Nonpoint Source Control Plan for the Fond du Lac River 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 Wisconsin Department of Agriculture, Trade and Consumer Protection, the Fond du Lac County Land Conservation Department and the Winnebago County Land Conservation Department.

Watershed Plan Organization Information

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Nonpoint Source Control Plan For the Fond du Lac River Priority Watershed Project

The Wisconsin Runoff Management Program

December 1997

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources,
Wisconsin Department of Agriculture, Trade and Consumer Protection,
The Fond du Lac County Land Conservation Department and the
Winnebago County Land and Water Conservation Department

Publication Number: WT-705-01

For copies of this document please contact:

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The Department of Natural Resources acknowledges the Environmental Protection Agency's Region V Office for their involvement in the partial funding of this activity through Section 319 of the Water Quality Act.

Watershed Plan Credits

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Graphics and Maps

Eric Venden - Winnebago County GIS Manager

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ACRONYMS

ACP	Agricultural Conservation Program
BARNY	Barnyard nutrient analysis model
BIM-GEO	DNR Bureau of Information Management-Geographical Unit
BOD	Biological Oxygen Demand
BMP	Best Management Practice
CAC	Citizen Advisory Committee
COD	Chemical Oxygen Demand
CRP	Cropland Reserve Program (federal)
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
FOCS	Field Offices Computing System
FPP	Wisconsin Farmland Protection Program
FSA	Farm Services Agency (United States Department of Agriculture)
GW	Groundwater
I&E	Information and Education
LCC	Land Conservation Committee
LCD	Land Conservation Department
LWCD	Land and Water Conservation Department
LWCB	Land and Water Conservation Board
NPM	Nutrient and Pest Management
NPS	Nonpoint Source (Pollution)
NRCS	Natural Resource Conservation Service
SHS	Wisconsin State Historical Society
SIP	Stewardship Incentive Program
SOS	Signs of Success monitoring program
SSMS	Single Source Monitoring Site
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
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
WCMP	Winnebago Comprehensive Management Plan

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary

101 South Webster Street
P.O. Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
FAX 608-267-3579
TDD 608-267-6897

December 2, 1997

George A. Stanchfield, Chair
Fond du Lac County Board of Supervisors
City - County Government Center
160 South Macy Street
Fond du Lac, WI 54935

Dear Mr. Stanchfield:

I am pleased to approve the Fond du Lac River 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 December 2, 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 Runoff Management Practices Program. I am also approving the plan as an amendment to the Upper Fox River Basin Areawide Water Quality Management Plan.

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

Sincerely,

George E. Meyer
Secretary

c: Lynn Mathias - Fond du Lac County LCD
Len Olson - DATCP
Cindy Hoffland - CA/8
Bradley Johnson - NER

RESOLUTION NO. 99-97

RESOLUTION ADOPTING THE FOND DU LAC RIVER/WINNEBAGO WEST NONPOINT SOURCE PRIORITY WATERSHED PLAN

WHEREAS, the Fond du Lac River/Winnebago West Watershed was designated a "Priority Watershed" in 1996 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS, the County Land Conservation Department in cooperation with the Wisconsin Department of Natural Resources conducted a detailed inventory of the land use within the watershed in 1996 and 1997, and

WHEREAS, this inventory resulted in the development of a detailed Nonpoint Source Control Plan for the watershed, and

WHEREAS, public information meetings were held on September 11 and 18, 1997, and an official public hearing was held on September 25, 1997, and

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

WHEREAS, each county within the watershed applying for cost-sharing grants for landowners in the watershed, must have an adopted watershed plan.

NOW, THEREFORE, BE IT RESOLVED by the Fond du Lac County Board of Supervisors that the Fond du Lac River/Winnebago West Nonpoint Source Priority Watershed Plan be adopted and that implementation of the plan begin as soon as possible.

Dated October 28, 1997

James D. Costello

Christine Schweser

Leonard Rosenbaum

LAND CONSERVATION COMMITTEE

FISCAL NOTE: Cost to the county for implementation of the Fond du Lac River/Winnebago West Watershed plan is expected to run about $ 10,200.00 per year.

APPROVED BY:

Allen J. Buechel
COUNTY EXECUTIVE

APPROVED BY:

Kathryn J. Kugler
CORPORATION COUNSEL

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
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101 South Webster Street
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December 2, 1997

Joseph Maehl, Chair
Winnebago County Board of Supervisors
258 Chatham Court
Neenah, WI 54956

Dear Mr. Maehl:

I am pleased to approve the Fond du Lac River 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 December 2, 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 Runoff Management Practices Program. I am also approving the plan as an amendment to the Upper Fox River Basin Areawide Water Quality Management Plan.

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

Sincerely,

George E. Meyer
Secretary

c: Pete Van Airsdale - Winnebago County LWCD
Len Olson - DATCP
Cindy Hoffland - CA/8
Bradley Johnson - NER

APPROVE THE NONPOINT SOURCE CONTROL PLAN AND AUTHORIZE GRANT APPLICATION FOR THE FOND DU LAC RIVER/WINNEBAGO WEST PRIORITY WATERSHED PROJECT

TO THE WINNEBAGO COUNTY BOARD OF SUPERVISORS:

WHEREAS, the Fond du Lac River/Winnebago West Priority Watershed Project, authorized and funded through the Wisconsin Nonpoint Source Water Pollution Abatement Program (Sec. 144.25 Wis. Stats., and Chapter NR 120, Wisconsin Administrative Code), was previously accepted by the Winnebago, and Fond du Lac County Boards (10/95); and

WHEREAS, the Winnebago County Land and Water Conservation Department, the Fond du Lac County Land Conservation Department, and the Watershed Project Citizen's Advisory Committee, along with the Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture, Trade and Consumer Protection, worked cooperatively to prepare a pollution control plan for the Watershed Project; and

WHEREAS, said plan assesses nonpoint sources of pollution throughout the watershed; identifies Best Management Practices needed to control those pollutants; and guides the voluntary implementation of those practices by landowners in an effort to achieve specific water quality and water resource improvement goals; and

WHEREAS, upon approval of the watershed plan, Wisconsin Nonpoint Source Grant funds will be made available to landowners, through the County Land and Water Conservation Department, in the form of cost share assistance for purposes of installing Best Management Practices; and

WHEREAS, the Wisconsin Nonpoint Source Grant amount for Winnebago County in 1998, estimated at $100,000, is to be budgeted within the Land and Water Conservation Department Fund 42272-7131: NPS Grant Revenue Account.

NOW, THEREFORE, BE IT RESOLVED, that the Winnebago County Board of Supervisors does hereby approve the Nonpoint Source Pollution Control Plan and authorizes the Nonpoint Source Grant application for the Fond du Lac River/Winnebago West Priority Watershed Project.

BE IT FURTHER RESOLVED that the Chairman of the Winnebago County Board is hereby authorized to notify the Wisconsin Department of Natural Resources of the Board's action, and that said notification be accompanied by a copy of this resolution.

Submitted by,

LAND CONSERVATION COMMITTEE

Committee Vote 11/06/97: **7 - 0**

CHAPTER ONE:
Purpose, Legal Status, and General Description

The purpose of this watershed plan is to assess the nonpoint source (NPS, or runoff) pollutants in the Fond du Lac Priority Watershed and to guide implementation of control measures. Implementation of best management practices and an education and outreach strategy will help reduce NPS pollution loads and enhance water quality of streams, lakes, and groundwater within the watershed. The 249 square mile watershed, located in Fond du Lac and Winnebago Counties, was designated a "priority" watershed in 1995. The Fond du Lac River Watershed is part of the Upper Fox River Basin.

The State Legislature created the Wisconsin Nonpoint Source (NPS) Water Pollution Abatement Program in 1978 to improve and protect water quality of streams, lakes, wetlands, and groundwater by reducing urban and rural NPS pollution sources. NPS pollution in the Fond du Lac Priority Watershed includes eroding agricultural lands, eroding shorelines and streambanks, runoff from livestock wastes and agricultural practices, erosion from roadsides and developing areas, and runoff from established urban areas. NPS pollution is carried to the surface water in rainfall runoff, snowmelt, and groundwater seepage.

Following is an overview of the Wisconsin NPS Priority Watershed program:

- The Department of Natural Resources (DNR) administers the program in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP). Wisconsin is divided into 333 discrete hydrologic units called watersheds that are assessed for water quality concerns as part of a comprehensive basin planning process. Watersheds with a high degree of water quality impairment from NPS pollution become eligible for consideration as a priority watershed project. Currently, there are 130 eligible watersheds, 22 projects are completed and 86 are ongoing. As directed by the state legislature, all of the high-ranking watersheds must have priority watershed plans in place by 2015. Designation as a priority watershed project provides state financial support for local units of governments and private landowners in the watershed to reduce NPS pollution.

- Priority watershed plans are cooperatively prepared by the DNR, DATCP, and local units of government with participation from a citizen's advisory committee. Agency staff evaluate surface water and groundwater quality conditions, nonpoint sources of pollution, and land uses in the watershed. Best management practices (BMPs) are identified to meet plan objectives.

- After state and local approval, local units of government are responsible for implementing the plan. Water quality improvements are achieved through mandatory and voluntary implementation of BMPs and adoption of local 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 help design BMPs and state funds are available to help with installation costs. Cost-share agreements include eligible practices, cost-share amounts, and an implementation schedule. Municipal governments are also assisted in developing and installing BMPs to help reduce urban pollutants.

- Information and education activities are developed to encourage stakeholder participation.

- DNR and DATCP monitor implementation progress of counties and municipal governments and provide assistance throughout the ten-year project.

Legal Status of the Nonpoint Source Control Plan

The Fond du Lac River Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 281.65 Wis. Stats. and Chapter NR120, Wisconsin Administrative Code. The plan was prepared through the cooperative effort of the DNR, DATCP, the Fond du Lac County Land Conservation Department, the Winnebago County Land and Water Conservation Department, and Citizen's Advisory Committee.

This watershed plan provides the basis for the DNR to enter into cost-share agreements and to provide implementation guidance. If a discrepancy occurs between the plan and state statutes or administrative rules, or if statutes or rules change during implementation, statutes and rules supersede the plan. This watershed plan does not in any way preclude use by local, state, or federal governments of existing environmental protection regulations, and 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, Wis. Stats. to regulate NPS pollution in the planning area.

This priority watershed plan was approved by DNR following approvals by the Land and Water Conservation Board, and both the Fond du Lac and Winnebago County Boards

Amendments to the Plan

For substantive changes this plan is subject to the amendment process under NR120.08(4), Wis. Adm. Code. The DNR, in consultation with local sponsors, will determine 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 Watershed Management under Chapter 283, Wis. Stats. This program is separate from the NPS Program and applies to certain classes of dischargers statewide as identified in NR 216, Wis. Adm. Code. In cases where programs overlap, implementation agreements apply only to activities identified in the watershed plan. Practices to control construction site erosion and storm water runoff from new development are not eligible for cost sharing. However, cost sharing is available in industrial areas and nonindustrial parts of facilities where the plan identifies pollution problems as specified in NR 120.10 (1)(g) Wis. Adm. Code.

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the Fond du Lac River Priority Watershed Project began in 1996. Information gathering and evaluation activities completed during this stage included the following:

- Determine the uses and condition of groundwater, streams, and lakes.
- Inventory types of land uses and the severity of nonpoint pollution sources affecting groundwater, streams and lakes.
- Evaluate the types and severity of other factors that may affect water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions. This evaluation has been completed through ongoing integrated resource management planning efforts in the Fox/Wolf River Basin.
- Determine NPS pollution controls and other measures necessary to improve and protect water quality.
- Generate public support for the plan to enhance local implementation.

Implementation Phase

The implementation phase of the Fond du Lac River Priority Watershed Project began following review of the draft priority watershed plan, a public hearing, and approval by DNR, LWCB, DATCP, and the Boards of Supervisors for Fond du Lac and Winnebago Counties. Public review during plan development occurred primarily through the efforts of the project's Citizen Advisory Committee.

During the implementation phase:

- DNR enters into local assistance agreements with counties and municipalities having implementation responsibilities identified in the plan.
- In rural portions of the watershed county conservation staff contact eligible landowners to determine interest in BMPs identified in the plan.
- In urban portions of the watershed the DNR or its designee contact local units of government to discuss implementation. In some situations, local units of government and the DNR sign agreements for urban practices. In other situations, agreements are between local units of government and private landowners.
- In rural areas landowners sign cost-share agreements with the county outlining practices, costs, cost-share amounts, and a schedule for installation of management practices. Practices are scheduled for installation after an agreement is signed and must be maintained for at least 10 years. At a minimum easements are in affect for 20 years; however, initial efforts will be made to enter into perpetual easements.
- Similar processes are used in urban areas.

Location, Land Use, and Community Information

The Fond du Lac River Watershed is a 249-square-mile drainage basin extending to the south and west of Oshkosh in Winnebago County, to just south of Oakfield in southern Fond du Lac County, including the western two-thirds of the City of Fond du Lac and the Town of Rosendale to the west. The Fond du Lac River is one of the southern-most watersheds in the Fox/Wolf River Basin comprising four percent of the 6,400 square mile basin.

Civil Divisions

The Fond du Lac River Watershed lies within Fond du Lac and Winnebago Counties. Incorporated areas include the cities of North Fond du Lac, the western two-thirds of the city of Fond du Lac, the Southern one-third of Oshkosh, and the villages of Rosendale, Eldorado, Van Dyne, Rogersville, Lamartine, and Oakfield. Public land within the

watershed includes the 6,000 acre Eldorado Marsh as well as several other smaller parks and natural areas throughout the watershed. (See Map 1-1 for civil divisions).

Population Size and Distribution

The Fond du Lac River Watershed population is estimated at 59,939 people; approximately 78 percent live in the cities of Fond du Lac and Oshkosh, and the villages of North Fond du Lac, Oakfield, and Rosendale. The remainder live in the rural townships of Byron, Eldorado, Fond du Lac, Friendship, Lamartine, Oakfield, Ripon, Rosendale, Springvale, Black Wolf, Nekimi, Utica, and Algoma. Population projections for the watershed indicate a 3.5 increase between 1990 and 2020.

Land Uses

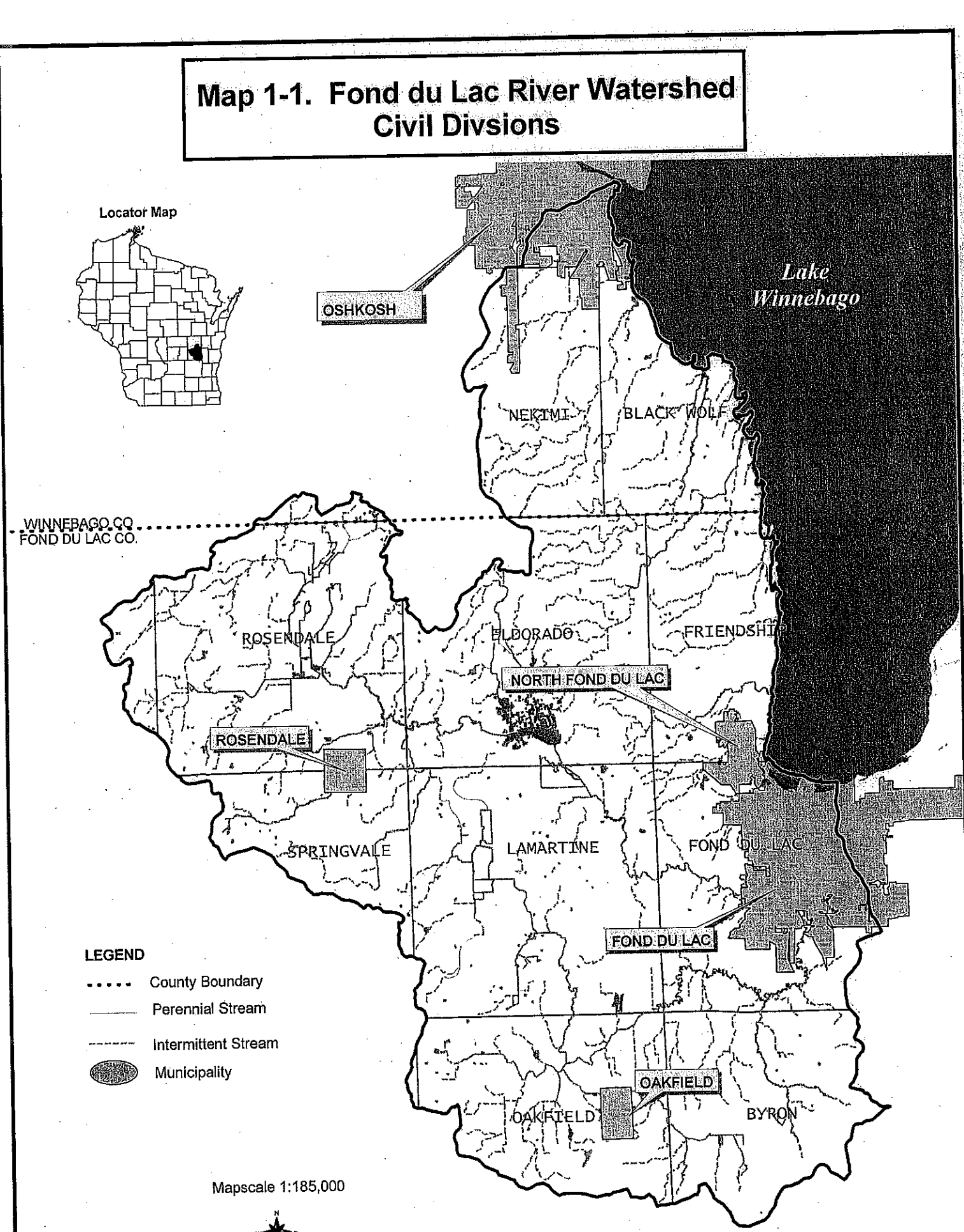
Rural land uses are prevalent in the watershed; agriculture is the most predominate land use, comprising 80 percent of the total. Dairy farming is the primary enterprise, with an average farm size of 214 acres. Woodlands are scattered throughout and cover four percent of the land area. Developed land uses occupy less than two percent of the watershed (Table 1-1).

Table 1-1. Land Use Distribution in the Fond du Lac River Watershed

Land Uses	Acres	Percent[2]
Agricultural	124,429	80
Pasture	(1,301)	(1)
Cropland	(123,128)	(79)
Natural Areas	3,164	2
Woodland	6,984	4
Developed	3,742	2
Wetland[1]	18,538	12

[1] These are estimates of wetland acres based on WINHUSLE inventory data. The estimates are of actual wetland acres, not cropped wet fields. See wetland section in this chapter for a more comprehensive estimate of wetland acreage.
[2] These percentages are based on extrapolated numbers form a 20 percent inventory.
Source: Fond du Lac County LCD and Winnebago County LWCD

Map 1-1. Fond du Lac River Watershed Civil Divsions



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
June 2000

CHAPTER TWO:
Watershed Conditions and Objectives

This chapter includes watershed physical characteristics, existing conditions, nonpoint pollution sources, and plan objectives for the Fond du Lac River Priority Watershed.

Physical Setting

Climate and Precipitation

Frequency, duration, and amount of precipitation influences surface and groundwater quality and quantity, soil moisture, runoff characteristics, and the physical condition of waterways within the watershed. Winters in this area are relatively long, cold and snowy; summers are mostly warm and humid. Typically the change from spring to summer is gradual and the change from summer to fall is abrupt. Mean annual precipitation is about 29 inches of rain, most falling during the growing season (May - September). Most runoff occurs in February, March, and April when the land surface is frozen and soil moisture is high.

Topography

Regional relief is largely controlled by underlying bedrock and glacial drift and divided into east and west physiographic regions. The area east of the Niagara Escarpment extends from the village of Pipe to the Horicon Marsh and is known as the Eastern Ridges of Wisconsin. This area has been modified by glacial features including kettle moraine, drumlins, and kames. West of the Niagara Escarpment topography is nearly level to sloping and includes some of the best farming soils in the area. Most of the Fond du Lac River Watershed is located in this region.

Geology

Rocks which underlie the Fond du Lac River Watershed range in age from Precambrian to Quaternary. The rock formations can be divided into two categories: (1) consolidated bedrock consisting of older crystalline rocks such as granite and of younger sedimentary rocks such as sandstone, shale, and dolomite; and (2) unconsolidated material consisting of sorted and unsorted deposits of sand, gravel, and clay. These deposits were formed during the Pleistocene geologic age by advancing and retreating glaciers. This movement eroded bedrock and deposited mantles of sand, gravel, and clay.

Erosion by a lobe of the glacier which moved down Green Bay to slightly beyond the Horicon Marsh, cutting deeply into the Maquoketa Shale, formed the broad valley of Lake Winnebago and the bulk of the watershed area. The harder Silurian dolomite along the eastern side of the watershed resisted erosion and still remains as part of the Niagara Escarpment.

Soils

Soils of the Fond du Lac River Watershed originate from three major sources: continental glaciation, bedrock weathering, and fluvial action. The majority of soils in the watershed are grouped in the following soil associations:

- Lomira-Virgil association: Well-drained to somewhat poorly drained, silty, moderately permeable soils underlain by calcareous loam till.
- Plano-Mendota association: Well-drained, silty, moderately permeable soils underlain by neutral or calcareous loam till.
- Beecher-Elliott association: Somewhat poorly drained, silty and clayey, moderately permeable soils underlain by moderately alkaline shale and till with a high shale content.
- Kewaunee-Manawa-Poygan association: Well-drained to poorly drained, silty and clayey, moderately slowly to slowly permeable soils underlain by calcareous sand and gravel.
- Houghton-Palms association: Organic soils over calcareous outwash, till or lacustrine deposits.

The nature of soils within the watershed affect the rate, amount, and quality of the surface water runoff. The soil erosion potential is based on texture, structure, organic matter content, permeability, slope, and position on the landscape.

Wetlands

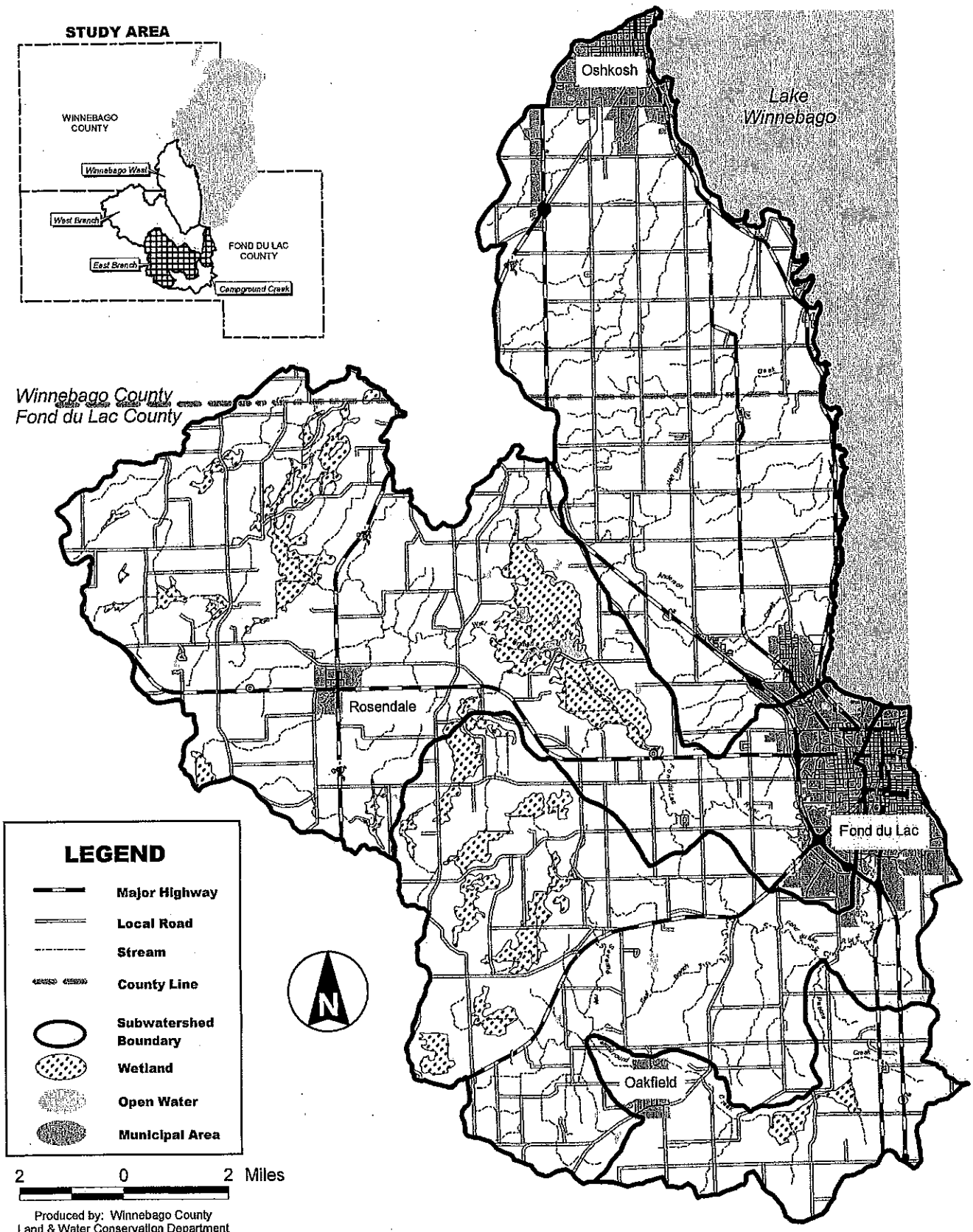
Wetlands are valuable natural resources providing wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff and flood flows, and removal of pollutants. Wetlands in the watershed are mainly in the Fond du Lac River floodplain. Extensive wetland areas are also located along the riparian corridor of Van Dyne Creek. Floodplain wetlands support furbearers and waterfowl populations and provide seasonal habitat for sport fish.

Since wetlands are an important ecological resource converted, prior-converted, or degraded wetlands identified by watershed staff are eligible for restoration. Measures will also be taken to protect existing wetlands.

Recreation

The streams, wetlands, and lakes in the watershed offer diverse and high-quality recreational opportunities including fishing and boating. Other popular watershed activities include wildlife observation, hiking, hunting, and trapping. The entire Lake Winnebago System is of great economic importance to the area due in part to the tourism industry.

Map 2-1. Subwatersheds in the Fond du Lac River Priority Watershed Project



Water Resource Conditions and Goals

The purpose of the surface water resource appraisal is to characterize existing and potential water resource conditions; identify causes of surface water use impairments; provide preliminary surface water resource goals and objectives; and provide the pollutant load reductions necessary to meet subwatershed objectives.

The Fond du Lac River Watershed ranked as a high priority for surface water concerns and a medium priority for groundwater concerns in the Upper Fox River Water Quality Management Plan (WDNR, PUBL WR-225-90). The project compliments the Winnebago Comprehensive Management Plan in addressing pollutant load reductions to Lake Winnebago.

