among early Madison's least appreciated features. Condemned by physicians and town boosters for their poor aesthetics, stench and disease-carrying mosquitos, they were the target of numerous drainage attempts. Those failing, the wetlands eventually fell victim to dredging and filling for park and residential land. Many of Madison's popular area parks and lakeshore areas were reclaimed by dredging and filling wetlands. Starting in the late 1890s, rock hauled in by train and wagon was used to lay out roads delineating city blocks, which were subsequently filled with sand piped in from Lakes Mendota and Monona by steam-powered dredges. By 1920, the Great Central Marsh was a memory, although it took the construction of a huge storm sewer draining to Lake Monona in combination with filling to finally subdue this last holdout among major Madison wetlands.

Although most of these isthmus wetlands actually drained to Lake Monona, the battle to subdue them set a tone for reclamation efforts on Lake Mendota wetlands that continued well into the 1960's. Significant wetland losses during that decade from dredging and/or filling occurred during the creation of Cherokee Lake and Park from Cherokee Marsh, development of UW recreation facilities adjacent to University Bay and the construction of Interstate 90/94. Occurring on the cusp of the environmental movement, these projects became increasingly controversial, and current regulations would now severely restrict large wetland losses of this type. Unfortunately, as the Mendota watershed becomes urbanized, less obvious but significant filling for road, housing and commercial development continues to this

day, often escaping regulation because previous agricultural drainage removed project lands from wetland delineations.

Wetland Protection Efforts -- It has only been in recent years that wetland protection efforts have since been used in the Lake Mendota watershed. All levels of government, as well as private conservation organizations, have promoted wetland preservation through efforts such as the purchase of Cherokee Marsh, Waunakee Marsh, Pheasant Branch Marsh, Sixmile and Dorn Creek Fisheries Areas, Token Creek Park, Governor Nelson Park, Schoenberg's Marsh and Goose Pond, among others.

Wetland protection regulations have come to the forefront since the early 1970's, complementing acquisition efforts. Section 404 of the federal Clean Water Act, and Chapters 30 and 31 of the State Statutes are regulations concerning navigable waters, NR 103 water quality certification, county wetland zoning, local land use ordinances and quasi-regulations such as USDA Swampbuster provisions have also combined to provide protection from wetland losses to ill-conceived projects. Increasingly, wetland mitigation is required as a permit requirement of unavoidable wetland losses.

Finally, incentive programs have shown great promise for wetland protection and restoration on private land. Federal Water Bank, Conservation Reserve and Wetland Reserve programs have provided compensation to landowners who protect wetlands on their property, while U.S. Fish and Wildlife Service, Natural Resource Conservation Service and state and county programs, including this watershed project, are now available to provide cost-sharing for wetland restoration on private land. Private organizations such as Ducks Unlimited, Wisconsin Waterfowl Association, Pheasants Forever and Madison Audubon continue to play a leadership role in private wetland protection.

Wetland Loss, and Watershed Impact, and Named Wetlands

The Lake Mendota watershed historically had large wetland areas, particularly along the low gradient tributaries to the lake. But a significant amount of wetlands have been lost in the watershed. One estimate is that 50% of the wetlands have been lost since 1835 (Lathrop, 1992). A second estimate was generated by the USDA's Natural Resources Conservation Service wetland inventory (1994). Their survey concluded that 31% of historic wetland acres have been lost to agriculture (USDA converted and prior converted categories) while 69% of historic wetlands still remain (USDA wetland and farmed wetland categories) in only the Dane County portion of the watershed. This may still be considered a conservative estimate, as it does not include some historic wetland acres, both lost and remaining, that were not inventoried because they are within urban or other nonagricultural areas.

Table 2-6. Wetland area in watersheds of the Yahara lakes between 1835 and 1974, with percentage lost since 1835.

Wetland Area (acres)								
Year	Mendota	% lost	Monona	% lost	Waubesa	% lost	Kegonsa	% lost
1835	10,176	-	4,891	-	6,200		5,829	
1938	7,879	23%	1,828	63%	4,792	23%	4,248	27%
1974	5,088	50%	371	92%	1,680	73%	1,754	70%

Sources: 1835 - Township survey maps (published by the U.S. Surveyor General's Office in 1851 and 1855).
1938 - Wisconsin Conservation Department (1961).
1974 - U.S. Geological Survey topographic maps (printed in 1976).
Adapted from: Lathrop, et. al., 1992.

Table 2-7. Wetland resources* of the Dane County portion of the Lake Mendota Watershed based on 1994 USDA's Natural Resources Conservation Service Wetland Inventory.

Wetland type		Acres	Total Acres	Percent
Total Remaining Wetland - 1990	Wetland	8,602	9,682	31%
	Farmed Wetland	1,080		
Total Lost Wetland	Prior Converted Wetland	4,262	4,301	69%
	Converted Wetland	39		

* Not including Lake Mendota, artificial wetlands, and non-inventory lands.

These data, while varying in estimates, agree that significant acreage in the Mendota watershed has been lost. The expected effect on the watershed has been greater peak runoff episodes, increased scouring, reduced filtration and ultimately increased sediment and nutrient delivery to Lake Mendota. This in turn contributes to a decline in Lake Mendota water clarity through increased algal blooms, reduced deep water and littoral zone aquatic beds and degraded fish and wildlife habitat.

The wetland resource inventory conducted in 1996 revealed that there are 49 named wetland resources of the Lake Mendota watershed, existing and lost. These are listed in "Appendix One - Wetlands" in recognition of the importance of wetlands to the watershed. Location, ownership (known but not published) and approximate size are shown where known. Wetland size or quality may be greatly reduced at some sites. Protection and enhancement of existing wetland resources in the watershed is important for maintaining and improving the water quality of Lake Mendota, as well as for their own inherent values. Enforcement of construction site erosion control ordinances and improved storm water management are a necessary part of wetland protection in and on the fringe of urban areas. Cooperative landowner agreements and purchase of wetland easements or other land rights are also options for protecting existing wetlands in the watershed.

Wetlands within the Lake Mendota "Flood Pool"

Appraisal for Restoration and Protection

Evaluations in this section are aimed at preventing further loss of emergent beds within the Lake Mendota 100 year flood pool (851.75 feet NGVD at Tenney Park Dam, 853.75 feet at Highway 113 bridge), and investigating possible mechanisms to restore in-lake wetland habitat.

Construction of the Tenney Park (Farwell) dam resulted in the drowning of swamp and deep marsh adjacent to the Yahara River where it passes through Cherokee Marsh (Bedford, 1974). However, the Mendota impoundment is also credited with preserving the Cherokee Marsh by making conversion to other uses difficult. Raising the water level also floated emergent beds along the Yahara and in the North Shore Bay of Mendota, allowing calving or scouring by subsequent high water events or by ice piles during spring breakup. These losses have not attracted as much attention as those of the Winnebago pool lakes at the confluence of the Fox and Wolf Rivers (Wisconsin DNR, 1989). The 1849 impoundment occurred before the memory of recent observers, and the more modest peak flows of the Yahara River have caused emergent loss to occur more gradually. Yet steady incremental losses persist, as evidenced by the loss of the peninsulas that once bordered Cherokee Lake. A comparison of the open water area of the Yahara River between Lake Mendota and the mouth of Token Creek on the 1904 and 1983 USGS topographic maps indicates that about 276 acres of riparian emergent wetlands have been lost this century. These losses can be expected to continue unless 1) Yahara River peak flows are attenuated, 2) Lake Mendota water levels are lowered, at least periodically, or 3) Structural barriers such as riprap are provided to protect riparian wetlands from calving. A more sophisticated evaluation of these alternatives will be required, including the alternative that wetland loss rates are acceptable relative to the cost of abatement.

Alternatives and Recommendations within the Lake Mendota Pool

In-Lake Alternatives

1) Evaluate benefits of raising the historic bar in the North Shore Bay running from Governor Nelson State Park east to the navigation channel for wave attenuation, sediment deposition, emergent and submergent vegetation colonization and fish and wildlife habitat. Cost: ~$30,000 for preliminary study.

2) Evaluate benefits of scheduled summer drawdowns of Lake Mendota on a 10-year interval to encourage colonization of emergent wetland beds in the North Shore Bay and Cherokee Marsh.

3) Evaluate structural protection methods such as riprap to prevent further loss of riparian emergent wetlands at the mouth of Lake Mendota. Cost: $25+/foot.

4) Evaluate benefits of no entry in-water refuges for waterfowl during spring and fall migration periods in North Shore and University Bays.

Cherokee Marsh Alternatives

1) Evaluate structural protection methods such as riprap to prevent further loss of riparian emergent wetlands. Important areas are the City of Madison parklands at Hickory Point in the North Unit of Cherokee Marsh Park, and the South Unit of Cherokee Marsh just upstream of the Highway 113 bridge. Cost: $25+/foot.

2) Evaluate impeding drainage through the Mud Creek tributary to Token Creek to help maintain the water levels in the marsh proper. The objective would help identify the source of the springs in the high value fen areas, without actually inundating the fens or destroying northern pike spawning habitat.

Cherokee Marsh Recommendations

1) Conduct a hydrological study to determine a) if Cherokee Marsh groundwater levels are falling; b) if groundwater levels determine rates of peat oxidation and nutrient release Lake Mendota; c) if there are methods to protect springflow in fens on the state natural area; and d) if limits on groundwater removal are necessary. Cost: ~$25,000.

2) Design and construct plugs for all possible Cherokee Marsh ditches to help capture sediment and nutrients during peak flood flows and reduce nutrient release during low flow periods. Any plans for this work must consider effects on northern pike spawning habitat. Cost: $20,000 - 30,000.

3) Design and construct floating baffle to prevent wave action from causing further enlargement of the sewer intercept ditch in the South Unit of Cherokee Marsh Conservation Park and erosion of the School Road (Wheeler Road) fen. Cost: $5,000

4) Assist state, county and city government in completing land acquisition goals within Cherokee Marsh and encourage cooperative vegetation management by use of prescribed burns and other techniques for control of exotics. Cost: None to priority watershed.

5) Maintain the flood profile between Westport Road and the Highway 113 Bridge (0.5 foot for 10-year flood, 1.5 foot for 50-year flood, 2 foot for 100-year flood) in recognition that increases in pool elevation may be necessary to maximize Cherokee Marsh sediment and nutrient trapping.

6) Develop and implement a design to prevent storm water runoff from across County Highway CV from causing erosion and sedimentation to the fens on the state natural area.

Upland Wetland Sites

Appraisal and Restoration

The upland wetland evaluation looked at wetlands that have been lost through various practices but still retain some wetland characteristics such as hydric soils, ponded water or the presence of wetland vegetation. To identify these sites, a number of data sources were consulted. A primary source was the Natural Resources Conservation Service (NRCS) wetland inventory. This inventory includes the following categories in the Lake Mendota Watershed: Lake Mendota (open water), artificial wetlands, converted wetlands, farmed wetlands, non-inventoried (usually wooded or urban areas), prior converted wetlands, upland surrounded by wetlands, upland, and wetland. Wetlands, farmed wetlands and prior converted lands were of primary interest.

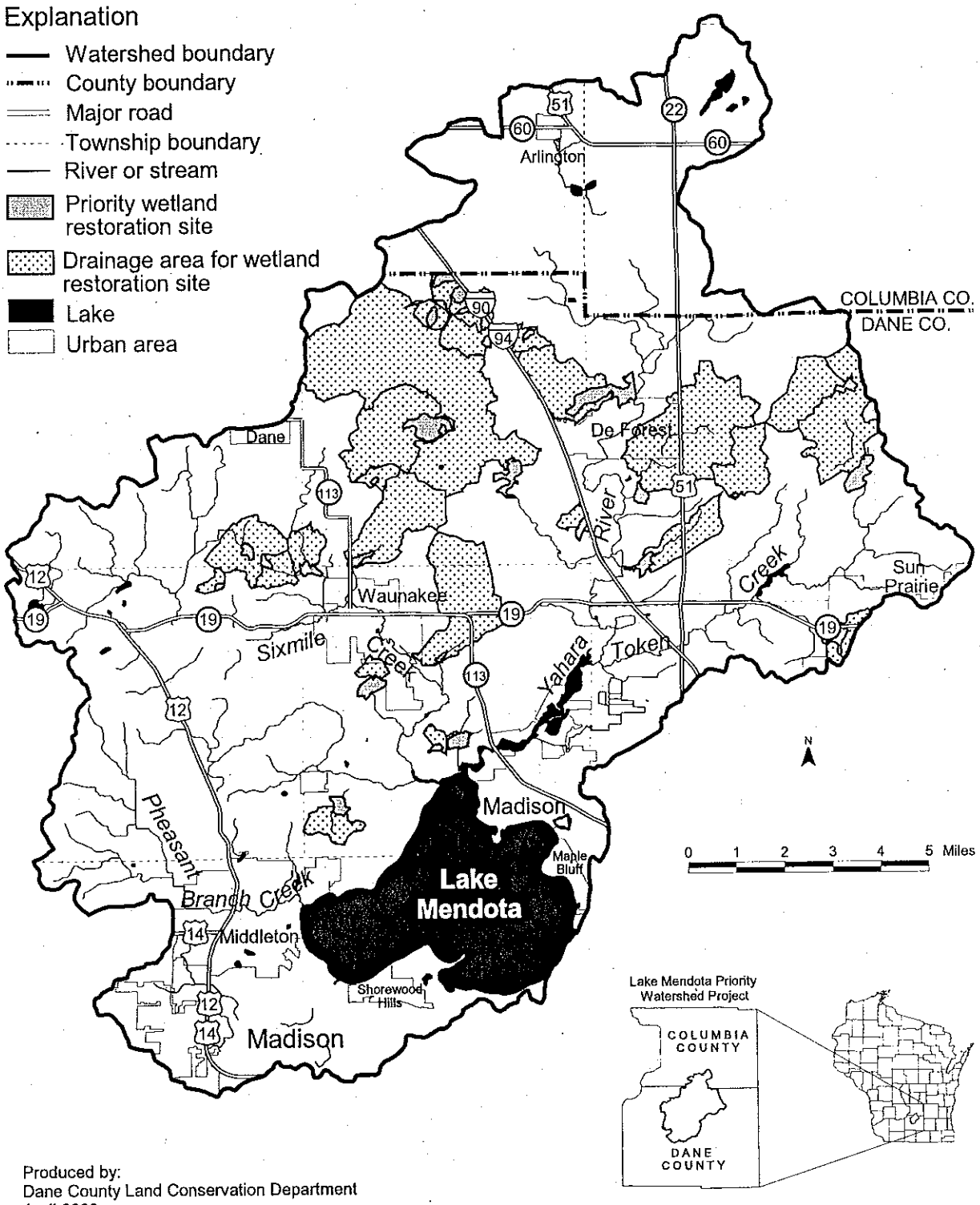
Wetlands (W) are defined by NRCS as lands that have wet, saturated soil during some part of the growing season, and would support plants that grow in wet soils if the area was not disturbed by tillage, mowing or similar actions. Farmed wetlands (FW) are defined as cropland that was cleared, drained or filled *and* cropped before December 23, 1985, *and* is a pothole that still meets wetland criteria, *or* is a wetland that, in many years, still floods or ponds in the spring or fall. Prior converted cropland (PC) is defined as cropland that may contain wetlands that were cleared, drained, filled or otherwise manipulated to make them cropable before December 23, 1985. The fields must also have been used to produce crops prior to this date.

Map 2-9 shows the potential upland wetland restoration sites. A list of possible restoration sites in the Lake Mendota watershed is found in Appendix One-Wetlands. That list presents restorable wetlands in the FW and PC categories. Some additional time was spent evaluating potential for enhancement of existing wetlands. The sites evaluated tend to be larger in size. The reason for this is twofold. First, we wanted to locate those wetland restorations that would have the greatest impact on water quality in Lake Mendota. A potential site was evaluated using the WINHUSLE computer model. The model estimated the sediment loading to a receiving water body, and estimates the ability of the downstream area to receive the load. Delivery efficiency is based on the site's location in relation to Lake Mendota or its main tributaries. Other factors such as wildlife habitat value were also used in the evaluation.

Second, we hoped to identify projects that could not be restored through other programs. Small wetland restoration projects already have funding available from the U.S. Fish and Wildlife Service, NRCS, the Department of Natural Resources, Wisconsin Waterfowl Association and Ducks Unlimited. We wanted to target wetland projects that could be accomplished through the cooperation, resources and financial assistance available though the priority watershed program. However, these agencies and organizations should be encouraged to continue their restoration efforts on the many smaller sites in the watershed.

Any measurements of areas and distances are an approximation only. If the site is reviewed further, more accurate measurements will need to be taken. Second, a cursory investigation

Map 2-9. Priority Wetland Restoration Sites in the Lake Mendota Priority Watershed Project



Produced by:
Dane County Land Conservation Department
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of whether a site is a navigable stream was determined based on its being at least an intermittent stream on the U.S.G.S. 7.5 minute series topographic map. Further investigation may be needed. Finally, no landowner contacts were made, and sites were physically reviewed from the roadway only. The presence of ditches and tile lines at a site may have been overlooked. If a site is pursued, tile records and ditches may need to be researched further.

Appendix One-Wetlands includes all the components of the inventory. These are: site location; list of hydric soils; location in relation to Lake Mendota, the nearest water body, and the nearest urban area; located in an active drainage district; wetland drainage area; size of restored wetland; type of restoration needed; any notes of interest, including but not limited to history of site (if known), current condition of wetland, current condition of surrounding uplands.

CHAPTER THREE
Nonpoint Source Pollutants and Management Strategy

This chapter describes the results of the nonpoint source inventories, objectives and cost-share eligibility criteria for each pollutant source. The rural sources include: barnyard runoff, agricultural nutrients, sediment from upland areas, and streambank erosion. Urban sources of pollutants are also presented in detail. The urban sources are pollutants from existing urban areas including storm water and loads from construction sites.

Management Categories

Cost-share funds for installing pollutant control measures will target sites that contribute the greatest pollutant load (upland fields, urban runoff, streambank and shoreline erosion, streambank habitat degradation sites, manure spreading, or barnyards). Management categories define which nonpoint sources are eligible for financial and technical assistance; they are based on the amount of pollution generated by a source and the feasibility of controlling the source. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that source of pollution is essential for meeting the pollutant reduction goals for the project. All critical sites must be controlled. Nonpoint sources that are eligible but not critical contribute less of the pollutant load but are included in cost sharing eligibility to insure that water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost-share assistance.

Management category eligibility criteria are expressed in terms of tons of sediment delivered to surface waters from eroding uplands and streambanks, pounds of phosphorus delivered to surface waters, the number of unsuitable acres spread with manure, feet of streambank trampled by cattle, and pounds of heavy metals and organics from urban areas. Management categories for particular sites may be revised up to the point that a landowner signs a cost-share agreement. Any newly created sources requiring controls after the signing of a cost-share agreement must be controlled at the landowner's expense.

The Dane and Columbia County LCDs will assist landowners in applying BMPs. Practices range from alterations in farm management (such as changes in manure-spreading and crop rotations) to engineered structures (such as clean water diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations.

Critical Site Management Category

Nonpoint source pollutant load reduction in the Lake Mendota Watershed project will be achieved mainly through voluntary participation. Nonpoint sources included in the critical category contribute a significant amount of the pollutants impacting surface waters. State statutes require that the nonpoint source control plan designates the necessary activities to ensure the reasonable likelihood of achieving water quality goals and objectives. Landowners with sites that meet the established critical sites criteria are required by law to address those specific sites by reducing the nonpoint source pollutant load to an acceptable level. Pollutant load reduction can occur solely through the action of the landowner with guidance from county staff, or through watershed participation. Each site will be field verified before receiving notification as a critical site, with the findings sent to the DNR District Office. Landowners interested in receiving cost-share assistance for the installation of Best Management Practices will need to sign a cost-share agreement with their respective county Land Conservation Department.

Notification of landowners with known critical sites will begin 6 months following plan approval and will continue through the completion of the inventory. The first to begin the process shall be those highest ranked critical sites based on estimated pollutant contribution. Critical sites will provide at least 25 percent of the pollutant reduction goal. On-site visits will be conducted within a 6 month period. The purpose of the visit will be to verify that the location still meets the criteria for critical sites. The notification will include the following information:

- The 36 month period in which landowners are eligible for the full level of state cost-sharing, after which the cost-share rate decreases by 50 percent;
- The potential consequences that a landowner may face if no action is taken and the site continues to meet the critical sites criteria described in the watershed plan;
- The right to appeal the designation of a critical site through a written request to the Land Conservation Committee of Dane or Columbia County within 60 days of receipt of the notification letter. (Economic hardship will only be considered for a structural Best Management Practice.)

A central component of the critical site management category are the Animal Waste Advisory Committee recommendations that were developed in 1996. These recommendations include four prohibitions on basic activities associated with the raising of livestock:

- No overflow of manure storage structures.
- No unconfined manure stacking (piling) within water quality management areas (adjacent to streambanks, lakeshores, and in drainage channels).
- No direct runoff from feedlots or stored manure to waters of the state.

- No unlimited livestock access to waters of the state where high concentrations of animals prevent adequate sod cover maintenance.

Another component of the critical site management will target cropland fields where nitrogen applications exceed twice the University of Wisconsin's soil test recommendations.

Eligible Management Category

Specific nonpoint sources of pollution in this category contribute less significantly to surface and groundwater impacts. These sites are eligible for technical and cost-share assistance but are not as critical to reaching water quality objectives.

Sites and practices that do not contribute pollution, but reduce pollutant loads, protect groundwater, or improve and protect habitat for wildlife and fish, will be eligible for cost-share assistance.

Ineligible Management Category

Sites that do not contribute significant amounts of pollutants are not eligible for funding and/or technical assistance under the priority watershed project. Other DNR programs (e.g., wildlife and fisheries management) can, if warranted, assist county project staff to control these sources through implementation of the integrated resource management plan for this watershed. Other local, state, or federal programs may also be applicable to these lands.

Rural Nonpoint Source Pollutants[1]

Barnyard Runoff

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a major source of pollutants in the streams of this watershed. Slightly less than 20,000 pounds of phosphorus are being generated by 344 barnyards in the Lake Mendota watershed each year. Forty of these barnyards are located in internally drained areas. About 15,000 pounds of phosphorus from barnyards are estimated to reach Lake Mendota; this is 75% of the total amount generated. The barnyard pollution control objective is to reduce phosphorus loading to Lake Mendota by 75% or about 11,240 pounds. Table 3-1 shows the number of barnyards in the watershed and the pollutant load generated from these barnyards.

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[1]This section was prepared by Sue Porter, DATCP, with assistance from Steve Ottelien, Dane Co. LCD, Laurie Lambert, Dane Co. LCD, and Brian Goepfert, Columbia Co. LCD.

Table 3-1. Barnyard Inventory Results

Goal: Reduce P load by 67%	Exisiting - 1996 Inventory				Critical Sites > 260 lbs P/yr Control estimated from clean water practice installation (in pounds)		Eligible for barnyard runoff systems > 50 lbs. P/yr. but <260 lbs. P/yr.		Eligible for Clean Water Practices > 15 lbs. P/yr. but <50 lbs. P/yr.	
Subwatershed	**# Brnyds**	**Internally Drained[1]**	**Exist'g P Load**	**% of Total**	**# of Brnyds**	**P reduct'n**	**# Brnyds**	**P reduct'n**	**# of Brnyds**	**P reduct'n**
Lake Windsor	3	0	178	<1	0	0	1	126	2	25
Token Creek	33	5	2,383	12	1	362	11	1,458	9	172
Yahara River	50	8	2,340	12	1	159	17	1,651	13	127
Cherokee Marsh	8	1	580	3	0	0	4	495	2	38
Brandenburg Lake	5	0	144	<1	0	0	1	93	1	10
Sixmile Creek	105	5	6,290	32	1	213	39	4,518	41	573
Dorn Creek	54	2	4,706	24	5	2,115	15	1,453	19	248
Pheasant Branch Creek	34	4	1,849	9	1	155	11	1116	9	105
Schoenberg Marsh	3	3	103	0	0	0	0	0	3	36
Goose Lake	12	12	321	0	0	0	1	101	5	49
N. Yahara River	37	0	1,088	6	1	340	2	125	16	15
Total	344	40	19,982	100	10	3,344	102	11,136	120	1,398
Total load estimated to Lake Mendota is 14,986 pounds.										

[1]The Internally drained barnyards are a subset of column one, total barnyards. We are assuming that phosphorus does not reach Lake Mendota from these internally drained barnyards. Internally drained barnyards may still be eligible for clean water practices if they cause a groundwater problem.

The relative amounts of phosphorus are measured using the BARNY model. It is an indicator of the quantity of phosphorus entering the stream. Phosphorus and the organic matter in manure are pollutants because they cause escalated growth of plants such as algae. Dense aquatic plant growth causes severe oxygen fluctuations during plant photosynthesis (daytime) and respiration (night time) resulting in additional stress to aquatic life. When these plants and other organic waste decompose, oxygen is depleted and water quality is further degraded.

Barnyard Critical Sites

A barnyard site contributing a phosphorus load greater than 260 pounds on an annual basis will be designated as a critical site for control. There are ten barnyards that fall into this category. Those landowners with an animal lot designated as a critical site for control are eligible for a complete barnyard system, including a nutrient management plan, but will only be required to install clean water practices. Installation of these low-cost, required practices alone will result in a 22% reduction of the total annual phosphorus load to Lake Mendota, or 3,344 pounds.

Eligible Barnyard Sites

Barnyard sites that contribute greater than 50 pounds but less than 260 pounds of phosphorus annually, will be **eligible** for cost-sharing on complete barnyard systems. There are 102 barnyards that fall into this category. Installation of best management practices will result in a 75% reduction in the total annual phosphorus load to Lake Mendota, or 11,136 pounds.

Barnyard sites that contribute greater than 15 pounds but less than 50 pounds of phosphorus annually will only be **eligible** for cost-sharing on clean water diversion practices. There are 120 barnyards that fall into this category, and applying clean water practices to these sites will reduce phosphorus loads by 1,398 pounds, or 9% of the total phosphorus load to Lake Mendota. It is important to gain the voluntary participation of the livestock operations who fall into the eligible category in order to meet the phosphorus reduction goal of 75% from barnyards. The goal appears to be realistic when combining the critical sites barnyards with those who can participate voluntarily, including the expectation that only 75% of the eligible landowners will participate.

In order to use cost-share dollars effectively, county staff will assess eligible livestock operations for the applicability and long-term usefulness of these practices prior to the development of the cost share agreement.

Certain components of waste management systems (as specified in NRCS Std. 312), specifically those involving collection, handling and storage, require the preparation of a nutrient management plan (NRCS Std. 590) for the acreage that the manure may be spread. Roof Runoff Management (NRCS Std. 588), Livestock Exclusion (NRCS Std. 472), and Clean Water Diversion (NRCS Std. 362) are practices that are exempt from this requirement. Operations eligible for waste management systems are also eligible for cost-sharing of

nutrient management and pest management plans (NRCS Std. 595), soil testing, and crop scouting. The section in this chapter called "Cropland Spread Manure & Pesticide Runoff" will provide additional detail.

The development and implementation of a nutrient management plan will be a requirement for landowners receiving cost share dollars for the installation of a barnyard runoff management system. All nutrient and pest management plans will be developed with a certified crop consultant. Those landowners installing low cost clean water diversions and or roof gutters will be encouraged to develop a nutrient management plan, but it is not required.

Ineligible Barnyards

Barnyard sites that contribute less than 15 pounds of phosphorus annually will not be eligible for cost-sharing. There are approximately 100 landowners with animal lots in this category. It is possible that individual barnyard sites may become eligible for cost sharing if county staff and DNR district biologists determine that corrective measures would improve water quality within a specific stream segment.

Table 3-2. Barnyard Runoff Objective: To Reduce Pollution by 75%

Management Category	Phosphorus (lbs./year)	Number of Barnyards	P Controlled (lbs./year)
Critical	> 260	10	3,344[1]
Eligible for full systems	> 50 but <260	102	11,136[2]
Eligible: Clean Water Diversion only	>15 and <50	120	
Not Eligible	< 15	72	-

[1] This reduction represents clean water diversion work only.
[2] This reduction represents full system installation.

Internally Drained Barnyards

Internally drained barnyards are those that drain to surface depressions or creviced bedrock rather than directly to surface waters or wetlands. There were 40 internally drained yards that were identified in the Lake Mendota Watershed. Eligibility for internally drained animal lots is based on a site by site analysis where significant groundwater contamination was determined to be likely. Field investigations will be conducted jointly by the county project staff and staff from DNR and DATCP's regional offices.

Cropland Spread Manure & Pesticide Runoff

The overall watershed objective is to reduce the amount of nutrients and sediment that are being delivered to the stream, and eventually, to Lake Mendota. Mismanagement of cropland spread or stored manure and fertilizers causing runoff to surface and groundwater will be targeted for control through the adoption of a nutrient management plan. Development of a nutrient management plan allows landowners an opportunity to balance water quality while maintaining a sustainable agricultural system that reduces excess nutrient applications and the costs associated with it. Reduced nutrient runoff is achieved by taking nutrient credits for legumes and landspread manure, which in turn reduces the need for application of commercial nutrients. In addition, nutrient runoff will be reduced by the requirement of reducing soil erosion rates to the tolerable soil loss (T) as a minimum to qualify for nutrient management planning.

Nutrient Management

In order to reduce over-application of nutrients, livestock and cash grain operations are eligible and are encouraged to participate in an on-farm nutrient management educational program. This program is intended to reduce over-application of nutrients through implementing a nutrient management plan using NRCS Standard 590. Up to 75,000 acres of cropland are eligible for soil testing and nutrient management plan development by certified crop consultants. Landowners are eligible to participate for up to three years and may receive 50% cost-sharing of the consultant's fee for plan development. Nutrient management plans will be submitted to and approved by the Dane and Columbia County Land Conservation Departments.

Eligibility for manure storage cost sharing will be based on the nutrient management plan, developed in accordance with NRCS Std. 590, demonstrating that manure cannot be practically managed during periods of snow covered, frozen, and saturated conditions without the use of storage practices. The nutrient management plan must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice.

Cost sharing for manure storage facilities will also be based on the least-cost system. These options may include manure stacks (in accordance with Std. 313), short-term storage (capacity for 30 to 100 days production in accordance with Std. 313), and long-term storage (capacity for up to 365 days production in accordance with Std. 313). Least-cost analysis will also include evaluation of alternatives to storage. Alternatives to manure storage for reducing the surface water quality impact from the over-application of manure to cropland are to:

- Reduce on-farm animal numbers
- Rent or purchase additional land that is suitable for winter spreading
- Haul manure or broker manure to a neighboring farm

Cost sharing will not be provided to landowners for manure storage or manure spreading if a nutrient management plan demonstrates that sufficient land is available for winter spreading.

Landowners receiving cost sharing to install a manure storage structure or implement a spreading program, will be required to develop a nutrient management plan with a certified crop consultant.

Manure Storage Ordinance

Dane and Columbia Counties each have enacted manure storage ordinances that implement requirements outlined in Section 92.16 Wis. Statutes. A good ordinance is designed to protect surface water and groundwater resources from improperly located, designed, or constructed manure storage facilities. Manure overflows and storage facility failures are a serious threat to aquatic life. An ordinance must meet the guidelines adopted by DATCP and cite the applicable NRCS construction and management standards. Ordinances require permits for the installation, modification and major repair of manure storage facilities. These ordinances are implemented by the county LCDs.

Upland Sediment Runoff

The cropland sediment reduction objective is to reduce the amount of cropland sediment delivered to Lake Mendota from eroding cropland by 40%, or about 2,242 tons per year. Intensive agricultural practices have caused considerable amounts of eroded soil to reach streams, ponds, and wetlands in the Lake Mendota watershed. Upland erosion is the major source of the sediments that are carried downstream, from one subwatershed to the next.

All of the upland watershed land area was inventoried in both Columbia and Dane Counties, amounting to about 90,000 acres. Updated farm plans were used as the basis of the upland inventory, and for Dane County, digital orthophotography was used to establish hydrologic units for determining flow patterns. Soil erosion was calculated using the Universal Soil Loss Equation (USLE). Sediment delivery was calculated using USLE and hydrology information using the WINHUSLE computer model.

Results from the WINHUSLE computer model estimated that 35,197 tons of soil per year are delivered to wetlands or streams in the watershed from uplands (cropland, grassland, wildlife and pasture). However, because of deposition, not all the sediment that is delivered to streams and wetlands is delivered to Lake Mendota. It is estimated that about 5,600 tons of sediment actually reach Lake Mendota annually. The estimated sediment and phosphorus loading to Lake Mendota are presented in Table 3-3. The results of the upland inventory and reduction goals are summarized in Table 3-4. Uplands include cropland, grassland, wildlife and pasture.

Upland Critical Sites

Any cropland fields delivering sediment to surface water at a rate greater than the tolerable soil loss T and greater than 1.3 tons/acre/year will be targeted as cropland critical sites and are subject to pollution abatement action. The sediment reduction rate is based on general recommendations in the Water Resource Appraisal Report completed for the Lake Mendota

Priority Watershed (Sorge, 1996). Approximately 1,670 acres or less than 2% of cropland in the Lake Mendota watershed meet the critical site criteria. Critical sites will affect an estimated 54 landowners who operate 80 fields within the watershed. When controlled through various management actions, these sites will account for 23% of the water quality objective for sediment reduction. This would reduce the sediment load delivered to Lake Mendota by an estimated 470 tons over the course of the project. All critical site cropland fields will need to erode only to T or less.

The critical site verification contact strategy, as explained in Chapter 4, "Implementation Schedule," will focus on the development of cost-share agreements with landowners that have cropland fields that meet the critical site criteria. The Farmland Preservation Program and cross-compliance activities will be used to maintain erosion levels below the tolerable soil loss (T).

Table 3-3. Sediment and Phosphorus Loading to Lake Mendota

Subwatershed	Upland Area draining to Lake Mendota (Acres)	Sediment delivered to Lake Mendota (Tons per year)	Percent	Phosphorus delivered to Lake Mendota (pounds per year)	Percent
Lake Windsor	665	127	2.2	794	2.3
Token Creek	13,277	752	13.4	4699	13.4
Yahara River	21,203	710	12.7	4437	12.7
Cherokee Marsh	4,437	424	7.5	2650	7.6
Brandenburg Lake	1,342	42	.7	262	0.7
Sixmile Creek	23,230	1020	18.2	6374	18.2
Dorn Creek	6,890	1008	18.0	6299	18.0
Pheasant Branch Creek	9,890	1070	19.1	6686	19.1
Lake Mendota	841	83	1.4	519	1.5
Schoenberg Marsh[1]	0	0	N/A	0	0
Goose Lake[1]	0	0	N/A	0	0
North Yahara River	7,430	369	6.5	2306	6.6
Total	89,205	5,605	100%	35,026	100

[1] Subwatersheds do not drain to Lake Mendota

Table 3-4. Upland Sediments

Subwatershed	Inventory Results		Goal- 40 % reduction in sediment delivered to Lake Mendota or (2,242 tons)					
			Critical - >T soil loss and >1.3 sediment delivered			Eligible - >T soil loss or > 0.2 sed. del		
	Upland Area - Draining to Lake Mendota (Acres)	Sediment delivered to Lake Mendota (Tons per year)	Number of Acres	Target - Tons Reduced	Percent Reduced (of goal of 2,242 tons)	Number of Acres	Target - Tons Reduced	Percent Reduced (of goal of 2,242 tonsl)
Lake Windsor	665	127	0	0	0	610	19.5	.9
Token Creek	13,277	752	12	5.6	.3	9411	263.6	11.7
Yahara River	21,203	710	474	23.0	1.3	14075	188.7	8.4
Cherokee Marsh	4,437	424	136	109.0	6.1	2130	421.6	18.8
Brandenburg Lake	1,342	42	0	0	0	998	0.4	0
Sixmile Creek	23,230	1019	664	39.9	2.2	11184	636.7	28.4
Dorn Creek	6,890	1008	267	184.0	10.3	5099	373.3	16.7
Pheasant Branch Creek	9,890	1070	117	108.9	6.1	5696	647.3	28.9
Lake Mendota	841	83	0	0	0	57	115.0	5.1
Schoenberg Marsh[1]	0	0	0	0	0	0	0	0
Goose Lake[1]	0	0	0	0	0	0	0	0
North Yahara River	7,430	369	0	0	0	704	122	5.4
Total	89,205	5,604	1,670	470.4	26.2%	49,964	2,788.1	124%

[1] Internally drained areas. Goal exceeds 100% because not all eligible landowners will participate.

Source: Dane and Columbia Co. LCD staff using WINHUSLE computer model. More acres may be eligible than are presented here.