Summary of Water Resource Conditions

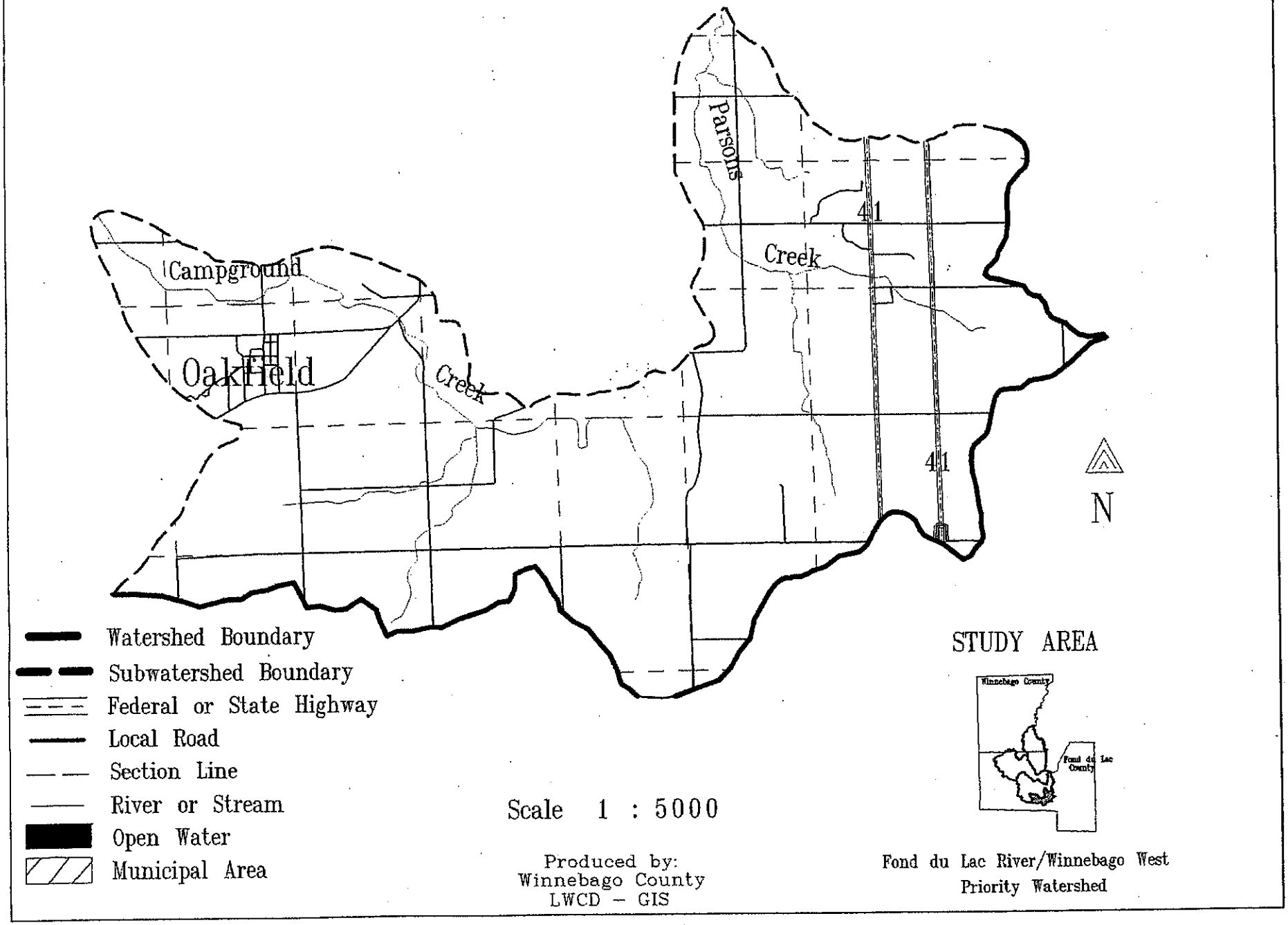
DNR staff with assistance from County and DATCP staff developed plan goals and objectives based, in part, on existing water quality conditions. Objectives are identified and listed for each subwatershed and for both rural and urban nonpoint sources (NPS)s of pollution.

The Fond du Lac River Watershed covers 249 square miles (159,119 acres) and is located in the counties of Fond du Lac (83 percent) and Winnebago (17 percent). Land use is primarily agriculture and residential. Wetlands in the watershed are limited. The watershed originates at the headwaters of the East and West Branches of the Fond du Lac River. Two miles of Parsons Creek has been designated as an Exceptional Resource Water (ERW). Section NR 102.11, Wis. Adm. Code defines an ERW 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." Approximately 165 miles of streams are located in the watershed that drains into Lake Winnebago, the state's largest inland lake. Parsons Creek and a portion of Campground Creek are the only streams currently classified as Cold Water Trout. The watershed includes two lakes: Lake Winnebago (137,708 acres) and Raspberry Lake (11 acres).

Table 2-1. Size of Subwatersheds in the Fond du Lac River Priority Watershed

Watershed Abbreviations	Subwatershed	Drainage Area (square miles)	Size (acres)
CC	Campground Creek	19.8	12,674
EB	East Br. Fond du Lac River	64.6	41,340
WB	West Br. Fond du Lac River	92.5	59,215
WW	Winnebago West	71.7	45,890
	Total:	**248.6**	**159,119**

Map 2-2. Campground Creek Subwatershed



Campground Creek (CC)

Campground Creek is the smallest of the four subwatersheds (12,674 acres); it contains two named streams (Parsons and Campground Creek), and several unnamed intermittent and perennial tributaries. There are several drainage ditch systems covering large expanses of agricultural soils. These systems maintain flow throughout the entire year contributing large amounts of soil to adjacent surface waters. This subwatershed contains 9.0 miles of stream classified as Cold Water Class I and II trout water. Parsons Creek has two miles of the trout water considered to be Exceptional Resource Waters as defined by S.NR 102.11, Wis. Adm. Code. This subwatershed has a drainage area of 19.8 square miles with land use dominated by agriculture: dairy farming, cash cropping, and vegetable production. The remaining land uses include wetlands, woodlands, and residential development.

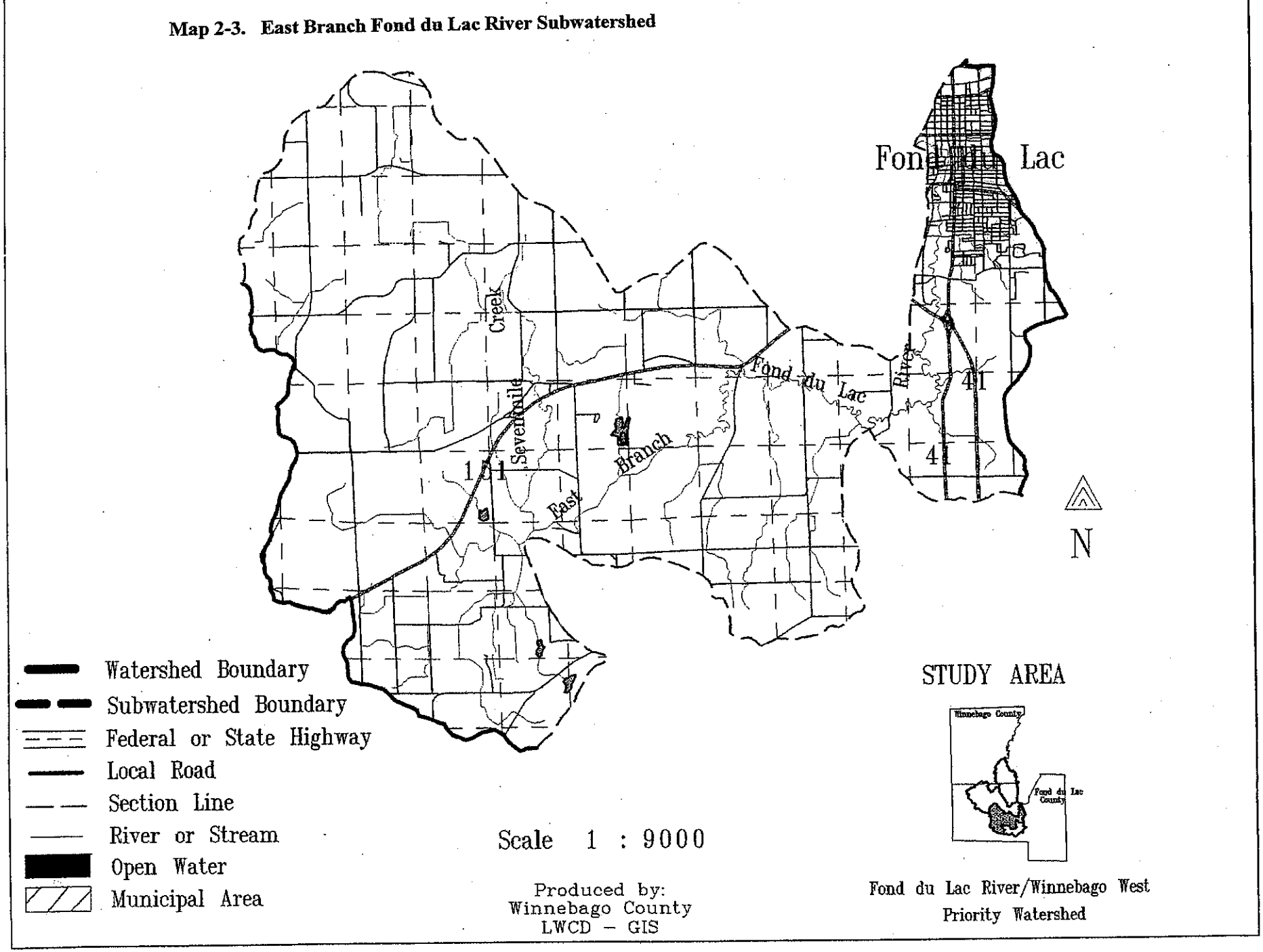
Campground Creek, also known as "Byron Creek", originates from springs located at the base of the Niagara escarpment in the township of Byron. This creek is 8.0 miles in length, and has a drainage area of 10.8 square miles (6,912 acres). Campground Creek is one of two main tributaries to the East Branch of the Fond du Lac River. It enters the East Branch in the township of Oakfield located northwest of the Village of Oakfield. Land use is dominated by agriculture, woodlands, wetlands, and residential development.

Historically farmers pastured livestock immediately adjacent to the stream corridor causing streambank failure. Old scars still remain although the banks have begun to stabilize with vegetation. For example, at CTH Y outside of Oakfield soft, deleterious substrate has been replaced by course sand, gravel, rubble, and boulders. Several areas, however, still include overgrazing of stream corridors resulting in sedimentation, stream bank erosion, and water quality degradation.

Parsons Creek originates from springs located at the base of the Niagara Escarpment in the township of Byron. The creek is 4.3 miles long with a drainage area of approximately 8.0 square miles. Parsons Creek is a tributary to the East Branch of the Fond du Lac River; its confluence is located in the township of Fond du Lac. The creek has the steepest gradient in the watershed dropping on average 41.0 feet per mile of stream. Land use is dominated by agriculture, pasture, woodland, narrow wetlands, and recent residential development.

These streams are both affected by elevated temperatures, wetland loading, streambank erosion, sedimentation, barnyard/agricultural runoff, low flow, urban runoff, and construction site erosion. This entire subwatershed drains into the East Branch of the Fond du Lac River.

Map 2-3. East Branch Fond du Lac River Subwatershed



East Branch Fond du Lac River (EB)

As the second-smallest subwatershed, the East Branch Fond du Lac River covers 41,340 acres in Fond du Lac County, draining 64.6 square miles. It contains two named rivers (East Branch Fond du Lac and Sevenmile Creek), one named lake (Raspberry Lake), and several unnamed intermittent and perennial tributaries. Several drainage ditch systems cover large expanses of agricultural soils. These systems maintain flow throughout the entire year transporting large amounts of sediment to adjacent surface waters.

This subwatershed contains several miles of unnamed perennial and intermittent tributaries draining into the East Branch Fond du Lac River. Some of the tributaries are drainage ditches constructed for agricultural benefits. Most of these ditches flow throughout the year transporting tremendous amounts of sediment and nutrients into the East Branch system.

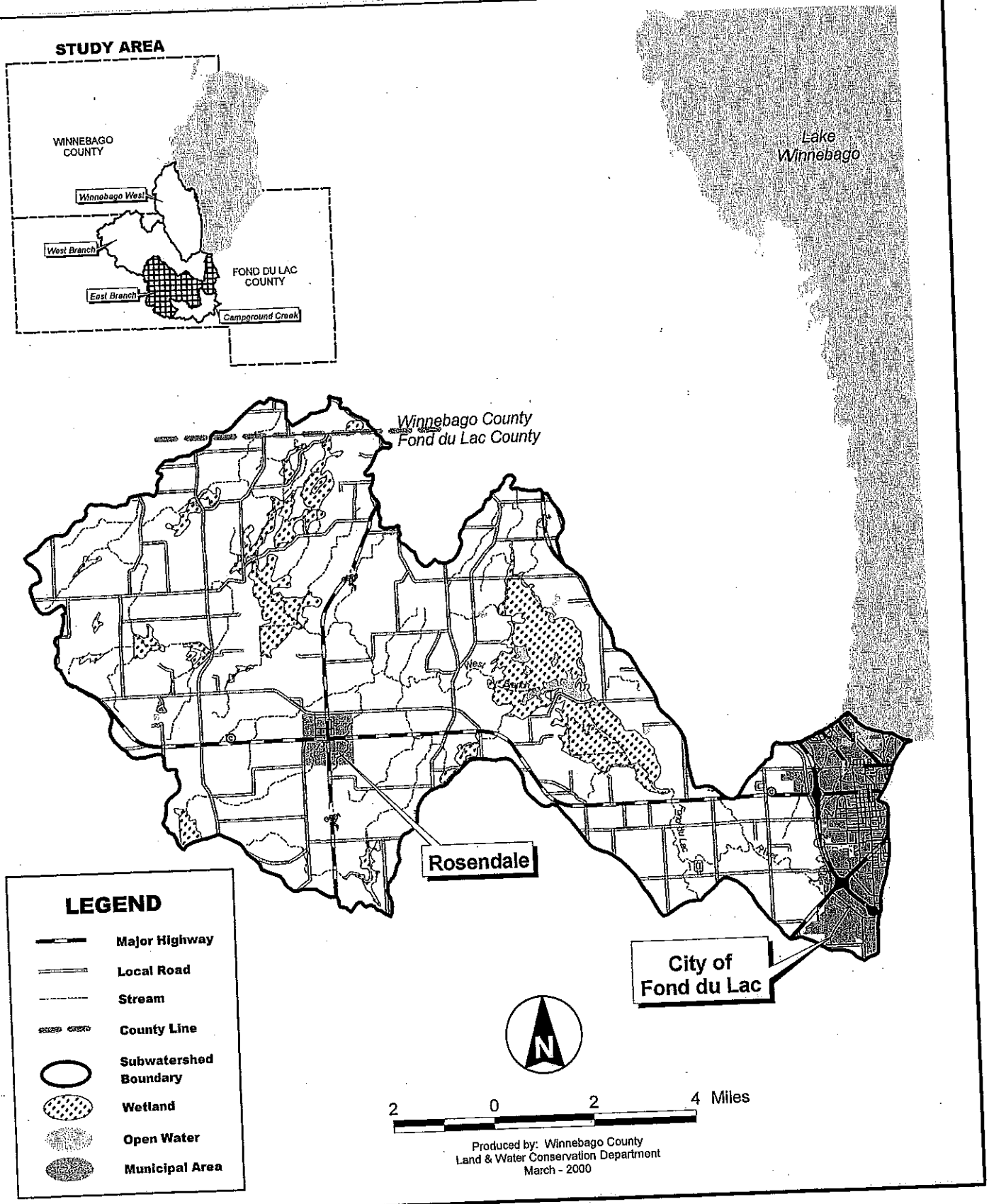
Raspberry Lake is located along the southern border of Fond du Lac County in the township of Oakfield. This drainage lake is an impoundment created by the Mammoth Springs Canning Company on a small un-named tributary to the East Branch of the Fond du Lac River. This lake covers 11.4 acres and has a maximum depth of 14 feet. Land use is dominated by agriculture, woodlands, wetlands, and residential development. A small wetland surrounds the lake providing valuable wildlife habitat. Factors affecting water quality include barnyard runoff, agricultural runoff, excessive plant and algal growth, sediment and nutrient loading, and periodic fish kills. The lake and adjacent land are owned by the Mammoth Springs Canning Company. The Oakfield Sportsmen's Club leases the property providing public access. A small, unimproved boat landing provides access for non-motorized watercraft. Raspberry Lake has a small area designated as an overnight campground. This is a hypereutrophic lake and has had historical problems with winter fish kills directly associated with excessive plant and algae growth. Fishing for largemouth bass, pan fish, bullheads, and northern pike occurs in this lake.

The East Branch Fond du Lac River originates at the confluence of Sevenmile Creek and Campground Creek in the township of Oakfield. The river is 14.5 miles long with a drainage area of 82.1 square miles. The East Branch has the lowest gradient (5.5 feet per mile) of all surface waters in the watershed and is highly susceptible to sediment deposition. Land use is dominated by agriculture consisting of dairy farming, cash cropping, and vegetable production. Remaining land use consists of large wetlands, urban areas, residential development, and woodland.

Sevenmile Creek, one of the two main tributaries to the East Branch Fond du Lac River, originates in a large wetland complex northwest of Lamartine. Sevenmile Creek is 11.0 miles long and has a 20.8 square mile drainage area.

Rogersville tributary is an intermittent stream originating from a small waterway in the township of Lamartine. This 2.5 mile stream drains in a northeasterly direction toward a small wetland. Land use in this area is dominated by intense agriculture, with small areas of wetlands.

Map 2-4. West Branch Fond du Lac River Subwatershed



The East Branch Fond du Lac River is 14.5 miles long and covers an 82.1 square mile drainage area. This river originates at the confluence of Sevenmile and Campground Creek located northwest of Oakfield. This system flows through the most intensively managed agricultural land in the entire watershed.. The creek is 5.6 miles long, drains 20.8 square miles, and has a gradient of 8.0 feet per mile. It enters the East Branch in the township of Oakfield northwest of the Village of Oakfield. Land use is dominated by agriculture, woodlands, wetlands, and residential development.

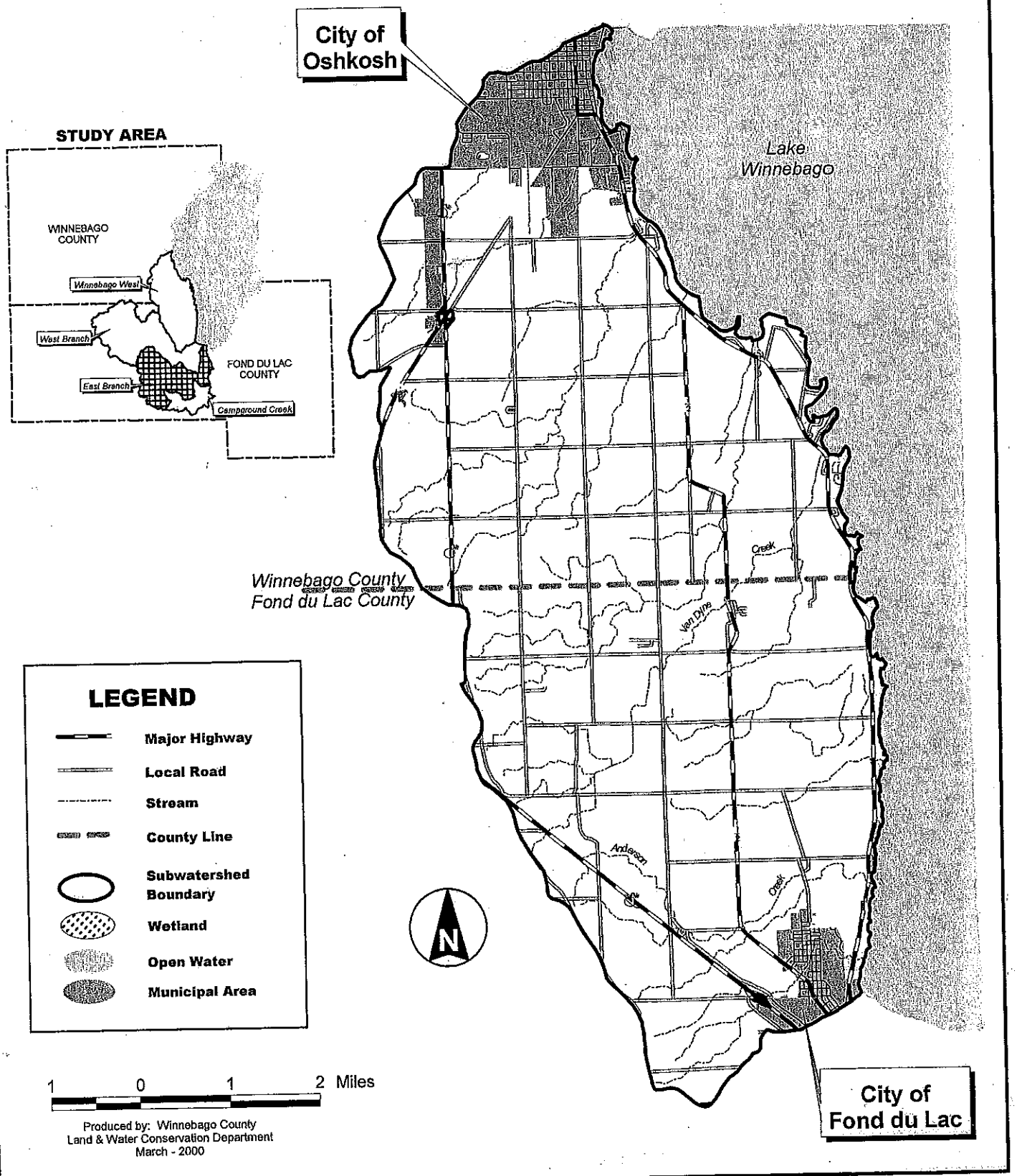
West Branch Fond du Lac River (WB)

The West Branch Fond du Lac River is the largest of the four subwatersheds covering 59,215 acres and draining 92.5 square miles. The majority of this subwatershed is located in Fond du Lac County. Land-use consists of agriculture (dairy and cash cropping), wetlands, urban and rural residential development, woodlands, and lands enrolled in the Conservation Reserve Program (CRP). Surface waters in the subwatershed include the Eldorado Marsh, West Branch Fond du Lac River, Rosendale tributaries, and several unnamed intermittent and perennial tributaries. The Eldorado Marsh covers approximately 6,300 acres and makes up 10 percent of the subwatershed. In 1963, a dike was constructed on the West Branch Fond du Lac River to create what is known today as the Eldorado Marsh Wildlife Area. This marsh was created as a "Canadian Goose Satellite Area" providing valuable habitat for migrating Canada Goose populations, which in return provides relief to the Horicon Marsh Wildlife Area. Several drainage ditch systems cover large expanses of agricultural land maintaining flow throughout the entire year transporting large amounts of sediment to adjacent surface waters.

Eldorado Marsh is located in north central Fond du Lac County, covers 6,000 acres, and has a drainage area of 40,320 acres (63 sq. mi.). In 1951 the Wisconsin Conservation Commission established the Eldorado Marsh as a wildlife area. Land was purchased with Pittman Robertson Funds which are generated from an excise tax on guns and ammunition and ear marked for wildlife use. In 1963, a long dike was constructed on the West Branch of the Fond du Lac River creating the large wetland complex. The wetland was created for several reasons, most importantly to preserve the marsh and prevent further attempts to drain or have it developed. The Eldorado Marsh is one of several "Canada goose satellite areas" created to relieve waterfowl overcrowding on the Horicon Marsh. This wetland is highly diverse, and contains a wide range of flora and fauna common in wetland and upland habitats. Bird surveys conducted in 1965 to 1967 found 144 different species. No threatened or endangered species are known to exist in this area.

Features of this wetland area include a large heron and egret rookery; a 1,060 acre wildlife refuge; a 23 acre flora / fauna refuge for the Fond du Lac School District; a hiking trail; and a dog training area. Wildlife biologist, Maureen Rowe described the Eldorado Marsh as a biological gem located in a biological desert". Wildlife managers are continually working to enhance, restore, and protect this valuable resource. Shallow scrapes, small ponds, and upland prairie restoration are all methods used to enhance this wildlife area. A management goal for Eldorado Marsh Wildlife Area is to add an additional 260 more acres to area increasing the total size to 6,257 acres. Vegetative cover types within the Eldorado Marsh boundary include: cattail marsh (2,767 acres / 45.7%),

Map 2-5. West Winnebago Subwatershed



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Land & Water Conservation Department
March - 2000

grass / sedge meadow (546 acres / 9.0%), farmland (1,589 acres / 26.3%), upland / lowland woods (560 acres / 9.3%), lowland brush (328 acres / 5.4%), and dense nesting cover / native grass (263 acres / 4.3%). Land use adjacent to this wetland consists primarily of agriculture but also includes urban areas and small wood lots.

The West Branch Fond du Lac River is 26.0 miles in length with a drainage area of 85.1 square miles (54,464 acres). This river originates north of Rosendale and flows southeast before entering the Eldorado Marsh; after leaving the marsh it flows southeast before becoming the main stem in the City of Fond du Lac. The river system provides the major source of water for the Eldorado Marsh. The section of river upstream of STH 23 has low gradient features while downstream of STH 23 to CTH VVV has a much greater gradient (20 to 30 ft. per mile). Land use is dominated by agriculture, large wetlands, narrow woodlots, agricultural lands not in production (CRP, HRA), urban developments, and small rural subdivisions.

The unnamed tributary at the Village of Rosendale is 6.0 miles long and originates from a small wetland in Springvale township. This creek is a tributary to the West Branch Fond du Lac River. The tributary enters the West Branch two miles northeast of Rosendale. Land use is dominated by agriculture, small wetlands, narrow woodlots, and urban development.

Winnebago West (WW)

The Winnebago West Subwatershed is the second largest subwatershed totaling 45,890 acres and draining a 71.7 square mile area. This subwatershed, is split almost equally between Winnebago and Fond du Lac counties. Land-use consists of agriculture (cash / dairy farming), urban / rural development, lands in CRP, wildlife production areas (WPA), and wetlands. Surface waters located in Winnebago West include Lake Winnebago, Anderson Creek, Mosher Creek, Van Dyne Creek, several miles of unnamed tributaries, and several drainage ditch systems covering large expanses of agricultural lands. This subwatershed contains several miles of unnamed perennial and intermittent tributaries, including some agricultural drainage ditches, flowing directly into Lake Winnebago. Most of these ditches maintain flow throughout the year; others only have visible flow during periods of runoff. These systems transport a tremendous amount of sediment and nutrients from agricultural uplands to Lake Winnebago.

Anderson Creek is 5.0 miles long and with a drainage area of 8.1 square miles (5,127 acres). It is an intermittent tributary to Lake Winnebago with a gradient of 14.3 feet per mile. The creek originates just west of STH 41 in the township of Eldorado, flows northeast before entering Lake Winnebago just outside the city limits of North Fond du Lac. Land use is dominated by intense agriculture, small wetlands, and urban development.

Mosher Creek is 3.0 miles long and has a drainage area of 4.1 square miles (2,624 acres). Mosher Creek is a intermittent tributary to Lake Winnebago with a gradient of 20.0 feet per mile. The creek originates southwest of STH 41 in Lamartine township and flows northeast through North Fond du Lac before entering Lake Winnebago. Land-use consists primarily of agriculture, urban development, and a limited amount of wetlands. The lower reaches of Mosher and Anderson Creek are both influenced by the lake levels maintained in Lake Winnebago.

Van Dyne Creek is 8.0 miles long with a drainage area of 9.6 square miles (6,138 acres). The creek originates northeast of the Eldorado Marsh in the township of Eldorado and flows northeast through Van Dyne before entering Lake Winnebago between Little Point and Black Wolf Point. Van Dyne Creek is an intermittent tributary to Lake Winnebago with a gradient of 13.7 feet per mile. Agricultural cropland, small woodlots, narrow wetlands, and urban development dominate land use.

Appraisal Monitoring Methods

Following is a brief description of monitoring activities completed for the surface water appraisal, August 1995 to September 1996. Monitoring procedures are consistent with the QA/QC control "Field Procedures Manual" (WDNR, 1988). Historical monitoring data from the Bureau of Water Resources and Fisheries Management is referenced in this chapter.

Macroinvertebrates

Aquatic macroinvertebrates were collected at 13 locations in the watershed using methods described in Hilsenhoff (1977, 1982). Sites were selected at representative locations throughout the watershed to provide information on an individual subwatershed basis. Samples were taken from riffle areas using a D-Frame net and the "kick" method. Specimens were placed in mason jars and preserved first with a solution of 95 percent ethanol, then drained and replaced in a solution of 70 percent ethanol. The samples where delivered to the University of Wisconsin Stevens Point, sorted and identified. Sample results were evaluated using the Hilsenhoff Biotic Index (HBI) (Hilsenhoff, 1987), or Hilsenhoff Family Biotic Index (FBI), (Hilsenhoff, 1988) and Ephemereoptera, Plecoptera, and Trichoptera (EPT) Index (Plafkin et al. 1989). The HBI and FBI provide a relative measure of organic loading to the stream. Percent EPT is the percent of Ephemeroptera, Plecoptera, and Trichoptera genera out of the total number of genera in a sample. These insect orders are generally considered intolerant of pollution.

Habitat Evaluations

Stream habitat conditions were evaluated in all of the subwatersheds in spring and fall, 1996. A matrix is used to numerically rank physical habitat characteristics that may limit the quantity and quality of aquatic life (Ball, 1982). In-stream habitat was also evaluated at five sites in Parsons Creek and the West Branch Fond du Lac River according to methods developed by Lyons (et al. 1994).