Eligible Upland

Cropland fields not identified as critical sites but delivering sediment to receiving waterbodies at a rate greater than the tolerable soil loss T OR greater than 0.2 tons/acre/year sediment delivery, will be eligible for cost-sharing and pollution abatement. These sites are categorized as "Eligible Sites" in Table 3-3. These eligible site cropland fields will need to reduce the soil erosion to T or less, and the sediment delivery rate to 0.2 tons/acre/year or less. Implementing best management practices on these sites would exceed the goal established to reduce sediment delivery by 2,000 tons per year, based on the realistic expectation that not all eligible landowners will choose to participate. When controlled through various management actions, these sites will account for 138% of the water quality objective for sediment reduction. This would reduce the sediment load delivered to Lake Mendota by an estimated 2,788 tons over the course of the project.

Ineligible Upland

Cropland fields that erode less than T and deliver less than 0.2 tons/acre/year will **not be eligible** for cost sharing of sediment reducing practices.

Table 3-5. Criteria for Eligibility for Upland Source Sediment Control

Management Category	Sediment Delivery	Design Target	Acres	Tons of Sediment Reduced
Critical	>.T soil loss *and* >1.3 sediment delivery	<=T and <0.2 sediment delivery	1,670	470
Eligible	> T soil loss *or* >0.2 sediment delivery	<=T <0.2 sediment delivery	50,630	2,788
Ineligible	< T soil loss *and* <0.2 sediment delivery	-	36,905	

Gully and Streambank Sediment Runoff

Gully erosion has not been determined to be a significant nonpoint pollution source in the Lake Mendota watershed; therefore, an inventory of gully erosion was not done.

Streambank erosion contributes approximately 728 tons of sediment into streams annually, and 4,608 pounds of phosphorus. The objective for streambank sediment loading is to reduce the amount of sediment delivered to Lake Mendota from these sources by 50%.

Critical site designation will not be a component of the sediment control strategy for gullies or streambanks in this watershed. All active gullies and all trampled streambanks identified during implementation will be **eligible** to receive cost share assistance to abate the runoff of sediment into intermittent or continuous streams. Those sites with a) bare soils and evidence of active erosion, b) direct connection to surface waters via channelized flow, and c) reasonable access to machinery necessary for installing BMPs are eligible for cost sharing.

Federal Program Integration

Landowners with high sediment delivery fields will be encouraged to participate in future federal set aside programs which are Conservation Reserve Program (CRP) and Wetland Reserve.

Pollutant Reduction Goals and Project Objectives for Rural Nonpoint Sources

Goals for water quality in the Lake Mendota priority watershed project were identified earlier in this chapter as protection, enhancement, and restoration of water resources. These goals will be achieved through project objectives for sediment, phosphorus, groundwater, and community education.

The following is a summary of reductions to be targeted for the entire watershed.

Sediment Objectives: Reduce overall sediment delivered to Lake Mendota from rural sources by implementing the following:

- Reduce sediment delivered to the lake from agricultural uplands by about 1,800 tons or 32% of the existing contribution from uplands--from 5,600 tons per year to no more than 3,800 tons per year. At a minimum, all landowners should reduce or maintain soil erosion on all cropland to tolerable (T) soil loss rates, as calculated by the Universal Soil Loss Equation (USLE). All fields that are already at T may initiate a water management system to further reduce erosion rates;

- Reduce streambank erosion by 50%--from about 730 tons per year to no more than 365 tons per year through the implementation of streambank protection practices such as riprap, fencing, and shaping and seeding. In addition, efforts will be used to maintain or develop stream woodland and grassland corridors by developing buffers that provide wildlife habitat, canopy, bank stabilization, and sediment reduction.

- Establish or restore wetlands in as many of the 27 priority areas identified in Chapter 2 as possible. The wetlands were targeted based on their ability to accomodate sediment loading from its upstream drainage area.

Phosphorus Objective: Reduce overall phosphorus delivered to Lake Mendota from rural sources by implementing the following:

- Reduce the phosphorus delivered to streams and ultimately the lake in the watershed from soil erosion in agricultural upland by at least 32%, from about 35,000 pounds per year going to Lake Mendota to no more than 24,000 pounds per year. This can be achieved by reaching the sediment reduction objective.

- Reduce phosphorus loading from eroding streambanks by 50%, from about 4,600 pounds per year to no more than 2,300 pounds per year. This can be achieved through the mechanisms associated with reducing sediment loss as identifed above.

- Reduce phosphorus runoff from barnyards in the watershed by approximately 67%, from about 15,000 pounds per year to no more than 5,000 pounds per year. This can

achieved through implementation of clean water diversions and/or complete system improvement.

- Promote nutrient management as an economically and environmentally sound practice within the watershed.

Groundwater Objective: Protect and enhance the groundwater resource in the Lake Mendota watershed. To meet this objective, the following is needed:

- Use nutrient management plans to reduce the over-application of commercial fertilizer and manure and the application of winterspread manure on unsuitable cropland.
- Implement BMPs as appropriate to protect and enhance groundwater quality.
- Encourage proper abandonment of unused wells per NR 120 and NR 812, Wis. Adm. Code.
- Reduce over-application of pesticides.
- Provide landowners with extensive information and educational materials to promote awareness and to instill responsibility for the groundwater resource.
- Use water conservation techniques to help decrease the flow of water out of the deeper aquifer and over-use of the upper aquifer which may be more susceptible to contamination.

Community Education and Action Objective: Foster understanding of runoff pollution problems and promote participation in resource protection within the Lake Mendota watershed. To meet this objective, the following is needed:

- Translate the project goals into action items by identifying target audiences and designing a program to meet those goals by working with that audience. There are three target audiences: the general audience, the urban transition and established urban audience, and the rural audience. The rural audiences are those involved directly with land management or livestock and manure management, those who work with landowners/operators and livestock operators, and those involved in conservation courses/activities. Chapter 5 is the Information and Education chapter and provides more detailed information about these activities.

Eligibility for Wetland Restoration and Easements

Wetland Restoration

There will be no critical sites for wetland restoration. The targeted goal is to restore as many of the 27 wetland sites that are listed in the Wetlands Appendix. During the inventory, these

sites were evaluated to have the greatest restoration potential and potential to result in improvements to water quality. Other wetlands may be classified as eligible for restoration based on additional field investigations by county staff.

Wetland restoration is considered as a best management practice for the purpose of controlling nonpoint sources of pollution. Wetland restoration includes: the plugging or breaking up of existing tile drainage systems; the plugging of open channel drainage systems; other methods of restoring the pre-development water levels of an altered wetland; and the fencing of wetlands to exclude livestock. Secondary benefits of wetland restoration may be enhancement of fish and wildlife habitat.

Wetland restoration is an available option to address any of the following:

1. Cultivated hydric soils with tile or open channel drainage systems discharging to a stream or tributary.

   Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource either by establishing permanent vegetation or altering the drainage system.

2. Pastured wetlands adjacent to streams or tributaries.

   Eliminating livestock grazing within wetlands will reduce the organic and sediment loading to the wetland and adjacent water resource, and reduce the direct damage to the wetland from the livestock. Livestock exclusion by fencing will control the pollutants and restore the wetland.

3. Prior converted wetlands downslope or upslope from fields identified as Critical Management Area upland sediment sources through the WINHUSLE model.

   Restoration of wetlands in these situations will do one of two things: 1) create a wetland filter which reduces the pollutants from an upslope field(s) to a water resource; or 2) reduce the volume and/or velocity of water flowing from an up-slope wetland to a down-slope critical field. Two eligibility conditions must be met to use wetland restoration in this situation:

   - All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to the soil's T value.

   - Wetland restoration costs must be the least-cost practice to reach sediment reduction goals. Wetland restorations of eligible prior converted wetlands will be considered over lower cost practices to control nonpoint source pollutants.

Land Easements

Nonpoint source program funds may be used to purchase land easements in order to support specified best management practices. These practices, all of which involve the establishment of permanent vegetative cover, include:

- Shoreline Buffers: vegetative areas which minimize nonpoint source impacts and other direct impacts to streams;

- Critical Area Stabilization: stabilization efforts needed on sites that either erode at an excessive rate, or have high sediment delivery rates to surface water;

- Wetland Restoration: areas where wetlands are intentionally restored or enhanced in order to improve their ecological values, such as natural filters of surface water.

Easements may also be considered for protecting municipal well heads if it can be established that vegetative cover will correct an existing groundwater quality threat.

Although easements are not considered a best management practice, they may help achieve desired levels of nonpoint source pollution control in specific conditions. Easements are used to support best management practices, enhance landowner cooperation and more accurately compensate landowners for loss or altered usage of property. The benefits of using easements in conjunction with a management practice are: 1) riparian easements can provide fish and wildlife habitat along with the pollutant reduction function; 2) easements are generally perpetual, so the protection is longer term than a management practice by itself; and 3) an easement may allow for limited public access (depending on the situation). However, the primary justification of an easement must be for water quality improvement.

Easements should be considered in the following situations:

- to exclude livestock from grazed wetlands or along eroding streambanks within the watershed. Easements are strongly recommended whenever:

  - there is any grazing of wetlands;
  - livestock density is so great that areas of unvegetated soil are within 60 feet of streams or intermittent streams;
  - channel erosion is exacerbated by livestock grazing such that unvegetated streambanks are two feet or more in height.

- when elimination of row cropping and the establishment of permanent vegetative cover will stabilize a critical area. Easements are strongly recommended whenever:

  - Row cropping is occurring within 60 feet or less of perenniel or intermittent streams;
  - Row cropping is practiced on slopes greater than 6% percent.

- To support eligible wetland restorations.

When a barnyard or animal feedlot is located within the flood plain and: a) a permanent easement is the least-cost alternative to provide adequate pollution reduction or b) a permanent easement provides a greater level of pollution reduction than on-site engineering options at a price that is cost-effective when compared to the level of pollution reduction and the price of the available engineering options. Easements are strongly recommended whenever:

- Engineering options would require intensive management in order to continue to provide adequate pollution reduction.
- Surrounding land use is predominantly agricultural and it is anticipated that it will remain so for two decades or more.

Land Acquisition

Units of Government, including Lake Protection and Rehabilitation Districts, within the Lake Mendota watershed are eligible for nonpoint source grants of 50% to supplement the purchase of land or land in fee that is contributing or will contribute nonpoint source pollution. Land acquisition strategies are developed by the individual units of government located in the project area.

Eligibility Criteria - Eligibility for land acquisition must meet one of the following items.

- Only lands in the environmental corridors of the watershed project area will be eligible for land acquisition grants or;
- Any cropland proposed for acquisition must have sediment delivery levels above the criteria for eligible as specified in the sediment delivery section of the plan or;
- The acquisition of the property must provide for the protection or improvement of water quality or;
- The acquisition of the property must provide for protection or improvement of other aspects of the natural ecosystem such as fish, wildlife, wetlands, or natural beauty or;
- The acquisition of the property must compliment other watershed management efforts or;
- Any acquisition proposal must meet the applicable goals of the watershed project.

Urban Inventory Results, Nonpoint Source Pollutants, Pollution Reduction Goals, and Eligibility Criteria[2]

An urban nonpoint source inventory and analysis was conducted to identify the urban nonpoint source pollutants and to prioritize major and minor obstacles to achieving water quality goals in the Lake Mendota watershed. This section also presents the reduction objectives for each pollutant in the urban component of the program. It includes assessments for stormwater conveyance, sediment from construction site erosion, and pollution prevention practices. This section ends with a summary of the pollutant reduction goals and project objectives for urban nonpoint sources of pollution.

Description of Urban Runoff

The principal water quality and quantity problems derived from urban runoff result from many factors including:

- Loadings of sediment, nutrients, heavy metals and other toxic materials.
- Stream channel modifications, including straightening and lining with concrete.
- Hydrologic disturbances, including flashy high flows and loss of base flow.
- Streambank erosion.

Urban runoff carries a variety of pollutants to surface water. Pollutants found in urban runoff include heavy metals (lead, copper, zinc, cadmium and chromium) and a large number of toxic organic chemicals (polycyclic aromatic hydrocarbons (PAH), pesticides and many others). Other substances in urban runoff include sediment, nutrients, bacteria, and protozoans. The pollutants that are the focus of this watershed are sediment and phosphorus.

Urban Pollutants

The delivery of pollutants to streams from existing urban areas depends on the types of urban land uses, the types of storm water conveyance systems, and urban pollution prevention practices, such as street sweeping, yard waste collection, and waste oil recycling programs. A study conducted in the Madison area in 1991 focused on streets, parking lots, roofs, driveways, and lawns in residential, commercial, and industrial areas (Bannerman and others, 1993). The study concluded that streets are critical source areas for most contaminants in all the land uses. Parking lots are critical in the commercial and industrial land uses. Lawns

[2] This section was prepared by Aicardo Roa, Dane County LCD, and Mary Anne Lowndes, DNR.

and driveways contribute large phosphorus loads in the residential land use. Roofs produce significant zinc loads in the commercial and industrial land uses. Their connection to the storm drainage system may be direct or indirect, depending on the use of downspouts, grassed areas, drain tiles, and other factors.

Table 3-6 shows current (1996) land uses by municipality in the Lake Mendota watershed. Table 3-7 shows the growth that each municipality anticipates to take place in each land use category by the year 2020. The five major municipalities in the watershed are expected to experience significant urban growth by the year 2020 in all land categories. Residential land use will still be the largest land use category in the watershed. The percent increase in total number of urban acres per municipality is DeForest 49%, Middleton 26%, Sun Prairie 57%, Waunakee 54%, and Madison 18%.

Existing urban land uses and their respective amounts and types of pollutant loads estimated for 1996 are shown in Table 3-8. These pollutant loads are to streams and to Lake Mendota. The data reflect existing control practices such as street sweeping, grass swales, and wet detention ponds. Runoff from new urban areas has the potential to further degrade lake and stream water quality unless storm water management controls are incorporated during development. Table 3-9 shows the increase in urban nonpoint source loading that will occur in the watershed for the year 2020 if new urban source areas are not controlled. Like Table 3-8, these data show loads to streams and to Lake Mendota. These data were generated using a spreadsheet version of the Source Loading and Management Model (SLAMM).

Table 3-6. Urban Land Uses for Municipalities in the Lake Mendota Watershed - 1996

Municipality	Land Use in Acres								
	Residential Density								
	Low	Med	High	Comm	Ind	Hwy	Inst	Urban Open Space	Total Acres
DeForest	0	877	79	83	159	139	75	469	1,881
Middleton	231	3,658	103	660	298	309	16	2,568	7,842
Sun Prairie	160	767	0	101	16	29	10	0	1,083
Waunakee	0	636	309	252	123	33	106	304	1,762
Madison	51	3,856	911	804	56	727	318	2,796	9,520
Total	442	9,794	1,402	1,900	652	1,237	525	6,137	22,088

Table 3-7. Urban Land Uses for Municipalities in the Lake Mendota Watershed - Year 2020

Municipality	Land Use in Acres								
	Residential Density								
	Low	Med	High	Comm	Ind	Hwy	Inst	Urban Open Space	Total Acres
DeForest	0	1,836	136	202	491	145	75	785	3,670
Middleton	257	5,203	421	679	860	309	107	2,733	10,570
Sun Prairie	328	1,242	0	652	94	29	128	35	2,509
Waunakee	0	1,888	208	880	177	133	125	415	3,826
Madison	151	4,456	1211	1304	166	827	318	3,129	11,563
Total	736	14,625	1,976	3,717	1,788	1,443	753	7,097	32,138

Key: Comm = Commercial Inst = Institutional (Schools, hospitals) Ind = Industrial
Open = Urban Open Space Hwy = Highway

Source: Dane County LCD

Table 3-8. Estimated Pollutant Loading from Urban Sources - 1996

Subwatershed	Muni-cipality	Urban Acres	Sediment in Tons/yr		Phosphorus in Pounds/Yr.	
			To Streams	To Lake Mendota	To Streams	To Lake Mendota
Yahara River	DeForest	1,881	306	44	511	57
Pheasant Branch Creek	Middleton	7,842	660	273	2,060	779
Token Creek	Sun Prairie	1,083	148	12	488	39
Six Mile Creek	Waunakee	1,762	511	148	1,481	428
Upper Yahara River	Madison	9,520	1,100	607	4,633	2,437
	Total	22,088	2,725	1,084	9,173	3,740

Source: Dane County LCD

Table 3-9. Estimated Pollutant Loading from urban sources - Year 2020

Subwatershed	Muni-cipality	Urban Acres	Sediment in tons per year		Phosphorus in Pounds/Yr.	
			To Streams	To Lake Mendota	To Streams	To Lake Mendota
Yahara River	DeForest	3,670	487	70	1,117	160
Pheasant Branch Creek	Middleton	10,569	794	329	2,461	1,032
Token Creek	Sun Prairie	2,509	383	34	954	76
Six Mile Creek	Waunakee	3,826	797	218	1,993	606
Upper Yahara River	Madison	11,563	1,399	879	5,897	3,222
	Total	32,138	3,860	1,530	12,422	5,096

Source: Dane County LCD

Storm Water Conveyance

Description

Storm water is most commonly conveyed to streams through a combination of storm sewers, roadside ditches, grassed swales, and ponds. Storm sewers transport runoff rapidly with no pretreatment or filtering of the runoff before it enters streams. Properly designed grassed swales generally reduce runoff velocity because the increase in retardance due to the grass. Swale vegetation serves to remove some pollutants from runoff before it flows into streams and storm sewer systems.

The types and amounts of pollutants transported by runoff depend on the way that pollutant-bearing impervious surfaces are connected to the storm drainage system. For example, commercial parking areas and arterial streets deliver the highest concentrations of pollutants because these areas usually are drained by storm sewers without pretreatment that discharge directly to a stream or lake.

Reducing pollutant transport to surface waters involves reducing the volume of urban storm water reaching streams, from primarily impervious surfaces. This is accomplished by increasing the infiltration of storm water into the soil and ground layers. Storm water infiltration on a suitable site can effectively reduce nonpoint pollution by reducing the volume of water reaching the stream. In addition, infiltration can help stabilize the hydrology of small urban streams by replenishing base flow and groundwater, much of which is ultimately discharged as baseflow to surface water as baseflow in the stream. Infiltration can also reduce bank erosion and the need for expensive, highly engineered drainage structures such as concrete lined channels. Infiltration practices can be used with wet detention ponds to supplement pollutant removal effectiveness or reduce pond size, or with alternative practices such as the urban catchment basin (see Appendix Two, "Interim Best Management Practices").

Practices that increase on-site infiltration include porous pavements, redirecting roof downspouts to grassed areas, and directing runoff water to infiltration trenches. These practices are generally most applicable to small source areas such as rooftops and parking lots. Grassed swale drainage systems can also be used to reduce runoff volume and limit erosion. Finally, infiltration basins can be located at the end of drainage outlets serving larger drainage areas.

Management Needs and Alternatives

In the Lake Mendota watershed, management alternatives were considered for each municipality for storm water control in existing urban area, redevelopment of existing urban areas and for future development.

For *existing urban areas*, the following management alternatives are recommended:

- Increase street-sweeping frequencies using existing equipment to one time per week in areas identified as downtown and commercial strip.

- Increase and maintain street sweeping in other established urban areas to once every three weeks.

- Construct and maintain urban catchment basins (see Appendix B "Interim Best Management Practices") where there is direct discharge of stormwater to surface waters. Maintenance would be through regular sweeping.

For *redevelopment in urban areas*, the following management alternative is recommended:

- Direct runoff to buffer strips, porous pavement, infiltration trenches, and shallow depressions where sediment can be deposited, and runoff reduced.

For *future development in urban areas*, the following management alternative is recommended:

- Adopt effective storm water management plans for each future development site.

The management alternatives strategy assumes that urban catchment basins will theoretically trap all sediment particles of 20 microns or larger. This will result in about a 50 percent control of suspended sediment and about 30 percent control of phosphorus in urban runoff. Actual monitoring data for this practice have not been provided. The analysis assumes a moderate rate of infiltration through the surface of the catchment basin. This will provide less control of pollutants than wet detention ponds, but it will be a cheaper and more practicable alternative in existing urban areas. Existing levels of street sweeping and grassed swale drainage are accounted for in evaluating these alternatives.

Street sweeping is currently proposed using existing equipment such as brush or vacuum street sweepers, at an increased frequency. The level of control expected is 10% for sediment and 5% phosphorus. If high efficiency sweepers, such as a combination brush and vacuum unit are used, the level of control increases to 50% for sediment. An interim BMP for the use of high efficiency sweepers, in accordance with an improved street sweeping program, is being piloted in the Village of Osceola in the Lower Rib Priority Watershed. After one full year of operation this practice will receive a qualitative evaluation. The City of Madison is proposing a quantitative analysis of a high-efficiency sweeper for 1998. This study will look at the high-efficiency sweeper's ability to reduce pollutants on the street and at the end of the pipe. Both studies will determine whether cost-sharing for this practice will be extended to the municipalities in the watershed. Each municipality will be reviewed against the criteria set for this interim BMP.

Wet detention and infiltration practices should be located where land availability and soil conditions are suitable for providing a high level of control as determined by probable permeability map of Dane County. Infiltration basins or trenches may be used in combination with wet detention ponds which would provide groundwater recharge and base flow enhancement.

The probable permeability maps proposed to be used by the Dane County Land Conservation Department will be needed to select the site specific infiltration and wet detention practices

consistent with this watershed plan. The cost and complexity of studies will vary, depending on the availability of land for locating practices and the compatibility of the existing storm sewer networks with locating structures. Assistance available to communities under the priority watershed project to develop nonpoint source controls in established urban areas is presented in Chapter Four, "Implementation."

Objectives

Sun Prairie, Waunakee, and DeForest had stormwater management plans prepared during the planning phase of the Lake Mendota watershed project. These plans, available as separate documents, recommend implementation of specific practices to control stormwater runoff, including the use of infiltration basins, wet detention ponds, and increased street sweeping. Madison and Middleton may also choose to develop stormwater management plans through the watershed project to guide their communities.

For future development, all municipalities should adopt new storm water ordinances, or amend existing ordinances to reflect the following goal: All post-construction storm water peak discharges for the 1, 2, and 10-year-24 hour storm should be maintained at pre-construction peak discharges from areas identified as urban in the year 2020 plan. In addition, the watershed plan has a goal of 80% reduction in sediment from new development.

Analysis of storm water management techniques shows that certain best management practices (BMPs), such as infiltration basins and storm water detention ponds, can significantly reduce sediment and other pollutant loadings to lakes and streams. Adoption of storm water management ordinances and use of storm water management practices will be a priority in the implementation of this plan.

Redeveloped urban areas should have storm water quality and flow control practices included as part of the development plan.

Interim Best Management Practices

Two interim best management practices will be available as cost-sharable items through the watershed project. They are the use of polymers, and urban catchment basins. The appendix called "Interim Best Management Practices" has a description of these practices. An evaluation of the effectiveness of these practices will be necessary before these practices can be used in any other watershed project.

Finance Mechanisms

Each municipality should evaluate the possibility of developing a storm water utility, or special taxing authority, for the purposes of water quality control. A storm water utility allows for a self-sustaining method of financing water quality and water quantity controls. The use of performance bonds may also be evaluated.

Construction Site Erosion

Description

Construction sites are those areas in any phase of construction that involve disturbing the soil through grading or excavation. Construction sites in the project area entail new development and renovation or redevelopment. The renovation and redevelopment activities include utility replacement, street replacement, bridge reconstruction, or rehabilitation of commercial, industrial, or residential areas.

Construction site erosion is a major water quality concern in the watershed. Uncontrolled construction site erosion can devastate aquatic communities in lakes receiving sediment-laden runoff. The reduced capacity of stormwater conveyance systems resulting from sedimentation can cause localized flooding. Importantly, water quality improvements occurring through implementation of nonpoint source control practices for existing urban areas can be negated by construction site erosion pollution sources. In this watershed, a rate of 13.5 tons per acre of soil erosion was used to assess soil loss. Often the proximity of construction sites to storm sewers or other drainage ways serving urban areas results in nearly all of the sediment being delivered to streams. A large percentage of sediment is lost to streams and rivers, but on average, between 4.5 and 5.0 tons per acre of soil from areas under construction (transitional areas) ends up in Lake Mendota. Variability is due to acreage and distance to receiving water body.

About 437 acres of land are in transition from rural to urban uses in the watershed each year, representing less than 0.5% of the total land use in the watershed per year. Each year an estimated 5,902 tons of sediment and 37,357 pounds of phosphorus are deposited into streams in the watershed, of which an estimated 2,198 tons of sediment and 13,911 pounds of phosphorus are deposited into Lake Mendota from this type of land use. Despite being only 0.5% of total land use, transitional areas account for 22% of the total sediment load and 18% of the total phosphorus load to Lake Mendota from all sources. Table 3-10 summarizes these data and also shows projected transitional land use acreages over the next 23 years.

Table 3-10. Projected pollutant loading to Lake Mendota from lands undergoing construction from 1997 until 2020

Subwatershed	Municipality	Total Projected Transitional Acres	Projected Trans-itional Acres Per Year	Sediment (tons/yr.)		Phosphorus (lbs./yr.)	
				To Streams	To Lake Mendota	To Streams	To Lake Mendota
Yahara River	DeForest	1,789	77	983	109	6,244	690
Pheasant Branch Creek	Middleton	2,727	119	1,701	704	10,767	4,457
Token Creek	Sun Prairie	1,435	62	370	27	2,340	171
Sixmile Creek	Waunakee	2,064	90	1,503	607	9,512	3,842
	Madison	2,043	89	1,345	751	8,514	4,751
	Total	10,058	437	5,902	2,198	37,357	13,911

Source: Dane County LCD

Management Needs and Alternatives

Four management recommendations are presented for transitional areas:

1. Apply and enforce the 7.5 tons/acre construction site erosion control standard that has been adopted in Dane County to all municipalities in the watershed. This will be accomplished through proper seeding and mulching of the site, promotion and use of polymers, use of diversions, and placement of wet detention ponds.

2. Avoid development in areas with hydric soils.

3. Reduce direct discharge coming from developing areas by 80%.

4. Maintain peak stormwater flows to pre-development conditions for the 1,2 and 10-year 24-hour storm.

Construction site erosion control throughout most of the watershed project area is critical to achieving sediment reduction goals. It is expected that the rate of construction activity will remain steady in the future. Without at least a 70% control of the sediment from these sites, construction site erosion will remain a serious deterrent to desired water quality and aquatic life in the watershed project area.

Developing, revising and enforcing state and local ordinances can be an effective means to reduce construction site erosion and its adverse water quality impacts. In Dane County, an

amendment to an existing erosion control ordinance was adopted in January, 1995 (14.53, Dane County Code of Ordinances). An erosion control plan is required for any land disturbing activity occurring anywhere within the territorial limits of Dane County which involves an area in excess of 4,000 square feet, or involving activity on a slope of greater than 12% grade which may have off-site impacts, excluding agricultural activities or government highway construction.

Each of the five municipalities in the project area should adopt this standard into their own ordinance language. Countywide consistency will be the most effective way to reach the water quality goals outlined in this plan. In addition, developers are governed by state regulations (Ch. 144 Wis. Stats.) set forth by the Department of Commerce for erosion control on sites with one and two family dwellings (UDC); and the DNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit regulations for sites greater than five acres. Dane County regulates erosion control for one and two family dwellings consistent with the UDC. Dane County LCD staff review site-specific erosion control plans pursuant to the Natural Resource Conservation Service Technical Guide as adopted by Dane County.

Despite these regulations, several potential impediments to effective erosion control exist. Developers sometimes perceive erosion control as an add-on cost and not a built-in cost of construction. Enforcement is often done only in response to complaints. Maintenance of erosion control is often poor. Developers fear that sedimentation basin designs will consume large areas where vacant land is scarce. Unnecessary grading and excavation is commonplace. Soil is routinely tracked onto roads because preventative measures are not a high priority for builders. Further, there is often confusion about who is responsible for installing and maintaining erosion control practices.

- Municipalities should review (and modify where needed) their existing ordinances to assure effective penalties for non-compliance and appropriate responses to the concerns of citizens, inspection staff and developers.

- Municipalities should evaluate staffing and training needs for effective ordinance administration and enforcement.

- Municipalities should evaluate their permit fee schedule to investigate ways to raise revenue to support effective enforcement activities.

- Developers and contractors need to know what is expected of them, and they need better access to technical information through seminars and other educational activities and materials.

- Erosion control inspectors need specific guidelines for documenting ordinance violations in order to provide for more consistent and effective legal action.

An erosion control information and education strategy is described in Chapter Six.

Objectives

The overall ojective for construction site erosion control in the watershed is a reduction in loading by 80%.

Uniform standards for construction site erosion control are a high priority for the watershed, using the Dane County construction site erosion control ordinance as the model. All communities must adopt this ordinance before enforcement funding will be granted.

Urban Streambank Erosion

Any urban streambank that is being considered for restoration work will be evaluated on a site-by-site basis during the implementation phase of the watershed project. Low cost alternatives and environmentally sensitive approaches, such as bioengineering, will be applied where appropriate.

Pollution Prevention Practices

Description

Pollution prevention practices are conducted to remove pollution at its source and prevent the need for treatment once they enter the resource. Practices include street sweeping, yard waste collection, recycling programs, and a variety of behavioral changes.

These factors affect the amount of pollutants from urban surfaces carried to lakes and streams by runoff. Street sweeping removes some of the particulate pollutants from street and parking lot surfaces before they can be transported to surface waters. Repeated street sweeping of commercial and industrial areas in the early spring to remove winter accumulation of sand and street dirt, and in the fall to remove leaves provides the greatest benefit. The potential for lawn care chemicals to be carried by runoff to nearby streams and drainageways is also a concern. Fertilizer residues can enrich surface waters with nutrients and promote algae growth. Pesticides can add to toxic pollution.

Many benefits can be gained through changes in lifestyle by urban residents such as reducing the amount of automobile traffic and adopting erosion control practices. There are many actions individuals can take. The following is a partial list:

- Reduce or eliminate the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff. Revise municipal building codes where possible.

- Remove pet wastes immediately from lawns, sidewalks, and streets to reduce bacterial contamination of urban runoff. Enforce local pet waste ordinances and familiarize pet owners with good pollution prevention practices.

- Control the timing and reduce the amount and type of fertilizer and pesticide applications in all areas. Market phosphorus-free fertilizer.

- Dispose of automobile waste fluids such as radiator water and engine oil appropriately, keeping them out of the storm sewer system. Set up municipal recycling programs for antifreeze and waste oil. Create partnerships with car dealerships and auto maintenance shops in the watershed project area.

- Remove street dirt, leaves and debris from catch basins, streets and parking lot surfaces through municipal street maintenance and leaf collection programs.

- Control development and redevelopment through zoning which, in part, considers on-site suitability for storm water management practices to meet water quality, habitat, and flood prevention objectives.

- Control construction site erosion.

- Minimize use of street de-icing compounds.

- Reduce the amount of motorized traffic.

- Reduce the areal extent of parking lots.

Objective

Encourage the use of pollution prevention practices, such as those listed through local programs. This goal ties together closely with the information and education component of the project.

Urban Critical Sites

- In the urban areas, all transitional areas as identified in the year 2020 build-out plan that exceed 7.5 tons/acre/year in soil loss during the construction phase are identified as critical sites. Correction of these sites will be through enforcement of uniform construction site erosion control standards throughout Dane County.

- Other critical sites in urban areas are identified as those that directly discharge into Lake Mendota or other surface waters and deliver pollutants to that water body according to the following: outfalls with a ratio of sediment (tons) to land area (acres) that is greater or equal to 0.2 and where best management practices are identified through a feasibility study. The inventory should be completed during the first three years of the implementation period.

Pollutant Reduction for Urban Nonpoint Sources

A summary of the reduction objectives:

- Reduce sedimentation contributions from existing urban areas by 40%, from transitional areas by 80%, and from future urban areas by 80%. These

reductions will be achieved in part by increased good housekeeping practices, such as street sweeping, and through the adoption of uniform construction site erosion control ordinances across all municipalities in Dane County.

- Reduce phosphorus from exising urban areas by 20%, from transitional areas by 60%, and from future urban areas by 50% through practices used to reduce sediment loads to the lake. The phosphorus adsorbed to the sediment will also be reduced proportionally.

- All stormwater peak discharges for 1, 2, 10-year 24-hour storm should be maintained for post-construction from areas identified as urban in the year 2020 plan to pre-construction peak discharges. In addition, any stormwater best management practice must safely pass the 100-year storm.

The adequacy of these objectives will be reviewed after five years (or sooner if future water quality data indicate a need for revision as determined by the watershed project staff).

Rural and Urban Pollution Load Summary

Tables 3-11 and 3-12 summarize the sediment and phosphorus loading to Lake Mendota and presents the reduction goals for the watershed project. It is important to recognize that some activities that may take place have not been quantified and are therefore not listed in these tables. These include wetland restoration, and nutrient management. Use of these practices will also help improve the quality of Lake Mendota.

Table 3-11. Sediment Reduction Objectives - Lake Mendota Priority Watershed

Source	Sediment Delivered to Lake Mendota (tons)	Percent of Total	GOAL Sediment Reduced (% and tons)	GOAL Future Sediment Load (tons)
Uplands	5,604	58%	40% 2,242 tons	3,811
Streambanks	728	8%	50% 364 tons	364
Transitional Areas	2,198	23%	80% 1758 tons	440
Existing Urban	1,083	11%	40% 433 tons	650
Total	9,613	100%	43% 4,130 tons	5,483

Table 3-12. Phosphorus Reduction Objectives - Lake Mendota Priority Watershed

Source	Phosphorus Delivered to Lake Mendota (lbs)	Percent of Total	GOAL Phosphorus Reduced (% and lbs)	GOAL Future Phosphorus Load (lbs)
Uplands	35,030	48%	40% 14,012	21,018
Streambank	4,608	6%	50% 2,304	2,304
Barnyards	14,986	21%	75% 11,240	3,747
Transitional Areas	13,911	19%	60% 8,347	5,564
Existing Urban	3,740	5%	20% 748	2,992
Total	72,275	100%	46% 32,650	35,625

Additional phosphorus reductions are expected through the implementation of nutrient management plans which have not been quantified.

Other Pollution Sources

Many pollution sources contributing to surface water quality degradation in the watershed are typically not addressed by the priority watershed project. Control of these pollution sources occurs through other state and county regulatory programs, as described below.

Industrial Point Sources of Pollution

In Wisconsin, wastewater treatment plants (WWTPs) and other wastewater discharges are regulated through the Wisconsin Pollutant Discharge Elimination System (WPDES) permits administered by the DNR. Regulated discharges include both municipal and industrial treatment plant effluent and residual wastes (sludge).

In the Lake Mendota watershed, there are approximately five permitted industrial point source facilities. Current information about these facilities is available through the DNR South Central Region office.

Sewage Treatment Systems

Sanitary sewer service availability is extensive throughout the Lake Mendota watershed. The Madison Metropolitan Sewerage District serves the cities of Madison, and Middleton, the villages of Dane, DeForest, Maple Bluff, Shorewood Hills and Waunakee, and the towns of Burke, Middleton, Vienna, Westport and Windsor. Effluent from the MMSD is discharged to Badfish Creek which then flows to the Rock River. The City of Sun Prairie has its own sewage treatment plant, as does the Village of Arlington. Sun Prairie's effluent discharges to Koshkonong Creek. Wastewater generated by the remainder of the watershed is disposed of through private on-site systems. Soils in the watershed are generally suitable for conventional septic tank soil absorption systems.

Land Application of Municipal and Industrial Wastes

Sludge is an organic, non-sterile, by-product of treated wastewater, composed mostly of water (up to 99 percent). The re-use of sludge through land application is considered a beneficial recycling of nutrients and a valuable soil conditioner. Use of sludge in this manner is also considered to be the most cost-effective means for the treatment facility to dispose of the material.

Land application of municipal and industrial sludge is regulated under NR 204 and NR 214 respectively which require a WPDES permit. The following are taken into consideration when the DNR approves agricultural fields for sludge application: distance to wells, distance to surface water, depth to groundwater and soil type. The site information is used along with crop uptake estimates to determine sludge application rates.

There are 414 sites (12,274 acres) in the Lake Mendota Watershed and within a one-mile radius which are permitted to accept municipal and industrial waste for land application treatment.

Solid Waste Disposal Sites

There are three active permitted landfills within the Lake Mendota Watershed or within one-mile: Dane County Landfill #2 Rodefeld (Madison); W M W I - Madison Prairie (Sun Prairie) and Wisconsin Power & Light Co Columbia G (Columbia County). All active landfills in Wisconsin are "engineered" to prevent groundwater contamination and monitored quarterly to insure public health. Siting criteria under the permit process includes distance to wells, distance to surface water, depth to groundwater, soil type and depth to bedrock.

Refuse Hideaway Landfill is located in Middleton and accepted municipal, commercial and industrial wastes between 1974 and 1988. Wastes disposed of at the site included full barrels of glue and paint, spray booth by-products and paint stripper sludge. Contaminants were found in private wells southwest of the site. Public and private wells within 4 miles of the site provide water to approximately 14,600 people. The site is listed as a Superfund site. In 1991, WDNR installed source control mechanisms including a methane gas extraction system, leachate collection system and a clay cap to reduce infiltration. Levels of volatile organic compounds present in groundwater have decreased and the contaminant plume has stabilized. DNR plans to continue monitoring the groundwater and maintaining the source control measures.