Dissolved Oxygen/Temperature

Continuous dissolved oxygen and temperature meters were deployed in streams throughout the watershed for seven-day periods in July and August. Grab samples were collected at other locations. Chapter NR 102, Wis. Admin. Code, establishes dissolved oxygen water quality standards required to support fish and aquatic life. Standards for warm water and cold water streams are 5.0 mg/l and 6.0 mg/l respectively.

Electro-Fishing Surveys

Electrofishing surveys were conducted at 17 sites throughout the entire watershed. Sites were surveyed with streamboat and backpack electrofishing gear according to methods developed by Lyons (1992, 1996) for warm and cold water systems. Data was analyzed and Index of Biotic Integrity (IBI) scores were generated.

Signs of Success (SOS)

A SOS site was not selected although several have been identified as suitable candidates including sites on Parsons, Campground, and Sevenmile Creeks. The Land Conservation Department of Fond du Lac County will select a site and monitoring activities will be conducted according to the guidelines developed by Cahow (1996). After the PRE/POST monitoring has been completed an informational pamphlet is prepared to use of cost share agreements.

Table 2-2. Water Use Classifications

Classification	Description
COLD	Cold water community - includes surface waters capable of supporting a cold water fishery and other aquatic life and serving as a spawning area for cold water species. This includes three levels of cold water classification (CLASS I, II, or III).
WWSF	Warm water sport fish communities – includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning or nursery for warm water sport fish.
WWFF	Warm water forage fish communities - includes surface waters capable of supporting an abundant and diverse community of forage fish and other aquatic life.
LFF	Limited forage fishery (intermediate surface waters (INT-D) - includes surface water of limited capacity because of low stream flow, naturally poor water quality, or poor habitat. These surface waters are capable of supporting only a limited community of tolerant forage fish and aquatic life.
LAL	Limited aquatic life - includes surface waters of limited capacity because of very low or intermittent flow and naturally poor water quality or habitat. These surface waters are capable of supporting only a limited community of aquatic life.

Trout streams carry a separate designation found in the DNR publication "Wisconsin Trout Streams" (DNR Publication number. 6-3600(80)) and Outstanding/Exceptional Resource Waters, Wis. Admin. Code NR 102.20 and NR 102.11. Trout classes include:

Class I - trout streams are high quality with populations sustained by natural reproduction.

Class II - trout streams have some natural reproduction but may need stocking to maintain a desirable fishery.

Class III - trout streams have no natural reproduction and require annual stocking of legal-size fish to provide sport fishing.

Water quality goals are commonly described using the following:

- **Protection**: Maintaining the present biological and recreational uses supported by a stream or the reservoir. For example, if a stream supports a healthy cold water fishery and is used for full-body contact recreational activities, the goal seeks to maintain those uses.

- **Enhancement**: A change in the overall condition of a stream or lake within its given biological and recreational use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the goal focuses on

changing those water quality conditions which keep it from achieving its full biological potential.

- **Restoration**: Upgrading the existing capability of the resource to support a higher category of biological use. An example is a stream which no longer supports a healthy population of warmwater game fish. This goal seeks to improve conditions allowing viable populations of forage and warmwater game fish species to reestablish.

Monitoring Results by Subwatershed

This section includes a summary of the surface waters in each of the four subwatersheds including monitoring results, observations, problems, causes of degradation, and the surface water resource potential. Appendix A summarizes existing and potential biological uses, potential use attainment, and limiting factors affecting the surface water resources. A summary of the 1996 monitoring activities is included in Appendix B.

The following subwatershed descriptions provide a summary of the current and potential surface water resource conditions, sources of pollutants and other factors impairing surface water quality, 1996 monitoring results, and surface water resource management goals and objectives.

Campground Creek Subwatershed (CC)

Factors affecting water quality include sediment and nutrient loads from farm fields, barnyard runoff, streambank erosion, overgrazing of pasture areas, historical fish kills, canning waste runoff, turbidity, sediment bedload transport, hydrologic manipulation, construction site erosion, and urban runoff. The biological use classification for campground Creek is Cold Water Class II for 3.3 miles; the remaining 4.7 miles is classified as a Warm Water Sport Fishery (WWSF).

While Campground Creek has been stocked with trout for several years none were observed in 1996 fish shocking surveys. (For a complete breakdown of species by location refer to Appendix II). While Campground Creek has an abundant forage fishery, including 14 different species, most are tolerant forage fauna typically found in warm or cool water systems. Cold Water Index of Biotic Integrity (IBI) scores (Table 2-3) were generated with results ranging from poor (10) to very poor (0), indicating severe degradation and decimation of native cold water fauna. A variety of point and nonpoint sources of pollution over the past 20 to 30 years are the major limiting factors affecting the cold water fish community, and contributing to fish kills. Fisheries data as far back as 1962 indicates fish kills occurred on a frequent basis and were directly linked to improper disposal of canning wastewater. When wastewater was sprayed directly into Byron Creek bacteria breaking down wastewater created an increased demand for oxygen. Monitoring data indicated dissolved oxygen readings above the discharge were 10.0 mg/l; immediately downstream of the discharge the d.o. plummeted to 0.5 mg/l, leading to fish kills as a result of suffocation.

Table 2-3. Cold Water Biotic Integrity Scores

Surface Water	Location	Score	Rating
Parsons Creek	@ Hobbs Woods	10	Poor
Parsons Creek	@ Lost Arrow Road	0	Very Poor
Parsons Creek	@ STH 175	NSC [1]	N/A
Trib to Parsons Creek	@ Church Road	0	Very Poor
Campground Creek	@ River Road	0	Very Poor
Campground Creek	@ CTH Y	0	Very Poor
Tributary to Campground Creek	@ River Road	10	Poor
Sevenmile Creek	@ Veilbig Road	0	Very Poor
Sevenmile Creek	@ CTH Y	10	Poor

[1]NSC= No Score Calculated (<25 individuals)

Macroinvertebrate samples collected during the spring of 1996 indicated "fair to good" water quality with Hilsenhoff Biotic Index (HBI) scores ranging from 4.80 to 5.90, indicating the presence of organic pollution. Samples taken in 1983 indicated "poor to good" water quality. The "good" sample was located at CTH Y, while the poor samples were taken below the outfall of the Oakfield wastewater treatment plant (WWTP). See Tables 2-4 and 2-5 for sample and location information.

Habitat scores were generated at eleven sites according to methods outlined by Ball, 1982. Scores ranged from 107 to 229, reflecting "good" to "very poor" habitat. The scores were generally higher in the areas upstream of Oakfield. Several tributaries to Campground Creek scored above 200 (poor). These tributaries are significantly affected by nonpoint source pollution and have little habitat for aquatic organisms. See Table 2-8 for a list of scores by location.

Table 2-4. Index of Biotic Integrity Scores for Campground Creek (October 26, 1983)

Stream	Location	Biotic Index Score
Campground Creek	Oakfield, CTH Y, above WWTP	2.45 (Good)
Campground Creek	Oakfield, 40 yards above WWTP	2.95 (Fair)
Campground Creek	Oakfield, Thill Rd, below WWTP	3.82 (Poor)
Campground Creek	Oakfield, 100 yards below WWTP	2.97 (Fair)

Table 2-5. Water Quality Determination from Biotic Index Values

Biotic Index	Water Quality	State of the Stream
<1.75	Excellent	No Organic Pollution
1.76-2.25	Very Good	Possible Slight Pollution
2.26-2.75	Good	Some Pollution
2.76-3.50	Fair	Significant Pollution
3.51-4.25	Poor	Very Significant Pollution
4.26-5.00	Very Poor	Severe Pollution

Data Source: Tech. Bull. #132, 1982, W.L. Hilsenhoff

Two tributaries to Campground Creek on River Road supply sources of cold water throughout the year. The macroinvertebrate sample taken on the east tributary indicated the presence of "good" water quality, with a score of 4.880. Both of these tributaries run though agricultural areas but are fairly well buffered. The presence of water cress and marsh marigold indicate areas of strong groundwater upwelling or spring activity. These tributaries supply cold, highly oxygenated water to Campground Creek and helps to offset the poor water quality in the main stem of Campground Creek (above River Road) which is constantly in violation of NR 102 criteria.

When a coldwater system is decimated native cold water fish species take a long time to reestablish and, under some circumstances, may never reestablish. In April 1996, a large run of white suckers was observed in the East branch of the Fond du Lac River heading into Parsons Creek. Several dead white suckers were noticed which is typically a result of spawning activity. Historical fish kills during the spring and summer have been documented in this area and is likely the result of NPS source pollution, including manure runoff events.

Dissolved oxygen readings were recorded at 0.9 ppm and no fish were found during an electrofishing survey on August 8, 1996, at 12:25 pm. The only signs of aquatic life were leeches and frogs. Factors resulting in low oxygen levels include anoxic sediments, loading from adjacent wetlands, and excessive instream plant and algal growth. Over many years, the reach upstream of River Road has been channelized accumulating a tremendous amount of oxygen demanding sediment and organic material.

NPS pollution factors for Parsons Creek include barnyard runoff, streambank erosion, sedimentation, over-grazing of pasture areas, lack of habitat in lower reaches, flow, elevated temperatures, dissolved oxygen sags, and debris jams; all contributing to periodic fish kills. Parsons Creek is currently classified as having 1.9 miles of Class I trout water and 2.4 miles of Class II trout water. The remaining 1.7 miles have a biological use of Full Fish and Aquatic Life Trout (FALT). The creek also includes 2.0 miles (Hickory Road upstream to the headwaters) classified as Exceptional Resource Waters.

While Parsons Creek had been stocked with hatchery trout for several decades none were found in during a Electrofishing in the summer of 1996. Cold Water IBI scores were generated at three locations on Parsons Creek. The scores ranged from very poor (0) to poor (10), indicating environmental degradation has decimated the native cold water fishery. With the exception of the Hobbs Woods County Park, fish species consisted primarily of tolerant, warm water, forage fauna. The park was dominated by a native coolwater species called the pearl dace. No fish were observed on a tributary to Parsons Creek at Church Road.

Macroinvertebrate samples indicate the presence of good to very good water quality. Macroinvertebrate samples were collected at four locations during the spring of 1996. Results ranged from good (5.320) at STH 175 to very good (4.238) at a tributary to Parsons Creek at Church Road. For a complete listing of macroinvertebrate sampling sites and scores refer to Table 2-7. The Ephemeroptera, Plecoptera, and Trichoptera (EPT) ratios ranged from five percent to 37 percent. The EPT ratios represent organisms intolerant of pollution and indicative of good water quality. It is interesting to note the site with the best HBI score had the lowest EPT ratio. This site (located on a tributary to Parsons Creek on Church road) included a sample dominated by amphipods (*gammarus pseudolimnaeus).* Located in Hobbs Woods, this unique site, consisted of several species of stoneflies, mayflies, and caddisflies. However, aquatic midge larvae were also present and the overall the HBI scores indicated the presence of organic pollution. Sedimentation is also a major concern at this site.

Habitat assessments were conducted at six locations with scores ranging from good (94) to poor (223). The reach of stream from Hickory Road to STH 175 had the best habitat rating. This reach runs through a 59.2 acre parcel of land called "Hobbs Woods" which is owned and operated by Fond du Lac County. Down stream habitat scores were lower. Substrates changed dramatically from the headwaters downstream to the confluence with the East Branch Fond du Lac River. The headwater substrates were dominated by hard clay, sand, gravel, and cobble while the lower reaches were dominated by fine materials (sand, silt, and clay). Substrates in Hobbs Wood, which has included streambank enhancement efforts, consisted of cobble, gravel, clay, and some boulders.

However, there are still areas needing restoration. Riffle areas became less visible heading downstream. Available habitat for aquatic organisms (insects/ fish) also degrades from its headwaters to the confluence. Fishery potential could be greatly improved through the installation of habitat improvement structures (rip-rap, fencing, lunker structures, etc.). Several large snags in the lower reaches below CTH B should be removed as are depositing large amounts of sediment and causing surrounding banks to collapse.

Objectives

The following objectives are recommended for improving the surface water resources of Campground Creek Subwatershed.

- Significantly reduce sediment and nutrient loading from agricultural fields, intermittent waterways, and barnyards to enhance overall water quality.

- Improve the fishery, including restoration of coldwater species, by making habitat improvements.

- Protect streambanks and address gully erosion on Parsons and Campground Creek by implementing Best Management Practices (BMP's).

- Maintain native grassland buffers, grassed waterways, woodland, wetland, and upland buffers to help mitigate sediment erosion and nutrient enrichment.

- Maintain proper construction site erosion control practices on areas where soil has been disturbed through the use of environmentally protective land use planning, educational workshops, and installation of BMP's.

- Prevent fish kills through proper handling and disposal of canning wastes and livestock manure.

East Branch Fond du Lac River Subwatershed (EB)

The biological use classification for the East Branch Fond du Lac River is Warm Water Sport Fishery (WWSF). Factors affecting water quality include sediment and nutrient loads from agricultural fields, barnyard runoff, streambank erosion and turbidity, lack of habitat, flow rates, low dissolved oxygen levels, common carp, hydrologic manipulation, channelization, urban runoff, and construction site erosion.

The East Branch fishery is dominated by tolerant species such as the common carp, creek chubs, and common shiners. Electrofishing surveys conducted during the summer of 1996 revealed very few sport fish. The headwaters of the East Branch, upstream of CTH Y, were difficult to shock due to the extremely high specific conductance. (Specific conductance is a measure of the water's ability to conduct electric current. It is measured in mhos/cm, and is directly related to the amount of dissolved inorganic chemicals in the water). A few warmwater species intolerant of pollution (log perch, horneyhead chub, central stoneroller, and blacksided darter) were observed.

Macroinvertebrates, indicators of fair water quality, were sampled at two locations in spring and fall of 1980. Water quality results indicated water quality results ranged from very poor to good. Substrate located near CTH Y consisted primarily of cobble and boulders. Due to sedimentation this riffle complex no longer exists and the substrate is currently dominated by sand and other fine materials not providing adequate habitat for aquatic organisms.

Table 2-6. HBI Water Quality Scale for the East Branch Subwatershed

Hilsenhoff Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	Organic Pollution unlikely
3.51-4.50	Very Good	Possible slight organic pollution
4.51-5.50	Good	Some organic pollution probable
5.51-6.50	Fair	Fairly substantial pollution likely
6.51-7.50	Fairly Poor	Substantial pollution likely
7.51-8.50	Poor	Very substantial pollution likely
8.51-10.0	Very Poor	Severe Organic Pollution likely

The East Branch runs through the most intensively managed agricultural land in the watershed. Habitat evaluations were conducted at nine locations on the East Branch with scores ranging from 119 to 235 reflecting "good" to "poor" habitat (table 2-6). The best score was located on a small, unnamed tributary near the headwaters at STH 151 running through a small parcel of land currently owned by WDNR and managed as a Wildlife Protection Area.

The unnamed tributary originating southwest of Rogersville is 2.5 miles long and drains into a small, internally drained wetland. The entire length has an intermediate biological use dominated by tolerant macroinvertebrates and forage fish. Factors affecting water quality include: agricultural runoff, flow, habitat, temperature, dissolved oxygen, and sediment loads.

Factors affecting water quality in Sevenmile Creek include sediment and nutrient loads from agricultural fields, barnyard runoff, algal growth, low flows, temperature, summertime diurnal d.o. fluctuations, urban runoff, hydrologic manipulation, and construction site erosion. The biological use for Sevenmile Creek is currently unknown, however it has characteristics similar to a Warm Water Forage Fishery (WWFF).

The biological use for Sevenmile Creek is unknown, however it has characteristics of a WWSF. Macroinvertebrate samples indicated the presence of fair to poor water quality with substantial pollution likely. Fish surveys found several species of warm water sport fish present along with two intolerant forage species (see Appendix II for further information). Sevenmile Creek contains brown staining tannins released from headland wetlands. Factors affecting water quality include urban and rural NPS pollutants, wetland loading, dissolved oxygen sags, summertime plant / algae growth, sedimentation, and construction site erosion.

Electrofishing surveys during the summer of 1996 revealed large populations of tolerant forage fauna common in degraded warm water systems. Warm water sport fish were also present including bluegill, yellow perch, and largemouth bass. The stream survey found two species considered intolerant: central stoneroller and hornyhead chub. During spring 1996 large numbers of Northern Pike, and large runs of white suckers were observed in the town of Lamartine. These fish migrate out of Lake Winnebago and up the East Branch to spawn in the wetland headwaters of Sevenmile Creek.

Macroinvertebrate samples collected at two locations during the spring of 1996 were indicative of fair to poor water quality. The EPT values were both less than one percent. Samples were dominated by isopods (sow bugs) and diptera (aquatic midges), both indicators of poor water quality including organic pollutants. Organic pollutant loads are coming from several sources: wetlands, and runoff from barnyards, agriculture, and urban areas. Sevenmile Creek is a water system stained with tannins released from wetlands. Even though tannins give the water a brownish color visibility remains high. Habitat evaluations were conducted at six locations with scores ranging from 135 to 243 reflecting "fair to poor" water quality. The highest water quality score came from the area near CTH Y in Lamartine, while the lowest water quality score was obtained from the area northeast of Lamartine at CTH Y and south of CTH T. Instream fishery habitat doesn't appear to be a limiting factor as substrate is dominated by sheets of bedrock, gravel, sand, and fine silt and clay. Sedimentation from streambank erosion and agricultural runoff is a problem in parts of the stream. To prevent further degradation and to maintain important wildlife habitat, large wetlands at the headwaters should be protected and, where possible, enhanced. Several upland area barnyards should be cleaned up and managed with grassed waterways and buffer strips to reduce sediment loads.

Factors affecting water quality in the Rogersville tributary include low and intermittent flows, dissolved oxygen levels, temperature, sediment and nutrient loads, agricultural runoff, and lack of habitat. The current biological use of this tributary is Intermediate (INT-D) with a fishery consisting of tolerant forage fauna. Macroinvertebrates are also dominated by tolerant organisms, primarily isopods. Habitat limitations are due, in part,

to the intermittent nature of the stream. During extended dry periods the system is void of aquatic life and habitat. Wetland enhancements, grassed waterways, buffer strips and other BMPs would help to reduce sediment and nutrient tributary loads.

The Raspberry Lake fishery includes northern pike, largemouth bass, panfish, and bullheads. The lake receives a light amount of angling pressure from local residents. Waterfowl utilize the lake and wetland system for brood rearing as well as spring and fall migratory stops. Since this area is closed to the public for hunting it provides a waterfowl observation site. Water levels in the lake are regulated by a tin whistle structure, which has a surface flow discharge. During the summer discharge the water is warm, high in nutrients, and low in oxygen. Large growths of filamentous algae are visible just downstream of the tin whistle discharge. Visual inspection of macroinvertebrates below the tin whistle indicated the presence of mostly tolerant individuals, primarily isopods (sow bugs) and several species of chironomids (aquatic midge larvae). Aquatic habitat is also limited downstream of the outfall. Habitat assessment scores ranged from 183 to 224, indicating "fair to poor" water quality. The lowest water quality score was obtained downstream of the tin whistle. Both tributaries systems include barnyards which need to be addressed.

Objectives

The following objectives are recommended for improving the surface water resources of the East Branch Subwatershed.

- Significantly reduce sediment and nutrient loads from agricultural fields, intermittent waterways, and barnyards to enhance overall water quality.
- Significantly reduce upland sediment transport through conservation tillage programs.
- Significantly reduce sediment loads from streambank erosion through streambank stabilization (shaping, seeding, rip-rap, etc.).
- Protect and Enhance current wetlands on Sevenmile Creek.
- Restore wetlands previously altered for agricultural purposes to increase wildlife habitat and improve water quality.
- Maintain grassland buffers, grassed waterways, wetlands, and upland buffers to aid in retention of sediment and nutrients.
- Maintain proper construction site erosion control practices through the use of environmentally protective land use planning, educational workshops, and installation of BMPs.

West Branch Fond du Lac River Subwatershed (WB)

Factors affecting overall quality of the Eldorado wetland includes sediment and nutrient loads from agricultural runoff, summer and winter fish kills, biological oxygen demand from organic rich sediments, destruction of cattail stands, and sediment / nutrient loads from drainage ditch systems. The Eldorado Wetland biological use classification is 'deep water marsh'. If sedimentation continues as a major problem the size of the marsh will decrease and provide less open water habitat for migrating waterfowl. The dike located in the township of Eldorado and has created a 1,500 acre flowage. Due to frequent fish kills, the fishery in the flowage is limited primarily to tolerant forage and rough fish. Common carp are not a major concern due to the summer and winter oxygen problems.

Factors affecting water quality in the Rosendale tributary include sediment and nutrient loads from agricultural fields, barnyard runoff, habitat, turbidity, flow, d.o., temperature, hydrologic modification, urban runoff, and construction site erosion. The current biological use is Fish and Aquatic Life (FAL) for the first mile; the remaining five miles are INT(D). The fishery consists of tolerant forage fauna (fathead minnow, creek chub, white sucker, etc.). Macroinvertebrates are dominated by tolerant species, primarily asellus and gammarus. Habitat assessment scores ranged from 200 - 218, reflecting poor aquatic habitat. The habitat upstream of STH 26, is limited due to its small size, intermittent nature, and the soft sediments dominating the stream bed. Habitat downstream of Rose-Eld road is improved due in part to larger maintained flows and a substrate consisting of more sand, gravel, and cobble. Grassed waterways, buffer strips, construction site erosion control, and conservation tillage would help to reduce soil loss, and excessive nutrient loads.

Factors affecting water quality in the West Branch of the Fond du Lac River include sediment and nutrient loads from agricultural fields, barnyard runoff, streambank erosion, turbidity, wetland loads, hydrologic manipulation, urban runoff, and construction site erosion. The current biological use for the entire West Branch Fond du Lac River is Warm Water Sport Fishery (WWSF).

Electrofishing surveys during the summer of 1996 between CTH VVV upstream to STH 23 revealed 18 different fish species, including several eight species of sportfish. Fauna also included tolerant and intolerant forage fish. A few freshwater drum were the only rough fish present. Several species of fish indicative of healthy warm water systems were also found including logperch, central stoneroller, hornyhead chub, northern pike, grass pickerel, rock bass, and walleye. For a complete listing of species and locations see Appendix B.

One of the species present in all four reaches was the *Nocomis biguttatus,* or commonly called the Hornyhead Chub. Horneyhead Chub are extremely sensitive to turbidity and clean substrates. During spawning periods the Hornyhead Chub prefers gravel sized substrates not embedded with fine sediments. This three to six inch fish builds nests three

feet long, two feet in width, and one foot high. However, during the 1996 surveys five feet long, three feet wide, and two feet high nests were observed.

The river reach from CTH VVV to STH 23 has sufficient habitat, including mix of run – riffle – pool, to support a healthy sport fish population. Streambanks appear well vegetated and most corridors are well buffered. At several sites streambank erosion is a concern and should be addressed. Substrates are dominated by gravel with cobble, boulder, and sand. Diverse riffle substrate of boulder, cobble, and gravel provides excellent habitat for aquatic insects and fish propagation. During spring spawning migrations large runs of northern pike and white suckers are visible from most bridge crossings upstream of Lake Winnebago. Dead white suckers were visible on the bottom at several bridge crossings in the spring of 1996 due to exhaustion from vigorous spawning.

Macroinvertebrate samples were collected at three locations with scores ranging from 5.392 to 5.922 reflecting "good to fair" water quality, with organic pollution likely. Substrates are kept clean in this reach (CTH VVV - STH 23) due to steep gradients and fast water velocity. The EPT was less than one percent at all three sampling locations. Individual samples were dominated by riffle beetles, isopods, black fly larvae, and other midges, all species tolerate of moderate levels of organic pollution.

Habitat evaluations were conducted May 11 on the West Branch. Scores range from 83 to 206 reflecting "good" to "poor" habitat (see Table 2-8). The seven scores within the section CTH VVV to STH 23 ranged from 83 to 127. The averaged score was 97 which is indicative of "good" habitat. The best habitat score on the West Branch was from the Esterbrook Road area where agricultural practices appear more environmentally protective compared to the East Branch. Signs of conservation tillage, the cropland reserve program (CRP), habitat restoration areas (HRA's), native buffers, and grassed waterways are visible throughout the subwatershed and coincide with noticeable improvements in water quality.

With urban expansion into rural areas, construction site erosion is a major water quality concern. Storm water runoff from construction sites deliver tons of highly visible damaging sediment to urbanizing watersheds. During the summer of 1996, a 15 to 20 unit subdivision was constructed on Esterbrook Road adjacent to the river corridor and no effort was made to control construction site erosion. Due to the nature of the soils, steep slopes, and the lack of erosion control measures, large amounts of sediment were deposited in the West Branch. This site should have been properly stabilized using appropriate BMP's before construction was allowed to continue.

As rural areas in the Fond du Lac River Watershed become urbanized construction generated sediment will increasingly affect water quality. To cost effectively improve and protect water quality it will be critical to control concentrated sources of sediment. As the urban portion of the watershed increases each year construction related sediments will increasingly affect the water quality of Lake Winnebago and its tributaries. City and county erosion control ordinances, as well as state stormwater requirements (NR 216),

have been developed to mitigate construction site erosion. Cooperation between regulatory agencies and developers is critical for the success of this project.

Objectives

The following objectives are recommended to improve the surface water resources of the West Branch Subwatershed:

- Significantly reduce sediment and nutrient loads from agricultural fields and barnyard runoff to enhance overall water quality.
- Maintain proper native grassland buffers, grassed waterways, and other buffer areas to aid in nutrient uptake and sediment retention. Try to increase the amount of CRP, HRA, and WPA acres throughout the watershed.
- Maintain proper construction site erosion control practices in areas where soil has been disturbed (residential, commercial, or highways) through the use of planning, educational workshops, and proper installation of BMPs.
- Protect, maintain, and enhance the Eldorado Marsh Wildlife Area. Ongoing management efforts should continue to ensure this resource will continue to flourish with wildlife.
- Promote proper soil conserving tillage practices to reduce soil and nutrient loss.
- Restore and repair eroded streambanks and gullies using rip-rap, shaping, sloping, and seeding.
- Protect and enhance existing wetlands, particularly those upstream of STH 23 to the headwaters of the West Branch and its tributaries.
- Restore wetlands previously drained for agricultural purposes to increase wildlife habitat and improve overall water quality.

Winnebago West Subwatershed (WW)

The first 4.8 miles of Anderson Creek have a biological use of INT, with the remaining 0.2 miles FAL. Factors affecting water quality in Anderson Creek include sediment and nutrient loads from agricultural runoff, filamentous algae, intermittent flows, turbidity, temperature, d.o., urban runoff, a lack of habitat, construction site erosion, and channelized stream segments. The current biological use is intermittent (INT-D) for 4.8 miles, and fish and aquatic life (FAL) for 0.2 miles. Fish surveys were not conducted on Anderson Creek due to the intermittent nature of the stream. The only portion of stream containing water was the area from STH 45 downstream to Lake Winnebago. In this reach water levels are influenced by Lake Winnebago. The fishery in this small reach is

similar to species in Lake Winnebago and includes panfish, forage species, and several species of rough fish. Macroinvertebrates were not sampled due to the intermittent stream flow and the lack of suitable sampling habitat. Typical intermittent systems are dominated by highly tolerant species. Habitat evaluations were conducted at eight locations with scores ranging from 157 to 239 with a mean value of 215 which reflects "fair" to "poor" habitat. Periods of heavy rain and runoff transform this intermittent system into a raging creek transporting large loads of sediment and nutrients.

Factors affecting water quality in Mosher Creek include sediment and nutrient loads from agricultural runoff, filamentous algae, loss of habitat, low flow, low d.o., high temperatures, construction site erosion, urban runoff, streambank erosion, point source discharge, channelized stream course, fish kills, and turbidity. The current biological use is intermittent (INT-D) for 2.8 miles and fish and aquatic life (FAL) for 0.2 miles. Fish and macro-invertebrate surveys were not conducted on Mosher Creek due to the intermittent nature of the stream. Water levels in Mosher Creek are influenced water levels in Lake Winnebago.

Habitat evaluations were conducted at four locations with scores ranging from 169 to 229. The mean score of 210 is indicative of "fair" to "poor" habitat (see table 2-8). Historical fish kills were common, due to pollution generated at a local railroad yard located adjacent to Mosher Creek in North Fond du Lac.