Contaminated Sites

A search of the Bureau of Remediation and Redevelopment's Tracking System (BRRTS) by township and range shows there are 35 Environmental Repair Program sites, 162 leaking underground storage tank sites, 189 Spill sites and one voluntary party liability exemption site located within the Lake Mendota Watershed. There are additional sites which aren't listed here because they do not have location information. The sites listed in the BRRTS database are available through the DNR.

Wisconsin's List of Impaired Waters

Section 303(d) of the Clean Water Act requires states to report all waters in the state that are not meeting water quality standards. A list of these waterbodies must be submitted to the U.S. Environmental Protection Agency every two years, with the goal of waterbodies being delisted as the water quality problems are corrected. WDNR has developed a list, and is working on an implementation strategy that would restore water quality over the next 20 years. The restoration mechanisms will include development and implementation of "total maximum daily load" (TMDL) analyses. TMDL analyses involve:

- identification of all sources of the pollutant(s) of concern,
- allocation of discharges from point and nonpoint sources of pollution,

- and interactive monitoring and modeling to ensure the biological community and/or chemical status of the waters is fully restored.

Currently, Wisconsin lists more than 500 lakes, streams, wetlands, harbors and bays on the 303(d) list. A waterbody is placed on the list based on how it exceeds water quality criteria, or based on a determination that "designated uses" codified in state water quality standards are not being met. These impaired waters are categorized in one or more of the major source categories that are the dominant cause of quality problems, including: point source, nonpoint source, point and nonpoint source blended, contaminated sediment, atmospheric deposition, habitat modification, and multiple cases (other). There are two waterbodies in the Lake Mendota watershed that are currently on the 303(d) list: Lake Mendota and Token Creek.

Categories of Impairment

Following are definitions for the two categories causing impairment of water quality for Token Creek and Lake Mendota. Each category includes the strategy WDNR may use in the development and implementation of TMDLs.

Nonpoint source-dominated (polluted runoff)--In these waters the impairment is present primarily due to polluted runoff (nonpoint sources of pollution) from habitat destruction by polluted runoff. Most of these waters are headwater segments, or subwatershed areas--the smaller watersheds tributary to larger streams. All urban storm water sources are considered nonpoint sources for purposes of this list. The implementation strategy for nonpoint source-dominated impairments includes:

- Use of the nonpoint source priority watershed program for watershed-sized or small-scale (sub-watershed or lake) projects that were selected prior to 1998. The program incorporates cost-sharing incentives based on voluntary participation by landowners and other participants

- Enforcement of controls on sources of polluted runoff through the designation of "critical sites";

- Use of the new nonpoint source program established under Act 27, Laws of 1997, which will include options for designating individual sites or waterbodies as a priority project, based on application and need;

- Application of standards of performance; and

- Other statutory requirements.

Token Creek is in this category.

Other factors--Waters in this category are generally large waterbodies at the basin or multi-basin scale, which may be listed due to several categories of impairment. For example, remedial action plans have been prepared for identified Great Lakes Areas of Concern where many factors contribute to violations of water quality criteria and impaired designated uses.

TMDL implementation for these waters will be addressed depending on the nature of the impairment and the program activities deemed best for the location; combinations of implementation strategies identified in specific categories, above, will, or may, be used.

Lake Mendota is in this category.

Removing Waters From The List

Once a waterbody is placed on the 303(d) list, the manner in which it is removed is dictated in U.S. EPA guidance (August 1997). The process requires that data show the impairment no longer exists or that the basis for the original listing was in error.

CHAPTER FOUR
Implementation

Introduction

This chapter identifies the means for implementing the management actions for nonpoint source pollution control described in the previous chapter. The success of this priority watershed project depends on the aggressive implementation of these nonpoint source pollution control strategies. This chapter identifies:

- The best management practices (BMPs) needed to control nonpoint sources of pollution as described in Chapter Two;
- The cost containment policies;
- The cost-share agreement procedures;
- Schedules for implementing the project, including the critical sites notification schedule;
- The critical site designation appeal process;
- The estimated project budget for cost-sharing, staffing, and other support.

Best Management Practices

BMPs Eligible For Cost-Sharing And Their Rates

Best management practices control nonpoint sources of pollution and are identified in NR 120. Design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use standard specifications included in the NRCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14.

If the installation of BMPs destroys significant wildlife habitat, NR 120 requires that habitat will be recreated to replace the habitat lost. The DNR District Private Lands Wildlife Specialist or a designee will assist the LCD in determining the significance of wildlife habitat and the methods used to recreate the habitat. Every effort shall be made during the planning, design, and installation of BMPs to prevent or minimize the loss of existing wildlife habitat. Wildlife habitat restoration components of the practice are cost-shared at 70 percent.

The practices eligible for cost-sharing and the cost share rates for each BMP are listed in Tables 4-1 and 4-2 below; the BMPs listed in Table 4-1 can either be cost-shared at 50% or at the flat rates that are listed.

Table 4-1. Practices Using a Flat Rate for State Cost-Share Funding

BEST MANAGEMENT PRACTICE	MAXIMUM FLAT RATE
Contour Stripcropping	$ 13.50/ac[1]
Field Stripcropping	$ 7.50/ac[1]
High Residue Management	$ 18.50/ac[2]
Cropland Protection Cover	$25.00/ac[3]
Riparian Vegetated Buffer Strips	$100.00/ac[4]
Polyacriclamides for Reduction of Soil Loss	$10.00/ac [3, 5]

[1] Wildlife habitat restoration components of this practice are cost-shared at 70 percent.
[2] Cost-shared up to six years.
[3] Cost-shared up to three years.
[4] Contingent upon approval as a best management practice for all watersheds.
[5] This practice has been approved as an interim best management practice for the Lake Mendota Watershed.

Table 4-2. State Cost-Share Rates for Rural Best Management Practices

BEST MANAGEMENT PRACTICE	STATE COST-SHARE RATE
Nutrient Management	50%
Intensive Grazing Management	50% [1]
Manure Storage Facilities	70% and 50% [2]
Manure Storage Facility Abandonment	70%
Field Diversions and Terraces	70% [4,5]
Grassed Waterways	70%
Critical Area Stabilization	70% [3]
Grade Stabilization Structures	70% [4]
Agricultural Sediment Basins	70% [4,5]
Shoreline and Streambank Stabilization	70% [3]
Shoreline Buffers	70% [3]
Wetland Restoration	70% [3]
Barnyard Runoff Management	70%
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Milking Center Waste Control	70%

[1] To a maximum of $2,000 per watering system.
[2] Manure storage is cost-shared at 70% for the first $20,000 of cost and at 50% for the remaining cost, not to exceed $35,000.
[3] Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter Two for an explanation of where easements may apply.
[4] In Dane County, if an additional 10% is funded by the county or other group, DNR will add 10%, making the state cost-share rate 80%.
[5] A variance to NR 120 is needed to raise the state cost-share rate to 80% for these practices.

Urban BMPs Eligible for Cost Sharing

Eligible practices and state cost share likely to be used in the urban area of the Lake Mendota watershed are identified in Table 4-3. A complete description of the urban implementation program is found at the end of Chapter 4.

Table 4-3. State Cost Share Rates for Urban Management Practices

Best Management Practice	State Cost Share Rate
Structural Urban Practices	70%
Street Sweeping (Interim BMP)	70%
Land Acquisition for Practices	50%
Urban Catchment Basins	70%[1]

[1] This practice has been approved as an Interim BMP for the Lake Mendota Watershed.

Descriptions of Best Management Practices

Following is a brief description of the most commonly used BMPs. More detailed descriptions can be found in NR 120.14.

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

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

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

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.

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.

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.

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

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.

Critical Area Stabilization. The planting of suitable vegetation on nonpoint source sites and other treatment necessary to stabilize eroding lands.

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.

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

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 nonpoint sources or to filter pollutants from nonpoint sources.

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.

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

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

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

Manure Storage Facility. A structure for the storage of manure for a period of time that is needed to reduce the impact of manure as a nonpoint 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.

Manure Storage Facility Abandonment. Manure storage system 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 soil as well as shaping, filling, and seeding of the area.

Milking Center Waste Control Systems. 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.

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.

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

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.

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.

Easements. Easements are not a best management practice but another tool that can be used to benefit water quality. Easements are legally binding restrictions on land titles. Easements are purchased to provide permanent vegetative cover, and may be used in conjunction with other best management practices.

Rural Interim Best Management Practices

Under some circumstances, practices may be recommended that are not included on the BMP list. Administrative Rule NR 120.15 provides for alternative practices where necessary to meet the water resource objectives identified in the watershed plan. The Department may identify in the nonpoint source grant agreement the design criteria and standards and specifications where appropriate, cost share conditions, and cost share rates for each alternative best management practice. The rural interim best management practices are listed

in this section. The urban best management practices are presented in the urban section of this chapter.

An interim BMP has been approved for the rural portion of the Lake Mendota watershed project. It is the application of polyacrilamides (PAM) to crop fields to reduce the loss of sediment. It has been demonstrated that the application of PAM binds soil particles together, thus reducing soil erosion. See the Appendix Three, "Interim Best Management Practices" for a description of this practice.

Two other interim BMPs are currently being evaluated in a different watershed project, the Branch River. They are Vegetated Riparian Buffers and Manure Hauling and Brokering. Vegetated riparian buffers are permanently vegetated areas immediately adjacent to intermittent or perennial streams that are designed and constructed to function as a filter to delay, absorb, or purify contaminated runoff before it enters watershed streams. This practice is primarily an informational and educational tool to promote water quality awareness, with the intent of providing watershed participants with a feasibility management option that will reduce nonpoint source. The establishment of a 35-foot wide buffer strip will be required as a minimum, although a 66-foot wide buffer is preferred.

The intent of the manure hauling and brokering practice is to provide the local governmental unit with an additional management tool as well as to provide the landowner with another viable alternative to constructing a manure storage facility. Manure hauling would be an eligible component when a 590 nutrient management plan determines that a farm operation does not have adequate acreage to safely apply all livestock-generated manure to cropland within a reasonable hauling distance.

If these two interim BMPs are approved for use in other watershed projects based on evaluation, they will also be allowed as cost-sharable BMPs in the Lake Mendota Priority Watershed Project.

Practices Not Cost-Shared

Practices not cost-shared, but which shall be included on the cost share agreement if necessary to control the nonpoint sources, are listed below (as listed in NR 120.17):

- That portion of a practice to be funded through other programs.
- Practices previously installed and necessary to support cost-shared practices.
- Changes in crop rotations.
- Changes in location of unconfined manure stacks involving no capital cost.
- Non-stationary manure spreading equipment.
- Practices needed for land use changes during the cost-share agreement period.

- Other practices necessary to achieve the objectives of the watershed project.
- Minimum levels of street sweeping and leaf collecting.
- Operation and maintenance of cost-shared BMPs.
- Practices already installed,with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner.
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed, but which are producing an increased amount of pollutant loading to the surface or groundwater, counter to the water resource objectives of the watershed plan, due to the landowner's change in land management.
- Practices whose purpose is to accelerate or increase drainage of land or wetlands, except where drainage is required as a component of a BMP.
- Practices normally and routinely used in growing crops and required for growing crops or feeding livestock.
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Statutes, except urban nonpoint sources that must be controlled to obtain a WPDES permit if control of the sources is identified in the priority watershed plan and the sources are not required to obtain coverage under a WPDES storm water permit for discharges associated with an industrial activity, as defined under Ch. NR 216.
- Livestock operations which: have applied for and are eligible for WPDES permits, have been issued WPDES permits, have greater than 1,000 animal units, or are greater than 1,000 animal units and have been issued a notice of discharge.
- Septic system controls or maintenance.
- Dredging activities.
- Silviculture activities except as necessary for site stabilization.
- Practices to control spills from commercial bulk storage of pesticides, fertilizers, petroleum and similar materials.
- Activities and structures intended solely for flood control.
- Activities required as part of a license for a solid waste management site.

- Activities funded through state or federal grants for wastewater treatment plants.
- Active mining activities.
- Pollution control measures needed during building and utility construction and storm water management practices for new developments.
- Pollution control measures needed during construction of highways and bridges.
- Other practices or activities determined by DNR not to meet the objectives of the program.

Cost-Share Agreement Administration

Cost-share funding is available to landowners and local units of government for a percent of the costs of installing BMPs to meet project objectives. This funding is distributed to landowners by the LCD from a Nonpoint Source grant provided by the DNR. The LCD receives additional grant money from the DNR to support its staff and other administrative responsibilities. Cost-share agreements are binding contracts between landowners and the LCD. To qualify for cost-sharing funds, landowners must meet eligibility criteria defined in the previous chapter.

Cost share agreements must be initiated within eight years after formal approval of the watershed plan and are filed as part of the property deed. Agreements may be amended throughout the 10-year project period.

Practices included on cost share agreements must be installed within the schedule agreed to on the cost share agreement. Practices must be maintained for a minimum of ten years from the date of installing the final practice listed within the cost share agreement.

Local, state, or federal permits may be needed prior to installation of some BMPs. Areas in which a permit is 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 watershed project or not. The cost share recipient is responsible for acquiring the needed permits prior to installation of practices.

Local units of government are responsible for enforcing compliance of cost share agreements to which they are a party. Where DNR serves as party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time.

Cost Containment

Cost Containment Procedures

Chapter NR 120 requires that cost containment procedures be identified in this plan to control the costs of installing BMPs. The cost containment procedures to be used by Dane and Columbia Counties are described below. The bidding procedure, average cost, and flat rate lists can be obtained from the county LCD.

The Dane and Columbia County Land Conservation Committees chose to use an average cost procedure as its primary method to contain costs of best management practices. Average costs are determined for units of materials or labor. The average costs will be reviewed and updated at least annually. The Dane and Columbia County Land Conservation Committee intends to use the following policy to govern cost-share payments.

Cost-share payments will be based on actual average costs of installation. This cost will not exceed the estimated cost-share amount for the identified practice unless previously approved by the Land Conservation Committee.

For situations where an average cost procedure is inappropriate, Dane and Columbia Counties will use either a bidding procedure or flat rate. Examples of practices where bidding may be the most appropriate approach are streambank riprapping and manure storage facilities. Dane County Land Conservation Department staff are responsible for determining the cost containment procedure that is most appropriate.

Implementation Schedule

Landowner Contact Schedule

During the first 12 months of the implementation period, all landowners with sites defined as "eligible" or "critical" nonpoint sources will receive correspondence from the county LCD explaining the project and how they can become involved.

County LCD staff will continue to make contacts with eligible landowners until the landowners have made a definite decision regarding participation in the program. County staff will contact all eligible landowners not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up period to encourage participation.

- As part of the annual inventory work, LCD staff expect to identify fields that meet the criteria for critical sites. The LCD staff will verify all sites identified each year and note these in a report to DNR as explained in the critical site notification process below.

Critical Site Notification Process

At the time of critical site verification, any uninventoried sites on the same farm must be inventoried. This would determine all critical sites on a farm so the landowner would receive only one critical site notice and avoid the possibility of a notification of a barnyard critical site notice one year and another for uplands years later.

- Project staff will begin to contact the highest-ranked critical sites for verification immediately after plan approval and complete the contacts within six-months. Highest-ranked is defined as the top 25 percent of the inventoried critical site load. The plan approval date may be the same as the date on which the project receives the Nonpoint Source grant. The department may allow up to three 90-day extensions beyond the six-month period to allow the counties sufficient time to verify that all sites meet the critical site criteria. The county shall make a request to DNR, in writing, which includes the reasons to support the extension.

By the end of the six-month verification period, the project staff will send a report to DNR that states each site meets the critical sites criteria or has changed status according to sec. NR 120.09(6), Adm. Code. The reasons for these conclusions will be included. Documentation of site visits and additional information will be maintained at the appropriate LCD offices and will be available for inspection upon request.

- Following receipt of the report, the DNR has 60 days to send critical site notification letters to the landowners.

- The county LCD staff are intending to complete the verification of critical sites sometime between the year 2000 and no later than 2002. The notification schedule may be modified and revised at the annual watershed review meeting when progress on critical sites is discussed.

Critical Site Appeals Process

The owner or operator of a site designated as a critical site may appeal the critical site designation to the Land Conservation Committee of the county in which the site is located. If the site is located in more than one county, the appeal goes to the LCC of the county which contains the largest portion of the site. The site owner or operator, now called the appellant, must write to the LCC and ask for an informal hearing. The appeal request must be received by the LCC within 60 days of the day that the notification letter was received by the owner or operator.

The Land Conservation Committee shall:
- provide the appellant with a hearing and give reasonable notice of the hearing to the appellant, the DNR and the DATCP.
- conduct the hearing as an informal hearing. Chapter 68.11(2), Wis. stats., does not apply to this hearing. This language describes the conduct of the hearing.
- hold the hearing in a place that is convenient for the appellant.

The appellant and project staff will present information about the site so that LCC members may make a decision. Representatives of DNR and DATCP may attend the hearing. DNR is required to submit a report and recommendation to the LCC within 60 days after the hearing. DATCP has the option to submit a report and recommendation within 60 days.

The LCC shall provide a decision, in writing, within 45 days of receiving:
(1) to the DNR and DATCP reports and recommendations,
(2) the notification by the DNR and DATCP that no report or recommendations would be submitted, or
(3) the conclusion of the 60-day period following the hearing.

The LCC may support or overturn the designation of the site as a critical site. To make its decision, the LCC shall consider whether or not the critical site designation is consistent with the critical site criteria established in the project's priority watershed plan. The LCC shall also consider whether governmental representatives erred in their verification of the site conditions or management. Loss of profit is not grounds for support of an appeal. Violations by, or appeals granted to, other appellants shall not justify support of an appeal.

The owner or operator of a site designated as a critical site may request a review of the LCC decision by filing a written request with the Land and Water Conservation Board within 60 days after receiving the decision of the county LCC.

The owner or operator of a site designated as a critical site may request a contested case hearing under Chapter 227 to review the decision of the Land and Water Conservation Board by filing a written request with the DNR within 60 days after receiving an adverse decision by the LWCB.

Cost-Share Budget

Costs of Installing Rural BMPs

The quantity and type of management practices that are required to meet the water quality objectives of this project are listed in Table 4-4a and 4-4b. The capital cost of installing the BMPs are listed for a 75 percent landowner participation rate. Units of measurement and cost per unit for the various BMPs are also included.

The capital cost of installing the Best Management Practices is estimated to be about $5.8 million, assuming 75% landowner participation.

- State funds necessary to cost-share this level of control would be approximately $3.9 million.

- The local share provided by landowners and other cost-share recipients would be approximately $1.9 million.

The capital cost of installing the urban best management practices is discussed in the urban portion of this chapter.

Easement and Land Acquisition Costs

Chapter Two identifies where nonpoint source program funds can be used to purchase easements. The estimated cost of purchasing easements on eligible lands is shown in Table 4-4a and 4-b. At 75% participation, the estimated purchase price of easements on eligible lands would be $250,000. Easements are purchased by the DNR or counties and are funded at 100% state share.

Land acquisition costs represented in the budget are estimated for the Token Creek subwatershed. At 75% participation, the estimated purchase price of land acquisition of eligible lands would be $562,500. The state share is $281,250. The local match would be generated through Dane County.

Budget and Staffing Needs

Rural Budget and Staffing Needs

Table 4-5 lists the total estimated staff needed to implement the project assuming a 75 percent level of participation by eligible landowners. Approximately 82,000 staff hours are required to implement this plan. This includes 8,145 staff hours to carry out the information and education program.

Currently, 4.5 positions are being funded on the Lake Mendota Watershed. The LCD and agencies will determine the need for additional staff based on an annual workload analysis.

Table 4-4a. Cost-Share Budget Needs for Rural Management Practices - Dane County

Best Management Practices	Number per unit		Cost/Unit	Total Cost[1]	75% Participation *	
					State Share	Local Share
Upland NPS Control						
Change in Crop Rotation	0	ac	0	0	0	0
Contour Cropping (1)	1,000	ac	NA	0	0	0
Contour stripcropping (1)	0	ac	$13.50	0	0	0
Field stripcropping (1)	0	ac	$7.50	0	0	0
High Residue Mngmnt (1)(3)	20,000	ac	NA	0	0	0
Cropland Protection Cover (1)(2)	0	ac	$25	0	0	0
Intensive Grazing Management	3	ea	$4,000	12,000	4,500	4,500
Critical Area Stabilization	350	ac	$300	105,000	55,125	23,625
Grass Waterways	100	ac	$3,000	300,000	157,500	67,500
Field Diversions & Terraces	20,000	ft	$3.25	65,000	34,125	14,625
Grade Stabilization	20	ea	$4,000	80,000	42,000	18,000
Agricultural Sediment Basin	1	ea	$10,000	10,000	5,250	2,250
Polyacrilamide (PAM) (1)(2)	7,000	ac	$10	70,000	52,500	NA
Nutrient Mgmt only (2)	204,000	ac	$6	1,224,000	459,000	459,000
Nutrient and Pest Mgmt. (2)	0	ac	$10	0	0	0
Infield Buffers	0	ac	$150	0	0	0
Wetland Restoration	20	ea	$10,000	200,000	105,000	45,000
Livestock Exclusion from woodlots	0	ft	$1	0	0	0
Spill Control Basins	0	ea	$15,000	0	0	0
Animal Waste Management						
Barnyard Runoff Control						
Complete system	110	ea	$35,000	3,850,000	2,021;250	866,250000
Roof Gutters	96	ea	$3,500	336,000	176,400	75,600
Clean Water Diversion	26	ea	$5,000	130,000	68,250	29,250
Roofs	1	ea	$25,000	25,000	13,125	5,625
Cattle Mounds	0	ea	$3,000	0	0	0
Manure Storage Facility (4)	5	ea	$40,000	200,000	101,250	48,750
Animal Waste Storage Abandmnt	5	ea	$10,000	50,000	26,250	11,250
Well Abandonment	30	ea	$500	15,000	7,875	3,375
Animal Lot Abandonment	0	ea	$60,000	0	0	0
Milking Center Waste Control	5	ea	$7,000	35,000	18,375	7,875
Streambank Erosion Control						
Shape and seed	15,000	ft	$6.50	97,500	51,188	21,938
Shoreline Buffers	150	ac	$400	60,000	31,500	13,500

Table 4-4a. Cost-Share Budget Needs for Rural Management Practices - Dane County

Best Management Practices	Number per unit	Cost/Unit	Total Cost[1]	75% Participation *	
				State Share	Local Share
Bio Riprap	250 ft	$25	6,250	3,281	1,406
Livestock/Machinery Crossing/Watering Ramp	15 ea	$2,000	30,000	15,750	6,750
Remote Watering Systems	0 ea	$3,500	0	0	0
Subtotal:			7,088,250	$3,547,931	$1,768,256
Easements	250 ac	$1,000	250,000	187,500	0
Wetlands, Critical Area. Streambank Land Acquisition	150 ac	$5,000	750,000	281,250	281,250
TOTALS			$8,088,250	$4,016,681	$2,049,506

* Participation level to meet the established pollution reduction goals.
(1) Local share consists of labor and equipment costs. Also see flat rates in table 3-1.
(2) Number of acres shown reflects 3 times the eligible acres.
(3) Number of acres shown reflects 5 times the eligible acres. This is currently an IBMP in the Branch River Watershed. When approved for statewide use, this BMP will be cost shared in this project. The sediment delivery of a field adjacent to buffer must be < .6 tons/acre/yr.
(4) Maximum cost-share is $35,000. 70% of first $20,000 & 50% of the remaining cost including waste transfer equip.

Source: Wisconsin DATCP, DNR, and Dane County

Table 4-4b. Cost-Share Budget Needs for Rural Management Practices - Columbia County

Best Management Practices	Number per unit		Cost/Unit	Total Cost (1)	75% Participation *	
					State Share	Local Share
Upland NPS Control						
Change in Crop Rotation	0	ac	$0	0	0	0
Contour Cropping(1)	200	ac	NA	0	0	0
Contour stripcropping(1)	100	ac	$13.50	1,350	1,013	0
Field stripcropping(1)	100	ac	$7.50	750	563	0
High Residue Mngmnt (1)(3)	2,000	ac	$18.50	37,000	27,750	0
Cropland Protection Cover (1)(2)	1,500	ac	$25.0	37,500	28,125	0
Intensive Grazing Management	3	ea	$4,000	12,000	4,500	4,500
Critical Area Stabilization	10	ac	$300	3,000	1,575	675
Grass Waterways	15	ac	$3,000	45,000	23,625	10,125
Field Diversions & Terraces	4,000	ft	$3.25	13,000	6,825	2,925
Grade Stabilization	3	ea	$4,000	12,000	6,300	2,700
Agricultural Sediment Basin	1	ea	$10,000	10,000	5,250	2,250
Polyacrilamide (PAM) (1)(2)	900	ac	$10	9,000	6,750	NA
Nutrient Mgmt only (2)	21,000	ac	$6	126,000	47,250	47,250
Nutrient and Pest Mgmt. (2)	0	ac	$10	0	0	0
Infield Buffers	0	ac	$150	0	0	0
Wetland Restoration	2	ea	$10,000	20,000	10,500	4,500
Livestock Exclusion from woodlts	0	ft	$1	0	0	0
Spill Control Basins	0	ea	$15,000	0	0	0
Animal Waste Management						
Barnyard Runoff Control						
Complete System	4	ea	$35,000	140,000	73,500	31,500
Roof Gutters	20	ea	$3,500	70,000	36,750	15,750
Clean Water Diversion	20	ea	$5,000	100,000	52,500	22,500
Roofs	0	ea	$25,000	0	0	0
Cattle Mounds	0	ea	$3,000	0	0	0
Manure Storage Facility (4)	1	ea	$40,000	40,000	20,250	9,750
Animal Waste Storage Abandmnt	1	ea	$10,000	10,000	5,250	2,250
Well Abandonment	5	ea	$500	2,500	1,313	563
Animal Lot Abandonment	0	ea	$60,000	0	0	0
Milking Center Waste Control	2	ea	$7,000	14,000	7,350	3,150
Streambank Erosion Control						
Shape and seed	0	ft	$6.50	0	0	0
Shoreline Buffers	0	ac	$400	0	0	0
Streambank Fencing	0	ft	$1.50	0	0	0

Table 4-4b. Cost-Share Budget Needs for Rural Management Practices - Columbia County

Best Management Practices	Number per unit		Cost/Unit	Total Cost[1]	75% Participation *	
					State Share	Local Share
Livestock/Machinery						
Crossing/Watering Ramp	0	ea	$2,000	0	0	0
Remote Watering Systems	0	ea	$3,500	0	0	0
Subtotal:				703,100	$366,938	$160,388
Easements	0	ac	$1,000.0	0	0	0
Wetlands, Critical Area, Streambank, Land Acquisition	0	ac	$2,500.0	0	0	0
TOTALS				703,100	366,938	160,388

* Participation level to meet the established pollution reduction goals.
(1) Local share consists of labor and equipment costs. also see flat rates in table 3-1.
(2) Number of acres shown reflects 3 times the eligible acres.
(3) Number of acres shown reflects 5 times the eligible acres. This is currently an IBMP in the Branch River Watershed. When approved for statewide use, this BMP will be cost shared in this project. The sediment delivery of a field adjacent to buffer must be < .6 tons/acre/yr.
(4) Maximum cost-share is $35,000. 70% of first $20,000 & 50% of the remaining cost including waste transfer equip.

Source: Wisconsin DATCP, DNR, and Columbia County

The estimated cost for staff at the 75 percent participation rate is $1.7 million. These costs will be paid by the state through the Local Assistance Grant Agreement.

The total state funding required to meet the rural nonpoint source pollution control needs at 75 percent level of landowner participation is presented in Table 4-5. The estimated cost to the state is $6.8 million. This figure includes the state cost of practices, staff support, and easement costs as presented above.

This cost estimate is based on projections developed by agency planners and local staff. Historically, the actual expenditures for projects are less than the estimated costs. The factors affecting expenditures for this watershed project might include: the participation rate; the amount of cost sharing that is actually expended; the number of staff working on the project; and the amount of support costs.

The estimated staff required for Dane County in years 1-5 is 4.2, or 8,779 hours. For years 6-8, it is 2.6, or 5,310 hours. The estimated staff required for Columbia County in years 1-5 is 0.7, or 1,466 hours. For years 6-8, it is 0.4, or 884 hours.

Table 4-5. Estimated Staff Hours Needed to Meet the Water Quality Goals in Columbia County for Project Implementation at 75 Percent Landowner Participation

Activity	Project yrs work will be done	Staff Hours	
		Dane County	Columbia County
Project and Financial Management	1-8	4000	600
Information and Education Program	1-5	7845	300
Inventory and Planning	1-5	9500	2610
Practice Design/Installation	1-8		
Upland Sediment Control		27400	3350
Animal Waste Management		8900	750
Streambank Erosion Control		3700	0
Easements		1200	0
Monitoring	1-8	4500	1740
Training	1-8	1400	400
Total:		68445	9750

Source: DNR, DATCP, and the Columbia County LCD

Table 4-6. Project Costs: Lake Mendota Watershed - Rural only at 75% Participation

Activity	State Share		Local Share		Total Cost
	Dane County	Columbia County	Dane	Columbia	
Cost-Share Funds: Practices	$4,016,681	$366,938	1,768,256	160,388	6,312,263
Cost-Share Funds: Easements	187,500	0	0	0	187,500
Land Acquisition	281,250	0	281,250	0	562,500
Local Assistance Staff Support	1,470,892	245,340	0	0	1,716,232
Information/ Education Activities (staff not included)	50,500	8,000	0	0	58,500
Other (travel, supplies, etc.)	187,200	20,800	0	0	208,000
Engineering Assistance	0	0	0	0	0
Sub-Total	$6,194,023	$641,078	$2,049,506	$160,388	$9,044,995
Total	$6,835,101		$2,209,894		$9,044,995

Source: DATCP, DNR, Dane and Columbia Co. LCDs

Grant Disbursement and Project Management Schedule

Implementation of this Priority Watershed project shall begin upon both approval of this plan and receipt of the Nonpoint Source grant. The plan must be approved by the DNR, the Dane and Columbia County Board, and the Wisconsin Land and Water Conservation Board.

The project implementation period is ten years. During the first eight years of implementation, cost-share agreements with eligible landowners may be signed. Practices listed on any cost-sharing agreement must be installed before the end of the implementation phase. The implementation phase of this project is scheduled to conclude in 2007.

The initial Nonpoint Source grant will cover the cost of practices over the entire ten year implementation phase. The amount of the Nonpoint Source grant is calculated at 75% participation by eligible landowners; see Table 4-3 for a detailed explanation. This grant may be amended due to changes needed for time of performance, funding levels, or scope of work.

Local Assistance grants will be disbursed annually to Dane and Columbia Counties to cover the costs of personnel, operating expenses, and equipment. The DNR will evaluate an annual workload analysis and grant application submitted by these counties.

Urban Budget and Staffing Needs

The cost of implementing the urban portion of the project is presented in the next section entitled "Urban Implementation Program."

Urban Implementation Program

The following discussion provides guidance on how the urban nonpoint source control program will be implemented. It presents the "core" activities that provide a base for the urban program. In addition, more complex, "segmented" activities are presented. Eligibility for financial assistance is also described in this section.

Core Elements of the Urban Management Program

The core elements of the urban nonpoint control program include measures that can be implemented easily and without study or significant expenditures. Adopting a core program is the first step in the implementation process.

The basic elements of the core program are:

- Develop, adopt and enforce a construction erosion control ordinance consistent with the ordinance developed and implemented in Dane County by the Land Conservation Department (Dane Co. Ord. Chapter 14, Subchapter II [Erosion control System].) This ordinance presents a quantified level of control of soil loss not to exceed 7.5 tons per acre per year to land areas served by sewer and gutter. All incorporated areas in the watershed that receive grants from the DNR as part of this project must adopt this standard to result in a uniform approach to construction site erosion control and a reduced level of sedimentation to receiving waterbodies.

- Develop and implement a community specific program of urban housekeeping practices to reduce urban nonpoint source pollution. Each community should carry out a regular street sweeping program to sweep streets at least twice a year in the spring and fall, including fall leaf collection. Other practices might include regulating pet wastes, changing the timing and scheduling of leaf collection, or other strategies to reduce polluted runoff.

- Implement an information and education program containing the elements and achieving the goals of the urban information and education strategy.

Local Responsibilities and Timing for the Core Program

The following is a schedule for implementing the core elements of the urban nonpoint source control strategy for this project. In order to receive technical and financial assistance, communities must commit within the first three years of the project to implement the core program. This requirement applies only to the receipt of funds used directly by the municipality as a grantee. It does not apply to those instances where the municipality acts as a grantor and passes cost-share funds through to private landowners. Therefore, individual landowners could receive cost-share funds prior to a municipality's agreement to conduct core elements for the urban program.

To implement the Core program each municipality should:

- Identify in writing an authorized representative for the local unit of government.
- Adopt a construction site ordinance uniform with the Dane County standard (if the municipality is within Dane county), develop administrative procedures and determine staff needs to enforce a construction erosion control ordinance in the municipality within 2 years of implementation.
- Develop and implement a community specific program of urban housekeeping practices which reduce urban nonpoint pollution. The content of the community specific program and a schedule for implementation will be negotiated by the local unit of government and the DNR.
- Prepare and submit annual work plans for staff and activities.
- Apply for local assistance grants from DNR to support core activities.
- Implement an information and education strategy consistent with this plan.
- Prepare and submit to DNR tracking reports specified in Chapter 7.
- Participate in the annual watershed project review meeting.

Segmented Elements of the Urban Management Program

The "segmented" elements of the urban nonpoint source program include those requiring further study or site-specific investigations prior to implementation. Recommendations from Chapter 3 that are not included in the core element description are considered segmented elements. Examples include construction of a wet detention pond to capture runoff from an industrial park, erosion control or infiltration devices at storm sewer outlets, and the development of a storm water plan and ordinance. Detailed engineering studies will be required for some of these practices.

The municipalities may implement the segmented activities any time after expressing commitment to implement all of the core activities listed above. Cost sharing will be available throughout the eight year implementation period of the project.

Importantly, the higher costs of implementing this portion of the urban management program will require municipalities to budget expenditures over the course of several years. Best management practices implemented under this portion of the program likely will include detention ponds, urban catchment basins, infiltration and filtration devices, and other structural means for reducing pollution. Segmented program activities may also include changes in street sweeping schedules and equipment when used as a stepping stone to achieving the recommended level of urban structural practices.

Segmented activities will include engineering feasibility studies and other site-specific assessments for existing and new development. The results will determine the best as well as most economical means for reducing pollutant sources in a community.

The basic elements of the Segmented program are:

- Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures in existing developed areas. The detailed engineering studies shall set forth an equitable cost allocation when more than one municipality contributes runoff to an urban structural practice. Source reduction activities should also be considered when assessing the reduction goals for each community.
- Design and installation of structural best management practices for existing urban areas with completed engineering studies.
- Develop management plans for planned urban development.
- Adopt and enforce a comprehensive storm water management ordinance consistent with the state model storm water ordinance under preparation.
- Conduct as needed, detailed financing and implementation studies which determine the means to pay for administering an urban nonpoint program in each community. These studies should be conducted concurrently with other elements in the segmented program.

Local Responsibilities and Timing for the Segmented Program

The following is a schedule for the segmented elements of the urban control strategy:

- Identify the high priority segments the community wishes to pursue in the existing and planned urban areas.
- Enter into local assistance and nonpoint grants as appropriate to secure state funding support for segmented activities.
- Conduct engineering feasibility studies for control practices in existing urban development. The type and manner of practice installation will be guided by these studies.
- Prepare storm water management studies in planned areas which identifies the type and location of practices.
- Adopt, administer and enforce a comprehensive storm water management ordinance for planned urban development.
- Enter into cost-share agreements for eligible BMPs.
  - For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the local unit of government. The local units of government will be required to:
    - Design or contract for the design of best management practices and verify proper practice installation. Involve the DNR in pre-design and pre-construction conferences as outlines in NR 120.
    - Request reimbursement from the DNR for practices installed by private landowners, and in turn reimburse those landowners for the eligible amount of cost sharing.
    - Monitor landowner compliance with provisions of the cost-share agreement.
  - For practices installed and maintained by the local unit of government, the cost share agreement is with the DNR. Where more than one community contributes runoff to a control practice, the DNR will enter into cost-share agreements consistent with an equitable allocation based on municipal contributions to the pollutant loadings and volumes.
  - Practice maintenance is the responsibility of the grant recipient.

- Submit information needed for project evaluation to DNR.

In some situations, private landowners will install BMPs on their property. As such, landowners can be important participants in the urban implementation strategy. Eligible land owners will participate in the project by signing cost-share agreements with local units of government.

Communities can implement the segmented elements of the urban management strategy any time following the development and initial implementation of the Core program. However, cost sharing will be limited to those elements of the segmented program completed within the eight year implementation period. Some townships and lake districts may be eligible for cost share funds to implement the urban recommendations.

Storm Water Management Ordinances

A municipal storm water management ordinance is intended to manage the long-term, post-construction storm water discharges from land development activities. The best way to do this is to address storm water management problems and needs through the preparation of a comprehensive storm water management plan for subwatershed areas. These plans would include performance standards for storm water management measures for all land development activities. If plans have not been developed and approved by a governing body, then a storm water management ordinance will set forth generic storm water management standards. The Department, through the Nonpoint program will fund storm water management planning for new development and for existing development that requires more detailed study than provided during the Priority Watershed Plan. This program would also recommend that a governing body develop a storm water management ordinance for all areas not included in storm water management plans and as an appropriate enforcement mechanism for areas with plans.

The Department is required to develop a state model storm water ordinance. That ordinance is currently in draft form. When an approved state model ordinance is available, Priority Watershed Plans will begin to require, as part of the core program, the passage of ordinances. Until then, it is only a recommendation.

Relationship of this Project to the Federal Storm Water Permit Program

In 1990, the federal government enacted regulations for attenuating urban runoff pollution. The Wisconsin Department of Natural Resources is the designated state agency to carry out this federal mandate. The purpose of the Municipal Storm Water Permit Discharge Permit Program is to protect Wisconsin's water resources. The goal is to reduce or eliminate to the extent practicable, discharge of pollutants into waters of the state from municipal storm water runoff. The City of Madison, one of two Phase One permit holders (the other being Milwaukee), has completed the permit application process in accordance with EPA

regulations, prior to promulgation of ch. NR 216, Wisconsin Administrative Code (see below).

NR 216

In 1994, the State of Wisconsin adopted NR 216, Storm Water Discharge Permits, to address the discharge of pollutants from highly urbanized areas. There are three subchapters in NR 216 which cover storm water discharges from 1) municipalities, 2) industry and 3) construction sites. The following abbreviated discussion outlines what communities must do in order to comply with this permitting.

Municipal Storm Water Discharge Permits

The City of Madison, including the University of Wisconsin, has been issued a joint municipal storm water discharge permit. The major components of the City of Madison permit include implementing a comprehensive storm water management program to prevent and reduce pollutant sources, monitoring storm water discharges, assessing program effectiveness and management practices and preparing an annual report to summarize and assess compliance with permit conditions.

It is likely that before the year 2000, additional municipalities will be designated for permitting if present conditions indicate surrounding communities are contributing to urban surface water degradation. The petition shall contain information which explains how the entities listed for designation meet the criteria listed in NR 216.02(4). These criteria include:

a) Physical interconnection between the municipal separate storm sewers of your municipality and a designated municipality.

b) Location of the discharge from a designated municipality relative to your municipal separate storm sewer system.

c) The quantity and nature of pollutants discharged to waters of the state.

d) The nature of the receiving water. (For example, if the discharge is to a sensitive receiving stream, or within a priority watershed).

e) Protection of the watershed or basin drainage area receiving the municipal discharge.

f) Population of the municipality.

g) Other relevant factors.

The preapplication requirements for a municipal permit include:

1. General Information - background information and if a group permit is sought, then a copy of intermunicipal agreements.

2. Legal Authority - description of existing local ordinances for discharge control.

3. Urban Storm Water Planning Area - considers drainage basins and affected watersheds in the development areas.

4. Designated Municipalities - a petition to designate surrounding municipalities for permitting.

5. Fiscal Resources - a description of financial resources to complete storm water management permit applications, budgets and sources of funds.

Each applicant must next outline such things as the legal authority, existing management programs, discharge characterization, present pollutant loadings, proposed monitoring and management programs and a fiscal analysis in addressing storm water management.

Industrial Permits

Concurrent with the municipal permits are those necessary for the industrial sectors within the watershed. Tier 1 and 2 industries at this time are being contacted by the Bureau of Watershed Management (WI DNR), for permitting procedures. Most industries within the watersheds have already begun the permitting process and have been issued permits.

The DNR will review applications, determine additional monitoring requirements, and issue permits which require the development and implementation of a storm water pollution prevention plan to address specific management needs for each site. It is likely that many of the industrial activities targeted for permits will not be eligible for cost sharing through the nonpoint program.

Construction Site Permits

Landowners of construction projects disturbing five or more acres of land are required to obtain a Wisconsin Pollution Discharge Elimination System (WPDES) general permit. A notice of intent (NOI) for coverage under the WPDES general permit must be submitted to the DNR 14 working days prior to beginning construction activities. By submitting a completed NOI, the landowner is indicating that construction site erosion control and storm water management plans have been developed and the landowner will comply with term and conditions of the WPDES general permit.

Project Participants: Roles and Responsibilities

The following discussion presents the roles and responsibilities of landowners, land operators, local units of government, DNR, and UWEX in implementing the urban management recommendations.

Local Units of Government

Cities, villages, and towns play a prominent role in the implementation of the urban portion of the priority watershed project. These and other eligible units of government, such as lake districts, are allowed to apply for local assistance and nonpoint source grants directly with the Department of Natural Resources. The municipalities will provide the local share of the design and installation of BMPs, and the operation and maintenance costs.

They may also conduct planning and administrative services such as storm water planning, and engineering feasibility investigations, as well as the development, administration and enforcement of construction site erosion and storm water management ordinances. Lastly, these governmental entities will develop and conduct urban housekeeping and information/education programs.

The local unit of government may develop cost-share agreements with individual land owners for the installation of BMPs, and provide technical and financial assistance to individuals with funds obtained from the state runoff management program. If the governing entity enters into a cost share agreement with a private landowner, the individual land owner will pay the portion of the installation cost, consistent with the cost share guidelines.

Department of Natural Resources

The Department will provide administrative and financial support to the municipalities and others who apply for grants through the urban portion of the program. Urban grants will be awarded to local units of government to fulfill the goals and objectives outlined in Chapter 3. Several nonpoint source specialists are housed in the South Central Region and the Lower Rock River Basin Geographic Management Unit (GMU) to provide guidance to towns, cities, villages and lake districts in interpreting and implementing this plan. The DNR maintains a staff of storm water management engineers and technical specialists who are available to provide guidance and plan review directly to municipal staff. The Department will also provide assistance in development of ordinances and other project implementation activities, review designs for urban BMPs, and approve storm water management plans.

University of Wisconsin-Extension

UWEX has on its staff a water quality information and education specialist for the Southern Region. This individual is a regional resource to both the rural and urban portions of the project who are responsible for implementing the recommendation in this plan. In addition, UWEX sponsors training courses in construction site erosion and storm water management. DNR provides financial assistance to local units of government for sending staff and administrators to appropriate training sessions.

Dane County Land Conservation Department

The LCD will be responsible for the following activities in the urban area:

- Assist municipalities in the development of construction site erosion control and storm water management ordinances.

- Assist municipalities in the development and design of urban catchment basins.

- Develop and implement the recommended information and educational program outlined in chapter five of this plan.

- Provide assistance in the development of grant applications, cost share agreements, project schedules, and progress tracking.

State Funding for Best Management Practices (BMPs)

BMPs Eligible for Cost-Sharing and their Rates

Structural urban best management practices are those practices identified in NR 120 to be the most effective mechanisms available to reduce urban nonpoint sources of pollution. Eligible practices and cost-share rates for urban practices are shown in Table 4-8.

Structural urban best management practices are source area measures, transport system 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, but are not limited to, such practices as infiltration trenches, porous pavement, oil water separators, sediment chambers, sand filtration units, grassed swales, infiltration basins and detention/retention basins.

One practice has been included for this project as an interim best management practice:

- Urban catchment basins - A structure designed to reduce storm flow velocity and trap sediment and associated pollutants in established urban areas. This practice provides a low cost alternative to wet detention ponds. They are similar in design and functionality to agricultural sediment basins. The urban catchment basins would be constructed within the designated easement associated with each direct outfall.

Another practice may also be eligible to be cost-shared as part of the urban program for implementation:

- High efficiency street sweeping - Use of a combination brush and vacuum style sweeper to remove leaf litter and accumulated pollutants from street surfaces on a frequent schedule.

Street sweeping (several passes for each curb mile) is recommended as early in the spring as possible to collect the debris, sediment and associated pollutants generated during the winter months until late into the fall. The effectiveness of sweeping in residential areas during the summer months is not cost-effective, but the effectiveness for commercial and industrial areas of a 1-2 times/week schedule, spring through fall, is expected to provide continued reduction in pollutant loads.

The high efficiency street sweeping practice is currently being evaluated in the Osceola Creek Watershed Project. The results of that evaluation and monitoring of a high-efficiency sweeper either by the City of Madison (in a non-watershed funded project) or the Department of Transportation will determine whether that practice will be allowed in other watershed projects, including Lake Mendota, and will set the acceptable cost share rates.

Table 4-7. State Cost-share Rates for Urban Management Practices

Best Management Practice	State Cost-Share Rate
Critical Area Stabilization	70%[1]
Grade Stabilization Structures	70%
Streambank Stabilization	70%
Shoreline Buffers	70%[1]
Wetland Restoration	70%[1]
Structural Urban Practices	70%[2,3]
High Efficiency Street Sweeping	[4]
Urban Catchment Basin	70%

[1] Easements may be used in conjunction with these practices.
[2] Applies only to practices to control pollutants from existing urban surfaces. Existing urban surfaces are considered to be those in existence prior to the date the DNR approves this watershed plan. Eligible land uses include commercial and industrial, parking lots and streets. Modifications to existing ponds to control runoff from areas that have a portion of non-significant land uses may also be eligible, but a feasibility study would need to determine this.
[3]Cost-share grants up to 50% can be made for associated costs including land acquisition, storm sewer re-routing and structure removal.
[4] This is an interim best management practice not listed in NR 120, of the Wisconsin Administrative Code. Street sweeping, using high-efficiency sweepers is currently being piloted in the Osceola Creek Watershed Project. The results of that evaluation will determine the acceptable cost share rates for this and other watershed projects.

Design Criteria and Performance Standards for Urban Practices

Design and installation of the best management practices must meet the conditions listed in NR 120. Practice standards and specifications for critical area stabilization, grade stabilization structures, streambank stabilization, shoreline buffers and wetland restoration can be found in NR 120 and the Natural Resources Conservation Service's "Field Office Technical Guide".

NR 120.14(22) requires that the DNR participate in the process of selecting urban structural BMPs for site-specific application. The DNR role includes participation in a pre-design process, reviewing preliminary practice designs, and review and approval of final practice designs. The guidelines in this section are presented to facilitate the urban practices design, through the nonpoint source program.

The following preliminary standards should be used to guide the design of individual practices. These preliminary standards will be superseded by standards developed as part of the model ordinance for storm water, which the DNR is preparing.

- Wet detention ponds in existing and planned urban areas should be designed to control 80 percent of the incoming suspended sediment load. This will be achieved by trapping the 5 micron particle size. This will provide approximately 60 percent control of the annual lead load from lands draining to the pond. Where retro-fitted, ponds should be located to control runoff primarily from the significant land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses.

  Wet detention ponds in existing urban areas should help reduce stream velocities to speeds that do not erode banks or scour habitat.

  Wet detention ponds in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

- Infiltration devices in existing and planned urban areas should infiltrate all runoff from the half-inch storm in an off-line system. Infiltration basins and grassed swales are most effective, since they reduce the volume of runoff from all impervious surfaces (roofs, streets, parking lots) in the contributing area. If infiltration trenches are used that control selected impervious surfaces, such as parking lots and rooftops only, overall land use control efficiency drops significantly since street runoff remains uncontrolled. Where retro-fitted, these devices should be located to control runoff primarily from the significant land uses. In locating practices, infiltration rates should be carefully considered as these are prime determinants of the pollution control efficiency and the long term operation of infiltration practices, particularly in non-residential areas.

  It is important to note the inclusion of pretreatment and groundwater monitoring in the practice design for infiltration devices. Providing pretreatment for these devices will greatly reduce the frequency of clogging and maintain infiltration for longer periods of time before needing maintenance. Pretreatment could include a sediment trap, a wet detention pond, or a grass filter strip. Selected practices should be equipped with groundwater monitoring wells to assure that groundwater contamination remains within acceptable bounds.

  Finally, all above ground or visible urban structural practices should be equipped with signs that clearly identify that the site contains urban storm water pollutants. Such signs should also carry warnings, where appropriate, against using storm water practices in ways which could endanger public health. Wet detention ponds should not be used for consumptive fishing, swimming or wading. Infiltration basins might pose a hazard if used

during dry periods as open recreational space, due to possible suspension of contaminated dust.

Infiltration devices in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

Infiltration devices in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

- Filtration devices should be designed off-line to control the half-inch storm from contributing areas. These should be located to control runoff primarily fom the significant land uses for existing development.

- Stream corridor buffers and streambank stabilization are designed to reduce streambank erosion and provide filtering of overland flow to the stream.

Using Easements to Support Urban Pollution Control Practices

Easements may be used to support wetland restoration, critical area stabilization and shoreline buffers in urban areas in order to reduce the water quality impacts of storm water runoff. Use of these practices as storm water runoff control measures, and the use of easements to support these practices, must be reviewed on a case-by-case basis by the DNR. The same general rules set forth for the use of easements in rural areas also apply to urban stream reaches.

Funding for Local Staff Assistance

Table 4-8 shows the types of local management activities that are supported by the state. The state funds these activities through local assistance grants. These grants may be used to support additional staff hired or contracted for by local units of government. Support for most activities is cost-shared at 50-100%, since local governments cover only certain staff support costs. However, support for local staff to administer and enforce local ordinances is only meant to augment funds collected through local permit fees. State support will only be made available to provide that portion of the staff costs remaining after the use of permit fees. In many cases, ordinance administration and enforcement will be self-supporting.

Table 4-8. Urban Implementation Strategy Measures Eligible for State Funding Under Local Assistance Grants

Activity	Support Rate
Development of Construction Erosion Control Ordinances	70-100 %
Development of Storm Water Management Ordinances	70-100 %
Engineering Studies for Existing Urban Areas; Storm Water Planning Studies for Planned Urban Areas[1]	70-100 %
Design and Engineering for Structural Best Management Practices to Control Existing Significant Land Uses	70-100 %
Staff for Enforcing Construction Erosion and Storm Water Management Ordinances[2,3]	50-70%
Additional Staff Needed for Accelerated Street Sweeping[4]	[4]
Development of Alternative Financing and Administration Strategies	70-100 %
Information and Education Activities	70-100 %

1Funding not available for components dealing exclusively with drainage and flooding

[2]Funding limited to three to five years. Level of staffing based on a work plan submitted by local units of government and approved by the DNR.

[3]DNR covers only that portion of the local staff support that cannot be met through local permit fees. Formula used is total costs of enforcement minus fees collected up to 50-70% of the total costs of enforcement with fees being the limiting factor.

[4]State cost-share rates for street sweeping will be negotiated on a case-by-case basis. Grants for accelerated sweeping on significant land uses during the late spring to early fall period may be limited to demonstration and research projects, initially until the effects can be monitored.

Table 4-9. Urban Staffing Needs for Municipalities

Activity	Unit	Hours
Urban Demonstration Projects	160 hrs./site (1 site)	160
Erosion Control Inspection	1040 hrs./yr for Middleton and Madison; 100 hrs./year for Waunakee, DeForest, Sun Prairie.	2380 hrs./yr for 10 years (DNR pays half for first 5 yrs.)
Conduct Training, Seminars, Public Meetings & Presentations	40 hrs./yr for larger communities	80 hrs./yr
Administration	80 hrs./year for larger communities	160 hrs./yr
Total		26,360 hrs.

Activities and Sources of Pollution Not Eligible for State Funding Assistance

Priority watershed cost-share funds can not be used to control sources of pollution and land management activities specifically excluded in NR120.10 and NR 120.17. The following is a partial list of ineligible activities most often inquired about for cost-sharing in urban areas.

- Operation and maintenance of cost-shared best management practices (BMPs).
- Construction site erosion control practices.
- Structural BMPs for new urban development. New urban development is defined as that for which construction activity commences after the DNR approves this plan.
- BMPs installed prior to signing cost-share agreements.
- Most activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program.
- On-site septic system controls or maintenance.
- Dredging activities.
- Activities and structures intended primarily for flood control.
- Base levels of street sweeping (will be defined on a case-by-case basis).

Activities for Existing Urban Areas

Storm water management plans were completed in 1996 by Sun Prairie, DeForest and Waunakee. These plans as well as existing plans and other documentation by Middleton and Madison have identified areas where detention ponds, wetlands or other structural urban

practices can be located. In addition, the Dane County LCD has identified areas where urban catchment basins may be located based on the drainage area, the land use, siting practicality, size and maintenance requirements. Installing any of these practices will require engineering feasibility studies. Detention ponds will most likely be contracted out to private engineering firms. The urban catchment basins can be designed in-house by each municipality with the assistance of the Dane County LCD, although contracting with a consultant is acceptable. An average value for this cost is estimated to be $40 per acre of significant land use (industrial, commercial, and highway). There are an estimated 3,788 acres of existing significant land use for all municipalities. The cost for engineering design is estimated at $150,000.

Activities for Planned Urban Areas

Over the next 20 years, the Lake Mendota watershed will see an increase of 10,047 acres of urban, developed land. Sun Prairie, Deforest and Waunakee completed storm water management plans in 1996. Middleton and Madison will grow by 4,711 acres. Plans are estimated at $10/acre for new development. If Madison and Middleton update existing storm water management plans, the runoff management program will cost share the $47,710 estimated cost. If all new development were to be served by detention ponds, 100 acres of detention would be constructed by the year 2020 at a cost of $50,000/acre. The total cost of $5 million would be borne locally, as runoff management program funds are not used for practices in areas of new development.

The cost of controlling construction site erosion is estimated at $250/acre for practice design and installation. This amounts to $2.5 million for the watershed. This cost would be paid locally for developers.

Alternative Funding Sources

This plan recognizes that additional funding through new initiatives must be provided to improve full program implementation.

A substantial portion of the estimated costs of implementing this plan's urban management recommendations is for the construction of stormwater management practices in existing urban areas to control pollutants generated by a wide variety of activities.

It is clear that the nonpoint program will not be able to fund all the work needed to meet the goal in the project's time frame. The purpose of this analysis is to determine where the nonpoint dollars should best be spent. The priorities of the program are to encourage the adoption of construction site erosion control ordinances and/or their continued enforcement, to conduct stormwater management plans and/or stormwater management ordinances to reduce the pollutant contribution from new development, to conduct an information and education effort to prevent pollution or control the sources of pollution and to look for low cost/low technology solutions.

This plan endorses continued investigation into source control alternatives as well as development of alternatives for internalizing local pollution control costs. Alternatives such as the creation of local utility districts to finance the local share of these estimated costs

should be investigated by respective municipalities. The DNR will help finance studies through the priority watershed program.

Summary of Project Costs

Table 4-10 summarizes the total cost of implementing the urban portion of the Lake Mendota Priority Watershed Project if 75 percent of the need is met. The total project cost is estimated to be $8.7 million, given a 75% participation rate.

In urban areas, the local share of the project costs will be provided in general by municipal governments. The overall state support rate for existing urban areas is about $1.6 million; for planned and developing urban areas it is about $25,000. The local share of the project cost in these areas is expected to be paid for primarily by individual landowners and developers.

Table 4-10. Project Costs - Lake Mendota Priority Watershed - Urban Only at 75% Participation

Project Element	State Share	Local Share	Total Cost
Developing Urban Areas			
Construction Site BMPs	$0	$1,875,000	$1,875,000
Planned Urban Areas			
Storm Water Management Plans	25,200	10,800	36,000
Storm Water Management BMPs	0	$3,750,000	3,750,000
Existing Urban Areas			
Feasibility Studies	78,750	33,750	112,500
Structural BMPs	1,575,000	675,000	2,250,000
Information & Education			
Urban Staffing	178,500	571,500	750,000
TOTAL	$1,857,450	$6,916,050	$8,773,500

Table 4-11 summarizes the budget for both the rural and urban portions of the project.

Table 4-11. Total Budget - Lake Mendota Priority Watershed at 75% Participation

	State Share	Local Share	Total
Rural Total	$6,835,101	$2,209,892	$9,044,995
Urban Total	$1,857,450	$6,916,050	$8,773,500
Total	$8,692,551	$9,125,944	$17,818,495

CHAPTER FIVE
Information and Education

The education mission of the Lake Mendota Priority Watershed Project is to foster an understanding of nonpoint source pollution problems and promote participation in resource protection. The education strategy was developed as a cooperative effort by the University of Wisconsin-Extension, Dane County Extension, Dane County Land Conservation Department (LCD) staff with assistance from the Columbia County Land Conservation Department (LCD), the Lake Mendota Citizen Advisory Committee, the Department of Natural Resources, and the Dane County Lakes and Watershed Commission. This chapter provides a brief overview of the educational goals, objectives and action strategies developed for this watershed. A more complete information and education strategy was developed for this project and is available as a separate document (Wade and others, 1997). It provides more details than are presented here.

The education work group developed a series of goals, objectives and action strategies to achieve the education mission of the project. While the goals are broad, the action strategies are a set of detailed tasks that, when implemented, will assist the watershed staff with the education goals outlined below. The strategies are also designed to assist watershed residents and municipalities in adopting water quality best management practices (BMPs), and to develop the community-wide support needed to protect and improve our lakes, rivers, streams, and wetlands. The general public should also understand more about three things: the water resources at hand, the priority watershed project, and the effects of polluted runoff on Lake Mendota.

The staff of the Dane and Columbia County LCDs will implement the information and education plan. Staff include four conservation specialists, a public information officer, an urban conservationist and the watershed project manager.

The overall watershed project goals and the general citizen education issues guided the selection of the target audiences and education objectives. Target audiences were classified into two distinctive categories: general and specific. **General audience categories** can best be described as:

A) Those who must act (elected officials, homeowners, business owners)
B) Those who support change (conservation groups, civic organizations, media, and concerned citizens)
C) Those who are future actors and supporters (teachers, youth groups)

Specific target audiences include both urban and rural components. *Urban audiences* include:

D) Those involved directly in planning and developing a site (developers and engineers)
E) Those involved during implementation of a site plan (contractors, builders, machine operators, and inspectors)
F) Those who can support the development of the erosion control-stormwater management plan (bankers, boards of adjustment, municipal regulatory bodies, and zoning officials)

Rural target audiences include:

G) Those involved directly with land management (land owner/operator)
H) Those involved directly with livestock animals and manure management (livestock operators)
I) Those who work with landowners/operators and livestock operators (agricultural businesses, crop consultants, farm suppliers, seed companies, and co-ops)
J) Those involved in conservation courses/activities (high school, vocational technical and university instructors, FFA, and 4-H leaders and youth)

The following educational objectives and activities were considered high priorities by the information and education workgroup. The action column represents the educational activity along with the intended target audience (indicated by a letter corresponding to the previous section). The tables also detail which agency or group is responsible and the timeline of each activity.

Goals were developed for four program areas: general audiences, rural areas, established urban areas, and urban transitional areas, where land is being converted from rural use to urban use.

General Audiences

Goal 1: Project Awareness

Goal 1 is that local citizens will be aware and knowledgeable of the Lake Mendota Priority Watershed Project.

Objective 1. All citizens will know that the Lake Mendota Priority Watershed Project is a locally-run program to control polluted runoff and they will know who to contact for assistance.

Actions	Who	When
1. Provide workshops on various grant programs, including Local Assistance and Nonpoint Source grants from the DNR as a part of Priority Watershed Projects (target audience B)	LCD, L&W and Extension	Annually
2. Media releases	LCD and Extension	Ongoing

Objective 2. Local citizens will understand and will be able to express the concern that many small, individual actions from both rural and urban areas caused today's water pollution problems and that many individual actions are necessary for water quality solutions.

Goal 2: Resource Appreciation and Understanding

Goal 2 is that local citizens will be aware of the importance of the soil and water resources in the Lake Mendota watershed and the threats to these resources.

Objective 1. All citizens will understand what a watershed is and be able to describe the water resources within the Lake Mendota Watershed.

Actions	Who	When
1. Bike Tour of the Lake Mendota Watershed	CAC, LCD and Extension	3-4 times

Objective 2. Citizens will be knowledgeable of the best management practices that reduce NPS pollution.

Actions	Who	When
1. Utilize existing PSAs, brochures, videos, etc.	CAC, LCD and Extension	Ongoing

Objective 3. Teachers/youth group leaders will be knowledgeable about the watershed project, its goals and the principals of NPS and best management practices and will be able to teach about these subjects.

Actions	Who	When
1. Develop a listing of resource people: What they can help with, and how to contact	L&W and Extension, Wisconsin Environmental Resources Center (WERC)	Ongoing
2. Develop a summary of the various resources and programs (Adopt-a-Lake, Project WET, Water Education Resource Center, Give Water a Hand, Water Action Volunteers, etc.)	Extension and L&W and WERC	1997
3. WaterWatchers Workshops	Extension & UWEX	Ongoing
4. Participate in ongoing teacher/youth group leader training activities/inservice programs	LCD, L&W and Extension	Ongoing
5. Develop a series of short presentations and two hour workshop programs on watershed issues: NPS problems and solutions, wetlands, household hazardous waste, drinking water	Extension, LCD and L&W	Ongoing

Goal 3: Action

Goal 3 is that local citizens will take personal action to reduce their contribution to nonpoint source pollution.

Objective 1. Youth will take responsible action concerning water quality in the Lake Mendota Watershed.

Actions	Who	When
1. Develop step-by-step instructions that kids can follow on things they can do (organizing storm sewer stenciling, etc.)	Extension, L&W and WERC	1998
2. Develop a fact sheet on how to collect and share meaningful data on watersheds	WERC	1998
3. Signs of Success program promoted throughout watershed	L&W	Ongoing

Rural Area

Goal 1 – Cropland

Goal 1 is to reduce the overall sediment load by 2,242 tons or 40% of the total load from uplands.

Objective 1. The landowners/operators will be able to adopt residue management for sediment control.

Actions	Who	When
1. Demonstration field days	LCD and Extension	Fall 1997
2. Newsletter articles on success stories and how-to stories	LCD and Extension	2x/year
3. Media releases (print and radio)	Extension	Monthly
4. One-on-one contacts	LCD and Extension	Ongoing
5. Provide residue management tools such as residue ropes and calculators	LCD and Extension	Ongoing

Objective 2. Ag-business will be able to work with clients to promote residue management. (Examples are Metro-gro, canning companies, crop consultants, farm suppliers)

Actions	Who	When
1. One-on-one contacts	LCD and Extension	Ongoing
2. Invite them to assist in planning of events/workshops	LCD and Extension	Ongoing
3. Seek referrals from suppliers	LCD	Ongoing

Objective 3. Farm organizations will support the need to control runoff pollution through presentations and information distribution.

Objective 4. Local schools will be able to include conservation tillage and other agricultural pollution control information in their programs.

Actions	Who	When
1. Work with Vocational/Technical Colleges with their farm certification program, especially in the conservation, crops and soils courses	Extension	Ongoing

Objective 5. Landowners/operators will know how to utilize the concept of "whole farm planning" on their land. (Whole farm planning includes potential drinking water contamination risks, pollution prevention activities, etc.)

Actions	Who	When
1. Develop simplified farm checkoff list of potential concerns	LCD, UWEX and Extension	1997
2. Develop list of primary contacts for information or contractors/suppliers for each item on checkoff list	LCD, UWEX and Extension	1997
3. Well abandonment demonstration	Extension	1998

Objective 6. Landowners/operators will be able to initiate a 'water management' system on all fields that have been planned to meet 'T' value.

Actions	Who	When
1. Include information on diversions and terraces in appropriate written materials	LCD	As appropriate

Objective 7. Landowners will be able to explain how wetland restoration can improve water quality and will know where wetland restoration would be appropriate on their land.

Actions	Who	When
1. One-on-one meetings with landowners of priority sites	LCD	Ongoing
2. Field days at wetland demonstration sites	LCD	1999
3. Have available already produced items on wetlands restoration	LCD	Ongoing
4. Press release during construction and at completion of wetland restoration at St. Benedict Center	St. Benedict	1997

Goals 2-4: Nutrient and Barnyard Management

Goal 2 for rural areas is to support the four prohibition areas as established by the Animal Waste Advisory Committee of a) no overflow of manure storage structures, b) no unconfined manure stacking (piling) within Water Quality Management Areas, c) no direct runoff from feedlots or stored manure to waters of the state and d) no unlimited livestock access to waters of the state where high concentrations of animals prevent adequate sod cover maintenance.

Goal 3 for rural areas is to reduce the risk to the environment from excessive application of natural and commercial fertilizers by promoting nutrient management plans.

Goal 4 for rural areas is to reduce phosphorus from barnyard runoff by 11,240 pounds, or 75% of the total phosphorus load.

Since goals 2-4 are interrelated, their objectives are the same.

Objective 1. Landowners/operators will know the environmental and economic impacts of nutrient management.

Actions	Who	When
1. One-on-one meetings with landowners/operators	LCD	Ongoing
2. Promote UW-Extension Nutrient and Pest Management Program	LCD and Extension	Ongoing
3. Develop and promote nutrient and pest management demonstration sites	LCD and Extension	Ongoing

Objective 2. Landowners will consider pollution prevention when doing farmstead planning.

Actions	Who	When
1. Meet with engineers and builders regarding the Lake Mendota Watershed Project and the importance of clean water work and pollution prevention considerations when designing and placing new buildings and/or diversions	LCD and Extension	Ongoing
2. Host tours or field days for engineers and building contractors	Extension and LCD	Ongoing
3. Work with Vo-tech college regarding the farmstead planning portion of farmers certification program	Extension	Ongoing

Objective 3. Landowners/operators will know the advantages of developing and maintaining clean water practices.

Actions	Who	When
1. One-on-one meetings	LCD	Ongoing
2. Newsletter articles	LCD	Ongoing
3. Provide rural practices fact sheet to eligible landowners	LCD	Ongoing

Objective 4. Landowners will be able to explain the impact of animal waste runoff on surface and groundwater and will know how they can reduce animal waste runoff from their operation.

Actions	Who	When
1. One-on-one meetings	LCD	Ongoing
2. Open house for new systems	LCD	Ongoing
3. Field days	LCD	1998 or 1999
4. Newsletter articles	LCD and Extension	Ongoing

Established Urban Area

Goal 1: Storm Water Management

Goal 1 is to maintain storm water runoff peak discharges (1, 2 and 10-year 24-hour storm) for post-construction development to pre-construction peak discharges. This goal applies to areas identified as urban on the year 2020 map (Map 1-3).

Objective 1. All urban audiences will be able to explain the environmental, social and economic impacts of storm water runoff.

Actions	Who	When
1. Face to face meetings with elected officials	Land Conservation Department (LCD), Urban Conservationist (UC) and Lakes and Watershed Commission (L&W)	Ongoing
2. Encourage the inclusion of environmental considerations in building and development into local award programs, i.e. "Best of Madison"	Citizen Advisory Committee (CAC), LCD, Realtors	1998

Objective 2. All urban audiences will be able to describe how urbanization and storm water runoff can effect natural systems, floods, ground water and stream hydrology if not properly planned.

Actions	Who	When
1. Workshops specifice to each urban target audience (target audience D, E, F)	LCD and Extension	Annually
2. Resource handbook (target audience D, E)	LCD and L&W	1998
3. Fact sheets	LCD and L&W	1997
4. Provide information flow sheet at building supply places	LCD and L&W	1998
5. Face-to-face meetings with builders and developers	LCD	Ongoing

Objective 3. During the development and plat approval process, those involved with developing and implementing the plan will design and implement an effective storm water runoff control plan.

Actions	Who	When
1. Resource handbook (target audience D, E)	UC and L&W	1997
2. Workshops specific to the target audience (target audience D, E)	UC, LCD and L&W	1998
3. One-on-one discussions with key developers, zoning officials or board of adjustment (target audience D, F)	UC, LCD and L&W	Ongoing

Objective 4. Bankers, zoning officials and others from target audience F will require the development of a timely, effective storm water runoff control plan.

Actions	Who	When
1. Semi-annual meetings for regulators to share results and concerns	UC, LCD and L&W	2x year
2. Invite audience F to CSEC Workshops	UC, LCD and L&W	Annually
3. One on one discussion with key developers, zoning officials or boards of adjustment (target audience D, F)	UC, LCD and L&W	Ongoing
4. Provide the municipalities with appropriate up-to-date information on sewersheds, land use maps, topographic information, storm water system inventory, soils, wetlands, hydric soils, potential soils for water infiltration, stream vector network, and hydrologic units for each watershed.	LCD, L&W and Extension	As available

Objective 5. Those involved in planning and developing the site will utilize the best methods currently available as appropriate including but not limited to detention ponds, polymers, seeding or sodding and wetlands and will recognize that new technology is emerging and frequent updates are needed.

Actions	Who	When
1. One-on-one contact by Urban Conservationist	UC	Ongoing
2. Develop field design protocols	UC and UWEX	As needed
3. Annual workshop	UC, LCD and L&W	Annually
4. Resource handbook	UC, LCD and L&W	1997
5. Tours at demonstration sites as well as other sites	UC, LCD, L&W and Extension	Annually
6. Face-to-face discussions/ presentations with UW and Extension	UC	Ongoing

Objective 6. Homeowners/renters, business owners and government staff and officials will know how to encourage infiltration of storm water on their property.

Goal 2: Pollutant Load Reduction

Goal 2 for established urban areas is to reduce the pollutant load for sediment by 40%, or 433 tons per year and for phosphorus by 20% or 748 pounds per year entering waters that discharge into Lake Mendota or any other receiving water bodies in the watershed.

Objective 1. Citizens will be able to describe the most important sources and the impacts of nonpoint source pollution on health, economics and the environment.

Actions	Who	When
1. Media releases	LCD and Extension	ongoing

Objective 2. Homeowners/renters, government officials and business owners will know how to decrease pollutants coming from their property.

Actions	Who	When
1. Provide the town, village or city with a summary of the existing and future conditions within the appropriate planning time frame of 2020 urban plan (target audience F)	LCD, L&W and Extension	1998
2. Create a water resources committee for the purpose of recommending goals and strategies to maintain or improve water quality (target audience F)	LCD, L&W and Extension	1997

Urban Transitional Area

Goal 1: Construction Site Erosion Control
Goal 2: Pollutant Load Reduction

Goal 1 is to reduce soil erosion from construction sites to the standard value of 7.5 tons per acre, the same standard used in Dane County. This goal applies to areas identified as urban on the year 2020 map (Map 1-3). Goal 2 is to reduce the total load of pollutants from construction sites entering waters that discharge into Lake Mendota or any other receiving water bodies in the watershed. Sediment should be reduced by 80% or 1,758 tons per year and phosphorus by 60% or 8,347 pounds per year from transition areas.

Since goals 1 and 2 are interrelated, the objectives are the same.

Objective 1: All urban audiences will be able to describe the environmental, social and economic impacts of construction site erosion.

Actions	Who	When
1. Face to face meetings with elected officials	Land Conservation Department (LCD), Urban Conservationist (UC) and Lakes and Watershed Commission (L&W)	Ongoing
2. Encourage the inclusion of environmental considerations in building and development into local award programs, i.e. "Best of Madison"	Citizen Advisory Committee (CAC), LCD, Realtors	1998

Objective 2: All urban audiences will be able to explain how construction site, farm field and urban sediment differ from each other in terms of delivery rate to streams.

Actions	Who	When
1. Workshops specific to each urban target audience (target audience D, E, F)	LCD and Extension	Annually
2. Resource handbook (target audience D, E)	LCD and L&W	1998

Objective 3. Those involved in developing and implementing construction site erosion control plans will contact the Land Conservation Department for technical assistance in plan development and when questions arise during implementation and maintenance of the practice(s).

Actions	Who	When
1. Fact sheets	LCD and L&W	1997
2. Provide information flow sheet at building supply places	LCD and L&W	1998
3. Face-to-face meetings with builders and developers	LCD	Ongoing

Objective 4: During the development and plat approval process, those involved in site development will design and implement an effective erosion control plan using the soil loss equation, "A = R x K x LS x C x P."

Actions	Who	When
1. Resource handbook (target audience D, E)	UC and L&W	1997
2. Workshops specific to the target audience (target audience D, E)	UC, LCD and L&W	1998
3. One-on-one discussions with key developers, zoning officials or board of adjustment (target audience D, F)	UC, LCD and L&W	Ongoing

Objective 5. Bankers, zoning officials and others from target audience F will require the development of a timely, effective storm water runoff control plan.

Actions	Who	When
1. Semi-annual meetings for regulators to share results and concerns	UC, LCD and L&W	2x year
2. Invite audience F to CSEC Workshops	UC, LCD and L&W	Annually
3. One on one discussion with key developers, zoning officials or board of adjustment	UC, LCD and L&W	Ongoing

Objective 6. Those involved in developing and implementing the CSEC plan will utilize the best methods currently available as appropriate including, but not limited to, detention ponds, polymers, seeding or sodding and wetlands and will recognize that new technology is emerging and frequent updates are needed.

Actions	Who	When
1. One-on-one contact by Urban Conservationist	UC	Ongoing
2. Develop field design protocols	UC and UWEX	As needed
3. Annual workshop	UC, LCD and L&W	Annually
4. Resource handbook	UC, LCD and L&W	1997
5. Tours at demonstration sites as well as other sites	UC, LCD, L&W and Extension	Annually
6. Face-to-face discussions/ presentations with UW and Extension	UC	Ongoing

Objective 7. Contractors (target audience E) will be able to implement the construction site erosion plan.