The first 7.0 miles of Van Dyne Creek has a biological use of INT, the remainder is FAL. Factors affecting water quality include sediment and nutrient loads from agricultural, barnyard, and urban runoff, intermittent stream flow, high temperatures, low dissolved oxygen, loss of habitat, channelization of stream course, construction site erosion rural NPS pollution, low flow, habitat, turbidity, temperature, dissolved oxygen, urban runoff, in stream algae and plant growth, common carp, and sediment loading. Macroinvertebrate sample results from a 1984 stream classification indicated very poor water quality, as did a habitat rating in 1996.

The current biological use is intermediate (INT-D) for 7.0 miles, and fish and aquatic life (FAL) for 1.0 mile. Fish and macroinvertebrate surveys were not conducted on Van Dyne Creek due to the intermittent nature of the stream. Water levels in the lower reach are maintained by the water levels in Lake Winnebago. The portion of the creek from STH 45 to Lake Winnebago resembles a deep, open water, marsh. This area supports a diverse community of aquatic plants, including emergent and submergent species. This area provides excellent habitat for a wide range of fish, both game and nongame species, including panfish, northern pike, largemouth bass, bullheads, common carp, and various forage fish. Several other bayou type areas are found in this subwatershed, all of which are unique and offer valuable habitat. These areas also act as small sediment and nutrient traps during runoff events.

Table 2-7. Summary of Macroinvertebrate Scores by Subwatershed

Subwatershed	Stream Name, Location	HBI Score (year/mo/day)	%EPT
Campground Creek	Campground Creek, 10 m upstream of River Road	5.920 (96/05/07)	1.9%
Campground Creek	Campground Creek, 30 m downstream of CTH Y	5.608 (96/05/08)	11.7%
Campground Creek	Tributary to Campground Creek, 15m upstream of River Road.	4.880 (96/05/07)	5.2%
Campground Creek	Parsons Creek, 40m downstream of Lost Arrow Road	5.271 (96/05/07)	37.0%
Campground Creek	Parsons Creek, 100m upstream of Hickory Road @Hobbs Woods Park	4.580 (96/05/07)	18.3%
Campground Creek	Parsons Creek, 20m upstream of STH 175	5.320 (96/05/07)	18.5%
Campground Creek	Tributary to Parsons Creek, 20m upstream of Church Road	4.238 (96/05/07)	5.3%
East Branch	Tributary to East Branch Fond du Lac River, 75m upstream if STH 151	5.829 (96/05/08)	7.2%
East Branch	Sevenmile Creek, 40m upstream of Vielbig Road	6.460 (96/05/08)	0%
East Branch	Sevenmile Creek, 30m downstream of CTH Y	7.814 (96/05/08)	0%
West Branch	Tributary to West Branch Fond du Lac River, 70m upstream of STH 26	5.922 (96/05/14)	<1%
West Branch	West Branch Fond du Lac River, 320m upstream of CTH T	5.521 (96/05/07)	<1%
West Branch	West Branch Fond du Lac River, 75m upstream of Esterbrook Road	5.392 (96/05/07)	0%

Habitat evaluations were conducted at 11 locations on Van Dyne Creek and its tributaries. Scores ranged from 189 to 239 with a mean score of 230 which is reflective of "fair" to "poor" habitat. Table 2-8 contains a complete list of scores and locations in the subwatershed.

Objectives

The following objectives are recommended for improving the surface water resources of the Winnebago West Subwatershed:

- Reduce sediment and nutrient loading from agricultural fields, intermittent waterways, and barnyards by a high level to enhance overall water quality.
- Maintain native grasslands, grassed waterways, woodland, wetland, and upland buffers to aid in the retention of sediment and nutrients.
- Restore uplands to species native to prairies through CRP sign-up, tall grass prairie restoration, and by creating more habitat restoration areas (HRA's) similar to those in Winnebago County.
- Maintain proper construction site erosion control practices on areas where soil has been disturbed (commercial, residential, or highways) through proper planning, educational workshops, and proper installation of BMP's.
- Reduce sediment loads by repairing eroded streambanks and gullies by proper implementation of BMP's.
- Prevent future fish kills through proper handling of point source discharges.
- Emphasize the importance of soil conservation tillage practices to reduce soil and nutrient loss.
- Continue to address stormwater runoff through proper planning for future growth areas, holding educational workshops, and installing proper control structures.

Table 2-8 a. 1996 Summary of Habitat Evaluations (Ball, 1982): Winnebago West Subwatershed

Stream/River	Location	Habitat Score	Total Habitat Score (Average)	Ranking
Anderson Creek	@ Sales Road @ CTH OO @ Melody Lane @ Melody Lane & Pioneer Lane @ Melody Lane & Van Dyne Road @ Minnesota Road & RR tracks @ STH 45 (Lake Shore Drive) @ CTH OO & STH 41 Overpass	239/ Poor 229/ Poor 231/ Poor 220/ Poor 202/ Poor 205/ Poor 157/ Fair 235/ Poor	**1718 (215)**	**Poor**
Tributary to Mosher Creek	@ CTH VVV	229	**810 (210)**	**Poor**
Mosher Creek	@ CTH OO @Van Dyne Road & STH 175 @ STH 45	229/ Poor 213/ Poor 169/ Fair		
Tributary to Van Dyne Creek	@ Nitschike Road 1st crossing @ Nitschike Road 2nd crossing @ Nitschike Road 3rd crossing	239/ Poor 239/ Poor 239/ Poor 223/ Poor	**2,532 (230)**	**Poor**
Van Dyne Creek	@Cemetery Road @ Lincoln Road @ Van Dyne Road @ Lone Elm Road @ Howlett Road @ CTH Z @ STH 45	217/ Poor 235/ Poor 239/ Poor 234/ Poor 239/ Poor 239/ Poor 189/ Fair		
Trib to Lake Winnebago	@STH 45 @ Kinker Road @ Van Dyne Road @ County Line & Lone Elm Road @ East Black Wolf Road @ Koeplin Road @ ST 45 & Koeplin Road	229/ Poor 235/ Poor 235/ Poor 239/ Poor 195/ Fair 223/ Poor 177/ Fair	**1,533 (219)**	**Poor**

Legend: 0-70 Excellent Habitat; 71-129 Good Habitat; 130-200 Fair Habitat; >200= Poor Habitat

Table 2-8 b. 1996 Summary of Habitat Evaluations (Ball, 1982): Campground Creek Subwatershed

Stream/River	Location	Habitat Score	Total Habitat Score (Average)	Ranking
Tributary to Campground Creek	@ River Road @ Mill Pond Road @ CTH Y, in Oakfield @ CTH D, in Oakfield, 1st crossing @ Prairie Road, 2nd crossing @ Prairie Road, 3rd/ 4th crossing	157/ Fair 119/ Good 228/ Poor 193/ Poor 206/ Poor 229/ Poor	**1,908 (174)**	**Fair**
Campground Creek	@ River Road @ Mill Pond Road & CTH B @ Mill Pond Road & CTH B @ CTH Y @ Thill Road	173/ Fair 107/ Good 159/ Fair 129/ Good 208/ Poor		
East Branch Parsons Creek	@ STH 175	159/ Fair	**1,059 (177)**	**Fair**
South Branch Parsons Creek	@ Church Road	173/ Fair		
Parsons Creek	@ Hickory Road @ CTH B @ Lost Arrow Road	94/ Poor 217/ Poor 193/ Poor		
Tributary to Parsons Creek	@ Lost Arrow Road	223/ Poor		

Legend: 0-70 Excellent Habitat; 71-129 Good Habitat; 130-200 Fair Habitat; >200= Poor Habitat

Table 2-8 c. 1996 Summary of Habitat Evaluations (Ball, 1982): East Branch Subwatershed

Stream/River	Location	Habitat Score	Total Habitat Score (Average)	Ranking
Tributary to Raspberry Lake	@ CTH B @ Thill Road	216/ Poor 183/ Fair	**623 (208)**	**Poor**
Raspberry Lake	@ Tin Whistle outfall	224/ Poor		
Sevenmile Creek	@ CTH Y, N of Lamartine & Brown Road @ CTH T @ CTH Y, ½ mile south of CTH T @ CTH Y, in Lamartine @ Vielbig Road	175/ Fair 223/ Poor 243/ Poor 135/ Fair 169/ Fair	**1,150 (192)**	**Poor**

Legend: 0-70 Excellent Habitat; 71-129 Good Habitat; 130-200 Fair Habitat; >200= Poor Habitat

Table 2-8 d. 1996 Summary of Habitat Evaluations (Ball, 1982): West Branch Subwatershed

Stream/River	Location	Habitat Score	Total Habitat Score (Average)	Ranking
Main Stem Fond du Lac River	@West Scott Street @Johnson Street	189/Fair 189/Fair	**378 (189)**	**Fair**
Tributary to West Branch Fond du Lac River	@ Forest Avenue east of STH 26 @ Triple Kay Road, 1st crossing @ Triple Kay Road, 2nd crossing @ Triple Kay Road & STH 26, 3rd crossing @ STH 26, South of Rosendale @ STH 26 , North of Rosendale @ STH 26, in Rosendale @ Freemont Road @ Rose-eld Road, WWTP @ Lincoln Road @ CTH N (east trib) @ CTH N (west trib) @ Korth Road (east trib) @ Korth Road (west trib) @ Center Road @ Bell School Road @ Schmoldt Road & CTH M @ Center Road (SW of Rosendale) @ Townline Road @ CTH T @ Brown Road @ Forest Avenue	220/ Poor 233/ Poor 236/ Poor 193/ Fair 210/ Poor 185/ Fair 210/ Poor 187/ Fair 218/ Poor 235/ Poor 217/ Poor 159/ Fair 227/Poor 181/Fair 243/Poor 241/Poor 209/Poor 218/Poor 231/Poor 200/Poor 211/Poor 235/Poor	**4,679 (213)**	**Poor**
West Branch Fond du Lac River	@ Freemont Road @ STH 26 N of Rosendale @ CTH C @ STH 23 @ Forest Avenue @Townline Road @ Esterbrook Road @ CTH T, 2nd west @ CTH T, 1st west, USGS @ CTH VVV @ Grove Street, in FDL	123/ Good 179/ Fair 107/ Good 127/ Good 87/ Good 90/ Good 83/ Good 94/ Good 99/ Good 99/ Poor 206/ Poor	**1,294 (118)**	**Good**

Legend: 0-70 Excellent Habitat; 71-129 Good Habitat; 130-200 Fair Habitat; >200= Poor Habitat

Groundwater Resources

Regional Aquifers

Groundwater is a primary source of drinking water in the Fond du Lac River Priority Watershed and for the municipalities of Fond du Lac and Oakfield. The City of Oshkosh uses treated water from Lake Winnebago as a source of drinking water. Groundwater is stored underground in pore spaces and cracks within soil and rock layers. Unconsolidated material and rock layers which yield groundwater in usable quantities are called aquifers. Aquifers discharge groundwater to lakes, streams, wetlands, and wells. The following information was obtained from consultants, the United States Geological Survey (USGS), data collected from private wells located within the watershed, and other reports.

The principal aquifers in the Fond du Lac River Watershed from oldest to youngest are: Cambrian and Ordovician sandstones and dolomites (570 – 440 million years ago); Silurian dolomite (440 – 400 million years ago); and Pleistocene glacial sand and gravel (2 million years ago). Deeper, older rock layers were deposited first; shallow rock units are younger. In general, municipal and industrial wells within the watershed obtain water from deep sandstone and dolomite aquifers while domestic wells obtain water from shallower Silurian dolomite. Where available, water is also drawn from the sand and gravel aquifer.

The watershed is bordered on the east and south by the Niagara Escarpment, a topographic feature composed of Silurian Niagara dolomite. The Niagara formation is underlain by the Maquoketa shale, a layer with low permeability not present in the watershed. Springs and seeps occur along the escarpment where the dolomite is in contact with the impermeable Maquoketa shale and water is forced to the surface where it enters the drainage for the Fond du Lac River Watershed.

Groundwater Flow

Regional groundwater flow in the Cambrian and Ordovician sandstone aquifer is northeast toward Lake Winnebago. Regional recharge occurs at topographic highs and at exposed bedrock. Local groundwater flow in the shallower sand and gravel aquifer generally follows the topography; recharge occurs at the tops of hills and discharge occurs into streams, lakes and wetlands. A large dip in the water table, called a cone of depression, occurs in the sandstone aquifer near the City of Fond du Lac due to pumping of large municipal wells (Newport, 1962).

Groundwater Quality

Nearly anything spilled or spread on the ground has the potential to leach or seep into groundwater. The physical setting of an area and contaminant characteristics determine groundwater susceptibility to pollution from inadequate waste management and / or improper land use. Physical setting includes soil type, characteristics of the subsurface unconsolidated material, depth to bedrock, depth to groundwater, topography, and hydrologic characteristics. Potential point sources of groundwater contamination include spills, leaking underground storage tanks, pesticide contamination sites, old landfills, and improperly abandoned wells. Potential nonpoint sources of pollution include fertilizers and pesticides, sludge and septage, livestock waste, irrigation, and road salt.

Groundwater quality in the Fond du Lac River Watershed is generally considered good although radium is present in wells drawing from the Cambro-Ordovician aquifer where confined by Maquoketa shale and Silurian and Devonian dolomite (Weaver et, al.). Radium-226 and Radium-228 have been detected in the City of Fond du Lac wells in excess of groundwater standards (Kaemper, 1986).

High groundwater nitrate levels in parts of Wisconsin have been linked to agricultural practices, septage spreading, and faulty septic systems. High nitrate levels are a potential health concern for pregnant women and infants, and may also cause spontaneous livestock abortions. The enforcement standard (ES) health advisory level is defined as the concentration of a substance at which a facility regulated by DILHR, DATCP, DOT or DNR must take action to reduce the concentration of the substance in groundwater. The preventative action limit (PAL) is a lower concentration of a contaminant than the Enforcement Standard. The PAL serves to inform DNR of potential groundwater contamination problems, establish the level at which efforts to control the contamination should begin, and provide a basis for design codes and management criteria.

A total of 97 private wells were sampled for nitrate+nitrite analysis as part of the groundwater appraisal; concentrations ranged from nondetect to 44.7 mg/L (see table 2-9). Of the 97 wells sampled, 20 percent exceeded the preventative action limit (PAL) of 2 mg/L and 7 percent samples exceeded the enforcement standard (ES) of 10 mg/L. For comparison, a study done of all nitrate+nitrite analyzed in Wisconsin between 1988 and 1992 indicated over 12 percent of the wells sampled exceeded the ES of 10 mg/L.

Atrazine is a possible human carcinogen. Samples analyzed for atrazine using the triazine screen detected concentrations ranging from non-detect to 0.1 ug/L. No samples exceeded the PAL or ES for atrazine plus metabolites (see Table 2-10).

Table 2-9. Well Sampling Results for Nitrate

Sub-watershed	# of Samples < 2.0 mg/l (% of Total)	# of Samples 2.0 - 10.0mg/l (% of Total)	# of Samples > 10.0 mg/l (% of Total)
West Branch	19 (20%)	3 (3%)	7 (7%)
East Branch	14 (14%)	1 (1%)	1 (1%)
Campground Creek	5 (5%)	5 (5%)	1 (1%)
Winnebago West	40 (41%)	1 (1%)	0 (0%)
Totals	**78 (80%)**	**10 (10%)**	**9 (9%)**

Table 2-10. Well Sampling Results for Atrazine

Sub-watershed	# of Samples < 0.3 ug/l (% of Total)	# of Samples 0.3–3.0 ug/l (% of Total)	# of Samples > 3.0 ug/l (% of Total)
West Branch	3 (11%)	0 (0%)	0 (0%)
East Branch	1 (3.5%)	0 (0%)	0 (0%)
Campground Creek	1 (3.5%)	0 (0%)	0 (0%)
Winnebago West	23 (82%)	0 (0%)	0 (0%)
Totals	**28 (100%)**	**0 (0%)**	**0 (0%)**

No samples were collected for coliform bacteria or hazardous substances such as volatile organic compounds. Coliform bacteria can cause a drinking water problem where septic systems, land spreading of manure or barnyards are located up-gradient (generally uphill) from a private well. Bacteria can enter the drinking water supply along the well casing of improperly constructed wells. Wells with high levels of bacteria can be safely disinfected.

Volatile organic compounds generally enter a well from spills or nearby leaking underground gasoline or other fuel storage tanks. Cleaning contaminated groundwater can be a costly and difficult process: contaminated wells have to be abandoned and new wells must be drilled and / or the water must be treated to remove contaminants prior to use.

The DNR notified the City of Fond du Lac its water supply system was out of compliance with drinking water standards due to elevated levels of Radium-226 and Radium-228. To meet drinking water standards the City was required to have the radium removed or obtain another source of drinking water. No other contaminants requiring treatment were detected.

Groundwater Supply

Fond du Lac and Oakfield municipal water wells draw water from the Cambrian-Ordovician aquifer. In 1986, consultants for the City of Fond du Lac completed a water treatment and supply study (Robert E. Lee and Assoc., 1986) outlining alternatives for meeting peak water demands. The existing water supply system had been close to exceeding its summertime capacity during periods of peak water use. Fond du Lac has well fields north and south of its border where the Cambrian-Ordovician sandstone aquifer is thick and the Prairie du Chien, a low permeability layer, is absent. A test drilling program revealed no new, large, sources of groundwater are close to the City. Estimates indicate water supplies lasting 20 to 30 can be obtained from expansion of the south well field.

A comprehensive water supply analysis was completed for the Village of Oakfield (Kapur and Associates, Inc., 1995) evaluating the 20 year capacity of the existing water supply system. One of the recommendations included construction of a well on the south side of the village. To protect groundwater all new municipal wells must include a wellhead protection plan.

Potential Groundwater Quality Problems

DNR publication "The Wisconsin Remedial Response Site Evaluation Report" October, 1995, identifies sites having potential groundwater quality problems in the Fond du Lac River Watershed. Sites in the watershed and within two miles of the watershed boundary were included. The type and number of sites in this report include: Superfund Sites [no sites], Sites Which May Cause or Threaten To Cause Environmental Pollution [2 sites], High and Medium Priority Leaking Underground Storage Sites [35 sites], and High Priority Reported Hazardous Substance Spills Sites [7 sites]. These sites have the potential

to contaminate groundwater and drinking water. This information is periodically updated and subject to change.

Groundwater Recommendations

- BMPs should be Implemented to protect groundwater within the watershed. Most farms in the watershed should be eligible for Nutrient and Pest Management cost-sharing. Nitrate+Nitrite and Triazine Compounds are present in groundwater, although in low levels and in only a few of the wells tested.

- The City of Fond du Lac and the Village of Oakfield should adopt Wellhead Protection Plans and Ordinances. The City of Fond du Lac has a limited source of high quality groundwater which should be protected. All new municipal wells in Wisconsin must have a Wellhead Protection Plan.

- The Information and Education portion of this plan should have a groundwater conservation and protection element including information on low flow bathroom fixtures, lawn watering, and other means of conserving water.

  Private well owners should be provided with information on water testing and well maintenance. DNR, UW Extension, and County Health staff should make groundwater and wellhead protection presentations watershed stakeholders.

CHAPTER THREE: Rural Inventory Results, Nonpoint Source Pollutants, and Cost-Share Eligibility Criteria

This chapter describes the nonpoint source (NPS) inventories, plan objectives and cost-share eligibility criteria for rural pollutant sources: barnyard runoff, agricultural nutrients, sediments from upland areas, gully erosion, and streambank / shoreline erosion.

Management Categories

Cost-share funds for installing pollutant control measures will be targeted at sites and practices contributing the greatest amount of runoff pollution (urban runoff, barnyards, manure spreading, upland fields, streambank and shoreline erosion or streambank habitat degradation sites). Management categories define which nonpoint pollution sources are eligible for financial and technical assistance taking into consideration the amount of pollution generated and the feasibility of controlling it. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible". Designation as a critical site indicates controlling the source of pollution is essential -- indeed, mandatory by state law -- for meeting the project's water quality objectives.

Nonpoint sources of pollution not considered critical are still eligible for cost sharing to help insure water quality objectives are met. NPS pollutant load reductions in the Fond du Lac River Priority Watershed project will be achieved primarily through voluntary participation. Landowners with eligible sites need not control every eligible pollutant source to receive cost-share assistance. However, landowners with any combination of eligible and critical sites must control the critical sites to receive cost-share assistance for eligible, non-critical sites.

Management category eligibility criteria are expressed in terms tons of sediment delivered to surface waters from eroding uplands and streambanks; pounds of phosphorus [organic] delivered to surface waters; feet of streambank trampled by cattle; and pounds of heavy metals and organics from urban areas. Pollutant runoff sources created after a cost-share agreement is in place must be controlled at the landowner's expense.

The Fond du Lac County Land Conservation Department and the Winnebago County Land and Water Conservation Department will assist landowners implementing BMPs. Site specific BMPs range from alterations in farm management (such as changes in manure spreading and crop rotations) to engineered structures (such as diversions, sediment basins, and manure storage facilities).

Critical Sites Management Category

NPS pollutant load reduction may occur solely through the action of the landowner with guidance from county staff, or through participation in this watershed plan. NPS pollutant load reductions in the Fond du Lac River Watershed project will be achieved mainly through voluntary participation. Nonpoint sources included in the critical category contribute a significant amount of the surface water pollutants. State statutes require NPS control plans include measures necessary to ensure the reasonable likelihood of achieving the plan's water quality goals and objectives. Landowners with critical sites are required by law to reduce the NPS pollutant load to an acceptable level.
Each critical site will be field verified before landowner notification takes place with findings sent to the appropriate DNR regional office. Landowners interested in receiving BMP cost-share assistance must sign a cost-share agreement with the appropriate County Conservation Department.

Notification of critical site landowners begins six months following plan approval and continues through the completion of the inventory. The first landowners contacted are those with the highest ranked critical sites based on pollutant load estimates. Critical sites will provide at least 25 percent of the pollutant reduction goal. On-site visits will be conducted within a six month period to verify critical site criteria are still met. 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 a landowner may face if no action is taken and the site continues to meet critical sites criteria.
- The right to appeal the designation of a critical site through a written request to the Land Conservation Committee within 60 days of receipt of the notification letter. (Also see the "Appeal Process" section).

In addition to the specific management strategies described above, four Animal Waste Advisory Committee (AWAC) prohibitions will be addressed when encountered:

- No overflow of manure storage structures,
- No unconfined manure stacking (piling) within 300 feet of a stream, 1,000 feet around a lake and specific sites susceptible to groundwater contamination (Water Quality Management Areas),
- No direct runoff from feedlots or stored manure to water, and
- No unlimited livestock access to waters of the state where high concentrations of animals prevent adequate sod cover maintenance.

Eligible Management Category

Nonpoint sources of pollution in this category contribute less water quality impairing pollution. These sites are eligible for technical and cost-share assistance but are not as critical to attaining water quality objectives.

Ineligible Management Category

Sites and practices not contributing significant amounts of pollutants are not eligible for funding as part of the priority watershed project. Other DNR programs (e.g., wildlife and fisheries management) may assist county project staff in controlling these sources as part of an integrated resource management plan for the watershed. Other local, state, or federal programs may also be applicable to implementation of this plan.

Rural Nonpoint Source Pollution

Sediment, nutrients, oxygen-demanding substances, pesticides, and bacteria are pollutants carried in rural runoff. These pollutants degrade water quality and impair recreational and biological uses. The principal rural nonpoint sources of pollution in the Fond du Lac River / Winnebago West watershed include:

- Runoff from barnyards and livestock feeding and pasturing areas
- Discharges from milkhouses
- Runoff from land spread with manure
- Runoff from cropland
- Sediment from streambanks and gullies

Barnyard Runoff

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a major source of pollution to streams in the Fond du Lac River Watershed. Barnyard runoff contains high concentrations of BOD (biological oxygen demand), COD (chemical oxygen demand), bacteria, phosphorus, ammonia, salts and sediment - all of which contribute to degradation of water quality. Phosphorus is the nutrient of primary concern in the watershed because it is most often the limiting nutrient in natural water bodies. Phosphorus is also the nutrient most amenable to control; subsequently, it will become the target of most broad strategies for water quality management in the Fond du Lac River Watershed project. A total of 176 animal lots in watershed are an annual source of 8,000 pounds of phosphorus (Table 3-1). Most of the oxygen-demanding pollutants and nutrients associated with these operations drain in concentrated flows to surface waters in the Watershed.

Phosphorous Reduction Goal: The barnyard runoff control objective for this plan is to reduce phosphorus loads to streams by 50 percent. Based upon past experience it is estimated 65 percent of this reduction can be obtained through voluntary participation.

Barnyard sites contributing a phosphorus load of 140 pounds or greater annually will be designated as critical sites. Twelve sites in the watershed are expected to meet this criteria. Landowners with an animal lot designated as a critical site are eligible for a complete barnyard system. If the site owner is unable to manage the installation or operation of a complete barnyard system, or if the County Conservation Department

determines a complete system is not necessary to greatly reduce the phosphorus load from that site, the owner will only be required to divert upland clean water and roof runoff away from the lot. Installation of these low-cost practices in the watershed will provide significant pollutant load reductions.

Barnyard sites contributing between 50 lbs. and 140 lbs. of phosphorus annually will be considered as eligible for cost-sharing on either low-cost diversion practices or full barnyard systems. Inclusion of these sites is important if phosphorus reduction objectives are to be met. After the barnyard inventory, watershed staff identified 46 yards in the watershed which meet this phosphorus loading criteria.

Barnyard sites contributing between 30 lbs. and 50 lbs. of phosphorus annually will only be eligible for clean water diversions and roof runoff controls (low cost practices). Twenty-two barnyards currently fall into this category. Barnyards contributing less than 30 lbs. of phosphorus are not eligible for cost sharing.

Certain components of waste management systems (as specified in NRCS Std. 312), specifically those involving collection, handling and storage, require preparation of a nutrient management plan (NRCS Std. 590) for the acreage where the waste may be spread. Roof Runoff Management (NRCS Std. 588), Livestock Exclusion (NRCS Std. 472), Clean Water Diversion (NRCS Std. 362) are practices exempt from this requirement. Operations eligible for waste management systems are also eligible for cost-sharing of nutrient management practices, specifically development of nutrient management and pest management (NRCS Std. 595) plans, soil testing and crop scouting. See "Nutrient and Pest Management" in this chapter for additional detail.

Internally Drained Barnyards: Internally drained barnyards drain to surface depressions rather than directly to surface waters or wetlands. A total of 17 internally drained yards were identified in the Fond du Lac River Watershed. Eligibility for internally drained animal lots will be based on a site by site analysis based on susceptibility to groundwater contamination.

Where eligibility of internally drained lots was not identified during the planning phase, field investigations will be conducted jointly by the county project staff, water resource management staff from the appropriate DNR Regional office, and staff from the DATCP.

Table 3-1. Barnyard Inventory Results and Site Eligibility (Goal: 50% reduction in phosphorus loading = 4000 pounds)

Sub-watershed	Inventory Results			Site Eligibility (# Barnyards)		
	# of Barnyards	Pounds of Phos.	% of Barnyard Phos.	Critical Sites (≥ 140 lbs. Phos.)	Eligible Sites (50 – 140 lbs. Phos.)	Eligible Sites: Clean Water Practices Only (30 - 50 lbs. Phos.)
Winnebago West	64	2282	29	2	14	8
West Branch	45	2000	25	3	16	4
East Branch	40	1954	24	2	13	3
Campground Creek	27	1740	22	5	3	7
Total	**176**	**7976**	**100**	**12**	**46**	**22**

Table 3-2. Barnyard Runoff Pollution Reduction (Goal: 50% reduction in phosphorus loading = 4000 pounds)

Category	No. of Sites	Lbs. Reduced	% Reduced (Goal)
Critical Sites	12	1,400	35%
Eligible	68	2,600	65%
Ineligible	96	---	---
Total	**176**	**4,000**	**100%**

Agricultural Nutrients

The overall goal of the Fond du Lac River Priority Watershed Plan is to reduce nutrient, pesticide, and sediment stream loads. Poor management practices associated with manure, fertilizers, and pesticides will be targeted through the adoption of a nutrient management plan (NRCS standard 590) and a pesticide management plan (NRCS standard 595). Development and implementation of site specific nutrient and pesticide management plans provide landowners an opportunity to maintain a sustainable agricultural system while at the same time enhancing water quality.