Actions	Who	When
1. Workshop	UC, LCD and L&W	Annually
2. Resource handbook	UC, LCD and L&W	1997
3. One-on-one meetings with Urban Conservationist	UC	Ongoing
4. Tours at demonstration sites as well as other sites	UC, LCD, L&W and Extension	Annually

Objective 8. Contractors (target audience E) will know who to contact for specialty building materials and other resources.

Actions	Who	When
1. Develop list of suppliers	UC	1997

Objective 9. Contractors (target audience E) will be able and willing to maintain erosion controls measures.

Actions	Who	When
1. Tours at demonstration sites as well as other sites	LCD and Extension	Annually
2. Workshop/presentations	UC, LCD and L&W	Annually
3. Resource handbook	UC, LCD and L&W	1997

Conclusion

The previous tables only list those activities that were given a high priority. Additional activities that received either a medium or low priority are not listed in these tables but are available in the full Information and Education document (Wade, 1997). High priority activities are those, which the Information and Education workgroup felt, were critical to assist in the implementation of BMPs. They are also where available funds will be directed first. In addition, these actions have a high likelihood of being accomplished.

It is estimated that the total amount of time needed to accomplish all aspects of the Information and Education plan is 57,980 hours. Of this, approximately 29,000 will be spent working one-on-one with individual landowners and municipalities in the watershed.

Not all of the activities have associated costs. Activities such as workshops, newsletters, and special events will have to be budgeted for. Estimated total costs for implementing all facets of the information and education plan are $38,900.

CHAPTER SIX
Integrated Resource Management Program

Introduction

The purpose of this chapter is to identify existing state, federal and local resource management programs which provide benefits for water quality and/or fish and wildlife resources in the Lake Mendota watershed. Watershed staff will work to coordinate the efforts of these programs to provide the best possible management of land and water resources in the watershed. This comprehensive approach will facilitate consideration of the various goals and objectives for all the programs in which the landowner participates. Each of these activities is described below.

Fisheries and Wildlife Management

Watershed best management practices (BMPs) such as streambank protection, shoreline buffer strips and easements should be implemented in a manner that preserves and enhances the management goal of providing a quality fishery in the Lake Mendota watershed. Specifically, all streambank protection BMPs should be installed using large diameter-sized rock below the water line. Rock riprap should be installed and sized so that the placement and size of rock will positively benefit fish habitat. Vegetative shoreline erosion control using emergent aquatic vegetation for habitat enhancement should be used where applicable. Wildlife habitat components should also be incorporated into vegetative filter strips along streams or in upland areas.

Shoreline erosion control measures will be installed in a manner beneficial to fisheries and wildlife habitat. DNR Fish Management and Wildlife Management personnel will be consulted for input in the design of streambank and shoreline protection BMPs to maximize benefits to the fish and wildlife communities. In cooperation with counties, DNR staff will also review placement of agricultural sediment basins, provide technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat, and assist in resolving questions concerning effects of agricultural nonpoint source BMPs on wetlands.

Wetland Restoration

A priority list of restorable wetlands has been identified in the Lake Mendota watershed as presented in Chapter Two. The general guidelines for wetland restoration, easement acquisition and shoreline buffers to protect existing wetlands should be followed. Wetlands

that are important wildlife habitats will be identified in consultation with DNR Wildlife Management and Water Management personnel. Shoreline buffer easements may be acquired adjacent to these wetlands to offer better protection from sedimentation and other nonpoint source pollution.

Groundwater Management

Wells provide a direct conduit for pollutants to reach groundwater resources. Preventing well contamination and sealing abandoned wells are important steps for protecting these resources. If not properly sealed, abandoned wells can directly channel contaminated surface water or shallow groundwater into deeper drinking water aquifers, bypassing the normal purifying action that takes place as surface water slowly percolates downward. Abandoned wells are a significant threat to groundwater quality in the Lake Mendota watershed.

The Dane and Columbia County LCDs will encourage all landowners to properly seal abandoned wells. Information on the proper abandonment procedures will be provided to landowners when abandoned wells are located.

Well Abandonment

The Farm Services Agency (FSA), provides cost-share assistance to Lake Mendota farm operators to properly seal abandoned wells to protect groundwater resources. Well abandonment is also an eligible cost-share practice under NR 120.

Wisconsin Well Compensation Grants

Wisconsin's Well Compensation grant program provides financial assistance to replace or treat private wells contaminated with heavy metals, pesticides, solvents or gasoline. Contaminated wells must exceed state or federal drinking water standards. Replacement of wells contaminated with bacteria or nitrates are not eligible for cost-sharing, with the exception of livestock wells contaminated with more than 40 ppm of nitrate. DNR regional water supply personnel should be consulted for more information concerning income limits and other eligibility requirements. Eligible landowners will be encouraged to apply for well replacement funds through the Wisconsin Well Compensation Grant Program.

Private Sewage System Maintenance and Rehabilitation

Poorly sited or improperly functioning private sewage systems have the potential to contaminate groundwater and surface waters in the Lake Mendota watershed. Pollutants from sewage system discharge includes bacteria, viruses, household chemicals, nitrates and phosphorus. Many sewage systems located in riparian areas are out-dated and installed in soils which do not adequately filter pollutants due to the poor filtering ability of the soil and/or a high water table. Failing sewage systems in riparian areas are a special concern

since pollutants can enter the surface waters with minimal filtering. Sewage system failure is often due to poor maintenance, primarily a failure to pump septic tanks on a regular basis.

It is also recommended that Dane and Columbia Counties adopt an "update at date of sale" policy to require the proper inspection, update and/or replacement of septic systems when homes are sold.

Wisconsin Fund

The Private Sewage System Replacement & Rehabilitation Grant Program (Wisconsin Fund) provides financial incentives to protect and improve groundwater quality in Wisconsin. The Wisconsin Fund provides funds to update private sewage systems installed before 1978. To be eligible the septic system must have been inspected by the Dane or Columbia County Sanitarian and determined to be failing by discharging waste to the groundwater or surface water. Only permanent residences qualify, and there are income restrictions. Applications for Wisconsin Fund assistance are made through the Dane and Columbia County Planning and Zoning Departments. Watershed staff will inform watershed residents about the benefits of the Wisconsin Fund grant program and encourage eligible landowners to apply.

Riparian Zones

Any sites impacted by cattle access that are identified during the implementation phase of the project should be protected through the implementation of BMPs. Cattle access to streams and lakes has not been identified as a serious problem in the watershed. Any sites impacted by cattle access that are identified during the implementation phase of the project should be protected with BMPs. Sensitive riparian areas can be acquired through easements so they receive lasting protection. Watershed staff will promote the protection of riparian areas where possible.

Stewardship

The Stewardship program enables the purchase of land or easements to protect sensitive environmental areas. The streambank protection program under stewardship is an important additional means of protecting water quality. Under this program, the DNR could obtain an easement on both sides of streams in the watershed (generally 66 feet wide on each side). If needed, the DNR will financially support the fencing of the stream to protect it from livestock access.

Dane County supports the nomination of the Upper Yahara River, Six Mile Creek and Token Creek for stewardship eligibility. Dane County staff and DNR Fisheries personnel will participate in the selection process and review watershed streams for recommendation.

Lake Management Program

Wisconsin's 15,000 inland lakes are under increasing pressure from the activities of people who live and recreate near them. Increasing development and recreational use of lakes has

led to user conflicts, the introduction of exotic species and the disruption of lake ecology. Land use changes in lake watersheds has resulted in the nutrient enrichment of many Wisconsin lakes, leading to nuisance growth of aquatic plants and algae, sedimentation and the loss of native plant communities. The Wisconsin Lakes Management Program is a cooperative program between the Wisconsin DNR, UW-Extension, the Wisconsin Association of Lakes (WAL), and lake organizations to assist local governments and the inland lake management organizations in the long-term management and protection of their lakes. The Wisconsin Lakes Management Program provides technical assistance, information and education to lake groups and lake residents, and planning, protection, and implementation grants to qualified lake organizations and local units of government.

Organizing Lake Groups

Lake groups range from informal groups of concerned property owners to lake districts which have the power to levy taxes against property owners for the operation of lake management programs. Most of the DNR grant programs designed to help lake residents become better lake stewards require that the lake organizations meet certain minimum standards relating to membership, dues and by-laws. At a minimum, a lake group must be a legal lake association incorporated under Chapter 181 Wisconsin Statutes. Lake Mendota is part of the Yahara Lakes Association.

In addition to the ability to apply for lake assistance grants, qualified lake organizations have much to offer lake residents. A unified lake association or lake district can lobby towns for changes in zoning laws and lake use restrictions and may join the Wisconsin Association of Lakes, which lobbies at the state-level for lake stewardship, cooperatively with the DNR, to express their concerns and the opportunity to educate residents about proper lake stewardship. Many Wisconsin counties have formed county lake associations to further assist in these efforts.

Coordinating Regulations, Permits, and Zoning

Best management practices that address shoreline erosion such as riprap or vegetative shoreline stabilization will require permits from the DNR. Any BMP which effects wetland form or function may require permits form the DNR, County Zoning offices and the US Army Corps of Engineers.

The watershed staff will work closely with the DNR Floodplain and Shoreland Management staff, the Dane and Columbia County Zoning Departments and the US Army Corps of Engineers to assure that necessary permits are received prior to the installation of shoreline stabilization practices.

In an attempt to protect the use, enjoyment and water quality of our lakes and streams the state, federal and local government regulates some activities on riparian properties. Activities that disturb or remove the natural vegetation surrounding our lakes and streams reduces the buffering capacity of the area and often drastically increases erosion, sedimentation and nutrient runoff. Many lakefront property owners, particularly those who are purchasing

waterfront property for the first time, are not aware of these regulations or the need for them.

Coordination With State and Federal Conservation Compliance Programs

The Lake Mendota Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by DATCP, and the Federal Food Security Act (FSA) administered by the Natural Resource Conservation Service. DATCP will assist the LCD and the NRCS offices to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FSA by December 31, 1989.

Implementation and amendment of these conservation plans will be necessary during the implementation phase of the watershed project. Watershed project staff will inform FPP and NRCS staff of changes in plans resulting from management decisions and the installation of needed BMPs for nonpoint source pollution abatement.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is administered by the Natural Resources Conservation Service (NRCS). EQIP consolidates the functions of four existing conservation programs into one and focuses assistance to locally identified conservation priority areas or areas where agricultural improvements will help meet water quality goals. The program will be funded at $200 million annually, nationwide. Funds will be used to pay for technical assistance and cost sharing on conservation practices. Fifty percent of the funds are dedicated to conservation associated with livestock operations.

The Dane County portion of the Lake Mendota watershed project competed for EQIP funds and was awarded a grant of $693,000 to be used in Fiscal Years 1998, 1999 and 2000 to install best management practices. Additional funding may be added to this grants as money is made available.

Wetland Reserve Program

The Wetland Reserve Program (WRP) is administered through NRCS and has been extended through the year 2002. WRP is a voluntary program to restore and protect wetlands on private property. The program provides financial incentives to enhance wetlands in exchange for retiring marginal agricultural land. Landowners who choose to participate in WRP may sell a conservation easement of enter into a cost share restoration agreement. Other agencies and private conservation organizations may provide additional assistance for easement payment and wetland restoration costs as a way to reduce the landowners share of the costs. Such special partnership efforts are encouraged. Recent changes in the programs provide landowners more options for protecting wetlands. Landowners are now able to choose between permanent easement, 30 year easements, or restoration-only cost share agreements.

Conservation Reserve Program

The Conservation Reserve Program (CRP) has also been extended through the year 2002, and is administered through the Farm Services Agency (FSA). CRP assists owners and operators to conserve and improve soil, water, and wildlife resources by converting highly erodible and other environmentally sensitive acreage used to produce agricultural commodities to a long-term vegetative cover. CRP participants enroll contracts for 10 to 15 years in exchange for annual rental payments and cost share assistance for installing certain conservation practices. Applicants submit bids to enroll their acreage. The maximum rental payments paid to successful applicants reflect site based soil productivity, prevailing local cash equivalent rental rates, and maintenance cost. The rental payment portion of the financial assistance provided through the CRP program may be piggy backed with other nonfederal programs. Cost sharing for practice installation may also be combined with other nonfederal programs, provided that the total cost share assistance does not exceed the cost of the practice.

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners who volunteer to participate in the program. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.40, Wis. Stats., have been blended to produce a cultural resource management program which is both compatible to preserving cultural sites and implementing the watershed project.

Any known archeological sites will need special consideration when structural best management practices are being considered. Settling basins, manure storage structures, and streambank or shoreline shaping and riprapping are likely practices that may impact archaeological sites. As discussed above, state and federal laws require preservation of archaeological resources within the framework of the NPS Program.

Before finalizing the cost-share agreement with the landowner, project staff should review the maps showing known archaeological and historic sites. If a known site occurs in the vicinity of a proposed BMP, this does not necessarily mean the BMP needs to be moved or altered. In some cases, the specific location of the BMP will not actually be near enough to the location of the known site to warrant further review. Project staff should visit the area and conduct a "pre-review" to ensure that the *specific* location of the proposed BMP will not disturb the known archaeologic or historic site. Instructions and Cultural Resource Site Review Documentation forms are available in the Implementation Manual.

If it is too difficult to determine through a pre-review, or if it appears that the known site would indeed be disturbed, contact the DNR-State Historical Society Liason to set up a formal Archaeological or Historic Site Review of the area. Any costs incurred as part of a

site review *will not be passed on to the landowner*. The DNR's Nonpoint Source Pollution Abatement Program will pick up the costs of professional historic and/or archaeological site reviews. In some cases, a representative from the U.S. Natural Resources Conservation Service (NRCS) may conduct the review.

Practices of concern
Archaeological Sites: Field diversions; terraces; grade stabilization structures; agricultural sediment basins; streambank and shoreline stabilization; sediment retention; erosion or water control structures; structural urban practices; wetland restoration.

Buildings: Barnyard runoff management systems; animal lot relocation; manure storage facilities; roofs for barnyard/manure storage facilities.

Practices - No Concern Needed for Cultural Sites: Contour farming; contour strip-cropping; field strip-cropping; reduced tillage; no-till systems; permanent vegetative cover; cropland protective cover; critical area stabilization; nutrient management; pesticide management; shoreline buffers; livestock exclusion from woodlots; grass waterways.

Endangered and Threatened Resources

The Endangered and Threatened Species list is only a first step toward identifying a problem that exists. It doesn't tell what the problem is or what to do about it. Moreover, it does not guarantee survival of the plants and animals listed. The real work follows listing. The Bureau of Endangered Resources formulates management plans to aid the recovery of listed species. DNR resource managers put the plans to work in the field, while conservation wardens enforce laws protecting endangered resources.

Information on threatened and endangered resources was obtained from the Bureau of Endangered Resources of the DNR. Endangered resources include rare species and natural communities. It should be noted that comprehensive endangered resource surveys have not been completed for the entire Lake Mendota Priority Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and so are not listed in this document.

Rare Species

Rare species are tracked by Wisconsin's Natural Heritage Inventory of the Bureau of Endangered Resources. Species tracked by the inventory include those that are listed by the U.S. Fish and Wildlife Service or by the state of Wisconsin.

Wisconsin Endangered Species

An endangered species is one whose continued existence as a viable component of this state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. There are currently no Wisconsin endangered species known to exist within the watershed.

Wisconsin Threatened Species

A threatened species is one which, if not protected, has a strong probability or becoming endangered. Wisconsin threatened species within the watershed are:

Casmerodius albus, Great Egret
Emydoidea blandingii, Blanding's Turtle
Asclepias lanuginosa, Wooly Milkweed

Wisconsin Special Concern Species

A special concern species is one for which some problem of abundance or distribution is suspected in Wisconsin, but not yet proven. The purpose of this category is to focus attention on certain species **before** they become endangered or threatened. Wisconsin special concern species within the watershed are:

Eleocharis engelmannii, Engelmann Spike-rush

If specific location or other information is needed about these species or natural communities, contact the Bureau of Endangered Resources, DNR. **Please note** that the specific location of endangered resources is sensitive information. Exact locations are not released or reproduced in any publicly disseminated documents.

Farm Practices Inventory

A Farm Practices Inventory was conducted by the University of Wisconsin-Extension in 1996. The Farm Practices Inventory (FPI) is an assessment of landuser's nutrient and pesticide management practices. The overall objective of the FPI is to identify farmer needs which can guide and then evaluate information and assistance efforts in helping farmers adopt best management practices. These management practices are essential to protecting farm profitability and water quality. A series of three reports was generated with the results from the Lake Mendota survey. They are presented in Appendix Two-Farm Practices Inventory.

Economic Analysis[1]

An special economic analyis was conducted to estimate the benefits of implementing best management practices in the Lake Mendota watershed. Reduced sediment and nutrient loadings should result in improved water clarity. The improvemed in water clarity is a benefit to shoreline property owners, to people making use of recreational opportunities, and to the public lake shore property held by the State of Wisconsin, Dane County, and municipalities surrounding the lakes. This section provides an estimate of the resulting benefits.

Real Estate Values

The following is a summary of data collected from tax assessment rolls for the cities of Madison, Monona, Middleton, Shorewood Hills, Maple Bluff, and the Town of Westport. The data is public information, and is made available for public review by each city. The information includes only residential properties; no attempt was made to include commercial properties. The overwhelming majority of lake front private property is residential. An effort was made to ensure that all residential properties were included. However some are undoubtedly omitted, but represent a relatively small proportion of the total and should not significantly change the average values determined by the data. There are significant variations in average values between single family homes and multi-family units, and between single family homes located on Lake Monona proper, and single family homes located on coves, lagoons, and the Yahara River.

Within the individual categories of properties, there is proportionally more variation in values on Lake Monona than there is with Lake Mendota property. In general, narrower lots are more expensive on a per foot of lake frontage basis than wider lots. The total cost of wider lots is, of course, greater than the narrow lots. The depth of the lot has some impact on total cost, but it is not as significant as the frontage in determining assessed valuation. The differences in lot widths explains only part of the variation. Lots of approximately the same width can have much different costs per linear foot on Lake Monona. Some of the streets with frontage on Lake Monona also have heavy street traffic. This may explain some of the variation.

Lake Monona

Lake Monona has 230 single family homes which have lake frontage within the City of Monona. The average frontage for these properties according to tax assessment data, is 70 feet, with an average 1995 assessed valuation per linear foot of frontage of $1,831. There are several multi-family units with Lake Monona frontage within the City of Monona. Tax assessment records are somewhat unclear regarding how frontage is assessed to the individual units.

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[1] This section was prepared by Jan Whitcomb, NRCS

There are also 136 single family homes with lake frontage located within the City of Madison. These lots average about 67 linear feet of shoreline. The average 1995 assessed valuation of these properties is $2,215 per linear foot. In addition to these properties, there are also several homes along the Yahara River connecting Lake Monona and Lake Mendota.

The average 1995 assessed property value per linear foot of shoreline for single family homes on Lake Monona is $1,971. Total 1995 assessed valuation of land on Lake Monona is $55,350,300. Total assessed valuation of buildings is $49,938,900. This includes single family and multi-family dwellings.

Table 6-1. Lake Monona Waterfront Property Summary - 1995 Assessed Valuation

Municipality	Number	Land	Buildings	Total Frontage	$/Ft. Frontage
Monona, Single Family (SF)	230	$29,229,000	$26,169,900	15,966	$1,831
Madison, Single Family (SF)	136	20,244,800	$13,993,800	9,139	2,215
Average/home, Single Family		135,174	109,737	69	1,971
Monona, S.F., Back Channel	150	6,701,500	10,250,400	9,838	
Average/Home, S.F., Back Channel		44,677	68,336	66	681

Lake Mendota Madison, Middleton, Shorewood Hills, Maple Bluff, and the Town of Westport all have residential property with Lake Mendota frontage. There are 206 single family homes with Lake Mendota frontage in Madison. The average width of the lot is 68 feet with an assessed valuation of $2,661 per linear foot.

The Town of Westport has 111 single family residences, with an average frontage of 87 feet, and an average assessed valuation of $2,203 per linear foot.

Shorewood Hills has 48 single family homes with frontage, with an average lot width of 74 feet, and 1995 assessed valuation of $3,328 per linear foot.

There are 104 single family homes in Maple Bluff on Lake Mendota, with average lake frontage of 120 feet, and an assessed valuation of $2,937 per linear foot.

There are 108 single family homes with frontage in Middleton, which average 53 feet of shoreline, and a 1995 assessed valuation of $3,236 per linear foot.

The composite average for Lake Mendota is a lot with 79 feet of lake frontage at an average assessed valuation of $2,764 per linear foot. Total 1995 assessed valuation for residential properties on Lake Mendota for land is $127,102,600, with assessed valuation of buildings at $91,737,100.

Table 6-2. Lake Mendota Waterfront Property Summary - 1995 Assessed Valuation

Location	Number	Land	Buildings	Total Frontage	$/Ft. Frontage
Madison, Single Family	206	$37,511,500	$26,753,700	14,096	$2,661
Westport, Single Family	111	21,338,700	12,606,600	9,684	2,203
Shorewood, Single Family	48	11,873,600	10,495,700	3,567	3,328
Maple Bluff, Single Family	104	36,647,400	31,176,000	12,457	2,937
Middleton, Single Family	108	18,451,400	8,412,900	5702	3,236
Average Single Family Home		$218,063	$155,017	79	$2,764

Summary

The average assessed valuation for Lake Mendota is $2,764 per linear foot of frontage. The average assessed valuation for Lake Monona is $1,971. Lake Monona has several properties within the City of Monona that have relatively low assessed valuation. This may be due to factors unrelated to lake water quality, namely heavy street traffic nearby.

Madison assessed valuation will be used in the evaluation. It is more appropriate to use City of Madison assessed valuation data, since Madison borders both lakes. This will provide for a more consistent property valuation, since a single city assessor's office would be involved in the assessed valuations. Within the City of Madison, Lake Mendota property is assessed at an average rate of $2,661 per linear foot of frontage, and Lake Monona property is assessed at an average rate of $2,215 per linear foot of frontage.

This will also provide for a more conservative estimate of potential benefits.

Water Quality Issues

Evidence indicates that there is a difference in water quality between Lake Mendota and Lake Monona. The following table shows median summer secchi disk water depth in meters from 1984 to 1994.

Table 6-3. Median Summer Secchi Disk Readings

Year	Lake Mendota (m.)	Lake Monona (m.)
1984	1.8	1.9
1985	1.1	1.2
1986	2.2	1.5
1987	2.3	2.3
1988	3.7	2.9
1989	2.7	2.6
1990	2.1	1.4
1991	2.4	1.6
1992	2.2	2.2
1993	2.0	2.2
1994	1.7	1.2
Average	2.2	1.9

The median summer secchi disk readings on Lake Monona are not as high as those for Lake Mendota. Public perception of water quality related to secchi disk readings is being compiled. Initial indications are that about two meters is the threshold between "good" and "bad" from the public's perspective.

Assumptions

The following assumptions are used to evaluate the potential benefits resulting from project action to improve water quality.

1. Single family homes located on the lake proper will be considered representative of lake property values. Condominiums and apartments located on the lakes, and homes located on the Yahara River or lagoons will not be included in the value determination.

2. Differences in average assessed valuation between the two lakes are based on at least four factors. These are weed growth and water clarity, the "viewshed" of the lake shore property, the size of the lake, and the rail and highway crossing through Lake Monona. It is outside the scope of this analysis to determine the relative role that each of the factors plays. It is assumed in this evaluation that each factor plays an equal role. That is, each of the factors is responsible for one fourth of the difference in assessed valuation between the two lakes.

3. It will be assumed that the average differences in median summer secchi disk readings represent the long term relative difference in water clarity between the two lakes. It will be further assumed that these median secchi disk readings are representative of the water quality associated with phosphorus and sediment loadings existing under current land use conditions, without further practice installation.

4. Since predictive models are unavailable at this time to evaluate the magnitude of the change in water quality (as measured through secchi disk readings) associated with installation of BMPs in the rural and urban sectors, it will be assumed that the best that can be achieved through the installation of BMPs are those secchi disk readings associated with the drought year of 1988, and the following year of 1989. This is an average median secchi disk reading of 3.2 meters for Lake Mendota and will be used to represent the probable maximum improvement in Lake Mendota water clarity.

5. Improvements in water clarity may or may not increase weed growth in the lakes. DNR and Dane County officials familiar with weed removal on Lake Mendota indicated that there may not be a direct correlation between water clarity improvements and increased weed growth. Eurasian milfoil tends to have peaks and lows in its growth, and this tends to occur over a 30 year cycle. This cycle may have more of an impact on how much of a problem this aquatic weed causes than water clarity. In addition, if the niche opened by improved water clarity is filled by native aquatic plants, then there will be no more additional weed removal activities than at the present. Native aquatic plants tend not to reach the water surface, and therefore do not cause a major problem.

Impacts of potential increased weed growth on property values or increased costs due to increased frequency of weed cutting and removal were therefore not considered in the analysis. Longer term as weeds are removed, and with them some of the phosphorus, increased weed growth may not be as severe.

Evaluation of Potential Benefits to Real Estate Values

The Madison lake shore values are $2,661 per linear foot on Lake Mendota and $2,215 on Lake Monona. The average median summer secchi disk reading is 2.2 meters on Lake Mendota and 1.9 meters on Lake Monona. One fourth of the difference in property value per foot of $446, or $111.50 is the difference per foot of lake frontage attributable to water clarity and weed growth. Since this is the total for the 0.3 meter difference in water clarity, the value per 0.1 meter change in water clarity is $37.17.

If water clarity in Lake Mendota improves with the installation of rural and urban BMPs from the current average summer median secchi disk reading of 2.2 meters to the 3.2 meter average secchi disk readings of 1988-1989, the maximum increase in property value per linear foot would be $371.70. There is 45,527 feet of lake shore property along Lake Mendota within Madison, Middleton, Shorewood Hills, Maple Bluff, and the Town of Westport. This would amount to a total increase in property value of $16,922,400.

Converting this increase in property value to an average annual amount at 8 percent interest yields $1,353,800, after all practices are installed. Since the project will be completed over a number of years, the full level of benefits will not accrue until after the implementation period. The benefits will be steadily increasing over the installation period as more BMPs are completed and the pollutants are reduced. Discounting for this lag in benefit accrual results in an average annual benefit of $980,800. This means that up to $980,800 could be spent each year for the installation and maintenance of BMPs.

This amount represents the total annual benefit to lake shore residential properties. It should be remembered that less than half of the Lake Mendota shoreline is occupied by residential property. There is a total of 22.9 miles (120,912 feet) of shoreline on Lake Mendota. The State of Wisconsin (University of Wisconsin, Governor Nelson State Park, etc.), City of Madison (city parks), and Dane County (county parks) combined control about 60 percent of the shoreline. While this property is unlikely to ever be disposed of, the various levels of government, and hence the public, also will receive direct benefits from improvements in water quality, through improved recreational experiences and quality of life. There is also some commercial property along the lake shore, although this is a relatively small proportion of the total lake shore. Using the same $371.70 benefit per linear foot and applying it to the remaining public shoreline results in a total maximum increase in public land values of $28,020,600. Converting this amount to an annual value at 8 percent interest results in an additional public benefit of $2,241,600, after the end of the implementation period. Discounting for the lag in accrual of benefits results in an average annual benefit of $1,624,000.

The total estimated average annual benefit from both private and public property is $2,604,800.

This value captures improvements in the recreation values associated with improved water clarity.

Uncertainty

The assumptions used to make this evaluation have tended to be conservative where possible, to prevent or limit the possible overestimation of benefits. Maximum potential improvement in water clarity was reduced by using a two year average which included the drought year of 1988 and the following year of 1989, when weather patterns started to return to normal.

This analysis ignores the effects of changes in the food web. The analysis being done by Richard Lathrop, Bio-Chemical Limnologist, Bureau of Research, DNR, regarding impacts of

lake resulting from the installation of BMPs is not yet at the point where estimates can be made of the resulting changes in water clarity.

This analysis assumes that the relationship between property values on Lake Mendota and Lake Monona as related to water clarity is linear. This is unlikely, and the value used in the benefit estimate was based on the difference in secchi disk readings of 1.9 meters to 2.2 meters. The farther away from this range the greater the possible error in the benefit estimate. The range of improvement on Lake Mendota is used in the benefit evaluation is from 2.2 meters to 3.2 meters (7.2 feet to 10.5 feet).

Tax assessment records are intended to represent fair market values, and the differences between the property values on the two lakes are supported by the market, according to a representative contacted in the City of Madison Tax Assessors office. However, it is apparent that the last few years have seen dramatic increases in market values for lake shore property, and it is difficult for the assessed valuations to keep up with actual market values. As a result, actual market differences between the two lakes may vary from those indicated in the tax assessment records. Any variance between actual market values and assessed valuation would change the "real" benefit estimate.

CHAPTER SEVEN
Project Evaluation

This chapter summarizes the plan for evaluating the progress and effectiveness of the Lake Mendota Priority Watershed Project. The evaluation plan includes these components:

- Administrative review
- Nonpoint source pollutant load reduction
- Water resources monitoring

Information on the first two components will be collected by the Dane and Columbia County LCDs and reported on a regular basis to the DNR and the DATCP. The project team will meet early in the year throughout the implementation phase to review and evaluate the accomplishments of the preceding year. Additional information on the numbers and types of practices on cost-share agreements, funds encumbered on cost-share agreements, and funds expended will be provided by the DNR's Bureau of Community and Financial Assistance. The Water Resource Monitoring plan follows guidance established by DNR's Bureau of Watershed Management to select specific sites in the watershed to monitor resource quality changes.

A final report will be prepared for the Lake Mendota Priority Watershed Project within 18 months of the end of the grant period. This report will include information on landowner participation, project management, grant management, technical assistance, and any Signs of Success sites completed within the watershed among other topics. It is developed to evaluate progress, provide documentation on attainment of water quality and pollutant load reduction objectives, evaluate BMP effectiveness, and provide recommendations on key areas needing improvement in the NPS program. Watershed staff will prepare the final report.

Administrative Review

The first component, the administrative review, will focus on the progress of Dane and Columbia Counties and other units of government in implementing the project. The project will be evaluated with respect to accomplishments, financial expenditures, and staff time spent on project activities.

Accomplishment Reporting

The Dane and Columbia County LCDs will provide the following data to the DNR and the DATCP annually:

- Planned and completed BMPs
- Planned and completed conservation systems

- Major information and education activities undertaken

Accomplishment data are summarized in the Annual Accomplishment Report prepared by DATCP and DNR, and are also discussed at watershed review meetings held annually for projects in implementation. Additional evaluation data provided by Dane and Columbia County LCDs for the annual watershed review include:

- Pollutant load reductions (described below)
- Status of grants and related financial activities
- Evaluation of landowner participation
- Status of project administration including data management, staff training, and BMP monitoring
- Status of nutrient management planning and easement acquisition and development
- Effectiveness of construction site erosion control activities
- Status of stormwater management activities for new development undertaken by the municipalities in the watershed

Likewise, participating local units of government implementing the urban nonpoint source management program meet periodically with DNR staff to review progress. The DNR and local units of government will jointly evaluate the urban implementation program. Annual reports of governmental units will include:

- Information and education activities
- Construction site erosion control ordinance amendments adopted
- Number of permits monitored for ordinance compliance
- Implementation of urban "housekeeping" program activities
- Acres of existing (1997 survey year) urban development, by land use, covered by storm-water management plans for controlling water quality
- Acres of new (post-1997 survey year) urban development, by land use, covered by storm-water management plans for controlling water quality
- Stormwater management ordinance provisions adopted

Details of the reporting requirements are contained in DNR Publication WR-223-97, "An Evaluation Plan for the Soil and Water Resource Management Program and the Nonpoint source Water Pollution Abatement Program" which is reviewed every two years by DATCP and DNR and revised as necessary.

The Field Offices Computing System (FOCS) is a computer data management system that has been developed by the U.S. Natural Resources Conservation Service (NRCS). The NRCS, DNR and DATCP use FOCS to meet the accomplishment reporting requirements of all three agencies. The Columbia County LCD will use FOCS to collect data for administrative accomplishments, and will provide the information to the DNR and the DATCP for program evaluation. Dane County will use WINHUSLE which they are able to run without the FOCS system.

Financial Expenditures

Dane and Columbia County LCDs and other participating units of government will provide the following financial data to the DNR and the DATCP on an annual basis:

- Number of landowner cost-share agreements signed
- Amount of money encumbered in cost-share agreements
- Number of landowner reimbursement payments made for the installation of best management practices (BMPs), and the amount of money paid
- Staff travel expenditures
- Information and education expenditures
- Expenditures for equipment, materials, and supplies
- Expenditures for professional services and staff support costs
- Total project expenditures for the watershed staff
- Amount of money paid for installation of BMPs, and money encumbered in cost-share agreements
- Staff training expenditures
- Total budget and expenditures on the project

Time Spent On Project Activities

The LCD will provide time summaries to DNR for each employee by project on an annual basis.

Nonpoint Source Pollutant Load Reduction

Key sources of pollution and reduction goals were identified in Chapter 3. Pollutant load reduction goals were established for sediment from uplands, streambanks, gullies, and construction sites and for phosphorus from winter spreading of manure, barnyards, and cropland.

Cropland Sources

Dane and Columbia County LCDs will use WINHUSLE (Wisconsin Nonpoint Source) computer model to estimate sediment loads. The inventoried load from cropland is 5,604 tons of sediment per year. The reduction goal is 40%.

Streambank Sources

Watershed staff will estimate changes in streambank sediment erosion. A tally will be kept of landowners contacted, the amount of streambank sediment (in tons) being generated at the time of contact, and changes in erosion levels estimated after installing BMPs. The inventoried load is 728 tons of soil per year; the goal is 50% reduction.

Barnyard Runoff

Dane and Columbia County LCDs will use the BARNY model to estimate phosphorus reductions. The inventoried load from 304 barnyards is 14,986 pounds of phosphorus with a reduction goal of 75%.

Construction Sites

Local units of government participating in the urban implementation program will report annually to the DNR on the number of construction sites served by adequate erosion control practices, number of construction sites receiving appropriate permits, and any amendments to construction site erosion control ordinances that affect sediment loads associated with these sources. The reduction goal for sediment from construction sites is 80%.

Urban Areas

Local units of government will report annually to the DNR on any activities that may result in changes in urban pollutant loadings. Such activities include acres of existing and new urban land, by land use, served by new stormwater BMPs; new urban lands, by land use, not served by storm-water BMPs; and other information requested by the DNR concerning BMP characteristics. A 40% reduction in sediment from existing urban development is the goal.

Water Resource Monitoring

Limited funds and the intensive staffing needed to properly evaluate water quality changes prohibits monitoring each watershed individually. Instead, two types of evaluation monitoring are being conducted on a state-wide basis: Whole Stream Monitoring and Signs of Success. The goal of the monitoring activities is to determine the progress the Nonpoint Source Program is making towards improving the quality of Wisconsin's water resources. Monitoring activities were developed to answer five questions about the water resource objectives and the pollution reduction goals:

1) Do the levels and types of best management practices recommended in the watershed plans achieve the water resource objectives?

2) Do the types and levels of best management practices recommended in the watershed plans achieve the pollutant reduction goals?

3) Does any level of practice installation below 100% achieve the water resource objectives or the pollutant reduction goals?

4) Do we need to adjust the pollutant load reduction goals to achieve the water resource objectives?

5) Can we use simple environmental indicators in many of the watershed projects to provide some early evidence that the practices might achieve the water resource objectives and pollutant reduction goals?

A team of experts from state and federal agencies, and the University of Wisconsin was formed to develop and direct the evaluation monitoring activities at the Whole Stream Monitoring and Signs of Success sites.

Whole Stream Monitoring Sites

Criteria were developed to select and monitor twelve streams around the state. The stream sites represent the five major types of fishery found in agricultural and urban parts of priority watersheds, and they also represent three of the five eco-regions in the state. The five fishery types are: high gradient cold water sport fishery, high gradient warm water sport fishery, high gradient warm water forage fishery, low gradient warm water forage fishery, and low gradient cold water sport fishery. A storm sewer outfall is also being monitored. The three eco-region types represented are the Southeastern Wisconsin till plains, the Driftless area, and the North Central Hardwood Forest.

All but one of the stream sites drains a small area (about ten square miles or less). The schedule involves two years of monitoring before any best management practices are installed, five years of monitoring during the practice installation phase, 2 years of monitoring during the response period, and two years of monitoring during the post-practice installation phase, for a total of eleven years of monitoring.

State-of-the-art chemical and physical monitoring is being done at all the stream sites. State-of-the-art biological monitoring will be done at eight of the twelve streams. Results of the monitoring will be used to determine how well the best management practices achieve the pollution reduction goals and objectives. Improving the fish community is the most important water resource objective for all the streams.

A total of about $8,360,000 would be needed for the stream monitoring, if the work is carried out over a period of eleven years. The success of the evaluation monitoring activities depends on the installation of all the best management practices at the Whole Stream Monitoring Sites.

Signs of Success

Signs of Success (SOS) is short-term monitoring designed to provide some early evidence that better land management does make a difference. One site is being sought for each watershed project. Signs of Success will focus on one practice such as barnyard runoff controls, manure storage, or streambank fencing that is expected to have an early effect on the adjacent stream.

Monitoring will take place over a two-year period; the year before and the year after a practice is installed. Expected positive improvements will be on those sites where degraded

habitat has occurred. Habitat sampling and photographs will be used to indicate the benefit of the practice. Limited chemical monitoring and fish sampling will be done at some sites.

The cost of the Signs of Success program is $1,000 per year. The results of the Signs of Success monitoring will be featured in educational materials such as local newsletters and newspapers and the statewide newsletter "Fields and Streets."

SOS sites for the project area are still being identified and will be established shortly after the implementation stage begins.

Long-Term Ecological Research

Lake Mendota has been regularly sampled for various limnological parameters since 1976. This monitoring was conducted by the DNR Bureau of Research between 1976 and 1994. From 1987 through the early 1990s, the monitoring was part of a collaborative food web research project conducted jointly between the DNR and the UW Center for Limnology (UW). Beginning in 1995 the field work has been conducted by the UW as part of their North Temperate Lakes Long-term Ecological Research (NTL-LTER) project funded by the National Science Foundation. The UW will continue monitoring the lake for the foreseeable future as long-term funding is anticipated. The DNR will continue to collaborate with the UW in this project.

Limnological sampling generally has been conducted at the deep center region of the lake on a bi-weekly basis during each year's open water season. One or more winter samplings also have been conducted each year. This sampling schedule will continue in future years, although fall sampling will be reduced to every four weeks. Field measurements that are routinely taken include temperature and dissolved oxygen vertical profiles and Secchi disk readings for water transparency. Water samples are collected at discrete depths for phosphorus (total and dissolved reactive), nitrogen (ammonium, nitrate/nitrite and organic), and silica (dissolved reactive). On all sampling dates, these nutrients are analyzed from samples collected at 0 and 4 meter depths. Phosphorus, and to a lesser extent nitrogen and silica, also are analyzed from samples collected throughout the water column every four weeks during the spring and summer and at least once during the winter. Water chemistry analyses for nutrients have been conducted at the State Laboratory of Hygiene since 1980; samples will continue to be analyzed at the lab. Additional water chemistry analyses are conducted on various anions and cations as part of the LTER sampling protocol. These analyses are performed at the UW Geology laboratory.

In addition to the nutrients, phytoplankton and zooplankton are also analyzed on the same sampling schedule. Chlorophyll-*a* as a measure of phytoplankton density is routinely measured from samples collected throughout the photic zone (upper waters) at discrete depths as well as from 0-2m (the long-term database) and 0-8m composite samples. Phytoplankton species identification and biovolumes are analyzed from the 0-8m composite samples. On each sampling trip, a zooplankton vertical tow sample is collected from 0-20m; crustaceans are identified to species, enumerated, and measured for biomass determinations. The phytoplankton and zooplankton samples all represent a continuation of the long-term database on the lake.

Other than the routine limnological sampling, surveys of the aquatic macrophytes and fish communities are routinely conducted on Lake Mendota. The macrophyte surveys were initiated by the DNR in 1989. The fish surveys were begun in 1995 as part of the LTER sampling protocol. Additional fishery information was collected during the food web research study that began in 1987; the UW also conducted other fish surveys on the lake since the early 1980s.

Aside from the in-lake sampling program, monitoring is also conducted on some of the lake's major influent tributaries. The USGS maintains continuous flow monitoring stations on Pheasant Branch Creek, the Yahara River and Spring Harbor storm sewer. Total phosphorus is collected on numerous runoff events on the Pheasant Branch Creek and Yahara River stations. These data allow phosphorus loadings to the lake to be computed for those two stations. Based on these data and other monitoring work, phosphorus loadings have been developed for the lake dating back to 1975. Funding for this monitoring comes from other sources than the in-lake work. The USGS provides 50% matching money for the monitoring. Local match is provided by the cities of Middleton and Madison for the Pheasant Branch Creek and Spring Harbor stations (flow and suspended sediment analyses). Grants from the DNR have provided the match for the Yahara River station as well as the phosphorus analyses at the Pheasant Branch Creek station.

Appendix One
Wetland Site Appraisals

Named Wetlands in the Lake Mendota Watershed

The following is a list of the 49 named wetlands in the Lake Mendota Watershed that were identified in the 1996 survey. Wetland size or quality may be greatly reduced at some sites. Bolded numbers are wet acres (wetland and open water) only. Others are total acres, wetland, open water and upland together. Half or quarter section locations are given when appropriate, e.g., SES14 stands for SE1/4 of Section 14.

Barbian Pond - Springfield, T8N R8E NWS2. Privately owned, **6.6** acres. Apparently the historic headwaters of Six Mile Creek, at least during wet years when the basin overflowed south towards Waunakee Marsh. Otherwise internally drained, a condition now reinforced by excavation. See appendix --, Site 6, for restoration potential.

Beaver Pond (Indian Pond) - Madison, T7N R9E NWS15. University of Wisconsin. A small pond on Picnic Point; according to Cassidy, once frequented by Indians to trap muskrats.

Bernards' Spring (Vasen Spring) - Springfield, T8N R8E SES36. Dane County Parks. Large springs at the base of Bernards' (Vasen) Hill, which flow through Pheasant Branch Marsh into Pheasant Branch Creek.

Brandenberg Lake (Lake Katrine, Goltz's Lake) - Springfield, T8N R8E SWS6. Black Hawk Council of Girl Scouts, **38** acres. Land-locked.

C. Buechner Pond (Schoop's Lake) - Springfield, T8N R8E NES19. Privately owned, **11.7** acres. Land-locked.

L. Buechner Pond (Daentl Lake) - Springfield, T8N R8E NES8. Privately owned, **9.3** acres. Land-locked.

Cherokee Lake - Westport, T8N R9E NWS24. Public domain, **57** acres. Dredged at the expense of Cherokee Marsh in the early 1960's, this lake functions as a deep-water sedimentation basin for the Yahara River and is a popular recreation area.

Cherokee Marsh - Westport, T8N R9E S12 13 23 24 27; Burke, T8N R10E S5 6 7 8 17 18. DNR State Fishery Area, acquisition goal: 1027 acres, ownership to date: 908.85; Dane County Parks and Airport, Madison City Parks, ownership to date: 867 acres, and private owners. The major estuarine wetland of the Mendota watershed, including at least 4 major springs and high quality fens designated as a State Natural Area. Other areas considerably disturbed by ditching, filling, golf course development and farming.

Class of 1918 Marsh - Madison T7N R9E SES16. University of Wisconsin. All that remains of the once considerable emergent marsh bordering University Bay, mostly filled in the 1960's for University playing fields, parking lots, and the Nielson Tennis Stadium.

Dahmen Pond - Springfield, T8N R8E SWS16 SES17. Privately owned, **13.9** acres. Land-locked according to Day et al., but may overflow SW to Pheasant Branch Creek during high water.

Dauck Pond - Middleton, T7N R8E NES14. Ownership?, **0.6** acres. Land-locked.

Diedrich Pond - Middleton, T8N R8E NWS4. Privately owned, **19.8** acres. Drains to Six Mile Creek.

Dorn Creek State Fishery Area - Westport, T8N R9E S29 30. DNR, acquisition goal: 144.30 acres, ownership to date: 114.30 acres.

Dorn Pond - Springfield, T8N R8E SES25. Privately owned, **8.1** acres. Land-locked.

Dorn's Spring - Westport, T8N R9E NWS30. Privately owned (still extant?).

Esser Pond (Techam Pond) - Middleton, T7N R8E SES10. City of Middleton(?), **13.0** acres. Apparently engineered for stormwater management, its adjacent uplands are now under commercial development to the detriment of wildlife. Appears to drain to a tributary of Pheasant Branch Creek.

Graber Pond (Dreher Pond) - Springfield, T8N R8E SES35, and Middleton, T7N R8E NES2. City of Middleton Parks and privately owned, **12.7** acres. Land-locked.

Goose Pond - Arlington, T10N R9E S25. Madison Audubon Society, 11.1 acres. Audubon is currently working on a retention pond/wetland restoration with Del Monte Corporation and Wisconsin Waterfowl Association to protect Goose Pond from cannery washwater. This is a Mendota Watershed Demonstration Project.

Governor Nelson State Park - Westport, T8N R9E S28 33. DNR, acquisition goal: 441.00 acres, ownership to date: 421.73 acres. Parks staff are restoring sedge meadow in cooperation with U.S. Fish and Wildlife Service. A water control structure has been installed to prevent direct discharge of agricultural runoff to Lake Mendota. Plans are being made to disable a drainfield to restore the original hydrology as much as possible.

Hammersley Pond (Westside Pond) - City of Madison (14.9 acres): T7N R9E NES31 SES30. Within Odana public golf course. Part of this pond was excavated.

Kettle Pond - Madison, T7N R9E SWS18. City of Madison, 1.2 acres. A favorite haunt of neighborhood kids for many decades.

Kruchten Pond - Springfield, T8N R8E NWS9. Privately owned, 1.8 acres. Land-locked.

Lake Mendota - Madison T79 R9E, Middleton T7N R8E, Westport T8N R8E. Public domain, **9842** acres.

Lake Windsor - Windsor, T9N R10E NES31. Privately owned, 9 acres.

Livesey's Spring (Belle Fountaine) - Westport (S part), T7N R9E SWS6. According to Cassidy "... a spring early important in the history of the Pheasant Branch region...Now filled in, tho there are other springs nearby." Must have been somewhere near the outlet of Pheasant Branch Creek. There is development on fill land on each side of the creek north of CTH M.

Lost Lake (Kennedy Pond, O'Connell Pond) - Westport, T8N R9E SWS32. Sisters of St. Benedict, **5.3** acres. Suffers from extreme siltation that has greatly reduced its open water area from this figure. Dredging and restoration by St. Benedict Center is a Mendota Watershed demonstation project. Day et al. (1968) considers this land-locked, although it is thought to overflow to Lake Mendota during high water.

Marshall Park - Middleton, T7N R8E SES12. City of Madison, 1.5 acres. The shallow lagoon in this park and the pond in Middleton's Lakeview Community Park, though dredged, are a reminder of some 200 acres of marsh or swamp that once bordered the far west shore of Lake Mendota from Marshall Park north to the outlet

of Pheasant Branch Creek (see 1904 USGS topo). Most of this area has been filled or drained, although lowland hardwoods remain in Lakeview Park and between Allen Boulevard and Middleton Beach Road.

Marsh Corner - Madison, T79 R9E SWS15. Public domain, with shoreline owned by University of Wisconsin. According to Cassidy, "...a marshy indentation in the shore of Lake Mendota at the E side of University Bay. So called about 1900." Lies at the mouth of University Creek (University Bay Creek), which drains the playing fields, formerly marsh, west of the UW Natatorium.

Meier Pond - Springfield, T8N R8E NES18. Privately owned, **8.4** acres. According to Cassidy, before Joseph Meier's tenure it was successively known as Schurtz's, Watzke's, Schroeder's, and Kalscheur's Lake as ownership changed. Cassidy states that at low water it separates into 2 lakes. Land-locked.

Merrill Springs - Madison, T7N R9E SES18, within Spring Park plat. According to Russ Hefty, its flow may be affected by the amount of pumping from the municipal well near the entrance to Indian Hills along University Avenue. A wishing well there is now supplied by a pipe.

Minniwakan Spring - Madison, T7N R9E SES18, also within Spring Park plat according to Cassidy. Location uncertain, possibly in Spring Harbor Park?

North Shore Bay - Westport, T8N R9E S27 28. Public domain and private owners. While not formally named, this is the logical name (by location and by association with its use as an alternative name for the Second Ward Beach plat) for the bay of present day Lake Mendota that was north of the original meander line for the lake shown on the 1835(?) U.S. Government Survey map. It was flowed by construction of the Farwell Dam in 1849. It was formerly dominated by emergent wetland, and scattered emergents persisted past the turn of the century.

Pheasant Branch Marsh (Whittlesey's Marsh) - Middleton, T7N R8E ES1, Westport (S. part), T7N R9E NWS6, and Springfield, T8N R8E SES36. City of Middleton, 340 acres, Dane County Parks, 160.8 acres, and private owners.

Pheasant Branch Spring - Middleton, T7N R8E ES1. Do not believe this is the same as Bernard's Spring.

Schoenberg's Marsh Waterfowl Production Area - T10N R10E S3 4 9 10. U.S. Fish and Wildlife Service, acquisition goal: 750 acres, ownership to date: 509 acres.

Six Mile Creek Fishery Area - Westport, T8N R9E SWS21. Department of Natural Resources, 160.25 acres.

Slaughter's Marsh (The Big Marsh) - Middleton, T7N R8E S2 3 10 11. "a large peat bog...Now drained." Cassidy, 1968. The namesake for the former village of Peatville (subsequently Middleton Station and now Middleton), peat was once mined from this marsh. Though widely ditched, this area remains an important contributing area to Pheasant Branch Creek, which runs through it. Now under considerable development pressure dispite the soil limitations.

Springfield Pond (Pietchen's Pond) - Springfield, T8N R8E SES5. Privately owned, **2.9** acres. Land-locked.

Spring Harbor - Madison, T7N R9E SES18. The dredged harbor at the outlet of Warner Creek into Lake Mendota, shown as marsh on the 1904 USGS topo. Water cress in the creek in Spring Harbor park suggests springs or seeps still exist.

Stricker's Pond (Voss Pond) - Middleton, T7N R8E NES14. City of Madison, City of Middleton, **25.0** acres. This land-locked pond is suffering from high water levels and sedimentation as its watershed develops, causing loss of emergent vegetation and wildlife value.

Tiedeman's Pond - Middleton, T7N R8E SES11. City of Middleton?, **8.8** acres. Also land-locked, this pond has similar problems to Stricker's. There have been discussions about developing outlets for these ponds to relieve runoff effects.

Thornton's Marsh - Madison, T79 R9E SES12. According to Cassidy, "...a marsh W. of the outlet of Lake Mendota ... Now a part of Tenney Park". See also Cassidy's description of the former High Bank, which was leveled to fill this marsh. Although much of this marsh actually drained to Lake Monona, parts were shoreline beds of Lake Mendota.

Token Creek County Park - Burke, T8N R10E S4 9. Dane County, 387 acres. The U.S. Fish and Wildlife Service recently assisted Dane County Parks to restore 46 acres of wetlands in the park, and there is opportunities for additional restoration.

Token Creek Millpond - Windsor, T9N R10E ES34 WS35. Privately owned, **44** acres. In existence since 1860, this pond is subject of ongoing discussions about the future of the dam. It suffers from sedimentation and turbidity from runoff and carp.

Token Creek Rearing Station - Burke, T8N R10E NES4. Department of Natural Resources, 11.2 acres. Now little used.

Token Springs - Windsor T9N R10E, NWS35. According to Cassidy, three springs that are the major source of Token Creek.

University Bay (Picnic Point Bay) - Madison, T7N R9E S15 16. Public domain portion of Lake Mendota known for submerged aquatics, and at least historically, waterfowl use.

Warner Park (Castle's Marsh) - Westport, T8N R9E NS36. City of Madison, 30 acres; Department of Natural Resources, 15 acres. Wetland area has been reduced by filling and dredging, but there are still emergents of value for fish spawning. Keeping the outlet free of sand from wave action is a challenge.

Waunakee Marsh Wildlife Area - Springfield, T8N R8E S10 11 12. Department of Natural Resources, acquisition goal: 759.92 acres, ownership to date: 447.92 acres.

Upland Wetland Sites Identified as Priority Restoration Areas

The following list identifies the wetlands ranked high as priority restoration areas. THEY ARE **NOT** PRESENTED IN RANKED ORDER. Please refer to the wetland section in Chapter 2 for more information about these potential restoration sites and a map of the sites.

1) County: Dane; **Township**: Westport; **Section(s)**: 17, 20
Distance to named water body: Sixmile Creek, 0.5 mile **Distance to Lake Mendota**: 2 miles
Distance to urban area: Waunakee, 0.5-0.75 mile
Soil sheet number(s): 53; **Hydrologic soil types present**: Wa, RaA, Pa, TrB, EfB, SaA
NRCS Wetland Inventory designation: PC, FW, W
Restoration required: Dam or other engineered structure near the entrance to Sixmile Creek.
Drainage basin size (estimated acres): 938; **Wetland size (~acres)**: FW = 86.8, PC = 175.4, W = 14.4
Notes (history, current conditions, drainage facilities, other relevant comments):

- Currently cropped. Cropped every year since 1979 except for a small area at the head of the property ditch.
- Large drainage ditch present. It enters Sixmile Creek west of Carriage Ridge Liability Corp. property.
- Property may be tiled.
- Crops present on the uplands except for to the east where Southbridge subdivision is located.
- Wisconsin Waterfowl Association has completed a plan for the wetland restoration. Landowners want to use this restoration to meet their greenspace requirement for the subdivision.

2) **County**: Dane; **Township**: Westport; **Section(s)**: 9, 16
Distance to named waterbody: Sixmile Creek, 0.5 miles; **Distance to Lake Mendota**: 2.5 miles
Distance to urban area: Waunakee, 0.5 miles
Soil sheet number(s): 42, 54; **Hydrologic soil types present**: SaA, EfB, TrB
NRCS Wetland Inventory designation: W
Restoration required: Remove cattle from wet meadow south of Bong Rd. Not drainable.
Drainage basin size (estimated acres): 1888; **Wetland size (estimated acres)**: W = 25.38
Notes (history, current conditions, drainage facilities, other relevant comments):

- Immediate drainage area was not cropped 1979-present. Currently used as an active pasture.
- Drainage is coming from area of Hwy 113. It runs northeast to southwest under Bong Rd. Through a 6 foot cement culvert on unknown age.
- There is currently stream flow entering Sixmile Creek. Mike Sorge identified this as a good quality tributary to Sixmile Creek. He based his opinion on the fact that watercress was present, coldwater species of fish were present, and macroinvertebrate data suggest good water quality.
- Wetland species are present (dogwood, cattail, Joepye weed).
- Corn planted on the uplands surrounding the wetland on both sides of Bong Rd.
- Concern: May be part of Southbridge Farms subdivision development, so there may be increased storm water flow from the surrounding area.

3) **County**: Dane; **Township**: Westport; **Section(s)**: 30, 31
Distance to named waterbody: Spring Creek, 0.5 mile; **Distance to Lake Mendota**: 1.5 miles
Distance to urban area: Middleton, 1.0 miles
Soil sheet number(s): 65; **Hydrologic soil types present**: Mc, Wa, Mb, HaA, RaA, TrB
NRCS Wetland Inventory designation: FW
Restoration required: Ditch plug
Drainage basin size (estimated acres): 552; **Wetland size (estimated acres)**: FW = 9.34
Notes (history, current conditions, drainage facilities, other relevant comments):

- Currently cropped (corn and soybeans on the higher ground, although corn is not growing in the wetter areas).
- Drainage appears to go through here naturally as is apparent on air photos and topographic map, but the photos also show a possible ditch through the middle of the property.

- Drainage through 3-36 inch corrugated metal pipes (cmp's) under neath Oncken Road that drains to Spring Creek. The cmp's appear to have been in place quite a while.
- Westport Sand and Gravel Co. is located south of this area and some drainage from the gravel pit through this wetland is probable. Raising the water table in the pit would likely be a concern if drainage is blocked.
- Shown as a wetland on the 1904 topographic map.

4) **County**: Dane; **Township**: Westport; **Section(s)**: 22
Distance to named waterbody: Yahara, 0.5 miles; **Distance to Lake Mendota**: 0.5 miles
Distance to urban area: Madison, 0.5 miles
Soil sheet number(s): 54; **Hydrologic soil types present**: Ho, Pa, Mc, SaA
NRCS Wetland Inventory designation: FW, PC, W
Restoration required: Ditch plug
Drainage basin size (estimated acres): 3084 **Wetland size (estimated acres)**: FW = 17.3, PC = 25.5
Notes (history, current conditions, drainage facilities, other relevant comments):
- Partially farmed; partially a wooded marsh with dogwood and cottonwood present.
- Large ditches run through the property (see air photo/topo map) and drain under Hwy M into a ditch that flows to Lake Mendota.

5) **County**: Dane; **Township**: Westport; **Section(s)**: 21
Distance to named waterbody: Sixmile Creek, 0.5 miles; **Distance to Lake Mendota**: 0.5 miles
Distance to urban area: Madison, 0.5 miles
Soil sheet number(s): 53, 54; **Hydrologic soil types present**: Ho, Wa, HaA, VwA
NRCS Wetland Inventory designation: N/A
Restoration required: Ditch plug(s)(?). Air photos show a ditch with culvert structure.
Drainage basin size (estimated acres):N/A; **Wetland size (estimated acres)**: N/A

6) **County**: Dane; **Township**: Westport, Vienna; **Section(s)**: 6 (Westport), 31 (Vienna)
Distance to named waterbody: Sixmile Creek, 0.5 mile; **Distance to Lake Mendota**: 4 miles
Distance to urban area: Waunakee, < 0.25 miles
Soil sheet number(s): 29, 41; **Hydrologic soil types present**: Wa, SaA, VwA, TrB, RaA
NRCS Wetland Inventory designation: PC, FW, W
Restoration required: plug ditch draining from the west before it meets the other ditch draining from the north.
Drainage basin size (estimated acres): 3450; **Wetland size (~ acres)**: PC = 53.4, FW = 5.93, W = 7.3
Notes (history, current conditions, drainage facilities, other relevant comments):
- 2 ditches run through this area: 1 through the western cropland, the other next to a farm (see soil map). Both meet and flow through a large culvert under Kopp Rd.
- The ditches are deep.
- One low area with wetland vegetation present can be seen from Kopp Rd.
- The City of Waunakee is building a golf course immediately south of this area.

7) **County**: Dane; **Township**: Springfield; **Section(s)**: 2
Distance to named waterbody: Sixmile Creek, <0.5 mile; **Distance to Lake Mendota**: 8 miles
Distance to urban area: Waunakee, 2 miles
Soil sheet number(s): 40; **Hydrologic soil types present**: Mb, Os, TrB
NRCS Wetland Inventory designation: W, PC
Restoration required: Buffer around the wetland
Drainage basin size (estimated acres): 287; **Wetland size (estimated acres)**: W = 1.47 A, PC = 8.98 A
Notes (history, current conditions, drainage facilities, other relevant comments):
- Culvert under Kopp Road leading onto this property.
- Drainage also from Hyer Road (from the west) under Kuehn Road onto the property.
- Almost dry as of this survey, but according to air photos has held water every year since 1979 (date of last photo checked).
- An internally drained wetland.

8) **County**: Dane; **Township**: Springfield; **Section(s)**: 1 (also sec. 36 of Dane)
Distance to named waterbody: Sixmile Creek, 1 mile; **Distance to Lake Mendota**: 8 miles
Distance to urban area: Waunakee, 0.5 mile
Soil sheet number(s): 29, 41; **Hydrologic soil types present**: Wa, Ho, Os, RaA, SaA, VwA, EgA
NRCS Wetland Inventory designation: FW, PC, W
Restoration required: Ditch plug(s)
Drainage basin size (estimated acres): 668
Wetland size (estimated acres): FW = 9.5 A, PC = 7.1 A, W = 125.64 A
Notes (history, current conditions, drainage facilities, other relevant comments):

- Ditches present (see map). Some of the ditch work has been done recently.
- Drainage is to the southeast.
- Canary grass and dogwood present in center of the drainage way.
- Large wetland present west of the farmstead.
- Concern: newly paved road running in front of the property (Kopp Road) and a large amount of residential construction going on to the west and south of the property.

9) **County**: Dane; **Township**: Vienna; **Section(s)**: 3, 10
Distance to named waterbody: Yahara River, 3 miles; **Distance to Lake Mendota**: 9 miles
Distance to urban area: DeForest, 2 miles
Soil sheet number(s):6; **Hydrologic soil types present**: Wa, SaA, EgA, TrB
NRCS Wetland Inventory designation: W
Restoration required: restored itself
Drainage basin size (estimated acres): 1196; **Wetland size (estimated acres)**: W = 38.3
Notes (history, current conditions, drainage facilities, other relevant comments):

- Cropped around the border of the ponded area. Also looks like it gets planted in drier years.
- Internally drained.
- Swans, ducks and shorebirds make use of this property.
- Muskrat houses located here.

10) **County**: Dane; **Township**:Vienna; **Section(s)**: 4
Distance to named waterbody: Yahara River, 4.5 miles; **Distance to Lake Mendota**: 8.5 miles
Distance to urban area: De Forest, 2.5-3.5 miles
Soil sheet number(s): 6; **Hydrologic soil types present**: SaA
NRCS Wetland Inventory designation: W, FW
Restoration required: Ditch plug on Kutz property
Drainage basin size (estimated acres):N/A; **Wetland size (acres)**: W = 8.5, FW = 4.7
Notes (history, current conditions, drainage facilities, other relevant comments):

- A 3 foot cmp is present under Patten Road, and drainage is from east to west leading to the Jackson property.
- WWA has worked with landowner (1997). Wetland restoration plans and survey completed by WWA. At the time, cost of the project was prohibitive - landowner wanted to have 6 of his ditches cleaned out in return for allowing the wetland restoration.

11) **County**: Dane; **Township**: Vienna; **Section(s)**: 10
Distance to named waterbody: Yahara River, 3 miles; **Distance to Lake Mendota**: 9 miles
Distance to urban area: De Forest, 2 miles
Soil sheet number(s): 6; **Hydrologic soil types present**: Wa, SaA, EgA, TrB
NRCS Wetland Inventory designation: FW
Restoration required: Removal of bank/dike present in the middle of the wetland now. Possible ditch/culvert plug at outlet at Hwy DM
Drainage basin size (estimated acres): 1196; **Wetland size (estimated acres)**: FW = 11.5
Notes (history, current conditions, drainage facilities, other relevant comments):

- This property is just south of site 9 and has the same drainage basin.

- Currently ponded water present, although landowners were able to crop in drier years (1983, 1988).
- Drainage coming into this area under WIBU Road from east to west, and this area drains under Hwy DM into a wetland area north of Hwy DM.
- A ridge of land with trees runs through the ponded area paralleling WIBU Road. This bank was supposed to keep water off part of the field, but this water was present on both sides of the bank.
- Various waterfowl and shorebirds were present.

12) County: Dane; **Township**: Vienna; **Section(s)**: 4, 9
Distance to named waterbody: Yahara River, 6 miles; **Distance to Lake Mendota**: 10 miles
Distance to urban area: De Forest, 4 miles
Soil sheet number(s): 6; **Hydrologic soil types present**: Wa, VwA, ShA, HaA, EgA
NRCS Wetland Inventory designation: W
Restoration required: Work with current owner to finish sedge meadow restoration; work to remove channelized area
Drainage basin size (estimated acres): N/A; **Wetland size (estimated acres)**: W = 397
Notes (history, current conditions, drainage facilities, other relevant comments):
- Current owner (A. Jackson) involved in his own sedge meadow restoration.
- Some sort of channelized area is present on property that drains to the south.
- Ranked as a Priority Group II wetland in Bedford, Zimmerman, and Zimmerman's *Wetlands of Dane County Wisconsin*.

13) County: Dane; **Township**:Vienna; **Section(s)**: 21, 22
Distance to named waterbody: Sixmile Creek, 6.5 miles; **Distance to Lake Mendota**: 2 miles
Distance to urban area: DeForest, 2 miles
Soil sheet number(s):17, 18; **Hydrologic soil types present**: Mc, SaA, HaA, EgA, Co, VwA, EfB
NRCS Wetland Inventory designation: W
Restoration required: Currently restored itself by 2 ditches plugged. Permanent restoration would require ditch plugs at these areas.
Drainage basin size (estimated acres): 1760; **Wetland size (estimated acres)**: W = 173.4
Notes (history, current conditions, drainage facilities, other relevant comments):
- Surrounding uplands consist of cropped land, primarily corn to the east and west and running up to the edge of the water line; an active farmstead to the immediate north; a wooded ridge to the south.
- 2 foot cmp's run under Schumacher Road and under Hwy V
- Currently a high quality type 3 wetland. Lots of ponded water is present and wetland vegetation is present (cattail, bulrush and other emergent vegetation).
- Deliniated as a Waterfowl Production Area (WPA) by the U.S. Fish and Wildlife Service. Both WWA and FWS have discussed acquisition with the various landowners but at the time they had no interest in selling.
- Crops present on the uplands except for to the east where Southbridge subdivision is located.
- The cropland is currently (1997) leased to an individual who has expressed an interest in draining the property and increasing the cropland available.
- Concerns: multiple landowners, chance that landowner controlling the 2 plugged ditches will decide to clean them out.

14) County: Dane; **Township**:Vienna; **Section(s)**: 32
Distance to named waterbody: Sixmile Creek, 0.75 miles; **Distance to Lake Mendota**: 5.5 miles
Distance to urban area: Waunakee, 0.5 miles
Soil sheet number(s):32; **Hydrologic soil types present**: Wa, EfB, TrB
NRCS Wetland Inventory designation: FW
Restoration required: Ditch plug
Drainage basin size (estimated acres): 2006; **Wetland size (estimated acres)**: FW = 36.15, also an additional 18.1 on E. Side of Madison Rd.
Notes (history, current conditions, drainage facilities, other relevant comments):
- Current conditions: wet prairie species and some wetland vegetation (cattail, reed canary grass)

- 4 foot cmp under Easy St. Flow was present at the time of the field visit.
- A fairly deep drainage ditch is present that crosses the property from the northeast to the southwest
- WWA has been working with DCNHF (owner - 1997)to restore this wetland. Survey and plans are completed.
- There is some concern be adjoining neighbors over whether the proposed restoration will back up onto their property (although it is designed not to). Currently, DCNHF is waiting for county permits to move forward.

15) County: Dane; **Township**:Vienna; **Section(s)**: 3
Distance to named waterbody: Yahara River, 3.25 miles; **Distance to Lake Mendota**: 9.25 miles
Distance to urban area: DeForest, 2.25 miles
Soil sheet number(s):6, 18; **Hydrologic soil types present**: SaA, Wa, EgA
NRCS Wetland Inventory designation: W
Restoration required: Ditch plug; possible tile present, which would entail breaking tile.
Drainage basin size (estimated acres): 286, also some from Columbia Co.; **Wetland size (~ acres)**: W = 42.2
Notes (history, current conditions, drainage facilities, other relevant comments):
- Surface water ponding occurred in 1985, 1986, 1994.
- Property is cropped when ponding does not occur, or when the surface water disappears.
- Some work on the ditch draining this area was completed in 1995.

16) County: Dane; **Township**:Vienna; **Section(s)**: 11, 12
Distance to named waterbody:Yahara River, 2.5 miles; **Distance to Lake Mendota**: 9 miles
Distance to urban area: DeForest, 1.5 miles
Soil sheet number(s):6; **Hydrologic soil types present**: Os, SaA, EgA
NRCS Wetland Inventory designation: W
Restoration required: Wetland has restored itself. Protection through some type of easement may be necessary.
Drainage basin size (estimated acres): 170; **Wetland size (estimated acres)**: 21.3
Notes (history, current conditions, drainage facilities, other relevant comments):
- Ponded water present on both sides of Hwy DM.
- Drainage is from the southwest to the northeast.
- Gravel pit present on the northeast side.

17) County: Dane; **Township**:Vienna; **Section(s)**: 23, 26
Distance to named waterbody: Yahara River, 1.5 miles; **Distance to Lake Mendota**: 6 miles
Distance to urban area: DeForest, 1 mile
Soil sheet number(s):18, 30; **Hydrologic soil types present**:Os, RaA, EfB, SaA
NRCS Wetland Inventory designation: W, FW
Within an active Drainage District: possible
Restoration required: Ditch plug. Tile may be present, so ripping out tile may be necessary.
Drainage basin size (estimated acres): 5607; **Wetland size (estimated acres)**: W = 2.53, FW = .91
Notes (history, current conditions, drainage facilities, other relevant comments):
- Drainage to southeast from under Hwy I.
- Soybeans are present in the drainage way on the north side of Dale Road. Some wetland vegetation is present in the drainage way south of Dale Road
- Cropland surrounds the property and is either corn or soybeans.
- Because of disparity in size between the wetland and the drainage area, the wetland may be overwhelmed and may not have much of an affect on the overall loading.

18) County: Dane; **Township**:Vienna; **Section(s)**: 36
Distance to named waterbody: Yahara River, 0.75 miles; **Distance to Lake Mendota**: 6 miles
Distance to urban area: DeForest, 1 mile
Soil sheet number(s):30; **Hydrologic soil types present**: SaA, EfB

NRCS Wetland Inventory designation: W, FW
Restoration required: Ditch plug/dike
Drainage basin size (estimated acres): 3199; **Wetland size (estimated acres)**: W = 20.2, FW = 11.7
Notes (history, current conditions, drainage facilities, other relevant comments):

- Cropped land is present up to the edge of the wet area.
- Drains to the south through a subdivision but no ponded water present.
- Dredge banks present on the property.

19) County: Dane; **Township**:Vienna; **Section(s)**:20, 29
Distance to named waterbody: Sixmile Creek, 2.5 miles; **Distance to Lake Mendota**: 6 miles
Distance to urban area: Waunakee, 1.5 miles
Soil sheet number(s):17, 29; **Hydrologic soil types present**: Os, SaA, EgA
NRCS Wetland Inventory designation: W
Restoration required: Currently restored itself. Possibility of easement to protect.
Drainage basin size (estimated acres): 350; **Wetland size (estimated acres)**: 7.7
Notes (history, current conditions, drainage facilities, other relevant comments):

- Internally drained wetland.
- Corn and alfalfa present all around up to the edges.
- Ponded water present with a ring of trees on the outer edge of the wetland area.

20) County: Dane; **Township**: Windsor; **Section(s)**: 7
Distance to named waterbody: Yahara River, .5 miles; **Distance to Lake Mendota**: 11 miles
Distance to urban area: DeForest, <.25 miles
Soil sheet number(s): 7; **Hydrologic soil types present**: Wa, Pa, Ho, Ot, SaA, RaA, EfB, VwA
NRCS Wetland Inventory designation: PC, FW, W
Within an active Drainage District: possible
Restoration required: Ditch plug (?)
Drainage basin size (estimated acres): 348.8; **Wetland size (~ acres)**: PC = 94.7, W = = 69.2, FW = 3.1
Notes (history, current conditions, drainage facilities, other relevant comments):

- Air photos show ditches present.

21) County: Dane; **Township**: Windsor; **Section(s)**: 20
Distance to named waterbody: Yahara River, .5 miles; **Distance to Lake Mendota**: 10 miles
Distance to urban area: DeForest, <.5 miles
Soil sheet number(s): 19; **Hydrologic soil types present**: Pa, SaA
NRCS Wetland Inventory designation: PC, W
Restoration required: Ditch plug(?)
Drainage basin size (estimated acres): 2476.3; **Wetland size (estimated acres)**: PC = 5.6, W = 34.9
Notes (history, current conditions, drainage facilities, other relevant comments):

- Ditch running from N (on Erickson property).

22) County: Dane; **Township**: Windsor; **Section(s)**: 29, 32
Distance to named waterbody: Yahara River and Windsor Lake, 0.5 miles; **Distance to Lake Mendota**: 8 m.
Distance to urban area: Windsor, 0.5 miles
Soil sheet number(s): 31; **Hydrologic soil types present**: Ho, Ev, Os, Wa, HaA, VwA, RaA
NRCS Wetland Inventory designation: FW, PC
Restoration required: Ditch plug and breaking tiles
Drainage basin size (estimated acres): 777; **Wetland size (estimated acres)**: N/A
Notes (history, current conditions, drainage facilities, other relevant comments):

- Tile system is present south of ditches.
- A large ditch runs into a culvert under the railroad adjacent to the property and flows into Lake Windsor.
- Property accepted as a contract for the Wetland Reserve Program (file at NRCS office).

23) County: Dane; **Township**: Windsor; **Section(s)**: 22

Distance to named waterbody: Token Creek, 1 mile; **Distance to Lake Mendota**: 8 miles
Distance to urban area: Windsor, 1.5 miles
Soil sheet number(s): 19; **Hydrologic soil types present**: Os, EfB
NRCS Wetland Inventory designation: W
Restoration required: Some management opf storm water from the surrounding subdivision may be necessary. A buffer should be retained around the wetland.
Drainage basin size (estimated acres): 858
Wetland size (estimated acres): 14.7
Notes (history, current conditions, drainage facilities, other relevant comments):

- Internally drained.
- Subdivision on the north side of the basin (Windsor Hills).
- Some ponded water in the center in August.
- Looks as though used as pasture.