Nutrient and Pest Management: Nutrient and pest management is recognized as one of only a few BMPs to protect and improve of both groundwater and surface water. Farmers benefit from nutrient and pest management plans by taking nutrient credits for legumes and land spread manure. Commercial fertilizer applications are then adjusted (i.e., reduced) to meet site specific and crop specific requirements. Every landowner is eligible for cost sharing for nutrient management; watershed wide this totals over 123,000 acres.

Nutrient and pest management will be addressed in the development of both nutrient management and pest management plans, which may include crop scouting. These plans may be prepared by crop consultants and must be consistent with NRCS Standard 590 and 595. Landowners will be eligible for up to three years of cost sharing towards crop consultant fees, soil testing, and residual nitrogen analysis, and manure nutrient analysis. A cost share rate of 50 percent is available for all nutrient and pesticide management practices with a cost share rate of 70 percent on spill control basins. These plans are submitted to and approved by the Fond du Lac County Land Conservation Department and the Winnebago County Land and Water Conservation Department. Records should be kept showing progress towards reducing the use of fertilizer and pesticides.

Manure Storage: Nutrient management will be a significant component of manure management systems, barnyards, and manure storage facilities. Cost-sharing eligibility for manure storage practices will be based on the development of a preliminary Nutrient Management Plan developed in accordance with NRCS Standard 590. An operation is eligible if the nutrient management plan demonstrates manure cannot be practically managed during periods of snow-covered, frozen, and saturated conditions without the installation of storage practices. Nutrient management plans must also demonstrate proper utilization of the manure can be achieved following adoption of a specific storage practice. Inventory results estimate 34 farms are eligible for cost sharing for manure management practices.

Cost sharing for storage facilities will be based on the least cost system. These options may include, but are not limited to:

- a properly sited unconfined manure stack (in accordance with Std. 312)
- construction of a short term storage facility (capacity for 30 to 100 days manure production in accordance with Std. 313)
- construction of a long term storage facility (capacity for up to 365 days production in accordance with Std. 313 or 425).

Additional options for reducing surface pollution from over-application of manure to cropland include:

- reducing the number of animals
- rental of additional lands suitable for winter spreading
- haul or broker manure to a neighboring farm for use in accordance with a nutrient management plan.

Landowners with site-specific manure handling problems coming directly from the barn and with indirect runoff to the stream will be eligible for temporary manure stacking based on county and DNR evaluations. Landowners receiving cost-share funds for manure storage and/or barnyard practices are required to develop a nutrient management plan for the affected acres.

Manure Storage Ordinance: Surface water and groundwater resources are at risk when manure storage facilities are improperly located, designed, or constructed. Manure overflows and storage facility failures are a serious threat to aquatic life. Counties adopt manure storage ordinances to prevent ground and surface water pollution by requiring proper design, construction, location, and management of permitted facilities. Ordinances must meet guidelines adopted by DATCP and cite applicable NRCS construction and management standards. Fond du Lac County adopted a manure storage ordinance in 1996 requiring permits for installation, modification, and major repair of manure storage facilities. Winnebago County adopted a similar manure storage ordinance in 1985 and subsequently amended it to include abandonment.

Construction Site Erosion and Stormwater Management

Cost for development and administration of land use ordinances related to water quality may be eligible for reimbursement. Support for ordinances is based on the assumption that the cost of preventing damage is far less than the cost of restoration. Many local governments and other stakeholders believe the cost of preventing erosion damage should

be borne by those benefiting from development rather than by taxpayers paying to remove sediment from ditches, culverts, streets, harbors, lakes, and streams. Consequently, local governments are developing or amending subdivision ordinances, zoning ordinances, and other local ordinances to include stormwater and erosion control requirements for developing land areas.

Chapter 236, Wis. Stats., grants cities, towns, villages, and counties authority to control erosion from developing subdivisions and smaller land divisions. This chapter establishes the minimum standards and procedures for land division in Wisconsin. Chapter 236 enables local governments with an established planning agency or department to adopt subdivision ordinances more restrictive than the state standards. Several municipalities in the watershed have included runoff and erosion control provisions in their ordinances. These ordinances typically require a developer to submit a detailed plan specifying what control measures will be installed to minimize erosion and runoff during and after development. Typically the person who reviews erosion and runoff control plans visits the site and certifies that the measures have been installed in accordance with the plan before a final plat is filed.

Similar to erosion control, Wisconsin cities, villages, towns, and counties have authority to adopt stormwater management zoning ordinances. A Model Stormwater Management Zoning Ordinance was developed by the DNR in 1995. This model ordinance is meant to compliment the Model Construction Site Erosion Control Ordinance prepared in 1987 by the DNR in conjunction with the Wisconsin League of Municipalities.

It is recommended the Wisconsin Construction Site Erosion Best Management Handbook (DNR Publication WR-222-93) and the Wisconsin Stormwater Manual (DNR Publication WR-349-94) be used as a reference for development within the Fond du Lac River Watershed. All municipalities in Fond du Lac and Winnebago Counties are encouraged to adopt construction site erosion control and stormwater management zoning ordinances.

Rural Sediment

Intensive agricultural practices have caused considerable amounts of eroded soil to reach streams, lakes, ponds, and wetlands in the Fond du Lac River Watershed. Upland erosion is the major source of sediment carried downstream, beyond individual subwatershed boundaries.

Upland sediment sources were evaluated through sub-area sampling and extrapolated for the entire watershed. Inventory results are summarized in Table 3-3. An estimated 142,096 tons of cropland soil are delivered annually to surface water and wetlands in the watershed. An additional 7,445 tons per year are delivered from other non-cropland areas. Uplands are the source of 94 percent of the sediment delivered to surface waters. Table 3-3 summarizes upland sediment loading by land use for all subwatersheds.

Sediment Reduction Goal

A 40 percent (56,800 tons per year) reduction in soil from eroding fields is targeted for agricultural lands. This reduction could be realized if all lands in the watershed contributing sediment to streams greater than 1.8 tons/acre/year would reduce their sediment loads to 1.8 tons/acre/year. Soil erosion and sediment delivery rates were calculated using the USLE in addition to other hydrology information located in the WINHUSLE model (FOCS database). A partial inventory using a representative sample of roughly 20 percent of the watershed land area was completed with results extrapolated to the entire watershed. Consequently, county staff will need to continue the inventory after the plan is approved to more thoroughly identify eligible and critical fields.

Cropland Critical Sites: To be classified as "critical" a site must deliver soil greater than "T" (tolerable soil loss in tons/acre/year) and 3.0 tons/acre/year sediment to surface waters. Based on an extrapolation of the inventory data approximately 11,767 acres of cropland in the watershed meet the critical site criteria. Controlling these acres would reduce the sediment load delivered to surface waters by an estimated 14,447 tons per year or approximately 26 percent of the sediment reduction goal. All critical site cropland fields must be reduced to T and 3.0 tons/acre/year or less.

Cropland Eligible Sites: An additional 75 percent of the sediment reduction goal will be controlled through eligible sites, which total an estimated 100,658 acres of land and 42,353 tons of sediment. Eligible sites include fields delivering sediment at a rate greater than 0.5 tons/acre/year (Table 3-4).

Table 3-3. Upland Sediment Loading by Land Use: Area (Sediment Load) [1]

Sub-watershed	Cropland	Pasture	Woodland	Natural Areas	Wetlands	Developed	Totals
East Branch	**33,029**	**175**	**1,552**	**713**	**4,565**	**742**	**40,776**
	(44,358)	(49)	(12)	(27)	(4)	(1,280)	(45,730)
West Branch	**42,764**	**253**	**2,221**	**999**	**10,555**	**1,490**	**58,282**
	(40,626)	(166)	(49)	(39)	(5)	(1,548)	(42,433)
Campground Creek	**9,781**	**599**	**672**	**468**	**713**	**320**	**12,553**
	(12,949)	(589)	(17)	(21)	(0)	(718)	(14,294)
Winnebago West	**37,554**	**274**	**2,539**	**984**	**2,705**	**1,190**	**45,246**
	(44,163)	(21)	(16)	(30)	(0)	(2,854)	(47,084)
Totals	**123,128**	**1,301**	**6,984**	**3,164**	**18,538**	**3,742**	**156,857**
	(142,096)	(825)	(94)	(117)	(9)	(6,400)	(149,541)

[1] Data was extrapolated from sub-area sampling in rural areas only.
Area measured in acres. Sediment load measured in tons per year.

Gully Erosion: Since gully erosion has not been identified as a widespread problem in this watershed a field inventory of gully erosion was not done. Gullies identified as significant sediment sources during implementation will be evaluated and eligible for cost sharing. All active gullies will be eligible for critical stabilization and seeding. If LWCD staff conclude after an evaluation that installation of structural practices would not be cost effective the site will not be eligible for those specific practices.

Soil erosion on croplands from gullies will mainly be controlled through the installation of grassed waterways. In some instances other BMPs, such as high residue management and / or installation of structural practices, such as sediment and erosion control basins, may reduce or eliminate the need for grassed waterways.

Table 3-4. Cropland Sediment Goal and Inventory Results

Sub-watershed	Inventory Results			Goal: 40% Reduction In Sediment Delivered = 56,800 Tons						
	Cropland Area (Acres)	Sediment Delivered From Cropland (tons/yr)	% Sediment Contributed by Watershed	Critical Sites > T Soil Loss and 3.0 Tons/Acre/Year Sediment Delivery			Eligible Sites > or = 0.5 Tons/Acre/Year Sediment Delivery			Total % of Goal From Each Sub-watershed [1]
				# Acres	Target Tons Reduced	% Reduced of Goal	# Acres	Target Tons Reduced	% Reduced of Goal	
Winnebago West	37,554	44,163	31%	5,625	3,216	6%	26,946	15,491	27%	52%
West Branch	42,764	40,626	29%	631	1,376	2%	37,038	8,483	15%	15%
East Branch	33,029	44,358	31%	4,852	9,504	17%	28,859	16,147	29%	30%
Campground Creek	9,871	12,929	9%	659	351	%1	10,815	2,232	4%	3%
Total	123,128	142,096	100%	11,767	14,447	26%	100,658	42,353	75%	100%

[1] Based on WINHUSLE Alone

Less noticed, ephemeral, gullies often contribute significant amounts of eroded sediment. After the runoff has dissipated ephemeral gullies often blend in with the surrounding landscape and are difficult to detect. When contacting landowner LCD staff will consider upland farm areas susceptible to ephemeral gullies and examine options for reducing sediment runoff.

Streambank Erosion: Streams receiving large amounts of runoff water from storm events results in substantial water level fluctuations and erosion. These events are particularly severe and evident in the East Branch Fond du Lac River and Parsons Creek.

Approximately 120 miles of streams were evaluated for streambank erosion which is estimated to contribute 5.6 percent or 173 tons of the total sediment load to surface waters in the Watershed. Significant erosion and degradation of aquatic habitat and water quality exist along approximately 24 streambank miles contributing an estimated 9,173 tons of sediment each year. See Table 3-5 for streambank inventory results.

Factors contributing to development of flashy streams and streambank erosion include:

- loss of wetlands
- ditching and channelization of rural tributaries
- downstream urban channelization
- increased impervious areas in urban portions of the watershed

While streambank erosion has been identified as a significant problem in the watershed streambank erosion sites will not be designated due to the following:

- Approximately 50 percent of the highest sediment-producing banks are inaccessible to equipment due to forested areas along the stream corridor
- High bank heights, up to 30 feet, are extremely costly to repair
- The majority of the highest sediment producing banks are caused by factors beyond landowner control
- Although a significant problem, streambank erosion contributes only about 5.6 percent of the total sediment delivered to surface waters

Funding for installation of structures to control eroding streambanks are not covered if LCD staff determine the structures are not cost effective. In general, streambank sites within a woodland or wetland area are not accessible and installation of erosion control practices are not cost effective. See Table 3-6 for streambank eligibility criteria and additional information on streambank eligibility. Additional sites on continuous streams, un-inventoried ditches, and intermittent streams meeting the above criteria may also be identified as not eligible for cost sharing.

Livestock Access: Livestock have access to approximately 59,730 feet of streambanks in the watershed contributing to habitat degradation and removal of bank-stabilizing vegetation. Trampled banks and removal of vegetation leads to wider, slower moving streams with increased temperatures and turbidity. Warm, turbid stream channels are unsuitable for many forms of aquatic life, particularly sport fish. All trampled

streambanks are (1) evaluated according to habitat degradation and sediment loading by watershed staff, and (2) eligible for improvements.

Shoreline Erosion: A shoreline inventory completed in 1996 determined 1,930 feet of shoreline had slight to moderate erosion (less than or equal to 2.0 tons per year, per site). Shoreline erosion is estimated to contribute 13.3 tons annually to Lake Winnebago. Much of the developed shoreline was found to be rip-rapped while undeveloped areas were buffered by emergent vegetation. Shoreline erosion on Lake Winnebago is caused by wind, waves, and ice. Shoreline erosion is further exacerbated by water level fluctuations, human trampling, and poor shoreline land use practices.

While the inventory did not identify shoreline erosion as a major water quality problem specific sites may be affected by severe erosion and considered a significant source of sediment. Sites delivering three tons of sediment per year to Lake Winnebago are eligible for cost sharing.

Pollutant Reduction Goals and Project Objectives for Rural Nonpoint Sources

Goals for water quality in the Fond du Lac River Watershed were identified earlier in the chapter as water resource protection, enhancement, and restoration. Objectives for controlling sediment and phosphorus in rural areas are listed below. Following is a summary of reductions to be targeted for the entire watershed.

Sediment Objective

The sediment objective is to reduce the overall sediment delivered by 40 percent. Table 3-8 summarizes the sediment reduction goals for the Fond du Lac River Priority Watershed Project. To meet this objective the following necessary reductions are necessary:

- 40 percent reduction in sediment reaching streams from croplands.
- 25 percent reduction in streambank sediment, and
- 25 percent overall repair of streambank habitat.

Phosphorus Objective

The phosphorus objective is to reduce the overall phosphorus load by 40 percent. The following reductions are necessary to achieve this objective:

- 50 percent reduction in phosphorus from barnyards.
- A reduction in phosphorus from land spread manure.
- 40 percent reduction in phosphorus from sediment delivered from croplands to all streams in the watershed.

Table 3-5. Streambank Inventory Results: Fond du Lac River Watershed

Sub-watershed	Inventoried Streambank Length (feet)	Eroded Sites (feet)	Trampled Sites (feet)	Slumped Sites (feet)	Cattle Access (feet)	Total Sediment Loss (Tons/Yr)	% of Total Bank Erosion in Watershed (% From E, T, S)
Winnebago West	95,040	4,724	565	400	2,680	281	4% (6%)
West Branch	117,004	945	275	200	2,878	709	1% (1%)
East Branch	269,280	49,460	4,200	31,960	19,826	6,452	67% (32%)
Campground Creek	147,840	23,819	2,805	8,439	34,346	1,731	28% (24%)
Totals	**629,164**	**78,948**	**7,845**	**40,999**	**59,730**	**9,173**	**100% (20%)**

Source: Fond du Lac County LCD and Winnebago County LWCD.

Table 3-6. Streambank Eligibility Criteria and Reduction

Management Category	# Sites	Sediment Delivery	Target Reduction (25% = 2,250 tons)	Load Reduction
Eligible	178	= or > 3 Ton/Site/Year	2,250	25%
Not Eligible	N/A	< 3 Ton/Site/Year or in areas where BMPs would not be cost effective	N/A	N/A

Table 3-7. Trampled Streambank Eligibility Criteria

Management Category	Description	Objective
Eligible	Trampled / Degraded / Livestock Access	Maintain Vegetated Cover
Not Eligible	Vegetated / No Current Livestock Access	N/A

Table 3-8. Sediment Reduction Goals

Source	Sediment Delivered (tons)	Sediment Reduction Goal	Sediment Reduced (tons)	Percent of Total
Cropland	142,096	40%	56,800	35.8%
Streambank	9,137	25%	2,250	1.4%

Eligibility for Wetland Restoration, Easements, and Land Acquisition

Wetland Restoration

Prior to European settlement Wisconsin had an estimated 10 million acres of wetlands. Today, slightly more than 5.3 million acres remain. Many thousands of pre-development wetlands have been converted to cropland; thousands more have been filled for highways and urban development.

Wetlands are an important part of our ecosystem affecting surface and groundwater quality, flood control, erosion control, flora and fauna, and the food chain. As a water purifier wetlands remove, retain, and transform nutrients, process wastes, and trap sediment. Wetlands are a principal conduit for rainwater flowing to lakes and streams. Restoration of wetlands may increase base flow throughout the river, especially in the upstream reaches of the East Branch Fond du Lac River and Parsons Creek and in the streams of the Winnebago West Subwatershed. Infiltration is also increased through the use of other BMPs such as conservation tillage, riparian buffers, and sediment control basins.

Wetlands vary from areas with seasonally saturated soil conditions to areas with standing water year-round. Some of the diverse types of vegetation found in wetlands include pond lilies, cattails, rushes, black ash, and willow. Wetland restoration may include the plugging or breaking up of existing tile drainage systems, plugging of open channel drainage systems, and livestock fencing. Restoration must be in accordance with NRCS standard 657 (Wetland Restoration). Native seed and plants will be used wherever possible and no reed canary grass will be planted.

Restoration of wetlands provides primary and secondary benefits to water quality:

- Primary - Use of wetland restoration as a BMP to control nonpoint sources of pollution. To control runoff pollution wetlands must function as a sediment and nutrient filter, flood and storm water attenuation and storage area, and provide infiltration.
- Secondary - Enhancement of fish and wildlife habitat. Wetlands provide essential

habitat for fish, waterfowl, animals, and plants, including endangered species.

The targeted goal of this project is to restore as many wetlands as possible (but no fewer than 40). The following two conditions must be met for wetland restoration cost-sharing:

- All upland fields draining to the wetland must be controlled to a soil loss rate less than or equal to the soil's "T" value.
- Wetland restoration practice must be the least cost practice to reach sediment reduction goals.

Cost-share eligibility for wetland restoration is divided into three categories:

1) **Priority Restorations** - Priority wetland restorations provide at least one of the water quality benefits as described below ***and*** provide essential habitat for fish, waterfowl, animals, and plants, including endangered species.

   - 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 by establishing permanent vegetation and altering the drainage system.
   - Pastured wetlands riparian to streams, or tributaries. Eliminating livestock grazing within wetlands will reduce 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 pollutants and restore the wetland.
   - Wetlands and prior converted wetlands down-slope or up-slope from fields identified as significant upland sediment sources. Restoration of these wetlands will help to: 1) create a wetland filter which reduces the pollutants from an up-slope field(s) to a water resource, or 2) reduce the volume and velocity of water flowing from an up-slope wetland to a down-slope critical field.
   - Wetlands providing water quality improvements through infiltration. Water stored in wetlands is (1) filtered as it infiltrates to groundwater, and (2) helps to increase stream flows.

   Preference will be given to prior converted and farmed wetlands. Prior converted wetlands are those that have been drained, dredged, filled, leveled, or otherwise manipulated (including removal of woody vegetation) for agricultural use prior to December 23, 1985. Farmed wetlands include potholes and seasonally flooded or ponded wetlands not fully converted prior to December 1985. Farmed wetlands are cropped in dry years.

2) **Eligible Restorations** – Includes sites not meeting the definition of a priority site but offer significant water quality benefits such as providing storage of storm event runoff and flood flows. Also included are sites functioning as a filter to delay, absorb, or purify contaminated runoff before it enters a stream or lake.

3) **Ineligible Restorations** – Sites with existing physical characteristics or conditions are such that the potential for restoration would not be environmentally viable or economically feasible.

Wetland Restoration Permits

County staff, DNR, US Fish & Wildlife, or NRCS wetland restoration experts will assist landowners in developing restoration plans and obtaining permits. Permits may be needed from three sources:

- Federal (Army Corps of Engineers) Clean Water Act §404 – Prior converted wetlands may be exempt from this permit.
- State (DNR) Clean Water Act §401 Water Quality Certification, Chapter 30 and 31, Wis. Stats.
- Local Authority(County or Municipal Zoning Office)

Land Easements

NPS program funds may be used to purchase land easements to support specified BMPs. These practices, all of which involve the establishment of permanent vegetative cover, include:

- **Shoreline Buffers**: vegetative areas which minimize NPS 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 to improve their ecological values, such as natural filters of surface water

To protect groundwater, easements can be used as part of a wellhead protection area. Easements are used to support BMPs, enhance landowner cooperation, and more accurately compensate landowners for loss or altered usage of property. Although easements are not considered a BMP under certain conditions they may help achieve desired levels NPS pollution control.

The benefits of using easements in conjunction with a management practice include the following:

- riparian easements can provide fish and wildlife habitat along with reducing pollution
- since easements are generally perpetual the protection is longer term than a management practice by itself
- an easement may allow for limited public access (depending on the situation).

Easements should be considered in the following situations.

1) To exclude livestock from grazed wetlands or along eroding streambanks within the watershed. Easements are strongly recommended whenever:
   - Wetlands are grazed;

- Livestock density creates areas of unvegetated soil within 60 feet of streams (intermittent and perennial);
- Streambanks are severely trampled and eroded.
- Channel erosion is exacerbated by livestock grazing such that unvegetated streambanks are two feet or more in height.

2) When elimination of row cropping and the establishment of permanent vegetative cover will stabilize a critical area. Use of easements are strongly recommended when they are supportive of eligible wetland restorations. Use of easements are also strongly recommended whenever:
   - Row cropping is occurring within 60 feet or less of perennial or intermittent streams.
   - Row cropping is practiced on slopes greater than six percent.

3) When a barnyard or animal feedlot is located within the flood plain and a permanent easement is the least-cost alternative to provide adequate pollution reduction or a permanent easement provides a greater level cost effective, pollution reduction than on-site engineering options.

   Easements are strongly recommended whenever:
   - Engineering options would require intensive management to provide adequate pollution reduction.
   - Surrounding land use is expected to remain primarily agricultural for two or more decades.

Land Acquisition

Units of Government, including Lake Protection and Rehabilitation Districts, within the Fond du Lac River Watershed Project area are eligible for NPS grants to supplement the purchase of land or land in fee that is contributing or will contribute NPS pollution.

Eligibility Criteria - Eligibility for land acquisition must meet <u>one</u> of the following criteria:

- Only lands in the environmental corridors of the watershed project area will be eligible for land acquisition grants.
- The acquisition of the property must provide for the protection or improvement of water quality.
- 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.
- The acquisition of the property must compliment other watershed management efforts.
- 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.
- Any acquisition proposal must meet the applicable goals of the watershed project.

CHAPTER FOUR:
Rural Implementation

Introduction

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

- Best management practices (BMPs) to control nonpoint sources of pollution as described in Chapter Two.
- Cost containment policies.
- Cost-share agreement procedures.
- Project implementation schedules, including critical site notification.
- Critical site designation appeal process.
- Project budget estimates for cost-sharing, staffing, and other support.

Eligible Best Management Practices

Design and installation of all NPS pollution BMPs must meet the conditions listed in NR 120, Wis. Adm. Code. Generally these practices use standard specifications included in the NRCS Field Office Technical Guide; additional specifications may also apply.

BMPs shall be planned, designed, and installed to prevent or minimize the loss of existing wildlife habitat. If the installation of a BMP destroys significant wildlife habitat NR 120 requires replacement or recreation of the lost habitat. The DNR Regional Wildlife Specialist or a designee will assist the County staff in determining the significance of wildlife habitat and the options available to recreate or replace it. Wildlife habitat restoration components of the practice are cost-shared at 70 percent.

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

A brief description of the most commonly used BMPs can be found in Appendix C. Detailed descriptions are included in NR120.14, Wis. Admin. Code.

Table 4-1. Practices with Flat Rates for State Cost-Share Funding

Best Management Practice	Maximum Flat Rate
Contour Farming	$9.00/ac[2]
Contour Stripcropping	$13.50/ac[2]
Field Stripcropping	$7.50/ac[2]
High Residue Management	$18.50/ac[3]
Riparian Buffer Strip[1]	$125.00/ac[4]
Cropland Protection Cover	$25.00/ac[5]

[1]This is currently an interim BMP and, as of plan approval date, is not yet an approved BMP for this watershed. If approved, it will be included in this project

[2]Wildlife habitat restoration components of this practice are cost-shared at 70 percent

[3]Cost-shared up to six years.

[4]Cost-shared up to five years.

[5]Cost-shared up to three years.

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

Best Management Practice	State Cost-Share Rate
Nutrient and Pesticide Management	50%
Pesticide Handling Spill Control Basins	70%
Livestock Exclusion from Woodlots	50%
Intensive Grazing Management	50% [1]
Manure Storage Facilities	70% and 50% [2]
Manure Storage Facility Abandonment	70%
Field Diversions and Terraces	70%
Grassed Waterways	70%
Critical Area Stabilization	70% [3]
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70% [3]
Shoreline Buffers	70% [3]
Wetland Restoration	70% [3]
Barnyard Runoff Management	70%
Barnyard Relocation	70%
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Structural Urban BMPs	70% [4]
Milking Center Waste Control	70%
Cattle Mounds	70%
Land Acquisition	50% [5]
Lake Sediment Treatment	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 Three for an explanation of where easements may apply.
4. The maximum cost-share rate for storm sewer rerouting and removal of structures necessary to install structural urban BMPs is 50%.
5. Cost-sharing is available to acquire land for the construction of an urban structural practice or to acquire land that is contributing or will contribute NPS pollution.

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 this plan. The Department may identify in the NPS grant agreement design criteria, standards and specifications, cost share conditions, and cost share rates for alternative BMPs.

Practices Not Cost-Shared

Listed below are practices not cost-shared but which may be included in an agreement if necessary to control nonpoint pollution sources:

- The portion of a practice 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 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 to accelerate or increase drainage of land or wetlands, except where drainage is required as a component of a BMP.
- Practices 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. **Exception**: 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 stormwater 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 stormwater management practices for new developments.
- Pollution control measures needed during construction of highways and bridges.
- Other practices or activities listed in NR 120.17 or determined by DNR not to meet the objectives of the program.

Administration of Cost-Share Agreements

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. Funding is distributed to landowners by a local unit of government from a NPS Grant provided by the DNR. The local unit of government 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 local unit of government. 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, or the first NPS Grant has been received, and are filed as part of the property deed. Agreements may be amended throughout the ten-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 with the exception of conservation tillage and nutrient management which has no term specified.

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 required permits prior to installation of practices.

Where a local unit of government serves as a party to a local cost share agreement, that local unit of government is responsible for enforcing agreement compliance. 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 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 Procedures

Chapter NR 120 requires identification of cost containment procedures in this plan to control BMP installation costs. The cost containment procedure to be used by the counties is described below. The bidding procedure and average cost and flat rate lists are available from County Conservation Departments.

Bids: Competitive bids will be required for all structural BMPs with estimated total costs exceeding $5,000 as determined by the project technician. The bidding process requires a minimum of three bids from qualified contractors in itemized bid format. In cases where only one bid is received, County Conservation Departments (CCDs) will determine if the bid constitutes an appropriate cost for the project. If no bids are received or if the lone bid is not deemed appropriate, the project may be placed back out for bids or counties may limit cost sharing based on average costs. CCDs and landowners reserve the right to refuse any bids not deemed appropriate for the practice.

Average Costs: Average costs will be used for all structural BMPs with an estimated cost of less than $5,000 and for all non-structural BMPs not using a flat rate, unless the cost share recipient decides, and the county agrees, to bid the installation of the BMPs. If the cost share recipient or any county decides to bid a structural BMP under $5,000 the bid procedure will apply.

Payments for "in kind" contributions will be based on the county's guidelines. Cost share recipients who wish to install a BMP using their own labor, material, and equipment must submit a quote plus one quote from a qualified contractor for the practice installation. The Wisconsin Conservation Corps Crew may be used to install BMPs for cost share recipients.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost-sharing determined by cost estimates, then the amount paid the grantee may be increased with the approval of the CCD. Appropriate documentation regarding the need for changes will be submitted to the DNR.

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 final 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.

Sediment Delivery Inventory Completion Schedule

Approximately 80 percent of the watershed's upland fields remained un-inventoried when the plan was approved. Each year LCD staff will inventory 20 percent of the remaining uplands and complete the entire the inventory in five years.

As part of the annual inventory work LCD staff expect to identify fields meeting critical site criteria. LCD staff will verify all sites identified each year and report this information to the DNR as part of the notification process.

Critical Site Notification Process

At the time of critical site verification, any un-inventoried sites on the same farm must be inventoried. Subsequently, 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 owners of the highest ranked critical sites for verification immediately after plan is approved and complete the contacts within six months. Highest ranked sites are defined as those making up the top 25 percent of the inventoried critical site load. The department may allow up to three 90-day extensions beyond the six-month period to allow counties sufficient time to verify all sites meet critical site criteria. Extension requests must be made to the DNR in writing and include the reason(s) for the extension.

By the end of the six-month verification period, the project staff will send a report to DNR stating each site meets critical site criteria or has changed status according to sec. NR 120.09(6), Wis. Adm. Code. Reasons for these conclusions must be included. Documentation of site visits and additional information will be maintained at the appropriate LCD offices and 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 will complete the verification of remaining critical sites at the rate of 25 percent per year according to the following schedule for 1999, 2000, 2001, and 2002. Critical site notification will be completed by December 2002.

- April-July: Conduct site visits and complete verification work.
- August 1: Send report to DNR implementation coordinator.
- November 1: DNR sends notification to the critical site landowners.

At the time of notification critical site landowners have three years to sign a cost-share agreement at the rates identified in NR 120. After three years cost-share rates are reduced by 50 percent. The notification schedule may be modified and revised at the annual watershed review meeting critical sites are discussed.

Critical Site Appeals Process

The owner or operator of a site designated as critical may appeal the designation to the County Land Conservation Committee (LCC). 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 (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 the notification letter was received by the owner or operator.

The LCC shall:

- provide the appellant with a hearing and give reasonable notice of the hearing to the appellant, DNR, and DATCP.
- conduct an informal hearing. Since the hearing is not formal Chapter 68.11(2), Wis. stats., does not apply.
- hold the hearing in a convenient place for the appellant.

The appellant and project staff present information for LCC to base a decision. Representatives of DNR and DATCP may attend the hearing. DNR must 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:

- the DNR and DATCP reports and recommendations,
- the notification by the DNR and DATCP that no report or recommendations will be submitted, or
- the conclusion of the 60-day period following the hearing.

The LCC may support or overturn the designation of the site as critical. 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 Wis. Stats., 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.

Rural BMP Cost-Share Budget

The quantity and type of management practices required to meet water quality objectives of this project are listed in Table 4-3. The capital costs of installing the BMPs are listed for a 100 percent landowner participation rate. Units of measurement and cost per unit for the various BMPs are also included.

- The capital cost of installing the BMPs is approximately $19.2 million, assuming 100 percent participation. At 75 percent participation the capital cost is $14.4 million.
- State funds necessary to cost-share this level of control would be approximately $12.6 million.
- The local share provided by landowners and other cost-share recipients would be approximately $1.5 million.

Easement and Land Acquisition Costs

Chapter Three identifies where NPS program funds can be used to purchase easements and land. The estimated cost of purchasing easements and land is shown in Table 4-4. At 75 percent participation, the estimated purchase price of easements on eligible lands would be $100,000 and $0 for land acquisition. Easements are state funded at 100 percent.

Rural Budget and Staffing Needs

Table 4-3 lists the total estimated staff needed to implement the project assuming a 75 percent level of participation by eligible landowners. Approximately 159,353 staff hours are required to implement this plan including 1,200 staff hours to carry out the information and education program.

Currently, two and one-half positions are funded on the Fond du Lac River Watershed, two positions in Fond du Lac and one-half position in Winnebago County. The counties and agencies will determine the need for additional staff based on an annual workload analysis. The estimated cost for staff at the 75 percent participation rate is $3.4 million. These costs will be paid by the state through the Local Assistance Grant Agreement.

The total state funding required to meet the rural NPS pollution control (at 75 percent landowner participation) is presented in tables 4-4 and 4-5. The estimated cost to the state is $12.6 million; the estimated cost to landowners and others is $1.5 million for a total project cost of $16.5 million. The total includes the capital 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. Factors potentially affecting project expenditures include: rate of participation, amount of cost sharing actually expended, number of staff working on the project, amount of support costs, and the amount of money actually available.

Grant Disbursement and Project Management Schedule

Implementation of the Fond du Lac River Priority Watershed project shall begin upon approval of this plan and receipt of the NPS Grant. The plan must be approved by the DNR, DATCP, the Fond du Lac County and Winnebago County Boards, and the Wisconsin Land and Water Conservation Board.

Project implementation begins from the date of the first NPS Grant. 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 amount of the NPS grant is calculated at 75 percent participation by eligible landowners (see Table 4-3 for a detailed explanation). This grant may be amended to reflect changes in the practice or timing of a project.

Local Assistance Grants will be disbursed annually to the counties to cover the costs of personnel, operating expenses, and equipment. The DNR will evaluate an annual workload analysis and grant application submitted by each county.

Table 4-3. Estimated County LWCD Staffing Needs (75% Landowner Participation)

Activity	Project Years	Fond du Lac County	Winnebago County
Project & Financial Mgmt	1-10	1,250	400
Information & Education Programs	1-5	1,000	200
Pre-Contact Office Inventory; Landowner Contacts, & Progress Tracking	1-5	1,000	400
Conservation Planning & Cost Share Agreement Development	1-5	1,300	750
Plan Revisions and Monitoring	1-10	950	600
Practice Design & Installation, Upland Sediment Control	1-10	56,542	10,135
Animal Waste Management,		6,082	917
Streambank Erosion Control		7,770	1,381
Easement		450	
Training	1-10	1,000	400
Total LCD Workload		77,344	15,333
Estimated Staff Required for Years	1-5	4.0 / yr	0.9 / yr
Estimated Staff Hours	1-5	8,264	1,868
Estimated Staff Required for Years	6-10	3.7 / yr	0.8 / yr
Estimated Staff Hours	6-10	7,604 / yr	1,598 / yr

Source: WI Department of Natural Resources; WI Department of Agriculture, Trade and Consumer Protection and Land Conservation Departments of Waushara and Winnebago Counties

Table 4-4. Grant Disbursement Schedule at 75% Landowner Participation

Item	Fond du Lac Co. (State Share)	Winnebago Co. (State Share)	Total Costs (State Share)
Best Management Practices	$8,252,710	$1,609,757	$9,862,467
Easements	$56,250	$18,750	$75,000
Local Assistance Staff Support	$1,656,619	$361,850	$2,018,470
Information/Education Direct	$50,500	$8,000	$58,500
Other Direct (Travel, Supplies)	$187,200	$20,800	$208,000
Total	**$10,203,279**	**$2,019,157**	**$12,222,437**

Table 4-5. Cost-Share Budget for Rural Management Practices in Fond du Lac and Winnebago Counties (75% Landowner Participation)

Best Management Practice	Units in Fond du Lac County	Units in Winnebago County	Cost/Unit	Total Cost	State Share	Local Share	Hrs/ Unit	Total Hrs
Upland Control								
Change in Crop Rotation (1)	93,369 ac	4,373	$0	0	0	0	0.1	437.3
Contour Cropping (1)	66,508 ac	0,222	$9	690,570	517,928	0	0.3	17,264.25
Contour Stripcropping (1)	100 ac	100	$14	2,700	2,025	0	0.5	75
High residue mgmt. (1) (2) (5) (7)	526,254 ac	104,190	$19	11,663,214	5,831,607	0	0.2	78,938.1
Cropland Protection Cover (1) (3)	10,000 ac	1,500	$25	287,500	215,625	0	0.04	345
Intensive grazing Mgmt..	5 each	1	$4,000	24,000	9,000	7,500	15	67.5
Critical Area Stabilization	100 ac	20	$300	36,000	18,900	8,100	0.5	45
Grass Waterways	30 ft.	15	$3,000	135,000	70,875	30,375	22	742.5
Field Diversions & Terraces	5,000	1,000	$3	19,500	10,238	4,388	0.04	180
Grade Stabilization	10	3	$4,000	52,000	27,300	11,700	50	487.5
Ag Sediment Basins	20	4	$10,000	240,000	126,000	54,000	90	1,620
Nutrient Mgmt. only (3)	52,500	7,095	$6	357,570	118,125	118,125	0.1	4,469.6
Nutrient and pest Mgmt.. (3)	26,000	3,550	$10	295,500	97,500	97,500	0.1	2,216.25
Infield buffers	50	10	$150	9,000	4,725	2,025	2	90
Wetland restoration	30	10	$10,000	400,000	210,000	90,000	34	1,020
Riparian Vegetative Buffer Strips (4) (5)	100 ac	20	$125	15,000	11,250	0	2	180
Livestock exclusion from woodlots	10,000 ft.	2,000	$1	12,000	6,300	2,700	0.01	90
Spill Control Basins	3 each	1	$15,000	60,000	31,500	13,500	40	120
Animal Waste Management								
Barnyard Runoff Control								
Complete System	52	6	$53,500	2,030,000	1,065,750	456,750	95	4,132.5
Roof Gutters	20	6	$3,500	91,000	47,775	20,475	2	39
Clean Water Diversion	20	6	$5,000	130,000	68,250	29,250	21	409.5
Roofs	1		$25,000	25,000	13,125	5,625	15	11.25
Cattle Mounds	5	1	$3,000	18,000	9,450	4,050	15	67.5
Manure Storage Facility (6)	29	5	$40,000	1,360,000	587,250	282,750	80	2,040
Animal Waste Storage Abandonment	3	1	$10,000	40,000	21,000	9,000	20	60
Well Abandonment	10	10	$500	10,000	5,250	2,250	2	30
Animal lot abandonment	1	1	$60,000	120,000	63,000	27,000	20	30
Milking Center Waste Control	10	2	$7,000	84,000	44,100	18,900	20	180

Table 4-5 cont. Cost-Share Budget for Rural Management Practices in Fond du Lac and Winnebago Counties (75% Landowner Participation)

Streambank Erosion Control								
Shape & Seed	26,000 ft.	1,000	$7	175,500	92,138	39,488	0.2	4,050
Shoreline Buffers	10 ac	10	$400	8,000	4,200	1,800	0.5	7.5
Streambank fencing	25,000 ft.	5,000	$2	45,000	23,625	10,125	0.06	1,350
Rock Riprap/ LUNKERS	13,000 ft	5,000	$30	540,000	283,500	121,500	0.2	2,700
Bio Riprap	4,000 ft	1,250	$25	131,250	68,906	29,531	0.2	787.5
Livestock/Machinery Crossing/Watering pump	10	4	$2,000	28,000	14,700	6,300	18	189
Remote watering system	5	1	$3,500	21,100	11,025	4,725	15	67.5
Easements								
Wetlands, Critical Area, Streambank	75 acres	25 acres	$1,000	$100,000	$75,000	0	8	600
Land Acquisition	0	0	$2,500	0	0	0	8	0
Totals				**$19,256,304**	**$9,806,941**	**$1,509,431**		**$125,139.275**

Table 4-6. Proportion of Estimated Annual Loads from Source Areas by Land Use Type

Land Use Type [1]	Source Area	Runoff Volume	Suspended Solids	Total Phosphorus	Total Copper	Total Lead	Total Zinc
Residential	Parking/Storage	0%	0%	0%	1%	0%	0%
	Streets	28%	70%	20%	35%	75%	25%
	Driveways	8%	5%	5%	2%	3%	4%
	Rooftops	18%	2%	4%	6%	4%	27%
	Lawns/Other	42%	21%	68%	55%	16%	42%
	Sidewalk/Other	4%	2%	3%	1%	2%	2%
Commercial	Parking/Storage	25%	3%	4%	4%	1%	4%
	Streets	32%	93%	62%	81%	92%	59%
	Driveways	2%	0%	1%	0%	0%	0%
	Rooftops	19%	1%	7%	4%	6%	32%
	Lawns/Other	20%	3%	25%	11%	1%	5%
	Sidewalk/Other	2%	0%	1%	0%	0%	0%
Industrial	Parking/Storage	46%	79%	50%	74%	Not available	25%
	Streets	11%	7%	8%	12%	Not available	3%
	Driveways	3%	2%	5%	4%	Not available	1%
	Rooftops	33%	7%	10%	8%	Not available	69%
	Lawns/Other	6%	15%	27%	3%	Not available	1%
	Sidewalk/Other	1%	0%	0%	0%	Not available	1%
Institutional	Parking/Storage	9%	2%	2%	2%	3%	7%
	Streets	14%	39%	8%	17%	52%	16%
	Driveways	2%	1%	1%	1%	1%	1%
	Rooftops	8%	1%	3%	4%	4%	5%
	Lawns/Other	65%	56%	85%	75%	39%	70%
	Sidewalk/Other	2%	1%	1%	1%	1%	1%

Table 4-6 continued. Proportion of Estimated Annual Loads from Source Areas by Land Use Type

Open Space	Parking/Storage	4%	11%	4%	9%	Not available	13%
	Streets	13%	50%	23%	38%	Not available	34%
	Driveways	1%	5%	5%	3%	Not available	3%
	Rooftops	0%	0%	0%	1%	Not available	2%
	Lawns/Other	90%	31%	63%	41%	Not available	27%
	Sidewalk/Other	4%	3%	4%	8%	Not available	21%

[1] Percentages for residential, commercial, and institutional land uses based on actual SLAMM modeling from the Winnebago East Priority Watershed study. Percentages for industrial and open space land uses are as found in the Duck-Apple-Ashwaubenon Creeks Watershed study.

Table 4-7. Pollutant Loadings for Suspended Solids and Phosphorus for Municipalities in the Fond du Lac River Watershed

Community	Existing Dev. Acres	Planned Dev. Acres	1997 SS Load (tons/yr.)	1997 Phos. Load (lbs./yr.)	2020 SS Load (tons/yr.)	2020 Phos. Load (lbs./yr.)
Rosendale (v.)[1]	300	32	77	515	83	575
Oakfield (v.)[2]	252	43.5	6	436	65	514
Oshkosh (c.)[3]	3,626	3,625	801	3,865	1,089	6,424
North Fond du Lac (v)[4]	1,051	2,252	279	1,519	831	4,003
Fond du Lac (c)	4,780	3,067	1,632	8,681	2,644	12,801
TOTAL	**10,009**	**9,019.5**	**2795**	**15,016**	**4712**	**24,317**

1. Information based on a 1969 zoning map prepared for the Village of Rosendale, available from the Fond du Lac County Planning Department.
2. Based on preliminary data provided by East Central Wisconsin Regional Planning Commission. Final plan due out in 1998.
3. Based on 1994 existing land use maps for Oshkosh and the comprehensive plan for the city for future development.
4. Based on Village of North Fond du Lac Community Development Plan, May 1995, prepared by East Central Wisconsin Regional Planning Commission.

CHAPTER FIVE: Urban Inventory Results, Nonpoint Source Pollutants, Reduction Goals, and Cost-Share Eligibility

An urban nonpoint source (NPS) inventory and analysis was conducted to identify and prioritize major and minor constraints to achieving water quality goals in the watershed. HNTB Corporation (Milwaukee) completed the urban inventory for the City of Fond du Lac, and inventory data for the other communities was extrapolated by DNR. This section describes the urban nonpoint source pollutants as well as the management needs and reduction objectives for each urban pollutant in the Fond du Lac River/Winnebago West Watershed. This section includes assessments for stormwater conveyance, sediment from construction site erosion and streambank erosion, pollution prevention practices, and urban toxic pollutants carried in runoff. The section ends with a summary of the pollutant reduction goals and project objectives for urban nonpoint sources.

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 Pollutants

Urban areas produce a wide variety of pollutants, which can degrade water quality. There are six constituents that are commonly found in urban runoff: sediments, nutrients, pathogens, organic enrichment, toxic pollutants, and salts.

Sediments can be made of either organic or inorganic material. Elevated levels of total suspended solids, turbidity and dissolved solids result from such urban sources as construction site runoff, urban runoff, landfill leachate and septic field leakage, and urban streambank erosion. The effects of excess sediment on surface water include turbidity, habitat alteration, recreational and aesthetic loss, and contaminant transport.
Excess nutrients can lead to algae blooms in shallow water and ammonia toxicity. Nutrient parameters include: nitrate, nitrite, ammonia, organic nitrogen, phosphate and total phosphorus. Urban sources of nutrients include: runoff, landfill leachate, septic field leakage, atmospheric deposition and streambank and construction site erosion.

Pathogens can have many and varied effects ranging from ear and intestinal infections, if consumed directly, or by contact exposure from swimming. Pathogenic parameters

include total and fecal coliform, fecal streptococci, viruses, cryptosporidium, and E. coli. Urban sources for these pathogens include runoff, leaking septic systems, and illicit sanitary connections.

Organic enrichment can be described as biochemical and chemical oxygen demand (BOD and COD, respectively) and total organic carbon (TOC). Urban sources of organic enrichment include runoff, landfill leachate and septic systems. In excess, organic enrichment can lead to low dissolved oxygen levels or anoxic conditions, which can lead to odor problems and fish kills. Excess organic enrichment is inextricably linked to the process of eutrophication, or excess production, in lakes and streams and has disturbing effects on an aquatic system's balance.

Pollutants with toxic properties can have deleterious effects on aquatic resources. Heavy metals such as lead, zinc, chromium, copper, cadmium and arsenic and organic compounds, such as polychlorinated biphenyls (PCBs) are responsible for chronic toxicity impacts. They can bioaccumulate in the food chain, leading to toxic build up and disruption of normal growth and reproduction in aquatic and terrestrial life. Acute toxicity can also occur from urban runoff. Runoff monitored from commercial and high density residential areas in Madison and Milwaukee during 1990 was found to exceed acute toxicity standards developed for point sources as defined in NR 105 and NR 106 Wis. Adm. Code. Sources of potentially toxic compounds may come from pesticide and herbicide runoff, leaking underground storage tanks, landfill leachate, illegal oil disposal, industrial effluent, automobile combustion byproducts, and particulates from wearing of tires.

Salts, such as sodium chloride used as a deicing agent, are present in runoff and snowmelt. Potential effects include vehicle corrosion, contamination of drinking water and harm to freshwater organisms, both plants and animals.

Stream Hydrology

A stream hydrograph is a two-dimensional representation of water flow used to show changes in streamflow over time. Base flow is that flow generated by groundwater discharge to the stream. The level of base flow for some streams is zero because flow only occurs during rain events. Other streams have year-round base flow from groundwater discharge from seeps or springs. Peak flows are levels of stream flow recorded during rain events when surface runoff contributes to the existing stream flow.

Land use that promotes over-land runoff rather than infiltration of rain has been shown to greatly affect hydrographs. A hydrograph showing a gradual and even rise in water levels during and immediately after a rain event represents a stream where infiltration of rain in the surrounding watershed occurs. Higher base flow is shown by the higher in-stream water level. The gradual rise and fall of the hydrograph line represents additions to base flow water level from increased infiltration and direct precipitation.

A hydrograph with a steep, sharp peak during and immediately after a rain event followed by a steep drop in water level corresponds to a stream with little or no base flow and watershed infiltration. The stream's little or no base flow and sharp, sudden increase in level during and immediately after a storm event (higher peak flow) represents a "flashy" hydrograph. A reduction in base flow may result in a stream drying up during parts of the year which has a direct effect on fish survival. Low base flow during non rain events also means the instream temperature will rise above historic levels, affecting all aquatic life. During rain events, the sudden increase in flow may be associated with flash flooding on some streams. The energy of this peak flow is dissipated by thrashing action against streambanks, which may result in streambank erosion, especially along poorly vegetated banks. Instream habitat is also disturbed by high peak flows which often carry sediment that eventually settles to cover "clean" substrate (rocky, pebbly stream bottoms) needed by fish and aquatic insects. The hydrologic instability of a flashy stream affects water temperature and bank structure and aquatic community health. In addition to these adverse effects, road culverts may experience surcharging if undersized for these peak flows.

Land Use Characteristics

A great many studies have been conducted on the effects of urbanization on surface and groundwater. Urban land uses vary in their significance as pollutant source areas. Table 5-1 lists the land uses in the Fond du Lac Watershed and Table 5-2 shows average unit area loads associated with different land uses. These values were developed from modeling efforts conducted previously for the portion of the City of Fond du Lac that lies within the Lake Winnebago East Priority Watershed. For a given pollutant, it is clear that the land use plays an important role in the amount generated on a per acre basis.

Vehicle traffic density and the type and density of industrial activity are important determinants of many heavy metal (lead, copper, zinc) loadings to waterbodies or the atmosphere. Generally, metals found in runoff are generated from tire and brake lining wear, oil, antifreeze, grease and gasoline. Generally, PAHs in runoff are delivered by atmospheric deposition from sources of incomplete combustion of hydrocarbons, such as vehicles and coal-fired power plants (both municipal and industrial). Residential, commercial and industrial land uses are major sources of fertilizers and pesticides, which generally contribute excess nutrients and complex organic compounds, respectively. Domestic pets are likely urban sources of bacteria in runoff, although urban wildlife such as rabbits and squirrels are also responsible.

Table 5-1. Urban Land Uses in the Fond du Lac River Watershed

Land Uses	Acres	Percent
Residential		
Low Density	161	2%
Medium Density	1982	23%
High Density	246	3%
Commercial	923	11%
Industrial	808	9%
Institutional	256	3%
Park/Open Space	3741	44%
Airport	179	2%
WDOT Highway	225	3%
TOTAL:	**8521**	**100%**

Significance of Pollutant Concentrations

Table 5-2 illustrates the variability of unit area loads from different land uses. Land uses that contribute a comparatively small unit load but which currently or in the future will occupy a large proportion of the total land acreage should be evaluated and managed closely. Strategies to reduce mass loads are generally applied watershed or community-wide.

Table 5-2. Pollutant Generation Unit Area Load from Urban Land Uses

Urban Land Use	Unit Area Load (lbs/acre/year) [1]				
	Suspended Solids	Phosphorus	Copper	Lead	Zinc
Residential [2]	432	1.9	0.6	0.8	0.6
Commercial	1445	2.8	1.3	5.4	2.7
Industrial [3]	800	1.2	0.06	2.1	1.7
Institutional	240	1.7	0.5	0.4	0.4
Open Space [2]	25	0.01	---	0.005	---
Freeway [3]	600	0.9	0.03	2.5	1.9

[1] Unless otherwise noted, values were calculated from data specific to the watershed, using a Milwaukee rain file and parameter file calibrated from data collected from Madison, WI, Milwaukee, WI and Marquette, MI field tests.
[2] These values are an average of all residential land uses from single family to multi-family residential.
[3] Pollutant loads are DNR typical unit area loads.

Currently, no state standards exist for the concentration or mass of pollutants discharged through stormwater outfalls. However, the level of pollution discharged through stormwater outfalls can be evaluated by comparing the "end of pipe" (point where the storm sewer discharges into a water course) concentrations with discharge limits in place for municipal and industrial effluent. From the 1990 Madison and Milwaukee monitoring effort, event mean concentrations of copper and zinc were found to exceed NR 105 and NR 106 standards 45 percent of the time. Event mean concentrations of PCBs exceeded the human cancer criteria 100 percent of the time, and PAH concentrations exceeded the toxicity standard 60 percent of the time. Stormwater outfalls may exceed phosphorus and suspended solids limits that are required of municipal and industrial wastewater treatment plants, although no such limits are set for stormwater outfalls. Ultimately, however, the potential for this level of contamination to occur depends upon the mix of contributing land uses. While an equivalent monitoring effort was not performed on the subwatersheds in the Fond du Lac River/Winnebago West Priority Watershed Area, we would expect to find similar results, given the existing land uses.

Urban Inventory

Tables 5-3 and 5-4 show the mass loads of suspended solids, total phosphorus, total copper, total zinc and total lead for the urban areas of Fond du Lac under existing and future land use conditions. These pollutants were chosen because they are either conventional pollutants of general concern or toxic materials known to occur widely in relatively high concentrations in urban runoff.

The effectiveness of existing street sweeping and drainage controls were incorporated into the calculations of unit area pollutant loadings. SLAMM automatically reduces pollutant loadings for source areas that drain across landscaped areas as opposed to being directly connected to the conveyance system. Grassed swale densities for urban land uses were estimated based on aerial photographs and field reconnaissance. The effect from existing detention ponds and wetland areas on pollutant loadings is also reflected in these data.

Table 5-3. Existing Annual Pollutant Loads by Subwatershed (1997 Data)

Subwatershed	Suspended Solids (ton/yr.)	Total Phosphorus (lb./yr.)	Total Copper (lb./yr.)	Total Zinc (lb./yr.)	Total Lead (lb./yr.)
Adelaide Park	34	259	77	103	135
Arndt St.	51	229	43	195	244
Division St.	21	112	26	76	98
Gravity	25	109	38	92	156
Johnson St.	39	169	72	144	276
Lincoln Ave.	17	129	38	51	67
McWilliams St.	9	64	18	29	38
Merril Ave.	28	217	62	92	117
Military Rd.	38	200	68	136	226
Northwest (grav)	25	130	42	84	135
Oregon St.	20	109	33	73	112
Thomas St.	19	118	40	62	100
W. Scott St.	6	51	16	17	23
Western Ave.	17	96	32	59	95
Subtotals: Pump Station Subwatersheds	**348**	**1992**	**603**	**1214**	**1821**
Airport	61	209	49	138	196
Dutch Gap	159	1324	406	451	592
East Branch-N	143	990	280	471	622
East Branch-S	170	636	242	677	1207
Esterbrook Rd.	62	313	102	177	291
Ledgeview	3	5	1	2	6
Pioneer Rd.	198	875	323	763	1343
River Rd.	32	132	36	110	167
Rolling Meadows	170	654	284	633	1222
Sabish	99	646	167	342	431
Supple	108	402	78	426	587
West Branch-N	78	503	173	254	416
V/ N. Fond du Lac	0				
V/ Oakfield	0				
V/ Rosendale	0				
C/ Oshkosh	0				
Subtotals:Non-Pump Station Subwatersheds	**1284**	**6689**	**2142**	**4446**	**7081**
Total Existing Annual Pollutant Load	**1632**	**8681**	**2745**	**5660**	**8902**

Table 5-4. Projected Increase in Pollutant Loads with Ultimate Development (lbs / yr)

Subwatershed		Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total Lead
Adelaide Park	Existing	67882	259	77	103	135
	Add'l Planned	28453	65	28	16	99
	Increase (%)	42%	25%	36%	15%	73%
Arndt St.	Existing	101100	229	43	195	244
	Add'l Planned	12424	26	12	6	45
	Increase (%)	12%	11%	27%	3%	18%
Division St.	Existing	41650	112	26	76	98
	Add'l Planned	1040	3	1	2	3
	Increase (%)	2%	3%	2%	3%	3%
Gravity	Existing	49384	109	38	92	156
	Add'l Planned	4767	10.3	4.5	2.4	17
	Increase (%)	10%	9%	12%	3%	11%
Johnson St.	Existing	78534	169	72	144	276
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Lincoln Ave.	Existing	33616	129	38	51	67
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
McWilliams St.	Existing	18128	64	18	29	38
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Merril Ave.	Existing	56896	217	62	92	117
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Military Rd.	Existing	76224	200	68	136	226
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Northwest (grav)	Existing	49752	130	42	84	135
	Add'l Planned	21898	89	29	28	46
	Increase (%)	44%	69%	69%	33%	34%
Oregon St.	Existing	39670	109	33	73	112
	Add'l Planned	5295	15	6	3	18
	Increase (%)	13%	14%	18%	5%	16%
Thomas St.	Existing	37608	118	40	62	100
	Add'l Planned	432	1.9	0.6	0.6	0.8
	Increase (%)	1%	2%	2%	1%	1%

Table 5-4 continued. Projected Increase in Pollutant Loads with Ultimate Development

W. Scott St.	Existing	12082	51	16	17	23
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Western Ave.	Existing	34083	96	32	59	95
	Add'l Planned	0	0	0	0	0
	Increase (%)	0%	0%	0%	0%	0%
Airport	Existing	121597	209	49	138	196
	Add'l Planned	145380	239	38	179	231
	Increase (%)	120%	114%	77%	130%	118%
Dutch Gap	Existing	317836	1324	406	451	592
	Add'l Planned	130620	534	174	165	274
	Increase (%)	41%	40%	43%	37%	46%
East Branch-N	Existing	285755	990	280	471	622
	Add'l Planned	8959	24	8	9	26
	Increase (%)	3%	2%	3%	2%	4%
East Branch-S	Existing	340601	636	242	677	1207
	Add'l Planned	264324	565	172	325	798
	Increase (%)	78%	89%	71%	48%	66%
Esterbrook	Existing	123046	316	104	178	291
	Add'l Planned	428320	668	70	771	1020
	Increase (%)	348%	211%	67%	433%	351%
Ledgeview	Existing	6826	5	1	2	6
	Add'l Planned	31934.5	62	29	13	119
	Increase (%)	468%	1238%	2873%	663%	1989%
Pioneer Rd.	Existing	396859	875	323	763	1343
	Add'l Planned	163731	266	28	327	437
	Increase (%)	41%	30%	9%	43%	33%
River Rd.	Existing	63813	132	36	110	167
	Add'l Planned	296755	520	164	337	970
	Increase (%)	465%	394%	456%	306%	581%
Rolling Meadows	Existing	340395	654	284	663	1222
	Add'l Planned	100465	242	90	86	319
	Increase (%)	30%	37%	32%	13%	26%
Sabish	Existing	197498	646	167	342	431
	Add'l Planned	12360	24	11	5	44
	Increase (%)	6%	4%	6%	2%	10%
Supple	Existing	216732	402	78	426	587
	Add'l Planned	447565	739	149	695	1270
	Increase (%)	207%	184%	191%	163%	216%
West Branch-N	Existing	156549	503	173	254	416
	Add'l Planned	12457	23	7	14	40
	Increase (%)	8%	5%	4%	5%	10%

Table 5-5. Estimated Proportion of Annual Loads from Source Areas by Land Use

Land Use Type [1]	Source Area	Runoff Volume	Suspended Solids	Total Phosphorus	Total Copper	Total Lead	Total Zinc
Residential	Parking/Storage	0%	0%	0%	1%	0%	0%
	Streets	28%	70%	20%	35%	75%	25%
	Driveways	8%	5%	5%	2%	3%	4%
	Rooftops	18%	2%	4%	6%	4%	27%
	Lawns/Other	42%	21%	68%	55%	16%	42%
	Sidewalk/Other	4%	2%	3%	1%	2%	2%
Commercial	Parking/Storage	25%	3%	4%	4%	1%	4%
	Streets	32%	93%	62%	81%	92%	59%
	Driveways	2%	0%	1%	0%	0%	0%
	Rooftops	19%	1%	7%	4%	6%	32%
	Lawns/Other	20%	3%	25%	11%	1%	5%
	Sidewalk/Other	2%	0%	1%	0%	0%	0%
Industrial	Parking/Storage	46%	79%	50%	74%	N/A	25%
	Streets	11%	7%	8%	12%	N/A	3%
	Driveways	3%	2%	5%	4%	N/A	1%
	Rooftops	33%	7%	10%	8%	N/A	69%
	Lawns/Other	6%	15%	27%	3%	N/A	1%
	Sidewalk/Other	1%	0%	0%	0%	N/A	1%
Institutional	Parking/Storage	9%	2%	2%	2%	3%	7%
	Streets	14%	39%	8%	17%	52%	16%
	Driveways	2%	1%	1%	1%	1%	1%
	Rooftops	8%	1%	3%	4%	4%	5%
	Lawns/Other	65%	56%	85%	75%	39%	70%
	Sidewalk/Other	2%	1%	1%	1%	1%	1%
Open Space	Parking/Storage	4%	11%	4%	9%	N/A	13%
	Streets	13%	50%	23%	38%	N/A	34%
	Driveways	1%	5%	5%	3%	N/A	3%
	Rooftops	0%	0%	0%	1%	N/A	2%
	Lawns/Other	90%	31%	63%	41%	N/A	27%
	Sidewalk/Other	4%	3%	4%	8%	N/A	21%

[1] Percentages for residential, commercial, and institutional land uses based on actual SLAMM modeling from the Winnebago East Priority Watershed study. Percentages for industrial and open space land uses are as found in the Duck-Apple-Ashwaubenon Creeks Watershed study.