24) County: Dane; **Township**: Windsor; **Section(s)**: 13, 24
Distance to named waterbody: Token Creek, 0.5 miles; **Distance to Lake Mendota**: 12 miles
Distance to urban area: DeForest, 4 miles
Soil sheet number(s): 20; **Hydrologic soil types present**: Wa, Os, SaA, EfB
NRCS Wetland Inventory designation: FW, PC, W
Within an active Drainage District: possible
Restoration required: overflow pipe, dike and spillway, etc. something to control how much water backed up.
Drainage basin size (estimated acres): 1922; **Wetland size (~ acres)**: FW = 6.07, PC = 220.4, W = 5.16
Notes (history, current conditions, drainage facilities, other relevant comments):

- Drainage to southwest.
- Ditches are present and they are tree lined and deep. An approximately 3' diameter cmp is located under Vinburn Road.
- Concern: multiple owners. May be a possibility to flow only part of the basin.

25) County: Dane; **Township**: Windsor; **Section(s)**: 12
Distance to named waterbody: Token Creek, 3 miles; **Distance to Lake Mendota**: 13 miles
Distance to urban area: DeForest, 4 miles
Soil sheet number(s): 8; **Hydrologic soil types present**: Wa, SaA, EfB
NRCS Wetland Inventory designation: PC, FW, W
Restoration required: possible ditch plug
Drainage basin size (estimated acres): 480; **Wetland size (~ acres)**: PC = 57.8, FW = 6.88, W = 1.81
Notes (history, current conditions, drainage facilities, other relevant comments):

- Drainage is to the southeast. The property is ditched.
- An old stone/cement culvert is located under Hwy C, which cuts the basin in half.

26) County: Dane; **Township**: Burke; **Section(s)**: 1, 2, 11
Distance to named waterbody: Token Creek, 3 miles; **Distance to Lake Mendota**: 8 miles
Distance to urban area: Sun Prairie, <0.25 miles
Soil sheet number(s): 44; **Hydrologic soil types present**: Wa, SaA, EfB
NRCS Wetland Inventory designation: PC, FW, W
Restoration required: Remove/shut off pump; may also have to plug ditch system. There may be tile present that may need to be broken.
Drainage basin size (estimated acres): 1202
Wetland size (estimated acres): FW = 3.28 A, PC = 78.55 A, W = 23.2 A
Notes (history, current conditions, drainage facilities, other relevant comments):

- Pump present east of Hwy C (on the Dunlap property).
- Large, deep ditches are present. Some cattails line the ditches.
- Soybeans present at the time of the field check.
- Drainage is southwest across the Dunlap property.

- Site is immediately adjacent to the west side of Sun Prairie.

27) County: Dane; **Township**:Dane; **Section(s)**: 34, 35, 36
Distance to named waterbody: Sixmile Creek, .5 miles; **Distance to Lake Mendota**: 9 miles
Distance to urban area: Waunakee, 3 miles;
Soil sheet number(s): 28, 29, 40; **Hydrologic soil types present**: Os, Co, Ho, Ev, Ot, RaA, TrB, VwA
NRCS Wetland Inventory designation: FW, PC, W
Restoration required: Ditch plug(s)(?)
Drainage basin size (estimated acres): 3639
Wetland size (estimated acres): FW = 75.8, PC = 153.5, W = 125
Notes (history, current conditions, drainage facilities, other relevant comments):
- Connects to site #8 at the NW corner of his site.
- Air photos show a large system of ditches present.

28) County: Columbia; **Township**:Arlington; **Section(s)**:24
Distance to named waterbody: Goose Pond, <0.25 miles; **Distance to Lake Mendota**: 14 miles
Distance to urban area: Arlington, 0.5 miles
Soil sheet number(s):104, 115; **Hydrologic soil types present**: Ot, JoA
NRCS Wetland Inventory designation: N/A
Restoration required: Berm.
Drainage basin size (estimated acres): N/A; **Wetland size (estimated acres)**: 4.5
Notes (history, current conditions, drainage facilities, other relevant comments):
- The restoration would be designed as a combination wetland restoration project to trap sediment and to attract wildlife.
- Currently an unnamed intermittent, navigable stream that flows through the tract. Dominant vegetation is canary grass.
- Surface water runoff, treated sewage from Arlington, and can cooling water from Del Monte Canning Factory flows through the area.
- Surrounding uplands currently (1997) are owned by Del Monte Corp. and Madison Audubon Society. Audubon's uplands have been planted to warm season grasses.
- Downstream from the proposed project is Goose Pond, a prairie pothole being restored by Madison Audubon Society.
- Elevation readings completed and project ready to be designed. Contact Goose Pond Sanctuary resident managers.

Appendix Two
Farm Practices Inventory

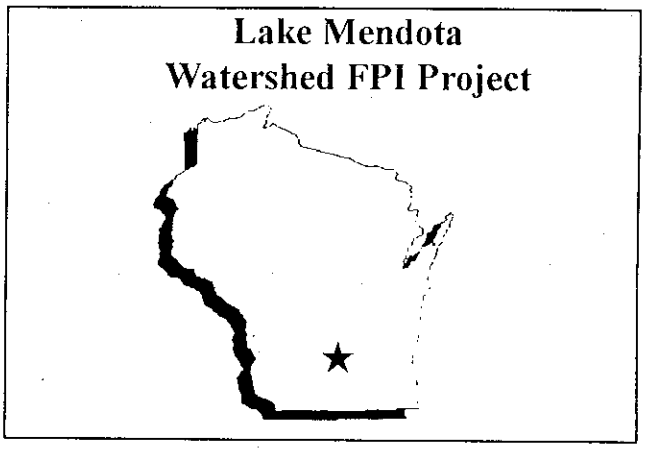
The Farm Practices Inventory

Utilizing A Needs Assessment in Water Quality Program Implementation: Lake Mendota Watershed

by Pete Nowak, Robin Shepard, and Christopher Weiland

Objective:

The overall objective of the Farm Practices Inventory (FPI) is to identify farmer needs which can guide and then evaluate information and assistance efforts in helping farmers adopt best management practices. These management practices are essential to protecting farm profitability and water quality.



Description:

The Farm Practices Inventory is an assessment of landuser's nutrient and pesticide management practices. The intent of this assessment is to gain an understanding of the practices farmers are currently using in the area of fertilizer and pesticide management. Results will be used to focus on management practices that improve profitability and protect water quality. The survey also provides insight to potential obstacles for adopting Best Management Practices (BMPs). Once these data are collected the intent is to work with the University of Wisconsin Extension (UWEX), Wisconsin Nutrient and Pesticide Management Program (NPM), the appropriate Wisconsin Land Conservation Department (LCD), county extension faculty and local agribusiness to develop targeted educational programs and technical assistance in the Lake Mendota Watershed.

A second purpose for designing and implementing this assessment instrument is program evaluation. The assessment conducted at the beginning of the water quality project will measure knowledge and behavior in terms of managing fertilizer and pesticide inputs. This will serve as a baseline to measure change in these management practices over time.

It is the goal of the Farm Practices Inventory to identify current fertilizer and pesticide management practices, and target areas for improved management practices that will protect farm profitability and reduce nonpoint source pollution in the Lake Mendota Watershed. This assessment records fertilizer and pesticide inputs that occurred in the 1994 crop year. The data includes commercial fertilizer inputs, manure applications, rotations, pesticide selection, as well as operator knowledge of the management practices. An important dimension of this assessment is a determination of current management practices which will guide educational and technical assistance provided to farmers in the watershed.

The Farm Practices Inventory In The Lake Mendota Watershed

The Lake Mendota Watershed FPI project involved face-to-face interviews for delivery of the survey to farm operators in the watershed. Most of the tasks associated with survey delivery, response tracking and follow-up procedures were conducted by Lake Mendota Watershed personnel. Survey delivery was completed in April, 1996. During that time 82 face-to-face interviews were conducted with full-time dairy and livestock farmers in the watershed. These farmers are responsible for 42% of the cropland in the watershed.

Farm Practices in the Lake Mendota Watershed: An Overview

General Farm Characteristics:

The farmers responding to the Lake Mendota Watershed FPI survey are collectively responsible for the management decisions involving a total of 53,500 tillable acres. The farmers responding have a combined estimated gross income of $17.5 million. Most of the respondents (73%) consider dairy farming as their main source of income, with average gross farm sales between 100,000 and 200,000 dollars per year.

Farmers reporting as main source of farm income

dairy	73%
livestock	10%
other	17%

The economic structure of the farm as a business can be a potential barrier to the adoption of improved management practices. The number of cows or the amount of tillable ground the manager is responsible for, when large, can be seen as a constraint to adopting practices that require more of the farmer's time. Likewise, farm operators with lower cash flow than those with more liquid assest are limited to invest financially in some management decisions.

In the Lake Mendota, the average farmer manages 229 dairy animals including heifers and young stock, 358 acres of corn and 142 acres of alfalfa.

Animal Units

Animal Herd	average size	number of farmers
dairy animals *(milking, heifers, and young stock)*	229	.63
beef animals *(only beef)*	172	36
hogs *(only hogs)*	396	12

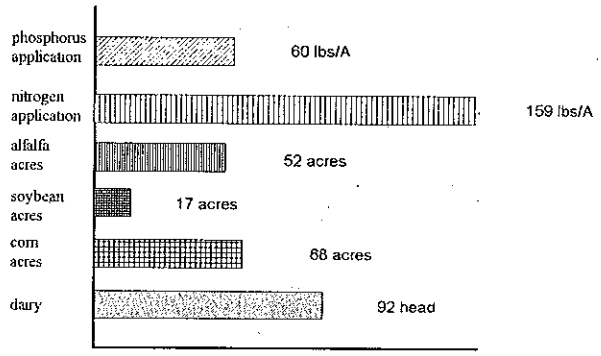
Cropping Commitments

Crop	average acres	number of farmers
corn *(only corn)*	358	82
alfalfa *(only alfalfa)*	142	82
soybeans *(only beans)*	65	182

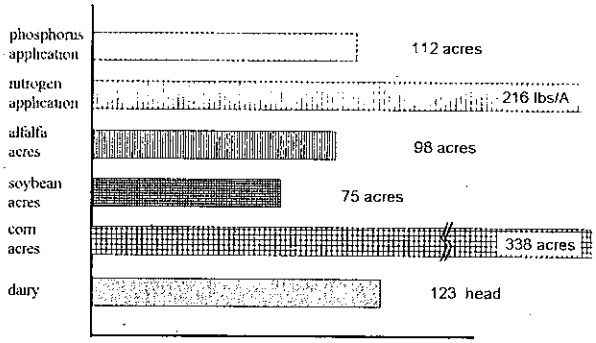
The size of the farm operation further helps identify potential audiences. Respondents were divided in four groups based on gross farm income and the number of tillable acres they own and rent.

Nitrogen application was found to be highest in the small to medium sized farms with 216 lbs per acre.

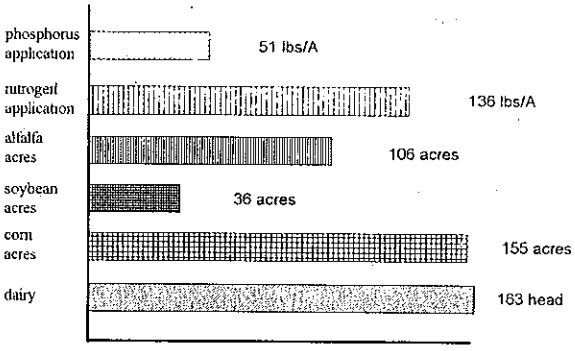
Small Farms Averages
(# = 10)



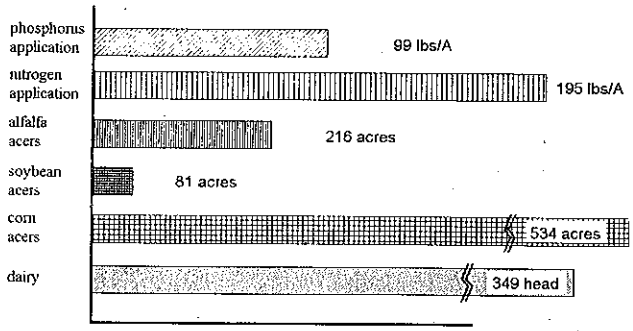
Small to Medium Farms Averages
(# = 26)



Medium to Large Farms Averages
(# = 12)



Large Farms Averages
(# = 34)



Farming in the Lake Mendota Watershed will experience moderate growth in the near future. When asked to consider the next five years, 16% of farmers responded they planned increases in their dairy operations, 15% said they would increase their livestock operations, 19% planned increases in their corn or soybean acres, while 15% planned increases in their forage operations.

Changes in the next 5 years

	stop	decrease	no change	increase
dairy	3%	3%	78%	16%
livestock	5%	5%	75%	15%
corn/soybeans	4%	4%	72%	19%
forage	4%	3%	78%	15%

Farmer Concerns:

The FPI askes farmers to rate their most important concerns about four farming practices: legume crediting, manure crediting, residue management/conservation tillage, and manure spreader calibration.

Farmers primary concern with each of the four practices was with profitability (over 50%). While this demonstrates the importance of profitability to farmers, it is important to note that depending on the farming practice, farmers secondary issues differ.

Farmers secondary concerns with manure crediting were "How will it affect water quality" and "How much time and labor will it require" (16% each). While secondary concerns with legume crediting were "How will it affect water quality" and "How difficult is it to use" (about 10%).

For manure spreader calibration the second most frequent issues were "How difficult will it be to use?" (19%) and "How much time and labor will it require". While the secondary concerns with conservation tillage were "How will it work?" (25%) and "How will it affect water quality".

Results indicate the role of private industry as a major source of information about new farming practices. In total, Coop/farm supply dealers made up over half (58%) of the preferred sources on information on manure crediting and legume crediting and over 30% of the preferred source of information on conservation tillage and manure spreader calibration.

What is the <u>most important</u> question about the following farming practices?

Farmer Concern	Practice: Legume Crediting	Manure Crediting	Conservation Tillage	Manure Spreader Calibration
Will it be profitable?	70%	53%	52%	50%
Will it work on my farm?	8%	7%	25%	5%
How difficult will it be to use?	10%	8%	2%	19%
How much time and labor will it require?	2%	16%	5%	16%
How will it affect water quality in my neighborhood?	11%	16%	16%	8%
Is anyone else using it?	0%	0%	0%	2%

Who is the best source to answer this question for you?

Primary Concerns	Local Extension Agent	Farm Supply Dealer or Independent Crop Consultant	Government Conservation Agencies (other than watershed staff)	Priority Watershed Staff	Other Farmers
Legume Management					
- profitability issues	16%	77%	2%	0%	2%
- water quality	14%	14%	14%	43%	14%
- how difficult will it be to use?	40%	40%	0%	0%	0%
Manure Management					
- profitability issues	20%	63%	7%	0%	3%
- how will it affect water quality?	40%	20%	0%	40%	0%
- how difficult will it be to use?	22%	56%	0%	0%	11%
Residue Management/ Conservation Tillage					
- profitability issues	13%	34%	22%	0%	25%
- how will it work?	7%	13%	53%	0%	27%
- how will it affect water quality?	20%	10%	0%	40%	0%
Manure Spreader Calibration					
- profitability issues	25%	53%	11%	0%	7%
- how difficult will it be to use?	42%	25%	17%	8%	0%
- how much time/labor will it require?	20%	10%	20%	10%	10%

The Farm Practices Inventory (FPI)

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July 1996

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by Peter Nowak, Robin Shepard, and Christopher Weiland

Objective:

The overall objective of the Farm Practices Inventory (FPI) is to identify farmer needs so as to guide and then evaluate information and assistance efforts in helping farmers adopt best management practices. These management practices are essential to protecting farm profitability and water quality.

Description:

The Farm Practices Inventory (FPI) is an assessment of landuser's nutrient and pesticide management practices. The intent is to use the information to develop educational programs that begin with an understanding of what farmers are actually doing and why it is being done.

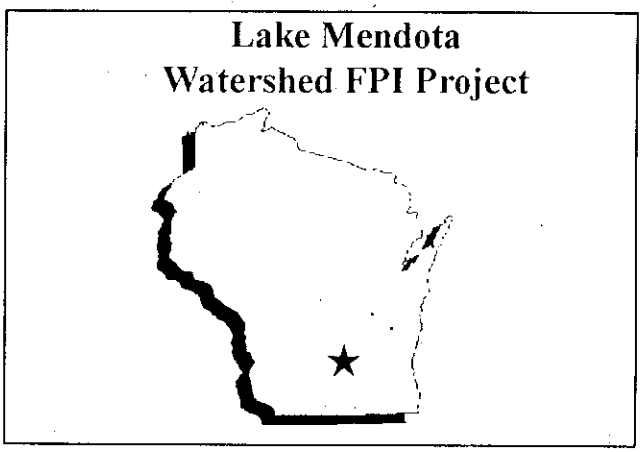
This is the second in a series of reports that highlights selected FPI data collected in the Lake Mendota Watershed. This report focuses on the use of farm fertilizers, specifically nitrogen and phosphorus.

An Overview of the Farm Practices Inventory in the Lake Mendota Watershed

The Lake Mendota Watershed project involved face-to-face delivery of the FPI to farm operators. Delivery was completed in April 1996. During that time 82 face-to-face interviews were conducted with watershed responsible for farming over 42% of the watershed.

Nutrient Management:

Farmers were asked about their nitrogen and phosphorus management as a major component of the Farm Practices Inventory. Supplemental



nutrient additions, especially nitrogen (N), to cropland are required for successful non-legume crop production (1). With this large of an area involved there is potential for minimizing fertilizer costs as well as environmental damage from inefficient nutrient management.

Results show on average, Lake Mendota Watershed farmers spend $10.19 per acre in actual costs more than needed for commercial nitrogen, phosphorus and potassium. These actual costs refer to what farmers paid for only commercial fertilizer and its application above the average university recommenations.

Total Application	average recommendation	average applied	range applied
nitrogen	160 lbs/A	188 lbs/A	0-484 lbs/A
phosphorus	40 lbs/A	91 lbs/A	0-383 lbs/A
potassium	25 lbs/A	207 lbs/A	0-940 lbs/A

If this figure is applied to the total acres of corn the respondents to the FPI are responsible for, farmers spent $98,730 for excess fertilizer applications in 1994.

Nitrogen and Phosphorus Management:

Nutrient management was measured in two ways; 1) field level, and 2) farm level. Field level questions asked the farmer to consider his or her most productive field that was planted to corn in 1994. The farmer was then asked how this field is different than other corn fields (farm level). In the Lake Mendota Watershed the most productive corn field was very representative. For most farmers manure (92%) and nitrogen (96%) application rates were about the same or higher on other corn fields, thus making the results for the most productive corn field conservative estimates of farm management practices in the watershed.

Nitrogen sources on the most productive corn field compared to other corn fields.

	lower on other fields	same on other fields	higher on other fields
manure applications	9%	77%	14%
nitrogen applications	5%	81%	15%

Each farmer was asked to identify the forms of nitrogen applied to their most productive corn field.

N-Source	Percent Using
starter	89%
manure	70%
28%-nitrogen solution	46%
anhydrous ammonia	32%
urea	20%
other commercial fertilizer	13%

Each farmer's nitrogen usage was assessed independently to determine the total rate of nitrogen application on their most productive corn field. These nitrogen application rates were then placed into three categories.

Nitrogen Application	Percent of Watershed
Under Average Recommended Rates	
More than 10 lbs/A under	30%
Within Average Recommended Rates	
Within ± 10 lbs/A	20%
Over Average Recommended Rates	
More than 10 lbs/A over	50%

The average estimated university recommended rate for the Lake Mendota Watershed is between 120 to 160 pounds of nitrogen per acre for corn (depending on soil type).

Each farmer's application rate of phosphorus was assessed based on the nutrients applied to their most productive corn field.

P-Source	Percent Using
starter	89%
manure	70%
other commercial fertilizer w/phosphorus	9%

Phosphorus rates were then placed into three categories based on the crop removal rate for corn. Perhaps the most striking result of the Farm Practices Inventory in the Lake Mendota Watershed is the high rates of phosphorus application.

Phosphorus Application	Percent of Respondents
Under Crop Removal Rates	
no phosphorus applied	0%
Within Crop Removal Rates	
1 lbs. - 40 lbs. P / acre	30%
Over Crop Removal Rates	
more than 40 lbs. P / acre	70%

Manure Application:

As expected, the most common type of manure being applied to cropland is dairy manure. Seventy percent of the respondents said they applied manure to their most productive corn field. Also, supporting the focusing of educational programs on manure management is appropriate since all of these farmers apply manure to more than 11,640 acres of cropland. On average, a farmer in the Lake Mendota Watershed applied manure to 27% of their cropland (176 acres), and manages animals which produce enough manure to supply all the nitrogen needed by 71 acres of corn.

As seen in the following table, the average value of the manure applied to the most productive corn field is $39.52 per acre, if it were replaced with comparable amounts of commercial nitrogen and phosphorus.

Manure Value in Equivalent Commercial Fertilizers

	average rate lbs / acre	estimated value per acre	estimated value of on-farm manure
manure N	92	$18.40	$3,3238.40
manure P	88	$21.12	$3,717.12
TOTALS		$39.52	$6,955.52

The values of commercial nitrogen and phosphorus (above table) represent University of Wisconsin estimates of $0.20 per pound for nitrogen and $0.24 per pound for phosphate. Manure value was then determined by considering herd size, type of animal, and the comparative cost for commercial nitrogen and phosphorus.

Manure Crediting:

Manure contributes significant amounts of nitrogen to the soil while decreasing the need for commercial fertilizer. Over-fertilization often occurred when manure is not credited.

Manure rates were determined by asking farmers to identify the type of manure, the size of their manure spreader, the number of loads applied to the most productive corn field, and the size of that field. Nitrogen credits were calculated from University of Wisconsin credit recommendations based on animal type and the method of application (liquid or solid). Farmers were asked if they credit nitrogen from manure, and if so, the amount of that credit.

Crediting Nitrogen in Manure

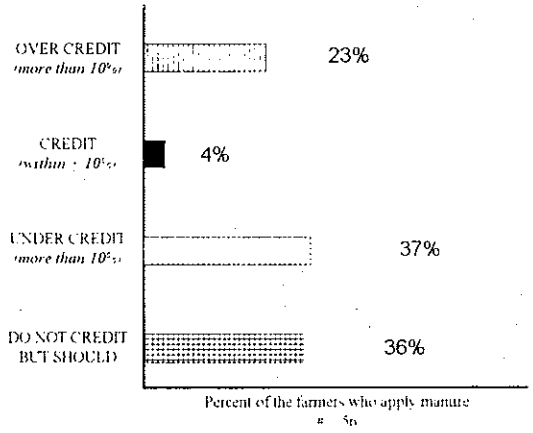
= 82

Farmer Category	number	percent
those applying manure to the MPCF	56	70%
those applying manure to the MPCF and use nitrogen credits	36	64%

MPCF-Most Productive Corn Field
* Percentage bases on those who could potentially credit manure

The accuracy of the crediting can be determined by looking at claimed credits versus a conservative estimate of actual manure nitrogen applied on their most productive corn field. Of the 56 farmers who **could** take advantage of the nitrogen from manure, almost two-thirds (64%) credit manure nitrogen. The farmers who do credit manure nitrogen tend to under utilize the nitrogen potential available.

Farmers Crediting Manure-Nitrogen



Manure storage is another important aspect of on-farm nutrient management. Storage of manure is necessary due to seasonal constraints in applying manure to cropland. Most farmers (61%) with livestock said they haul manure daily or frequently throughout the year.

Management Practice	Percent
Put directly in spreader	83%
Frequently hauled throughout the year	61%
Concrete wall pit.	32%
Pile on ground.	28%
As liquid in cement pit.	22%
Clay lined lagoon.	8%
Slurry system.	5%
Frequently hauled except winter.	1%
Unlined lagoon.	0%

The type of equipment a farmer owns can also serve as a direct barrier to adopting new management practices. Older, traditional (box type) spreaders and some liquid applicators without injection make uniform application difficult and reduce the trust in manure crediting. In the Lake Mendota Watershed, most farmers indicated they owned the traditional box type manure spreader.

Type of Manure Spreaders	% Presently Using
Box Type Spreader	70%
V-bottom Spreader	34%
Liquid without Injection	14%
Liquid Injection	12%
Barrel Side Spreader	5%

Legume Crediting:

The crediting of nitrogen from legumes is another critical issue of nutrient management. Legumes like alfalfa, clover, soybeans and peas can convert atmospheric nitrogen into a form used by plants. Up to 160 pounds of nitrogen per acre may be available to the succeeding crop following a legume. Conservative values of 130 pounds for alfalfa, 104 pounds for clover, 35 pounds for soybeans, and 20 pounds of available nitrogen from peas were used to determine legume nitrogen credits.

Crediting Nitrogen from Legumes
= 82

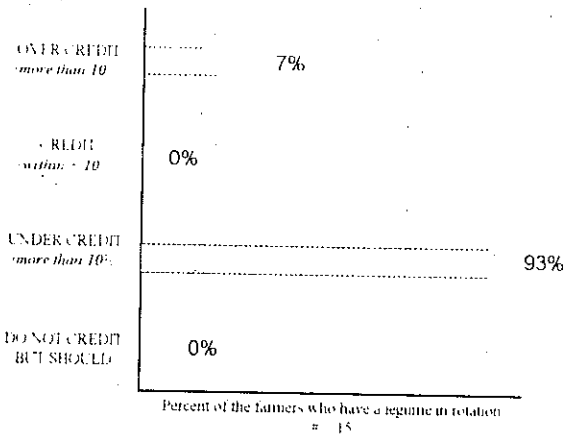
Farmer Category	number	percent
those growing a legume in 1994 on the MPCF	15	18%
those growing a legume on the MPCF and credit nitrogen	15	100%

MPCF - Most Productive Corn Field
* Percentage based on those who could potentially credit legumes

Farmers were asked to identify the rotation on the most productive corn field. A nitrogen credit was assigned based on the type of legume crop grown in 1993. Eighteen percent of farmers were eligible for legume credits. Only first year legume credits were calculated even though university research has shown there is still a substantial amount of nitrogen released from decaying legume residues in the second year following the legume crop in non-sandy soils.

Again as with manure crediting, just asking farmers if they credit only partially explains legume management in the Lake Mendota Watershed. The accuracy of crediting was determined by comparing claimed credit versus a conservative estimate of the actual nitrogen credit. All but one of the Lake Mendota Watershed farmers who were eligible for a legume credit underestimated the amount of credit.

Farmers Crediting Legume-Nitrogen



How farmers deal with surface and groundwater contamination potential from farmstead activities is the topic of REPORT #3: Farmstead Pollution Prevention.

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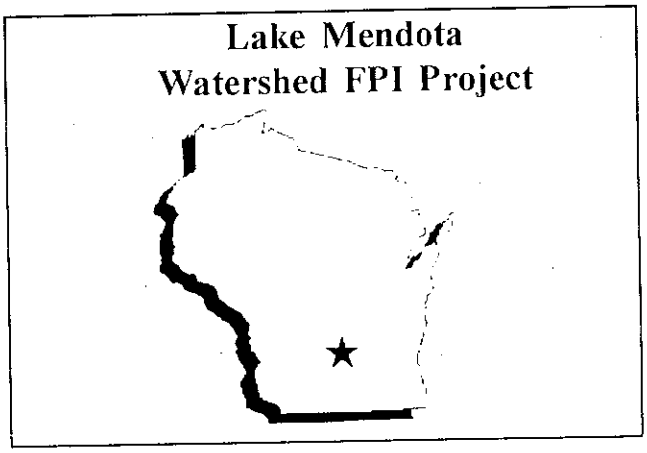

Objective:

The overall objective of the Farm Practices Inventory (FPI) is to identify farmer needs which can guide and then evaluate information and assistance efforts in helping farmers adopt best management practices. These management practices are essential to protecting farm profitability and water quality.

Description:

The Farm Practices Inventory (FPI) is an assessment of landuser's nutrient and pesticide management practices. The intent of this assessment is to gain an understanding of the fertilizer and pesticide management practices currently used by farmers .

This is the third in a series of reports that highlights selected FPI data collected in the Lake Mendota Watershed. This report focuses on the use of pest management strategies and farmstead pollution prevention.

The Farm Practices Inventory in the Lake Mendota Watershed

The Lake Mendota Watershed project involved face-to-face delivery of the FPI to farm operators. Delivery began in July 1994 and was completed in April 1996. During that time 82 face-to-face interviews were completed with farmers responsible for 42% of the tillable acres in the watershed.

Farm Practices in the Lake Mendota Watershed: Farmstead Protection

Surface and groundwater contamination can occur as a result of improper storage and handling of farm chemicals, fuels, fertilizers and waste products. The prevention of these point source pollution sources from these farmstead areas must be part of a water quality protection effort.

To address these issues, Lake Mendota Watershed farmers were asked to "self -assess" their farmstead pollution problems. Farmers were asked about the condition of their wells, fuel tanks, pesticide storage, pesticide mixing/loading, livestock manure storage, barnyard management, and waste disposal practices.

Pesticide Storage

Of the 98% of farmers in the Lake Mendota Watershed who use a herbicide on their most productive corn field, 49% indicated they store herbicides in a liquid or dry form. A full 88% of the farmers in the Lake Mendota Watershed indicated they used an insecticide on their most productive corn field. Of those farmers using an insecticide 53% indicated they stored excess chemicals in liquid or dry forms on the farmstead.

	Liquid Storage	Dry Storage
Herbicides		
< 1 gallon or 1 pound	24%	35%
1-10 gallons or 1-25 pounds	56%	40%
11-55 gallons or 26-250 pounds	17%	25%
56-250 gallons or 251-1000 pounds	3%	0%
> 250 gallons or 1000 pounds	0%	0%
did not store a herbicide.	49%	

	Liquid Storage	Dry Storage
Insecticides		
< 1 gallon or 1 pound	75%	19%
1-10 gallons or 1-25 pounds	17%	59%
11-55 gallons or 26-250 pounds	8%	14%
56-250 gallons or 251-1000 pounds	0%	4%
> 250 gallons or 1000 pounds	0%	4%
did not store an insecticide	53%	

Animal-Manure Storage

During periods when suitable sites for land application of manure are not available, farmers need to store manure. Such manure storage facilities should be located and constructed in a manner that reduces the risk of both groundwater and surface contamination.

Type of Storage

	Percent	Number of farms
directly in spreader	83%	65
cement pit	32%	25
pile on ground	28%	22
slurry system	5%	4
clay lined lagoon	8%	6
unlined lagoon	0%	0
daily haul (no storage)	46%	32

For specific information about animal manure storage see **Report #2: Nitrogen and Phosphorus Management.**

Milkhouse Waste Water

With the predominance of dairy farming in the Lake Mendota Watershed, milkhouse waste water represents a significant volume of wastewater. The proper treatment of this wastewater is crucial to protecting groundwater, especially in light of the planned increases in dairy operations (see **Report #1: Overview and Farmer Characteristics**).

Although farmers reported the majority of milkhouse wastewater drains to a treatment facility of some sort, the FPI does not ask about the maintenance and original capacity of the treatment facility.

Milkhouse Waste Water Disposal

(= 60)

	Percent
septic system	40%
liquid manure tank	20%
other	18%
nearby field	12%
settling tank	7%
nearby ditch	3%

Fuel Storage Tanks

Nearly every farm has tanks for storing fuel oil and other petroleum products. Petroleum storage tanks can represent a potential source of water contamination either from leaks or accidental spills. Farmers were asked to describe up to two tanks on their farmstead. The responses were separated into two categories: 1) above ground tanks, and 2) below ground tanks. Most of the 154 tanks described were steel tanks of 1-15 years in age.

Fuel Tank Condition

	Above Ground Tanks	Below Ground Tanks
Tanks Recorded	(# = 140)	(# = 14)
Type of Tank		
steel	96%	50%
galvanized	3%	0%
stainless steel	0%	0%
fiberglass/plastic	0%	0%
don't know	1%	50%
Age		
1-5 years	58%	22%
6-15 years	29%	56%
16-25 years	9%	0%
over 25 years	1%	22%
Type of Fuel		
gasoline	49%	86%
diesel	50%	14%
heating oil	1%	0%

Previous regulations for location of above ground storage tanks were concerned with protecting above ground tanks from accidental damage or leaking. Recently, state agencies have revised above ground storage tank regulations to better protect groundwater with requirements for tank security, ventilation and spill containment (2). There are also new state regulations for under ground tanks that pertain to how those tanks are installed and removed.

Well Protection

Proper well siting and construction are a landowner's first defense against unsafe water. Most wells draw water that enters the ground within a few miles of the well. Detecting water quality problems requires regular testing. University of Wisconsin Extension recommends homeowners test their well water each year (1).

As reported by voluntary BARNY nitrate tests of 172 well water samples in the Lake Mendota Watershed, 60% reported high (>10 mg/l) nitrate levels. Of these wells, 48% reported levels greater than 20 mg/l of nitrate.

Lake Mendota Watershed farmers were asked to describe up to two wells on their farmstead. Results were divided into four categories: barnyard wells, household wells, combination of barnyard and household well and field well. Of these, household drinking and barnyard uses were the most common purpose for private wells. Of those watershed farmers who tested their household or combination well 79% tested for nitrate, 67% tested for bacteria, 19% tested for lead, and 24% tested for pesticides.

Well Condition

	Personal Consumption Wells	Barnyard/Livestock Wells
Wells Recorded	(# = 65)	(# = 5)
Well Tests		
since 1993	55%	60%
before 1993	34%	20%
never	11%	20%
Well Protection		
sealed cap	57%	19%
house/shed	10%	31%
concrete pad/slab	4%	0%
covered pit	17%	6%
well in basement	2%	0%
other	10%	44%

Well protection merits special concern for those with wells located in pits or in the basement of a building. These locations can act as funnels for direct contamination in the event of flooding or accidental spills. This high risk well condition was present in only 2 percent of the wells used for personal consumption and none of the livestock wells. Overall, regardless of well usage, 12 percent of wells have never been tested for water quality.

Location of the Well

While the condition of a well is important, its location in relationship to potential contamination sources is equally important. A well is not just a source of water for drinking or livestock, but it can be a direct pipeline for groundwater contamination. Spills or runoff near the well pose a direct threat to the quality of your drinking water supply.

Structure	Distance to the drinking well in feet: < 50	50-150	150-250	> 250	Drinking wells downhill or level (PERCENT)
petroleum tank	5%	41%	23%	32%	55%
pesticide storage	5%	35%	35%	25%	49%
pesticide loading	8%	18%	30%	45%	34%
animal waste	2%	9%	32%	57%	23%
animal feedlot	2%	36%	34%	28%	24%

Whether a well taps water just below the ground or hundreds of feet deep, its location on top of the ground is a crucial risk factor (3). Generally, groundwater flows slowly underground from higher areas of elevation to lower areas. The slope of the water table or direction of groundwater movement often follows the slope of the land surface. Therefore, those wells which are downhill from potential pollution sources are at greater risk than those uphill. Of the reported 80 petroleum tanks and 37 pesticide storage sites, at least 49% are located in high risk areas.

Abandoned Wells

The appropriate closure of abandoned wells represents a special need for a smaller group of Lake Mendota Watershed landowners. Twenty-two percent indicated they have at least one abandoned well, while 4 percent indicated they have more than one abandoned well on their farmstead. Abandoned wells that are unused or improperly closed can present significant threats to groundwater. If not properly sealed they can directly channel contaminated surface or soil water into the groundwater.

Abandoned Well Condition

(# = 17)	Percent
filled with concrete	33%
open/not sealed	20%
sealed well cap	20%
other	13%
filled with sand/soil	7%
don't know	7%

In the Lake Mendota Watershed, of the 17 abandonded wells four are not sealed, while one respondent indicated they did not know the condition of abandoned wells on their farmstead. Before an abandoned well is filled or capped, the pump, associated piping, underground liner pipe, or other obstacles must be removed from the well. Filling material can be used, but it is best to consult a professional well driller, the Wisconsin Geological and Natural History Survey or the State Department of Natural Resources.

References

1. *Wisconsin Department of Agriculture Trade and Consumer Protection. 1991. Pesticide Use. WDATCP. Madison WI. 32p*

2. *Mechenich, Chris, George Gibson, Jim Peterson, Byron Shaw and Gary Jackson. Maintaining Your Home Well Water System. University of Wisconsin. Madison WI. Bulletin G3299*

3. *The Water Spot. The newsletter of the Water Quality Demonstration Project-East River. July 1991*

4. *F*A*S Fact Sheet #1, Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition. University of Wisconsin. Madison, WI.*

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Appendix Three
Interim Best Management Practices

Interim best management practices (IBPMs) are defined by NR 120 as a practice, technique, or measure approved by the DNR (in consultation with DATCP for agricultural practices) under NR 120.15. This subsection for the code stipulates that design criteria, standards and specification, and cost-share conditions and rates for the IBMP be specified by the DNR in the nonpoint source grant agreement for the program grantee desiring its use. No payment may be made for any IBMP unless it is listed on the grantee's nonpoint source grant.