Table 5-6. Pollutant Loadings for Suspended Solids and Phosphorus for Municipalities in the Fond du Lac River Priority Watershed

Community	Developed Acres		1997 SS Load (tons/yr.)	1997 Phos. Load (lbs./yr.)	2020 SS Load (tons/yr.)	2020 Phos. Load (lbs./yr.)
	Existing	Planned				
Rosendale [1]	300	32	77	515	83	575
Oakfield [2]	252	43.5	6	436	65	514
Oshkosh [3]	3,626	3,625	801	3,865	1,089	6,424
North Fond du Lac [4]	1,051	2,252	279	1,519	831	4,003
Fond du Lac	4,780	3,067	1,632	8,681	2,644	12,801
TOTAL	**10,009**	**9,019.5**	**2795**	**15,016**	**4712**	**24,317**

1. Information based on a 1969 zoning map prepared for the Village of Rosendale, available from the Fond du Lac County Planning Department.
2. Based on preliminary data provided by East Central Wisconsin Regional Planning Commission. Final plan due out in 1998.
3. Based on 1994 existing land use maps for Oshkosh and the comprehensive plan for the city for future development.
4. Based on Village of North Fond du Lac Community Development Plan, May 1995, prepared by East Central Wisconsin Regional Planning Commission.

Stormwater Runoff Pollutant Loads from Planned Areas

Table 5-4 shows the anticipated development in the urban areas of the Fond du Lac River/Winnebago West Watershed. The anticipated land use increases represent a full build-out scenario. The model analysis, based on this scenario, may therefore overestimate the actual loads that will occur in 2020. Table 5-4 shows the results of future loadings due to increased growth in the watershed.

Table 5-5 shows the results of an analysis done on source area contributions. Source areas include roofs, driveways, streets, sidewalks, lawns, etc. From this table it is clear that the source area contributions vary with the pollutant and with the land use. For suspended solids, the largest contributor from industrial land use is parking and storage, and then lawns, whereas streets exceed all other sources in residential, commercial, and open space land uses. Lead, however, is contributed by the rooftops in industrial settings, but by streets in the other land uses. Knowing where the pollutants come from allows a municipality to target significant source areas where a large reduction in pollutant loading can be accomplished with a set of smaller BMPs.

Urban Nonpoint Source Controls

To meet the project's urban pollution goals BMPs must:

1. Reduce the mass loading of urban pollutants so the pollutant load in the year 2020 is less than the pollutant load in 1997. This should be achieved by reducing pollutants by 25 percent from existing urban areas and 80 percent from planned urban areas.

Table 5-6 contains municipal pollutant loading estimates for suspended solids and phosphorus.

2. Educate the public to recognize and subsequently reduce contaminants entering surface waters. (See information and education chapter).

3. Integrate Non-Structural Best Management Practices (BMPs) into the site-by-site planning process for new development.

4. Maintain the hydrologic characteristics of surface waters so base flows are not significantly reduced below 1997 levels and stream discharge flows under the average annual flood aren't significantly increased over 1997 levels. To accomplish this the goal for new development is to maintain runoff characteristics under the 2-year, 24-hour rainfall conditions at levels consistent with pre-development conditions under good land management.

5. Construction site erosion control (CSEC). This plan seeks to fully implement adequate ordinances for CSE control. The goal of the plan is to reduce sediment from construction sites by 70 percent. It also seeks to have the local units of government intensify efforts to review erosion control plans and provide site inspection for compliance on all construction sites.

Non-structural Best Management Practices (BMPs)

Another management alternative is the incorporation of non-structural BMPs. These include: watershed-based land use planning, protecting sensitive areas, establishment of a buffer corridor, reduction of impervious cover, limiting erosion during the construction phase, and maintaining stream protection measures (Schueler, 1995). These are less quantifiable but will provide a benefit to water quality. The education of municipal staff, developers, homebuilders and the general public is critical to the success of non-structural BMPs.

Stormwater Conveyance

Stormwater 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 before it enters streams. Properly designed grassed swales generally reduce runoff volume because of infiltration and sod 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 how pollutant-bearing surfaces are connected to the storm drainage system. For example, commercial parking areas and arterial streets deliver the highest concentrations of lead, asbestos, cadmium, and street sediment because normally these areas are drained by storm sewers discharging directly to a stream or lake. Unfortunately, soils in the Fond du Lac River / Winnebago West Watershed are generally not considered very permeable.

Reducing pollutant transport to surface waters involves reducing the amount of urban storm water reaching streams, primarily from 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 NPS pollution. In addition, infiltration can help stabilize the

hydrology of small urban streams by replenishing groundwater, much of which is ultimately discharged to surface water.

Infiltration can reduce bank erosion and the need for expensive, highly engineered drainage structures such as concrete lined channels. This alternative may only be feasible in a relatively few locations. If land is available, disconnection of rooftop storm gutters from the storm sewer system will also allow more infiltration.

Management Needs and Alternatives

Two factors were used to identify significant (commercial, industrial, and institutional) urban land uses: yield of pollutants from each land use (pounds/year), and portion of the total urban pollutant load produced by each land use. Hydrologic analyses have not been conducted to investigate management alternatives on reducing and preventing streambank erosion and bed scour, or on maintaining stream base flows. Studies will need to be conducted as part of future feasibility studies for NPS control in established urban areas.

Table 5-7. Urban Management Alternatives for Existing and Planned Urban Areas in the Fond du Lac River / Winnebago West Watershed

Option	Description
1	Continue existing management
2	Improve street sweeping and other source area controls for existing development
3	Detain runoff from the land uses that include significant source areas
4	A combination of detention and source area controls

The analysis of management alternatives assumes that wet ponds will trap all sediment particles of five microns or larger. This will result in about an 80 percent control of suspended sediment and about 60 percent control of phosphorus and heavy metals in urban runoff. The analysis assumes that grassed swales will provide 25 percent control of pollutants, much less than wet detention basins. The City of Fond du Lac's existing level of street sweeping, once per month during spring, summer, and fall, is assumed to provide a five percent control of all pollutants.

Feasibility studies will be needed to select the site-specific 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 Six.

Objectives: 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. However, not all practices can be retrofitted into existing development. As a result, smaller source area control practices or street sweeping must be considered. Adoption of storm water management ordinances and use of storm water management and source area control practices will be a priority in the implementation of this plan.

The long-term management goal for the watershed is a 15 percent reduction in the current suspended sediment load from urban areas. This overall reduction can be achieved if an 80 percent level of control is provided for new development and a 25 percent level of control is provided for existing urban areas. Pollutant reduction can be best achieved by targeting significant land uses such as industrial and commercial areas and constructing new detention ponds or enhancing the efficiency of existing ones. Ponds will only be cost-effective if land is available near significant land uses. The construction of ponds for drainage areas where the majority of the acreage is a significant area will still be acceptable. This program does not encourage construction of detention ponds for existing areas draining medium-low density residential land uses, parks or large pervious areas if these land uses are the dominant land use.

If detention is not feasible, source area controls for parking lots and streets such as street sweeping with a high efficiency sweeper or infiltration or filtration devices should be considered. Finally, consideration should be given to the acceptability of disconnection of rooftops in all urban areas, especially commercial and industrial areas, so that they drain onto pervious surfaces before discharging to a stream or storm sewer. Redeveloping urban areas should also provide storm water quality and flow control practices.

Identification of Significant Land Uses

Significant land uses and source areas which contribute high amounts of pollutants have been identified in Tables 5-1 and 5-5. Of the five pollutants reported, suspended solids was chosen because it represents one of the primary pollutants found in urban stormwater. Other pollutant sources of concern include copper, zinc, PAH and urban stormwater. PAH and copper are closely associated with particulates found on streets and parking lots. Zinc is more frequently found in roofing material, and phosphorus is related to lawn and pervious surface management. Phosphorus use should be addressed through municipal information and education efforts.

For cost-effective control of existing development, a municipality should concentrate efforts on providing source area control on the significant land uses identified above. Source area controls may include roof top disconnection, street and parking lot sweeping or sophisticated oil/grit separators at individual sites. End-of-pipe practices, such as detention or infiltration basins, will provide mixed land use pollutant control, peak shaving and volume control. However, it may not be practical or socially feasible to use these BMPs on existing development because of site constraints, high land values, or topography. The NPS program can pay for the portion of a detention pond serving a significant area even if non-significant areas also drain to the same pond. In this situation, a pond may drain both significant and non-significant areas resulting in less; however, because land is available so are building costs. Stormwater management planning should continue evaluate to cost-effective options.

Construction Site Erosion

Construction sites are those areas in any phase of construction disturbing 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 NPS source control practices for existing urban areas can be negated by construction site erosion pollution sources. Predicting rates of construction site erosion is difficult. However, erosion rates exceeding 75 tons per acre per year can occur. This rate of erosion is greater than occurs on the most severely eroding croplands and 65 times the sediment loading rate from existing commercial and industrial areas. 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 70 percent reduction goal of construction related sediment exists for this watershed.

Management Needs and Alternatives: The reduction goals for this source of sediment will be achieved by:

1. Developing / Enforcing a construction site erosion control ordinance.

2. Installing best management practices to control 70 percent of the sediment delivered from a construction site.

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

Average annual sediment loading to streams from construction erosion for 1997 to 2020 conditions was determined by multiplying the amount of land planned for construction by an average of 30 tons per acre per year. This rate of erosion and sediment control and is based on observed land development patterns and generalized climatic conditions. It is estimated in the years between 1997 and 2020 construction erosion will contribute about 13,520 tons per year of sediment (about five times the sediment load from existing development) to streams in the project area.

Enforcing state and local ordinances can be an effective means to reduce construction site erosion and adverse affects on water quality. In 1986, the DNR and the League of Wisconsin Municipalities cooperatively developed a model ordinance for the control of construction site erosion (DNR, 1987). It contains provisions for planning, designing, installing and maintaining erosion control practices. It also contains guidance for administering and enforcing the ordinance.

Each municipality in the project area has ordinance requirements for controlling construction site erosion and sedimentation. In addition, developers are regulated by the Department of Commerce for erosion control on sites with one and two family dwellings; and the DNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit program for sites greater than five acres.

Despite these regulations, several potential impediments to effective erosion control exist. For example:

- 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.
- sedimentation basin designs 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.
- confusion about who is responsible for installing erosion control practices is common.

Local ordinances must meet the applicability and content requirements of NR 120.16 dealing with erosion control. The "Model Construction Site Erosion Control Ordinance," developed cooperatively by the DNR and the League of Wisconsin Municipalities (DNR, 1987), and suggested changes to the model ordinance (set forth by Mr. James H. Schneider, League Legal Counsel, in the March 1989 issue of "The Municipality") will be used as guides to determine adequacy of ordinances. Erosion control practice standards and applicability criteria should be consistent with those set forth in the *Wisconsin Construction Site Best Management Practice Handbook* (DNR, 1989).

The following is a list of specific recommendations local governments and developers should address in developing an effective construction site erosion control program.

- Municipalities should review (and modify where needed) their existing ordinances to assure effective penalties for non-compliance and responses to 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 have 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.

Objectives: Because of the significant sediment load due to construction in this watershed, a major emphasis of this plan is to enforce existing ordinances and control erosion using approved best management practices.

High priority items to improve compliance include more consistent issuance of citations, hiring of additional inspection staff where needed, new fee structures to cover the cost of improved staffing, and more effective court action when ordinance violations occur.

Because of the gaps in state agency regulations, construction erosion control is best accomplished through a local erosion control ordinance, locally administered building codes, practice standards and application guidelines, an effective administrative program, including enforcement. Training programs are needed for staff administering ordinances and developers who are responsible for installing and maintaining the erosion control practices.

Urban Streambank Erosion

Streambank erosion is caused primarily by channelization, upstream modifications, and the changing stream hydrology, which is characterized as "flashy" and having increasing volumes and peak flows. This exposes and erodes the banks, destroying the natural conditions needed for healthy aquatic communities. Also, the channel is scoured during heavy rainfall events, displacing in-stream cover such as rocks and logs and flushing away aquatic life as well. 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 bio-engineering will be implemented where appropriate.

Pollution Prevention Practices

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. Where possible, revise municipal building codes.

- 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 size 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.

CHAPTER SIX:
Urban Implementation

The following information provides guidance on an urban nonpoint source (NPS) control strategy including "core" activities and eligibility for financial assistance.

Urban Management

Core components or elements of urban NPS pollution control strategy include measures easily implemented (i.e., without study or significant expenditures). Adopting core elements is the first step in the implementation process. This show of support is required to receive financial assistance through the watershed program; however, it is only required where the municipality receives funds for its own use, such as where the municipality installs, owns, and operates a management practice. It does not apply to those instances where the municipality acts as a grantor, passing cost-share funds through to private landowners. Individual landowners within the municipality may receive funds before the municipality has agreed to conduct the core program.

Basic elements of the core program are:

- Develop, adopt and enforce a construction erosion control ordinance as outlined in the recommendations in Chapter Four. The ordinance should cover clearing, grading, and excavation conducted prior to the issuance of a building permit. The municipality must also commit to enforcing the erosion control provision of the Uniform Dwelling Code.

- Develop and implement a community specific program of urban housekeeping practices to reduce urban NPS 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 a 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.

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 and develop administrative procedures to enforce a construction erosion control ordinance within two years of implementation.

- Develop and implement a community specific program of urban housekeeping practices to reduce urban NPS pollution. The local unit of government and the DNR will negotiate the content of the community specific program and an implementation schedule.

- Prepare and submit annual (staff and activity) work plans.

- Apply for DNR local assistance grants to support core activities.
- Implement an information and education strategy consistent with this plan.
- Prepare and submit to DNR tracking reports.
- Participate in the annual watershed project review meeting.

Elements of Urban Management

Urban NPS pollution elements include those requiring further study or site-specific investigations prior to implementation. Examples include construction of a wet detention pond to capture runoff from an industrial park, source control practices such as filter strips or infiltration devices at parking lots, and development of a storm water management plan and ordinance. Detailed engineering studies will be required for some of these practices.

Municipalities may implement program elements any time after expressing commitment to implement all of the core activities listed above. Cost sharing is available throughout the project's 10 year implementation period.

Urban watershed elements include:

- Conduct detailed engineering studies to determine the best means to implement community specific NPS control measures in developed areas.
- Design and install structural BMPs for in urban areas with completed engineering studies.
- Develop management plans for proposed urban developments, including finance and implementation components.
- Adopt and enforce a comprehensive storm water management ordinance consistent with the state model storm water management ordinance.

Local Responsibilities and Timing

Following is a typical schedule for implementing an urban control strategy:

- Identify high priority initiatives the community wishes to pursue in existing and planned urban areas.
- Enter into local assistance and NPS grants as necessary to support implementation.
- Complete engineering feasibility studies for urban BMPs.
- Prepare an urban storm water management plan.
- Adopt and enforce a comprehensive storm water management ordinance for planned urban development.

- Enter into cost-share agreement 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. Local units of government are required to:

- Design or contract for the design of BMPs and verify proper installation.
- Involve the DNR in pre-design and pre-construction conferences as outlined in NR 120.
- Request reimbursement from the DNR for practices installed by private landowners, and in turn, reimburse landowners for eligible expenditures.
- Monitor landowner compliance of cost-share agreements.
- For practices installed and maintained by the local unit of government, the cost-share agreement is with the DNR. BMP maintenance is the responsibility of grant recipients, who submit project evaluations to the DNR.

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

Project Participants: Roles and Responsibilities

The following information includes 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 NPS grants directly with the Department of Natural Resources. Municipalities will provide the local share of the design and installation of BMPs and the operation and maintenance costs.

Local units of government 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.

Local unit of government may develop cost-share agreements with individual land owners for the installation of BMPs to provide technical and financial assistance. If the governing entity enters into a cost share agreement with a private landowner the individual land owner will pay the local portion of the installation costs consistent with the cost share guidelines.

Department of Natural Resources

The Department will provide administrative and financial support to municipalities and others who apply for grants through the urban portion of the program. Urban grants are awarded to local units of government to fulfill the goals and objectives outlined in Chapter Four. NPS pollution specialists in the Northeast Region and the Upper Fox River Basin Geographic Management Unit (GMU) will provide local government implementation guidance. The DNR maintains a staff of storm water management engineers and technical specialists to provide guidance and plan review. The Department also provides assistance in development of ordinances and other project implementation activities, including plan approval.

University of Wisconsin-Extension

UWEX staff includes a water quality information and education specialist to provide assistance for both the rural and urban portions of the project. 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.

Fond du Lac and Winnebago County Land Conservation Departments

The LCDs are responsible for the following urban activities:

- Assist municipalities in the development of construction site erosion control and storm water management ordinances.
- Develop and implement the recommended information and educational program outlined in Chapter Seven 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)

Structural urban BMPs, identified in NR 120, are considered most effective in reducing urban NPS pollution. Table 6-1 includes eligible practices and cost-share rates for urban practices.

Structural urban BMPs are source area measures, transport systems, and end-of-pipe measures designed to control storm water runoff rates, volume, and water quality. These practices reduce the amount of pollutants carried in runoff and flows destructive to stream habitat. These measures include, but are not limited to, infiltration devices, oil and water separators, sediment chambers, sand filtration units, grassed swales, and detention / retention basins.

Street sweeping (several passes for each curb mile) is recommended as early in the spring as possible to collect debris, sediment, and associated pollutants generated during winter months. Spring through fall residential sweeping in areas with heavy tree canopies, as well as in commercial and industrial areas, significantly reduces urban NPS pollutant loads.

Table 6-1. State Cost-share Rates for Urban Best Management Practices

Urban 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]

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 those in place prior to DNR plan approval. Eligible land uses include commercial and industrial parking lots, streets, and other land uses resulting in the runoff of high pollutant loads. Modifications to existing ponds to control runoff from areas having a portion of non-significant land uses may also be eligible if supported with results from a feasibility study.
3. Cost-share grants up to 50 percent 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, Wis. Admin. Code. Street sweeping, using high-efficiency sweepers is currently a pilot project in the Osceola Creek Watershed. Results of the evaluation will determine acceptable cost share rates for watershed projects.

Design Criteria and Performance Standards for Urban Practices

Design and installation of BMPs must meet conditions listed in NR 120. Practice standards and specifications for critical area stabilization, grade stabilization structures, streambank stabilization, shoreline buffers, and wetland restoration are found in NR 120 and NRCS "Field Office Technical Guide".

NR 120.14(22) requires the DNR to participate in the process of selecting site specific, urban structural BMPs. 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 design of urban practices, through the NPS 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 five micron particle size. This will provide approximately 60 percent control of the annual lead and phosphorus load draining to the pond. 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 that will 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 the first half inch of runoff in an off-line system. Where retro-fitted, these devices should be located to control runoff from significant land uses, taking into consideration infiltration rates. These rates are the primary determinants of pollution control efficiency and long term operation of infiltration practices, particularly in non-residential areas.

  It is important to include pretreatment and groundwater monitoring when designing infiltration devices. Pretreatment reduces the frequency of clogging and will 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 groundwater contamination remains within acceptable bounds.

  Infiltration devices in existing urban areas should held reduce stream velocities to deter bank erosion and habitat scouring. 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 first half-inch of runoff from contributing areas. These devices should be located to primarily control significant runoff from existing development.

- Stream corridor buffers and streambank stabilization are designed to reduce streambank erosion and filter surface water runoff to streams.

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 through 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 Source Pollution 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 planning process. This strategy should also recommend 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.

Easements to Support Urban Pollution Control Practices

Easements may be used to support wetland restoration, critical area stabilization, and shoreline buffers in urban areas to reduce water quality degradation from 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 by the DNR on a case-by-case basis. 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 6-2 shows the types of local management activities supported by the state through local assistance grants. These grants may be used to support additional staff hired or contracted by local units of government. Support for most activities is cost-shared at 50 to 70 percent, 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 the portion of the staff costs remaining after the use of permit fees. In many cases, ordinance administration and enforcement is self-supporting.

Table 6-2. Urban Implementation Strategy Measures Eligible for State Funding Under Local Assistance Grants

	Cost-Share Rate
Development of Construction Erosion Control Ordinances	70%
Development of Storm Water Management Ordinances	70%
Engineering Feasibility Studies for Existing Urban Areas; Storm Water Planning Studies for Planned Urban Areas[1]	70%
Design and Engineering for Structural Best Management Practices to Control Existing Significant Land Uses	70%
Staff for Enforcing Construction Erosion and Storm Water Management Ordinances [2, 3]	50%
Additional Staff Needed for Accelerated Street Sweeping[4]	
Development of Alternative Financing and Administration Strategies	70%
Information and Education Activities	70%

[1] Funding 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 cost of enforcement minus fees collected up to 50% 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 through to early fall period may be limited to demonstration and research projects, initially, until the effects can be monitored.

Activities and Sources of Pollution Not Eligible for State Funding Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically excluded in NR 120.10 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 BMPs.
- Construction site erosion control practices.
- Structural BMPs for new urban development. New urban development is defined as construction activity commencing after 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

The Cities of Fond du Lac and Oshkosh and the Village of North Fond du Lac should consider design and construction of some detention ponds to reduce the pollutant load from existing development. Commitment to the core program is required before the NPS Program can approve project costs. Table 6-3 includes feasibility study cost estimates for required urban area feasibility studies. These studies are projected to cost $941,000 with the DNR funding a large portion of the total. It is assumed most of the work associated with activities in this table will be contracted out to private consulting engineers; consulting fees are included in the budget estimate.

Table 6-3 also lists cost estimates of constructing wet detention ponds to control pollutants from commercial and industrial development. The cost for installing these ponds in densely urbanized areas is estimated at $400,000 per surface acre of pond. The total cost to achieve the 25 percent reduction goal from significant land uses is estimated at $15 million.

Table 6-3. Cost Estimates for Urban Area Feasibility Studies

Municipality	Existing Urban Area (acres)	Estimated Feasibility Study Cost [1]	Pond Surface Area (acres)	Construction Cost[2]
Fond du Lac[3]	4780	$478,000	19	$7,600,000
North Fond du Lac	1010	$101,000	4	$1,600,000
Rosendale	300	$0	0	$0
Oshkosh	3626	$362,600	14.5	$5,800,000
Oakfield	252	$0	0	$0
Watershed Total	**9968**	**$941,600**	**37.5**	**$15,000,000**

[1] Estimated cost of feasibility studies is $100/acre. Cost is based on planning for the entire existing urban area
[2] Estimated cost of constructing stormwater detention ponds in existing urban areas is $400,000 per acre of pond surface and includes pond site development, storm sewer modifications, land acquisition and engineering. This cost estimate does not include relocating existing structures such as businesses or homes, if required.

Table 6-4. Costs of Stormwater Management Planning and Implementation in Planned Urban Areas (Area in Acres)

Municipality	Pond Surface Area						Feasibility Studies Planning Cost[4]	Construction Cost[5]
	Residential / Other[2,3]		Commercial / Institutional[2]		Industrial[2]			
Fond du Lac	879	7	655	11	1533	31	$30,670	$2,450,000
North Fond du Lac	883	7	514	9	649	13	$20,460	$1,450,000
Rosendale	32	0	0	0	0	0	$320	$0
Oshkosh	911	7	1184	20	746	15	$28,410	$2,100,000
Oakfield	25	0	14	0	2	0	$410	$0
Watershed Total	**2730**	**21**	**2367**	**40**	**2930**	**59**	**$80,270**	**$6,000,000**

[1] Urban land planned for development.
[2] Ponds are assumed to provide 80% removal of sediment. Required surface areas are 0.8% of drainage area for residential and other land uses, 1.7% for commercial and institutional, and 2.0% from industrial sites.
[3] "Other" land uses include airports, parks and open spaces. The City of Fond du Lac has 394 acres of future airport development planned.
[4] Planning costs are assumed to be $10 / acre for planned land use.
[5] Cost of a pond in a new development is estimated at $50,000 per acre.