An alternative definition is that an IBMP is any practice that is not specifically listed in NR 120 for which funding is sought through the NPS Program. IBMPs have historically largely been a by-product of the watershed plan development process. As unique local conditions warrant, new solutions to nonpoint source pollution problems are proposed. Some of these are simply different twists on existing accepted practices; others use new technologies not previously part of other approaches. While IBMPs may be proposed at any time during a watershed project's lifetime, most are generally initiated during the first two years, or the time during which the watershed plan is being prepared. Other information about IBMPs can be found in the NPS "Implementation Manual for Priority Watershed and Lake Projects." (DNR, 1998).

Name of Practice: **Application of Polyacrilamide (PAM) for the Reduction of Soil Loss**

Definition: The mechanical application of PAM to crop fields and construction sites to reduce the loss of sediment.

Purpose: A high percentage of the sediment reduction goal of the Lake Mendota Priority Watershed Project is accomplished through the use of crop residues left on top of the soil surface after planting. Climatic factors have a constant bearing on the amount of residue produced by the prior year's crop. It has been demonstrated that the application of PAM bind soil particles together, thus reducing soil erosion. The application of PAM would give landowners another option to reduce soil erosion during years when climatic or crop conditions do not dictate adequate residue remaining after planting to reduce soil erosion.

During the construction phase of urban development, the surface cover of large land areas is disturbed leaving the soil prone to erosion, the application of PAM has the potential to bind the soil particles together minimizing the sediment loss impact. This practice will provide the local governmental unit with an additional management tool as well as provide the landowner with another viable alternative to the challenges of crop residue management and soil surface cover during the construction phase.

Conditions:

1. PAM must be of the anionic type meeting EPA and FDA acrylamide monomer limits of 0.05%, having a charge density of 15-35% and a molecular weight of 12 to 20 Mg/mole.

2. The PAM will be applied with a source of calcium in mixture to ensure the efficiency of the application.

3. The PAM shall be applied according to label requirements and conform to all federal, state and local laws, rules and regulations for agricultural lands.

4. Cost-sharing will not be provided for equipment needed to load, haul or apply the PAM.

For agricultural uses:

5. Cost sharing will be provided on a per acre basis at a flat rate of $10.00/acre.

6. Each landowner will be limited to a maximum cost-share period of 3 years.

7. Rate of application of PAM:
   - 2 pounds/acre for land slopes 0 to 6%
   - 4 pounds/acre for land slopes greater than 6%

8. All cropland will have and be implementing a conservation plan to tolerable soil loss levels.

9. Eligible fields will need crop residue management to reduce soil loss to tolerable levels or a sediment delivery rate of greater than 0.3 tons per acre per year to surface water.

10. PAM will be applied during the final tillage practice or after the final disturbance of the soil surface.

For urban areas and construction sites:

11. Cost-sharing will be provided on a per acre basis at a flat rate of $50.00 per acre.

12. Each individual site is eligible for cost-sharing only once.

13. Eligible construction sites will have and implement a construction site erosion control plan that limits soil erosion to 7.5 tons per acre per year or less.

14. For construction sites, the PAM shall be applied at a rate of 2.5 pounds per 1,000 gallons of water per acre after the final soil disturbance. The site shall be mulched at a rate of 750 pounds per acre and seeded as recommended.

Name of Practice: Urban Catchment Basin

Definition: A structure designed to reduce storm flow velocity and trap sediment and associated pollutants in established areas.

Purpose: The watershed inventory revealed that approximately 160 direct outfalls to the receiving waters. These direct discharges deliver sediment and pollutants associated with urban land use. It has been demonstrated that the reduction in velocity and the change in the flow direction will cause suspended solids to settle out of the water column.

It is extremely difficult and not cost effective to retrofit wet detention ponds in established urban areas. This practice provides a low cost alternative to wet detention ponds. These structures are similar in design and functionality to agricultural sediment basins which will be cost shared in the rural portion of the Lake Mendota Priority Watershed. These structures would be constructed within the designated easement associated with each direct outfall.

Conditions:

1. Outfalls within each eligible municipality will be evaluated on their current delivery and practicability of constructing a basin (i.e. size of easement, type of outfall).

2. Those locations with the highest delivery and practicability of construction would be cost shared at the rate of 70%.

3. This interim practices would be implemented on a trial basis based on the above criteria in those eligible municipalities. Further evaluation by the Dane County LCD, Wisconsin DNR, and the participating municipalities will identify whether or not the interim practice will be considered further.

4. Each municipality will be responsible for the operation and maintenance of the structure which will be determined at the time of design. At minimum, basins will be cleaned twice (fall and spring).

5. Cost sharing will not be provided for the operation and maintenance.

6. No more than three per eligible municipality will be funded and constructed during the evaluation period.

Appendix Four
Glossary

ACUTE TOXICITY:
Any poisonous effect produced by a single short-term exposure to a chemical that results in a rapid onset of severe symptoms.

ADVANCED WASTEWATER TREATMENT:
The highest level of wastewater treatment for municipal treatment systems. It requires removal of all but 10 parts per million of suspended solids and biological oxygen and/or 50 percent of the total nitrogen. Advanced wastewater treatment is also known as "tertiary treatment."

ALGAE:
A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Therefore, algae effect the oxygen content of water. Nutrient-enriched water increases algae growth.

AMMONIA:
A form of nitrogen (NH_3) found in human and manures. Ammonia can be toxic to aquatic life.

ANAEROBIC:
Without oxygen.

AREA OF CONCERN:
Areas of the Great Lakes identified by the International Joint Commission (IJC) as having serious water pollution problems. There are no areas of concern designated in the Pensaukee River Watershed as of this publication.

AREAWIDE WATER QUALITY MANAGEMENT PLANS (BASIN PLANS):
A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve basin water quality. Each basin in Wisconsin must have a plan prepared for it, according to section 208 of the Clean Water Act.

ANTIDEGRADATION:
A policy stating that water quality will not be lowered below background levels unless justified by economic and social development considerations. Wisconsin's antidegradation policy is currently being revised to make it more specific and meet EPA guidelines.

AVAILABILITY:
The degree to which toxic substances or other pollutants are present in sediments or elsewhere in the ecosystem and are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by sediment. Oxygen content, pH, temperature and other conditions in the water can affect availability.

BACTERIA:
Single-cell, microscopic organisms. Some can cause disease, but others are important in organic waste stabilization.

BARNY:
The Wisconsin Barnyard runoff model, a computer model used to assess the water quality impacts of barnyards or feedlots. It was developed by DNR with assistance from NRCS and DATCP.

BASIN PLAN:
See "Areawide Water Quality Management Plan."

BENTHIC ORGANISMS (BENTHOS):
Organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP):
The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION:
The uptake and retention of substances by an organism from its surrounding medium and food. As chemicals move through the food chain, they tend to increase in concentration in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOASSAY STUDY:
A test for pollutant toxicity. Tanks of fish or other organisms are exposed to varying doses of treatment plant effluent. Lethal doses of pollutants in the effluent are then determined.

BIOCHEMICAL OXYGEN DEMAND (BOD):
A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. BOD5 is the biochemical oxygen demand measured in a five day test. The greater the degree of pollution, the higher the BOD5.

BIODEGRADABLE:
Waste that can be broken down by bacteria into basic elements. Most organic wastes such as food remains and paper are biodegradable.

BIOTA:
All living organisms that exist in an area.

BUFFER STRIPS:
Strips of grass or other erosion-resisting vegetation between disturbed areas and a stream or lake.

BULKHEAD LINES:
Legally established lines that indicate how far into a stream or lake an adjacent property owner has the right to fill. Many of these lines were established many years ago and allow substantial filling of the bed of the river and bay. Other environmental laws may limit filling to some degree.

CARCINOGENIC:
A chemical capable of causing cancer.

CATEGORICAL LIMITS:
All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/1 effluent limits for SS and BOD). For industry the level depends on the type of industry and the level of production. More stringent effluent limits are required, if necessary, to meet water quality standards.

CHLORINATION:
The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CHLORORGANIC COMPOUNDS (CHLORORGANICS):
A class of chemicals that contain chlorine, carbon and hydrocarbon. This generally refers to pesticides and herbicides that can be toxic. Examples include PCB's and pesticides such as DDT and dieldrin.

CHRONIC TOXICITY:
The effects of long-term exposure of organisms to concentrations of a toxic chemical that are not lethal, but is injurious or debilitating in one or more ways. An example of the effect of chronic toxicity is reduced reproductive success.

CLEAN WATER ACT:
See "Public Law 92-500."

COMBINED SEWERS:
A wastewater collection system that carries both sanitary sewage and stormwater runoff. During dry weather, combined sewers carry only wastewater to the treatment plant. During heavy rainfall, the sewer becomes swollen with stormwater. Because the treatment plant cannot process the excess flow, untreated sewage is discharged to the plant's receiving waters, i.e., combined sewer outflow.

CONFINED DISPOSAL FACILITY (CDF):
A structure built to contain and dispose of dredged material.

CONGENERS:
Chemical compounds that have the same molecular composition, but have different molecular structures and formula. For example, the congeners of PCB have chlorine located at different spots on the molecule. These differences can cause differences in the properties and toxicity of the congeners.

CONSERVATION TILLAGE:
Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease.

CONSUMPTION ADVISORY:
A health warning issued by DNR and WDHSS that recommends people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT:
Some material that has been added to water that is not normally present. This is different from a pollutant, which suggests there is too much of the material present.

CONVENTIONAL POLLUTANT:
Refers to suspended solids, fecal coliforms, biochemical oxygen demand, and pH, as opposed to toxic pollutants

COST-EFFECTIVE:
A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA:
See water quality standard criteria.

CRITICAL SITE:
A major source of polluted runoff in a watershed project for which best management practices are available but not currently being used. The watershed plan contains the description and the means of identifying critical sites for different pollution sources. Critical sites are so important to the overall success of the priority watershed project that the state has been given authority to require site owners to install and/or use BMPs at identified critical sites.

DIOXIN (2,3,7,8-tetrachlorodibenso-p-dioxin):
A chlorinated organic chemical which is highly toxic.

DISINFECTION:
A chemical or physical process that kills organism that cause disease. Chlorine is often used to disinfect wastewater.

DISSOLVED OXYGEN (DO):
Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen often result from inadequate wastewater treatment. The DNR considers 5 ppm DO necessary for fish and aquatic life.

DISTRICTS:
DNR field offices, now called "regions" with the DNR's recent reorganization. There are five DNR administrative regions in the state (see inside back cover for map). The Pensaukee River Watershed area is located entirely in the DNR's Northeast Region.

DREDGING:
Removal of sediment from the bottom of water bodies.

ECOSYSTEM:
The interacting system of biological community and its nonliving surrounding.

EFFLUENT:
Solid, liquid or gas wastes (byproducts) that are disposed on land, in water or in air. As used in the RAP, effluent generally means wastewater discharges.

EFFLUENT LIMITS:
The DNR issues WPDES permits establishing the maximum amount of pollutant to be discharged to a receiving stream. Limits depend on the pollutant and the water quality standards that apply for the receiving waters.

EMISSION:
A direct (smokestack particles) or indirect (busy shopping center parking lot) release of any contaminant into the air.

ENVIRONMENTAL PROTECTION AGENCY (USEPA):
The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP):
Formerly ACP, EQIP is a federal cost-sharing program to help landowners install measures to conserve soil and water resources. EQIP is administered by the USDA-NRCS through county committees.

ENVIRONMENTAL REPAIR FUND:
A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EPIDEMIOLOGY:
The study of diseases as they affect populations rather than individuals, including the distribution and incidence of a disease mortality and morbidity rated, and the relationship of

climate, age, sex, race and other factors. EPA uses such data to establish national air quality standards.

EROSION:
The wearing away of the land surface by wind or water.

EUTROPHIC:
Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION:
The process of nutrient enrichment of a lake loading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FACILITY PLAN:
A preliminary planning and engineering document that identifies alternative solutions to a community's wastewater treatment problems.

FECAL COLIFORM:
A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

FISHABLE AND SWIMMABLE:
Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FOOD CHAIN:
A sequence of organisms where each uses the next as a food source.

GREEN STRIPS:
See buffer strip.

GROUNDWATER:
Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

HABITAT:
The place or type of site where a plant or animal naturally lives and grows.

HEAVY METALS:
Metals present in municipal and industrial wastes that pose long-tern environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: arsenic, barium, cadmium, chromium,

copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE:
A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

INFLUENT:
Influent for an industry would be the river water that the plant intakes for use in its processing. Influent to a municipal treatment plant is untreated wastewater.

IN-PLACE POLLUTION:
As used in the RAP, refers to pollution from contaminated sediments. These sediments are polluted from post discharges from municipal and industrial sources.

ISOROPYLBIPHENYL:
A chemical compound used as a substitute for PCB.

LANDFILL:
A conventional sanitary landfill is "a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading solid wastes in thin layers, materials at the end of each operating day". Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization chemical fixation encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LEACHATE:
The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

LOAD:
The total amount of materials or pollutants reaching a given local.

MACROPHYTE:
A rooted aquatic plant.

MASS:
The amount of material a substance contains causing it to have weight in a gravitational field.

MASS BALANCE:
A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC:
Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrohpic.")

MILLIGRAMS PER LITER (mg/1):
A measure of the concentration of substance in water. For most pollution measurement this is the equivalent of "parts per million".

MITIGATION:
The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses or replacing lost values.

MIXING ZONE:
The portion of a stream or lake where effluent is allowed to mix with the receiving water. The size of the area depends on the volume and flow of the discharge and receiving water. For streams the mixing zone it is one-third of the lowest flow that occurs once every 10 years for a seven day period.

NONPOINT SOURCE POLLUTION (NPS):
Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

OLIGOTROPHIC:
Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

OUTFALL:
The mouth of a sewer, drain, or pipe where effluent from a wastewater treatment plant is discharged.

PATHOGEN:
Any infective agent capable of producing disease. It may be a virus, bacterium, protozoan, etc.

PELAGIC:
Referring to open water portion of a lake.

PESTICIDE:
Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

PH:
A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral and 0 being most acid, and 14 being most alkaline.

PHENOLS:
Organic compounds that are byproducts of petroleum refining, textile, dye, and resin manufacture. High concentrations can cause taste and odor problems in fish. Higher concentration can be toxic to fish and aquatic life.

PHOSPHORUS:
A nutrient that, when reaching lakes in excess amounts, can lead to overfertile conditions and algae blooms.

PLANKTON:
Tiny plants and animals that live in water.

POINT SOURCES:
Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION:
The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

POLYCHLORINATED BIPHENYLS(PCBs):
A group of 209 compounds, PCBs have been manufactured since 1929 for such common uses as electrical insulation and heating/cooling equipment, because they resist wear and chemical breakdown. Although banned in 1979 because of their toxicity, they have been detected on air, land and water. Recent surveys found PCBs in every section of the country, even those remote from PCB manufacturers.

POLYCHLORINATED ORGANIC COMPOUNDS:
A group of toxic chemicals which contain several chlorine atoms.

PRETREATMENT:
A partial wastewater treatment required from some industries. Pretreatment removes some types of industrial pollutants before the wastewater is discharged to a municipal wastewater treatment plant.

PRIORITY POLLUTANT:
A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major dischargers are required to monitor all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED:
A drainage area roughly between 100,000 and 200,000 acres selected to receive state money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

PRODUCTIVITY:
A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

PUBLIC LAW 92-500 (CLEAN WATER ACT):
The federal law that sets national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all dischargers of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

PUBLIC PARTICIPATION:
The active involvement of interested and affected citizens in governmental decision-making.

PUBLICLY OWNED TREATMENT WORKS (POTW):
A wastewater treatment plat owned by a city, village or other unit of government.

RECYCLING:
The process that transforms waste materials into new products.

REGIONS:
DNR field offices. There are five DNR administrative regions in the state (see inside back cover for map). The Pensaukee River Watershed area is located entirely in the DNR's Northeast Region. DNR regions were formerly called "districts" before 1997.

REMEDIAL ACTION PLAN (RAP):
A plan designed to restore beneficial uses to a Great Lakes Area of Concern.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RF/FS):
An investigation of problems and assessment of management options conducted as part of a federal Superfund project.

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA):
This federal law amends the Solid Waste Disposal Act of 1965 and expands on the Resource Recovery Act of 1970 to provide a program that regulates hazardous wastes, to eliminate open dumping and to promote solid waste management programs.

RETRO-FIT:
The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN:
Belonging or relating to the bank of a lake, river or stream.

RIPRAP:
Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

RULE:
Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF:
Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS:
The indirect effects that an action can have on the health of the ecosystem or the economy.

SECONDARY TREATMENT:
Two-stage wastewater treatment that allows the coarse particles to settle out, as in primary treatment, followed by biological breakdowns of the remaining impurities. Secondary treatment commonly removes 90% of the impurities. Sometimes "secondary treatment" refers simply to the biological part of the treatment process.

SEDIMENT:
Soil particles suspended in and carried by water as a result of erosion.

SEICHES:
Changes in water levels due to the tipping of water in an elongated lake basin whereby water is raised in one end of the basin and lowered in the other.

SEPTIC SYSTEM:
Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

SLUDGE:
A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE:
Unwanted or discharged material with insufficient liquid to be free flowing.

STANDARDS:
See water quality standards.

STORM SEWERS:
A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUPERFUND:
A federal program that provides for cleanup of major hazardous landfills and land disposal areas.

SUSPENDED SOLIDS (SS):
Small particles of solid pollutants suspended in water.

SYNERGISM:
The total effect is greater than the sum of the individual effects. For example, the characteristic property of a mixture of toxicants that exhibits a greater-than-additive cumulative toxic effect.

TERTIARY TREATMENT:
See advanced wastewater treatment.

TOP-DOWN MANAGEMENT:
A management theory that uses biomanipulation, specifically the stocking of predator species of fish to improve water quality.

TOTAL MAXIMUM DAILY LOADS:
The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC:
An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE:
A chemical or mixture of chemicals which, through sufficient exposure, or ingestion, inhalation of assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TOXICANT:
See toxic substance.

TOXICITY:
The degree of danger posed by a toxic substance to animal or plant life. Also see acute toxicity, chronic toxicity and additivity.

TOXICITY REDUCTION EVALUATION:
A requirement for a discharger that the causes of toxicity in an effluent be determined and measures taken to eliminate the toxicity. The measures may be treatment, product substitution, chemical use reduction or other actions that will achieve the desired result.

TREATMENT PLANT:
See wastewater treatment plant.

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

TURBIDITY:
Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIFORM DWELLING CODE:
A statewide building code for communities larger than 2500 residents specifying requirements for electrical, heating, ventilation, fire, structural, plumbing, construction site erosion, and other construction related practices.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX):
A special outreach, education branch of the state university system.

VARIANCE:
Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

VOLATILE:
Any substance that evaporates at a low temperature.

WASTELOAD ALLOCATION:
Division of the amount of waste a stream can assimilate among the various dischargers to the stream. This limits the amount (in pounds) of chemical or biological constituent discharged from a wastewater treatment plant to a water body.

WASTEWATER:
Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE:
Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT:
A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY AGREEMENT:
The Great Lakes Water Quality agreement was initially signed by Canada and the United States in 1972 and was subsequently revised in 1978 and 1987. It proves guidance for the management of water quality, specifically phosphorus and toxics, in the Great Lakes.

WATER QUALITY LIMITED SEGMENT:
A section of river where water quality standards will not be met if only categorical effluent standards are met.

WATER QUALITY CRITERIA:
A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY STANDARDS:
The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE:
When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

WATERSHED:
The land area that drains into a lake or river.

WETLANDS:
Areas that are inundates or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WINHUSLE:
A computer model for evaluating sediment delivery to suface waters from agricultural lands. It was developed by DNR with assistance from NRCS.

WISCONSIN ADMINISTRATIVE CODE:
The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND:
A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state's taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for

treatment plant construction, but three percent of this fund is available for repair or replacement of private, on-site sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution. Nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. $500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM:
A state cost-share program established by the state Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES):
A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

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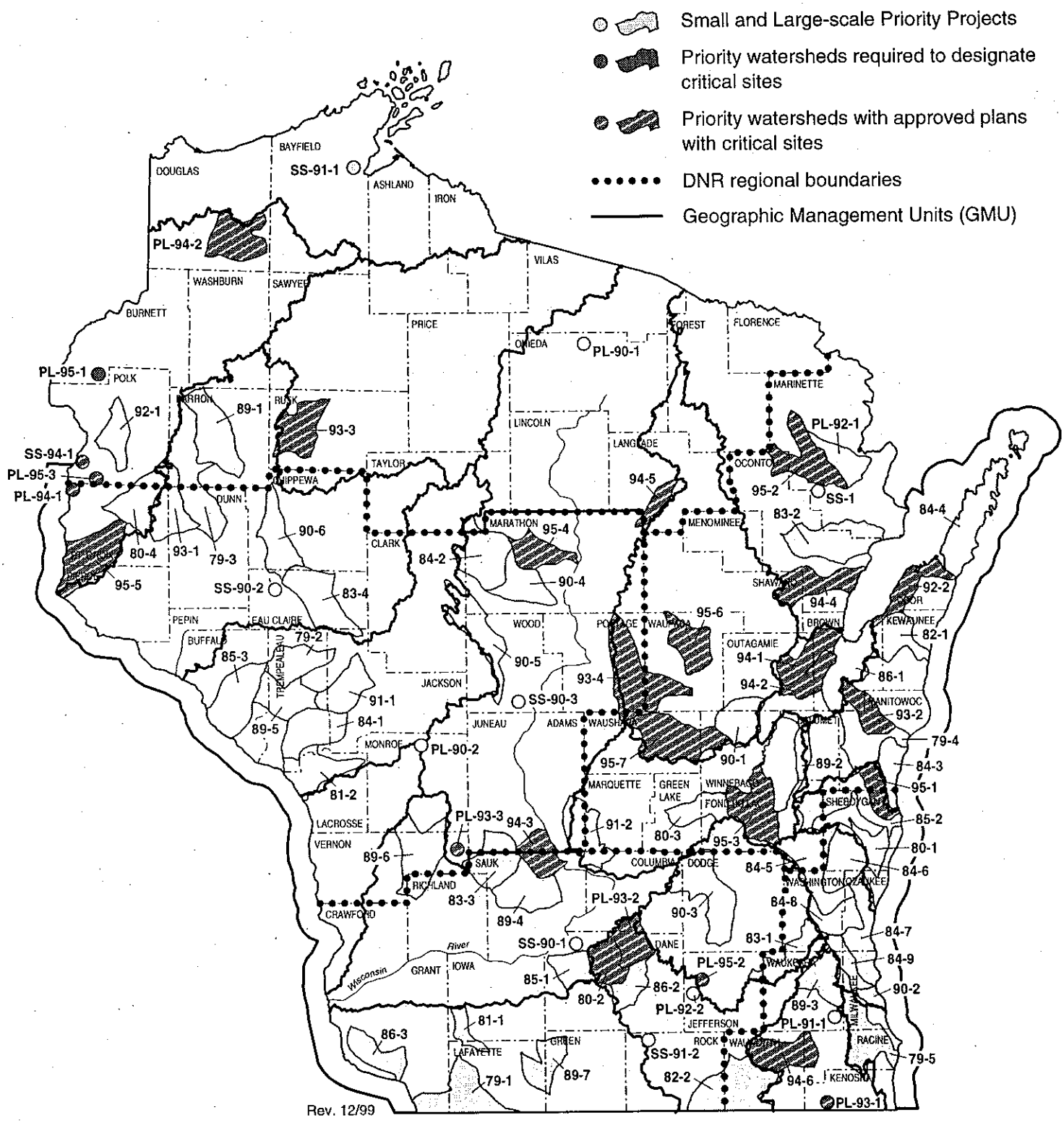
Priority Watershed Projects in Wisconsin



Priority Watershed Projects in Wisconsin: 1999

REV. 12/99

Year Selected-Map Number	Large-scale Priority Watershed Project	County(ies)
79-1	Galena River ♦	Grant, Lafayette
79-2	Elk Creek ♦	Trempealeau
79-3	Hay River ♦	Barron, Dunn
79-4	Lower Manitowoc River ♦	Manitowoc, Brown
79-5	Root River ♦	Racine, Milwaukee, Waukesha
80-1	Onion River ♦	Sheboygan, Ozaukee
80-2	Sixmile-Pheasant Branch Creek ♦†	Dane
80-3	Big Green Lake ♦	Green Lake, Fond du Lac
80-4	Upper Willow River ♦	Polk, St. Crox
81-1	Upper West Branch Pecatonica River ♦	Iowa, Lafayette
81-2	Lower Black River ♦	La Crosse, Trempealeau
82-1	Kewaunee River ♦	Kewaunee, Brown
82-2	Turtle Creek ♦	Walworth, Rock
83-1	Oconomowoc River ♦	Waukesha, Washington, Jefferson
83-2	Little River ♦	Oconto, Marinette
83-3	Crossman Creek/Little Baraboo River ♦	Sauk, Juneau, Richland
83-4	Lower Eau Claire River ♦	Eau Claire
84-1	Beaver Creek ♦	Trempealeau, Jackson
84-2	Upper Big Eau Pleine River ♦	Marathon, Taylor, Clark
84-3	Sevenmile-Silver Creeks ♦	Manitowoc, Sheboygan
84-4	Upper Door Peninsula ♦	Door
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac
84-7	Milwaukee River South	Ozaukee, Milwaukee
84-8	Cedar Creek	Washington, Ozaukee
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington
85-1	Black Earth Creek	Dane
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet
85-3	Waumandee Creek	Buffalo
86-1	East River	Brown, Calumet
86-2	Yahara River - Lake Monona	Dane
86-3	Lower Grant River	Grant
89-1	Yellow River	Barron
89-2	Lake Winnebago East	Calumet, Fond du Lac
89-3	Upper Fox River (Ill.)	Waukesha
89-4	Narrows Creek - Baraboo River	Sauk
89-5	Middle Trempealeau River	Trempealeau, Buffalo
89-6	Middle Kickapoo River	Vernon, Monroe, Richland
89-7	Lower East Branch Pecatonica River	Green, Lafayette
90-1	Arrowhead River & Daggets Creek	Winnebago, Outagamie, Waupaca
90-2	Kinnickinnic River (Milwaukee Basin)	Milwaukee
90-3	Beaverdam River	Dodge, Columbia, Green Lake
90-4	Lower Big Eau Pleine River	Marathon
90-5	Upper Yellow River	Wood, Marathon, Clark
90-6	Duncan Creek	Chippewa, Eau Claire
91-1	Upper Trempealeau River	Jackson, Trempealeau
91-2	Neenah Creek	Adams, Marquette, Columbia
92-1	Balsam Branch	Polk
92-2	Red River - Little Sturgeon Bay	Door, Brown, Kewaunee
93-1	South Fork Hay River	Dunn, Polk, Barron, St. Croix
93-2	Branch River	Manitowoc, Brown
93-3	Soft Maple/Hay Creek	Rusk
93-4	Tomorrow/Waupaca River	Portage, Waupaca, Waushara
94-1	Duck Creek	Outagamie, Brown
94-2	Apple/Ashwaubenon Creeks	Outagamie, Brown
94-3	Dell Creek	Sauk, Juneau
94-4	Pensaukee River	Shawano, Oconto
94-5	Spring Brook	Langlade, Marathon
94-6	Sugar/Honey Creeks	Walworth, Racine
95-1	Pigeon River	Manitowoc, Sheboygan
95-2	Middle Peshtigo/Thunder Rivers	Marinette, Oconto
95-3	Fond du Lac River	Fond du Lac, Winnebago
95-4	Lower Rib River	Marathon
95-5	Kinnickinnic River (St. Croix Basin)	St. Croix, Pierce
95-6	Lower Little Wolf	Waupaca
95-7	Pine & Willow Rivers	Waushara, Winnebago

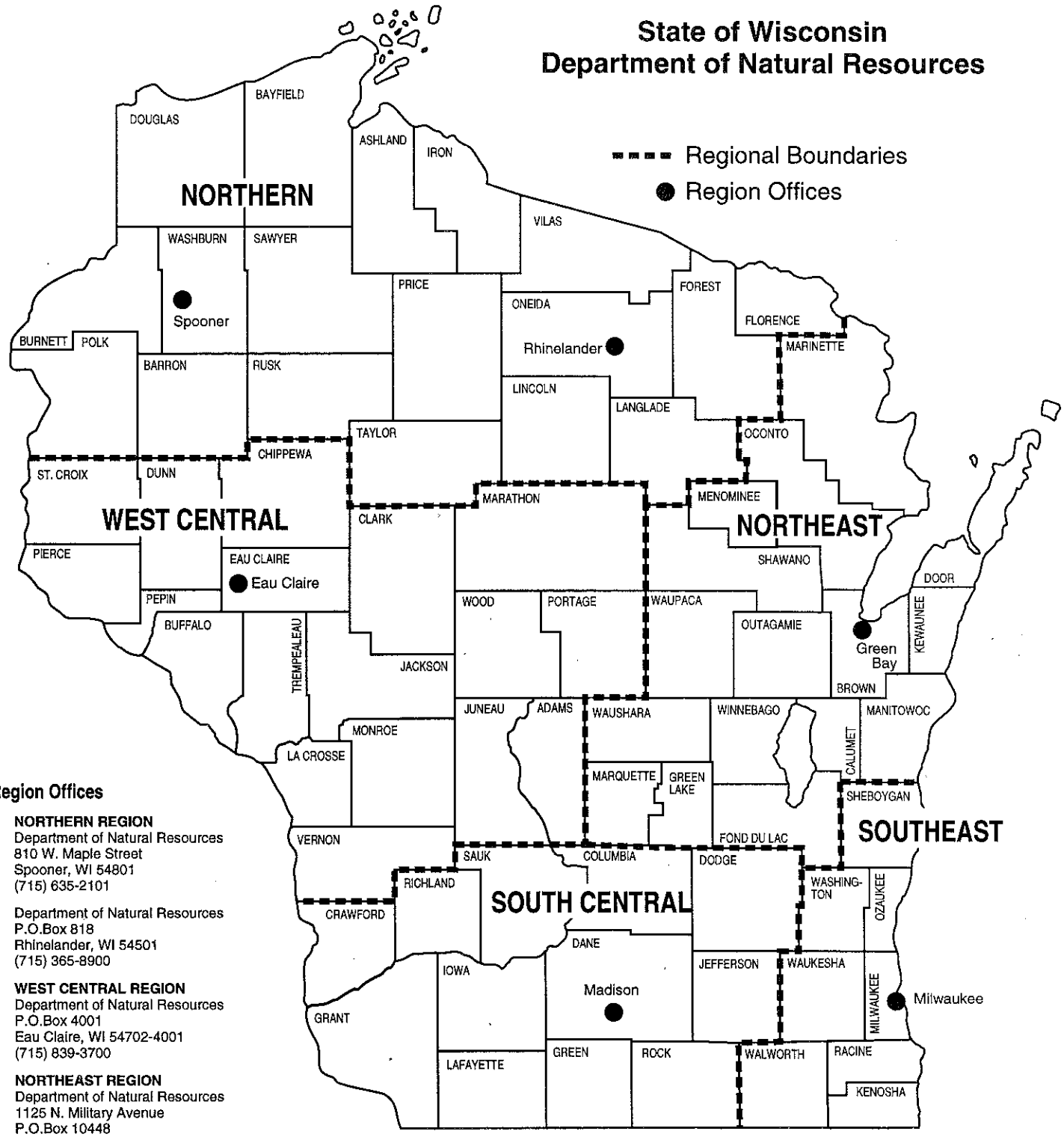
Year Selected-Map Number	Small-scale Priority Watershed Project	County(ies)
SS-1	Bass Lake ♦	Marinette
SS-90-1	Dunlap Creek	Dane
SS-90-2	Lowes Creek	Eau Claire
SS-90-3	Port Edwards - Groundwater Prototype ♦	Wood
SS-91-1	Whittlesey Creek	Bayfield
SS-91-2	Spring Creek	Rock
SS-94-1	Osceola Creek	Polk

Year Selected-Map Number	Priority Lake Project	County(ies)
PL-90-1	Minocqua Lake ♦	Oneida
PL-90-2	Lake Tomah	Monroe
PL-91-1	Little Muskego, Big Muskego, Wind Lakes	Waukesha, Racine, Milwaukee
PL-92-1	Lake Noquebay	Marinette
PL-92-2	Lake Ripley	Jefferson
PL-93-1	Camp/Center Lakes	Kenosha
PL-93-2	Lake Mendota	Dane, Columbia
PL-93-3	Hillsboro	Vernon
PL-94-1	St. Croix County Lakes Cluster	St. Croix
PL-94-2	Upper St. Croix/Eau Claire River	Douglas
PL-95-1	Big Wood Lake	Burnett, Polk
PL-95-2	Rock Lake	Jefferson
PL-95-3	Horse Creek	Polk, St. Croix

♦ *Project completed*

† *Sixmile-Pheasant Branch is being redone as part of the Lake Mendota project (PL-93-2).*

State of Wisconsin
Department of Natural Resources



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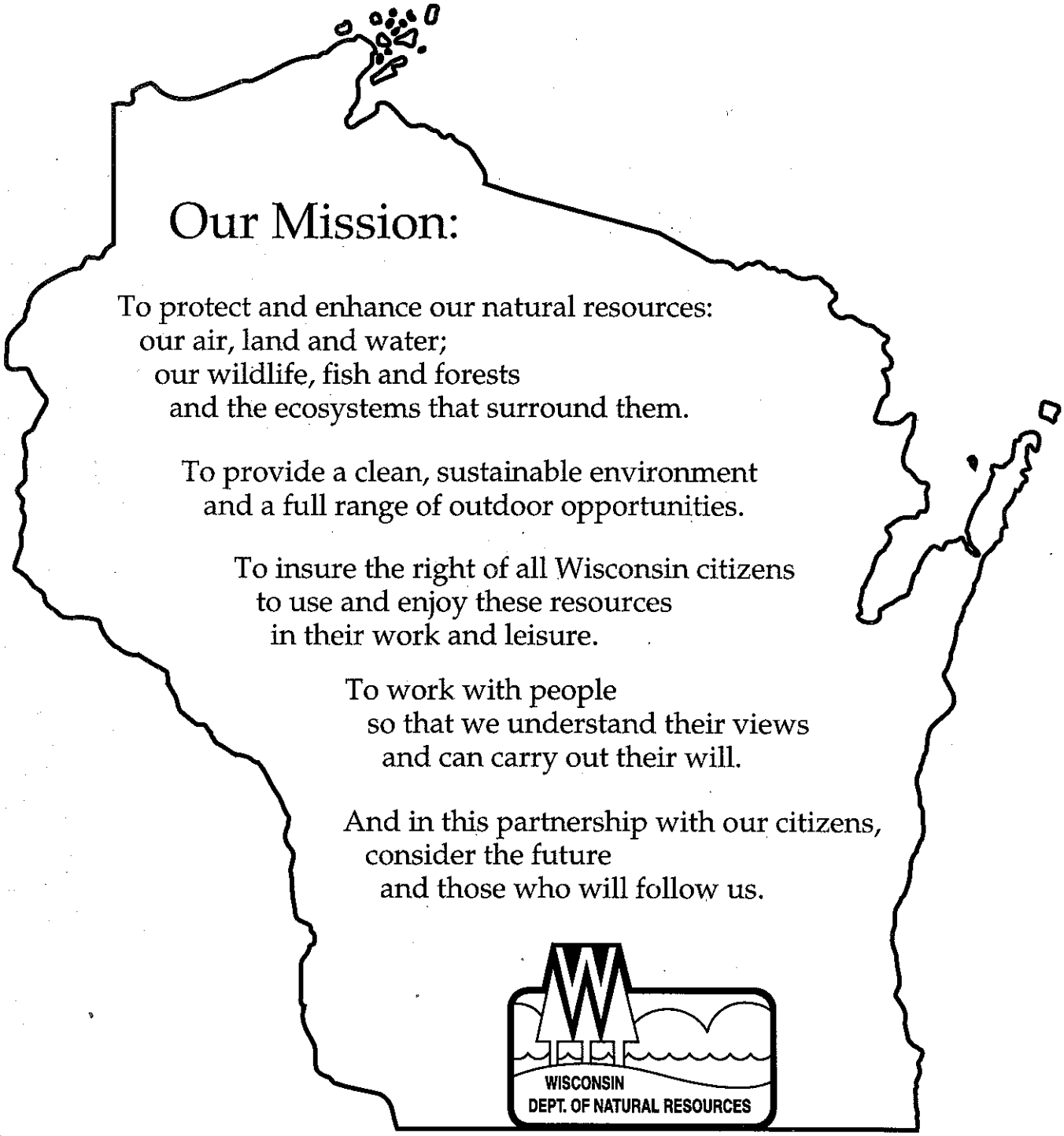

Our Mission:

To protect and enhance our natural resources:
our air, land and water;
our wildlife, fish and forests
and the ecosystems that surround them.

To provide a clean, sustainable environment
and a full range of outdoor opportunities.

To insure the right of all Wisconsin citizens
to use and enjoy these resources
in their work and leisure.

To work with people
so that we understand their views
and can carry out their will.

And in this partnership with our citizens,
consider the future
and those who will follow us.

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