Table 6-5. Cost Estimates for Urban Implementation

Project Element	Fond du Lac	North Fond du Lac	Rosendale	Oshkosh	Oakfield	State Share	Local Share
DEVELOPING URBAN AREAS							
1. Construction Site BMPs (1) 2. Local Ordinance Enforcement	$766,750 $480,000	$563,000 $160,000	$8,000 $32,000	$906,250 $400,000	$10,875 $32,000	$0 $11,000	$2,250,000 $1,090,000
PLANNED URBAN AREAS							
3. Feasibility Studies 4. Detention Pond Design & Construction	$30,670 $2,450,000	$22,520 $1,420,000	$0 $0	$28,410 $2,100,000	$0 $0	$57,120 $0	$24,480 $5,950,000
EXISTING URBAN AREAS							
5.Feasibility Studies 6. Detention Pond Design & Const.	$478,000 $7,600,000	$160,000 $1,420,000	$0 $0	$478,000 $4,088,000	$0 $0	$781,200 $9,175,600	$398,412 $3,932,400
STREAMBANK EROSION							
7. Design 8. Construction	N/A $1,150,000	$0	$0	$0	$0	$805,000	$345,000
INFORMATION & EDUCATION	$120,000	$40,000	$12,000	$100,000	$12,000	$198,800	$85,200
ADMINISTRATION	$200,000	$67,000	$20,000	$150,000	$20,000	$319,900	$137,100
SUBTOTAL BY SUBWATERSHED	**$13,275,420**	**$3,852,520**	**$72,000**	**$8,250,660**	**$74,875**	**$11,348,620**	**$14,212,592**
WATERSHED TOTAL COST	**$25,525,475**						

Activities for Planned Urban Areas

Stormwater management plans allow a community to plan for stormwater problems associated with increased development. When totally filled out, urban areas will increase by 9,000 acres. Plans are estimated to cost $10 per acre for new development for a total of about $90,000. If all new development were served by detention ponds 59 acres of pond surface would be required to meet the 80 percent reduction of solids from urban development. At a cost of $50,000 per acre of pond an estimated $6 million would be borne locally since priority watershed project funds are not used for practices in areas of new development. Cost estimates for stormwater management in planned urban areas are listed in Table 6-4.

Construction site erosion control design and implementation costs are estimated at $250 per acre. The total number of acres of development per year in the watershed is estimated at 487 acres. To reduce the sediment load from this development would cost $2.25 million for the 10 year life of the project with the cost absorbed by the developer.

Nonpoint Source (NPS) Program Constraints and Limitations

A substantial portion of the estimated costs of implementing the plan's urban management recommendations is for construction of stormwater management practices in existing and planned urban areas to control pollutants generated by a wide variety of activities. Urban implementation cost estimates are included in Table 6-5.

The NPS 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 the most effective and efficient use of available funding. Program priorities include the following:

- Encourage the adoption and / or enforcement of construction site erosion control ordinances.
- Develop stormwater management plans and / or stormwater management ordinances to reduce NPS pollution from new development.
- Conduct an information and education effort to prevent pollution or control sources of pollution and find low cost and low technology solutions.

This plan endorses continued investigation into source control alternatives including internalizing local pollution control costs. Respective municipalities should investigate alternatives such as the creation of local utility districts to finance local costs. The DNR will help finance studies through the priority watershed program.

Summary of Project Costs – Urban Portion

Table 6-6 summarizes the cost of implementing the urban portion of the Fond du Lac / Winnebago West Rivers Priority Watershed Project at a 50 percent participation rate. The total project cost is estimated at $12.2 million. In existing urban areas the local share of project costs are generally provided by municipal governments, which typically obtain the necessary revenue from developers and land owners. The overall state support rate for existing urban areas is about $5.25 million; for planned and developing urban areas it is about $34,060.

Table 6-6. Project Costs for Urban Areas

Project Element		State Share	Local Share	Total Costs
Developing Urban Areas	Construction Site BMPs	$0	$1,125,000	$1,125,000
	Construction Site Ordinance Development and Enforcement	$5,500	$545,000	$550,500
Planned Urban Areas	Storm Water Management Plans	$28,560	$12,240	$40,800
	Storm Water Management BMPs	$0	$2,975,000	$2,975,000
Existing Urban Areas	Feasibility Studies / Designs	$390,600	$199,206	$589,806
	Structural BMPs	$4,587,800	$1,966,200	$6,554,000
Information & Education	Urban Staffing	$259,350	$111,150	$370,500
TOTAL [1]		**$5,271,810**	**$6,933,796**	**$12,205,606**

[1] Implementation of the entire urban component of the plan would likely exceed $25 million (as shown in Table 6-5). Staff assumed such costs could not be borne by the NPS program and consequently assumed 50% of the water quality goal would be met, costing $12.2 million, of which $5.27 million would be paid by the state.

CHAPTER SEVEN:
Integrated Resource Management

The purpose of this chapter is to identify existing state, federal and local resource management programs providing benefits for water quality and/or fish and wildlife resources in the Fond du Lac River Watershed. Watershed staff will work to coordinate the efforts of these programs to provide the best possible management of land and water resources. This comprehensive approach will facilitate consideration of various goals and objectives for all the programs in which the landowner participates. Each of these activities is described below.

Land and Water Resource Management

County Land and Water Resource Management Plans are locally developed initiatives proposed in 1996 by county conservation professionals in response to draft state agency recommendations to redesign Wisconsin's NPS programs. The idea was promoted by the Wisconsin Land & Water Conservation Association during state legislative deliberations and was included in the state budget bill (WI Act 27). This provision, central to the approved legislation, created a County Land and Water Resource Management Planning Program to:

- Rely on a locally driven process to develop and implement the plans
- Maximize flexibility in use of program funds
- Foster comprehensive watershed-based efforts with minimal planning
- Support innovative and cost effective means to achieve plan objectives
- Foster seamless integration of programs and funding sources, and
- Establish an effective method to measure achievement of objectives.

Approval of the Fond du Lac County Land and Water Resource Management Plan is expected in the Fall of 2000. Goals in the Priority Watershed Plan are referenced in the Water Resource Management Plan. Accomplishments of the Watershed Plan will assist in achievement of the goals of the County's Land and Water Resource Management Plan. Winnebago County was one of the original seven pilot counties to develop as Land and Water Resource Management, approved in December 1998.

Fish and Wildlife Management

Watershed 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 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 the placement and size of rock will 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 and Wildlife Management personnel will be consulted for the design of streambank and shoreline protection BMPs to maximize benefits for fish and wildlife communities. In cooperation with the counties, DNR staff will:

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 NPS BMPs on wetlands.

Wetland Restoration

Significant amounts of restorable wetlands have been identified in the Fond du Lac River Watershed. The general guidelines for wetland restoration, easement acquisition, and shoreline buffers to protect existing wetlands should be followed. Wetlands important for wildlife habitat 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 NPS 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 as surface water slowly percolates downward. Abandoned wells are a significant threat to groundwater quality in the Fond du Lac River Watershed. Project Staff will encourage all landowners to properly seal abandoned wells and will provide information on the proper abandonment procedures when abandoned wells are located.

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. Wells must exceed state or federal drinking water standards. With the exception of livestock wells contaminated with more than 40 ppm of nitrate, replacement of wells contaminated with bacteria or nitrate are not eligible for cost sharing. Eligible landowners will be encouraged to apply for well replacement funds through the Wisconsin Well Compensation Grant Program. Contact DNR regional groundwater staff for more information concerning income limits and other eligibility requirements.

Private Sewage System Maintenance and Rehabilitation

Fond du Lac and Winnebago Counties should adopt an "update at date of sale" policy to require the proper inspection, update and/or replacement of septic systems when homes are sold. Poorly sited or improperly functioning private septic systems have the potential to contaminate groundwater and surface waters in the Fond du Lac River Watershed. Pollutants from septic system discharge include bacteria, viruses, household chemicals, nitrates, and phosphorus. Septic system failure is often due to poor maintenance, primarily a failure to pump septic tanks on a regular basis. Many septic systems located in riparian areas are out-dated and installed in soils which don't adequately filter pollutants and/or are located in areas with a high water table. Failing septic systems in riparian areas are a special concern since pollutants can enter the surface waters with minimal filtering.

Wisconsin Fund

The Private Sewage System Replacement & Rehabilitation Grant Program (Wisconsin Fund) provides financial incentives to protect and improve groundwater quality in Wisconsin. Watershed staff will inform watershed residents about the benefits of the Wisconsin Fund grant program and encourage eligible landowners to apply.

The Wisconsin Fund provides financial assistance to update private sewage systems installed before 1978. To be eligible the septic system must have been inspected by the Fond du Lac or Winnebago 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 Fond du Lac or Winnebago County Zoning and Solid Waste Department.

Riparian Zones

Where possible, watershed staff will promote protection of riparian areas. Sites affected by cattle access identified during the implementation phase of the project should be protected with BMPs. Sensitive riparian areas can be acquired through easements for long term protection.

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. As part of this program the DNR can obtain stream easements (generally 66 feet wide on each side). If needed, the DNR can also provide funding for livestock fencing. Three miles of stream along Parsons Creek are currently eligible for purchase through the stewardship program; other areas in the watershed are also under consideration for protection through the stewardship program.

Forestry Programs

Private forest lands, which account for over 9,000 acres within the Fond du Lac River Watershed, are important producers of forest products in Fond du Lac and Winnebago Counties. Private forest lands also contribute to the overall quality of the watershed's water, fish, and wildlife resources. Financial assistance is available for forest management and soil and water resource protection through the Stewardship Incentive Program (SIP), the Managed Forest Law Program (MFL) and other forest stewardship programs. Additional information can be found in DNR publication FR-093-95, Wisconsin Forestry Best Management Practices For Water Quality.

Stewardship Incentive Program

The Stewardship Incentive Program (SIP) was developed to stimulate enhanced management of forest lands by cost-sharing approved management practices. SIP provides cost share funding of up to 75 percent for practices providing soil and water protection. The SIP program applies to non-industrial private forest land of 10 acres or more on forested or forest related (i.e., prairie, wetlands) lands. Practices cost-shared through SIP include: development of a landowner forest stewardship plan; site preparation and tree planting; timber stand improvement; windbreak and hedgerow establishment; soil and water protection and improvement; riparian and wetland protection and improvement; fisheries habitat enhancement; wildlife habitat enhancement; and forest recreation enhancement.

Managed Forest Law

The goal of the Managed Forest Law (MFL) program is to encourage sound, long-term forest management. MFL is a tax incentive program for industrial and non-industrial private woodland owners who manage their woodlands for forest products while also managing for water quality protection, wildlife habitat, and public recreation. In return for following an approved management plan, property taxes are set at a lower rate. When the landowner receives an income from a timber harvest some of the deferred tax is collected in the form of a yield tax. Management plans are based on landowner objectives. Plans may address harvesting, planting, thinning, release, and soil erosion on a mandatory basis while addressing other practices such as wildlife and aesthetic activities on a voluntary basis.

Other Stewardship Programs

The Forest Improvement Program (FIP) is another forest stewardship program available to watershed landowners. This program provides funding for establishment of timber stands. Watershed staff and DNR Foresters will encourage eligible forest landowners in the Watershed to participate in the Forest Stewardship Program to protect water resources and forest habitat. Protection of soil and water resources should be addressed in all SIP and MFL plans.

Inland Lake Programs

Winnebago Comprehensive Management Plan (WCMP)

Approved in 1989, the WCMP identifies resource uses and management strategy for the Winnebago Pool System. The Winnebago Pool System is composed of Lakes Winnebago, Butte des Mortes, Winneconne and Poygan, including the main tributary waters of the Upper Fox and Wolf Rivers. This system comprises 17 percentage of the state's surface water acreage. The system receives water from 6,400 square miles of watershed. The primary goal of the WCMP is to restore, improve, and maintain the ecological diversity, quality, and beneficial uses of the fish, wildlife, and water resources of the Winnebago System. Some of the activities outlined in the WCMP are already part of either a DNR or other agency programs. Other activities will require permits, possibly legislation, or at least further study to fully implement. The goals outlined in the Fond du Lac River NPS Control Plan will compliment the goals and objectives of the WCMP.

Wisconsin Lakes 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 disruptions of lake ecology. Land use changes in lake watersheds has resulted in nutrient enrichment of many Wisconsin lakes leading to nuisance growth of algae and other aquatic plants, sedimentation, and loss of native plant communities. The Wisconsin Lakes Partnership is a cooperative program between the Wisconsin DNR, UW-Extension, the Wisconsin Association of Lakes (WAL), and lake organizations, to assist local governments and inland lake management organizations in long-term lake management and protection. The Wisconsin Lakes Management Program provides technical assistance, information and education to lake groups and lake residents, and planning, protection and implementation grants to local units of government and qualifying lake organizations.

Organizing Lake Groups

Lake groups range from information groups of concerned property owners to lake districts which have authority to levy property taxes for operation of lake management programs. Most DNR grant programs designed to help lake residents become better lake stewards require lake organizations meet certain minimum standards relating to membership, dues, and by-laws. At a minimum, a lake group must incorporate under Chapter 181, Wisconsin Statues.

In addition to the ability to apply for lake assistance grants, qualified lake organizations may provide other services and functions. A lake association or lake district can lobby towns for changes in zoning laws and lake use restrictions and join the Wisconsin Association of Lakes, which is an advocate at the state level for the Lake Stewardship Program. Many Wisconsin counties have formed county lake associations to further assist in these efforts.

Self Help Monitoring Program

The goal of the Self Help Monitoring Program is to educate lake property owners about lake ecology and water quality while building a long-term information base on a large number of Wisconsin lakes. The Self Help Monitoring Team consists of volunteers who collect lake water quality data on a regular basis to track lake health and guide Wisconsin's Lake Management Program.

Lake Management Planning Grant Program

The Wisconsin Lake Management Planning Grant Program was developed to provide financial assistance to qualified lake organizations and local governments to collect and analyze data concerning the physical, chemical, and biological health of their lakes. Grant money can also be used to investigate watershed conditions, review ordinances, and conduct social surveys to gauge local concerns and perceptions as they relate to lake use and water quality. The end product of most lake management planning grants is a comprehensive lake management plan addressing local concerns and analyzes alternatives for lake and watershed management. The DNR pays 75 percent of the cost of a planning project, not to exceed $10,000 during each two-year state budget period. The grant recipient pays the remaining 25 percent of the project cost.

Water Quality Trend Monitoring

Lake management planning grants are available through the Wisconsin DNR to conduct water quality trend monitoring on Wisconsin lakes. In many cases, previous Environmental Protection Agency (EPA) and DNR funded research projects may have provided a wealth of baseline water quality information on lakes and their tributaries. Continuing water quality trend monitoring is an important step in evaluating the effectiveness of watershed management techniques and adjusting lake management activities.

Project staff will encourage lake organizations to apply for additional lake management planning grants to continue water quality trend monitoring of lakes and inlets during the implementation phase of the priority watershed project.

Lake Protection Grant Program

Through the Lake Protection Grant Program qualified lake organizations can apply for funds to carry out a variety of lake protection projects at a state cost-share rate of 75 percent. Eligible projects include purchase of lands critical to a lake ecosystem, restoration of important wetlands and the development of regulations and ordinances designed to protect and enhance lake water quality. Funding is limited to $200,000 per grant. Qualified lake organizations will be encouraged to apply for lake protection grant funding where applicable.

Coordinating Regulations, Permits, and Zoning

Best management practices (BMP) applicable to 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 from the DNR, Fond du Lac or Winnebago County Zoning offices, and the US Army Corps of Engineers. Watershed staff will work closely with the DNR Water Regulation and Zoning staff, the Fond du Lac and Winnebago 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 disturbing or removing natural vegetation surrounding lakes and streams reduce 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.

Fond du Lac and Winnebago Counties will work in cooperation with the Property Listing Department, Zoning Department, and the DNR to provide information packets to new waterfront property owners about the existence of zoning regulations and the appropriate agency contacts. The guides will also inform lakefront residents about steps they can take as responsible lake stewards.

Coordination With State and Federal Conservation Compliance Programs

The Fond du Lac River 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 subject to compliance provisions of FPP and FSA.

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 NPS pollution abatement.

Archaeological Sites: Coordination with Historic Preservation Laws

Projects using or involving 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. These areas need special consideration when structural BMPs are considered such as settling basins, manure storage structures, streambank or shoreline shaping, and riprapping.

Before finalizing cost-share agreements project staff should review maps with known archaeological and historic sites and structures. Even if a known site or structure occurs in the vicinity of a proposed BMP or structure it does not necessarily mean the BMP or structure will have to be moved or altered. Project staff should visit the area and conduct a "pre-review" to ensure the location of the proposed BMP will not disturb a known archaeological or historic site or structure. In some cases, proposed BMPs or structures will not be near enough to a protected site to warrant further review. 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 the known site would be disturbed, the DNR's State Archeologist should be contacted 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 NPS Pollution Abatement Program will pick up the costs of professional historic and / or archaeological site review(s). In some cases a representative from the U.S. Natural Resources Conservation Service (NRCS) will conduct the review.

Sites and Practices Needing Archaeological Review

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 Grassed Waterways Shoreline Buffers Critical Area Stabilization Wetland Restoration
Buildings:	Barnyard Runoff Management Systems Animal Lot Relocation Manure Storage Facilities Roofs for Barnyard/Manure Storage Facilities

Endangered and Threatened 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 comprehensive endangered resource surveys have not been completed for the entire Fond du Lac River Watershed. The lack of additional occurrence records does not preclude the possibility other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work and consequently may not be listed in the plan. If specific location or other information is needed about these species or natural communities contact the DNR Bureau of Endangered Resources.

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 not listed by the U.S. Fish and Wildlife Service or by the state of Wisconsin.

Wisconsin Endangered Species

An endangered species is defined as a species 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. Wisconsin endangered species within the watershed are:

Common Tern - *Sterna **hirundo***

Wisconsin Threatened Species

A threatened species is defined as a species that, if not protected, has a strong probability of becoming endangered. Wisconsin threatened species in this watershed include:

Prairie Milkweed - *Asclepias sullivantii*
Small White Lady's Slipper – *Cypripedium candidum*

Wisconsin Special Concern Species

A special concern species is defined as a species 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 include:

Kentucky Coffee Tree - *Gymnocladus dioicus*
Wax Meadowrue – *Thalictrum revolutum*

CHAPTER EIGHT:
Information and Education

This chapter outlines an information and education strategy to help achieve the project's water quality goals. The strategy is designed to build awareness about local runoff pollution problems (a process that began during the planning phase), and encourage watershed residents to adopt Best Management Practices (BMPs).

Successfully encouraging people to adopt BMPs is not easy. Experience from other priority watershed projects has revealed that individuals often lack the motivation to try a BMP because they don't feel runoff pollution is a problem on their property or they may feel uncomfortable with the risks associated with using BMPs. Common risks may include financial concerns: "Can I afford the new practice?" or "Will it help my bottom line?"; competency concerns: "Will I be able to operate the new system?" or "Can I manage my records well enough to follow this conservation plan?"; and emotional concerns: "What will my dad think when he sees all that trash in my fields?" or "What will my friends say if I accept government assistance."

Before land owners adopt a new BMP they typically must recognize short comings with current management practices, have confidence the risks imposed by the BMP are manageable, and believe the benefits are worthwhile. The adoption process can be very slow (it can take many years, based on experience in other watersheds) and is far from guaranteed. Farmers are especially averse to assuming more risk since they already operate high risk businesses.

The watershed project will use three tools to encourage farmers to adopt new management practices: 1) Cost-sharing to ease the financial risks associated with certain BMPs, 2) Regulation to motive participation, and 3) the I&E strategy. The I&E strategy supports the first two tools by fostering awareness about them, but its primary function is to identify and overcome barriers preventing residents from adopting BMPs. There are three main barriers that prevent adoption:

Knowledge barriers - residents may not have the necessary information to make an informed decision about trying a new management practice.

Skill barriers - residents may not have the skills (management ability) to try a new management practice.

Attitude barriers - residents may not support the watershed project because they have different opinions about what needs to be done to protect the watershed.

To address knowledge barriers, the I&E strategy contains activities designed to disseminate information throughout the watershed. Examples include newsletters, direct mail, media coverage, and informational meetings. To address skill barriers,

demonstrations, field days and one-on-one instruction are planned. To address attitude barriers, volunteer opportunities like the citizen advisory committee, becoming a volunteer water quality monitor, or helping out at a river clean up or storm drain stenciling event are planned to get people involved in the project and give them a stake in its success.

Information and Education Strategy

This strategy is based on two goals: building awareness and reducing sediment and nutrient loads. These goals were developed from the water resource objectives listed for each subwatershed in Chapter Two.

Awareness and Knowledge

- Residents who are eligible for financial assistance will be aware of the watershed program, and the assistance it offers. They will know who to contact for help.
- Rural, urban, lakeshore, and farm residents will be informed about the ecological, recreational and economic value of clean streams, wetlands, and lakes.
- Rural, urban, lakeshore, and farm residents will be informed about rural and urban sources of runoff pollution, including what they can do to prevent it.

Sediment Reduction

- Reduce sediment loads to surface water from cropland erosion.
- Reduce sediment loads to surface water from construction site erosion and stormwater runoff.
- Reduce sediment loads to surface water from streambank erosion.

Nutrient Loading Reduction

- Reduce nutrient loads to surface water from barnyards.
- Reduce nutrient loads to surface water from manure and commercial fertilizers.
- Reduce nutrient loads to surface water from stormwater runoff.

To address these goals a list of the I&E objectives were developed. Each objective is intended to provide information about watershed related topics or inform stakeholders about specific BMPs. A list of applicable activities is included with each objective.

Objectives and Activities

Objectives to Increase Awareness and Knowledge

Aw 1) Inform rural and urban watershed residents, and local youth, about runoff pollution, what they can do to prevent it, and the ecological, recreational and economic value of clean streams, wetlands and lakes.

Activities:

- Newspaper and radio coverage of water quality related topics.
- Displays at community events like county fairs, walleye weekend, farm shows, and dairy breakfasts.
- Presentations and information packets to school groups, township boards, city officials, civic groups and farm producer groups.
- Volunteer projects including project WET workshops for area teachers, storm drain stenciling with help from local youth organizations, a river clean up and/or habitat improvement event with help from local schools and civic groups, as other opportunities as they become available.
- Cosponsor LCC *scholarships* so local youth can attend Wisconsin Conservation Camp.

Aw 2) Inform all eligible landowners of how cost-sharing can help them install a conservation practice on their property and who their contact is for more information.

Activities:

- Prepare list of eligible landowners and make sure they get the *newsletter*.
- Direct mailing to all eligible landowners letting them know who their contact is for watershed information.

Aw 3) Inform local county and city government officials about the watershed program and keep them up-to-date of progress.

Activities:

- Occasional presentations to town boards, key city officials, land conservation committees.
- Prepare list of key officials, make sure they each get the *newsletter*.
- Canoe trip down the Fond du Lac River for officials.

Aw 4) Initiate a long-term water quality monitoring effort to evaluate water quality trends in watershed streams and Lake Winnebago.

Activities:

- Form steering committee for testing effort
  Step 1. Steering committee reviews existing volunteer testing programs and selects a protocol to use for their effort.

Step 2. Steering committee recruits volunteer testers.
Step 3. Steering committee and volunteers plan testing effort.

Objectives to Reduce Sediment

Sed 1) Convince at least 50 percent of eligible dairy farms to adopt high residue management, establish buffers, or restore wetlands.

Activities:

- Tillage campaign
  Step 1. Develop an inventory of farmers and their cropping method(s).
  Step 2. Poll resource people (Local Ag Agents, Co-op consultants, University specialists, etc.) to gather information about the barriers preventing farmers from trying alternative cropping methods.
  Step 3. Poll a select group of farmers about the barriers preventing them from trying alternative cropping methods.
  Step 4. Develop the education strategy.
- Direct mail to inform all farmers about watershed cost sharing for high residue management and buffers.
- One-on-one contacts with all farmers eligible for high residue management, buffers and wetland restoration.
- Demonstrations to compare different high residue cropping systems and buffers.
- Field days to share results from field trials. Emphasis on profitability over production.
- Tours and mini-tours to visit local high residue fields.
- Newsletter features on high residue cropping, buffers, wetlands, and the importance of protected uplands. Emphasis on economic values and profitability.
- Media coverage to promote high residue management and feature the success of early adopters.
- Recognition picnic to support the efforts of farmers working to reduce sediment loads.

Sed 2) Improve farmer knowledge of their streams: increase awareness of the characteristics of healthy streams, the value of healthy streams, the reasons why local streams are degraded, and the BMPs available to improve local streams.

Activities:

- Newsletter feature on streams in watershed.
- Stream scrounge for farmers.
- Signs-of-success demonstration site.
- Have displays at community events that attract farmers.

Sed 3) Encourage town chairs and building inspectors to enforce construction site erosion control measures. City officials will be encouraged to implement core elements of the urban management program described in Chapter 4.

Activities:

- Construction site erosion control forum for local town chairs, building inspectors, developers, conservation staff, and local government officials. Invite the media.
- Information packet about construction site erosion control for builders, inspectors, developers, Realtors, and buyers. *Information packets* about core elements of the urban management program for city officials.
- Media coverage on construction site erosion and stormwater management.

Sed 4) Increase lakeshore resident awareness of when a building permit is required and environmental hazards associated with lakeshore development.

Activities:

- Newsletter features on lakeshore development and permit requirements.
- Direct mail information to residents. Titles may include *Life on the Edge* and various UWEX publications on yard care and the environment and lake landscaping.

Sed 5) Restricted cattle access to streams.

Activities:

- Prepare list of landowners who allow unrestricted cattle access.
- Newsletter feature about alternative watering systems, cattle crossings, pasture management, rotational grazing and streambank easements.
- One-on-one contacts with all landowners who allow unrestricted cattle access.

Sed 6) Inform farmers will about the benefits of rotational grazing.

Activities:

- Mini-tours for interested farmers
- Newsletter articles
- Field days

Sed 7) Landowners with eroding streambanks will take steps to reduce this source of sediment to local streams by 25 percent.

Activities:

- Prepare list of landowners with severely eroding streambanks.
- Newsletter feature about streambank stabilization practices.
- Direct mail information about streambank stabilization practices to landowners on list.
- Streambank stabilization demonstration site(s).
- Tour demonstration site(s).

Objectives to Control Nutrients

Nut 1) Farmers will improve their nutrient management planning skills so they know what nutrient management is, how it can save them money and protect water quality, and who they can call on for assistance with nutrient management planning.

Activities:

- Nutrient Campaign
  Step 1. Poll Co-op consultants, agency colleagues, CAC members, UWEX NPM Staff, and key farmers to develop list.
  Step 2. By the year 2000 develop an inventory describing the level of nutrient management local dairy farmers' practice and the name of their local crop consultant.
  Step 3. Update list twice a year to determine if farmers are improving NPM.
- Feature information about NPM in newsletter emphasizing profitability.
- Set up field trials (test plots) with help from Ag agents, co-op staff, and UWEX NPM staff.
- Provide tours and mini-tours to field trial sites.

Nut 2) Local crop consultants and co-op employees will understand how cost sharing for nutrient management works through the watershed program.

Activities:

- Develop a list of the crop consultants and co-op employees who work in watershed.
- Hold informational meetings for consultants and co-op employees about nutrient management planning and cost sharing.
- Provide consultants and co-op employees a list of farmers required to use nutrient management planning.

Nut 3) Improve manure management practices. Farmers eligible for barnyard improvements and/or manure storage will understand how cost sharing works.

Activities:

- Individually contact all landowners eligible for barnyard improvements and/or manure management. Explain how cost sharing works and the steps they need to follow to install a practice through the watershed program.
- Newsletter features about manure management.
- Direct mail information about manure management.
- Tours and mini-tours of a properly installed and maintained barnyard and manure storage facility. Consider featuring a site from another watershed that is a few years old and is maintained by a responsible landowner and have landowner tell their story.

Evaluation

As part of the annual watershed review, staff will prepare a summary of informational and educational efforts and accomplishments. The summary will address how the I&E strategy was implemented, how residents participated in the project, and how successful participants were in implementing BMPs.

Evaluating Implementation

Staff will summarize the I&E activities accomplished during the year. Whether the activities actually reached their intended audiences, and whether they caused participants to successfully change their behavior, are measured by evaluating participation rates and the BMP adoption process.

Evaluating Participation Rates

Since the strategy depends on activities to get people aware and involved, stakeholder participation rates can be used to evaluate the success of I&E efforts. Participation means more than just attendance at field days and volunteer events, but also includes newsletter readership, requests for information, and signed cost-share agreements. If residents are attending watershed events, remember the newsletter, and are signing cost share agreements, I&E activities are probably having their desired affect. If residents never call the County Conservation Department offices to learn more about the project, or attendance at field days and demonstrations is consistently low, it probably means new activities are needed.

Evaluating the success of I&E efforts based primarily on participation can be misleading since participation does not indicate successful BMP adoption. For example, just because someone attended a demonstration does not mean they learned what staff wanted them to, and just because a farmer installs a BMP does not mean they are using it successfully. To determine if I&E efforts are leading to BMP adoption involves monitoring participant performance.

Evaluating the BMP Adoption Process

Evaluating the adoption process involves keeping careful records of the successes and failure participants had with the BMPs they used at the start of the project and documenting their performance with the new BMP. It means staff will continue working with participants after a BMP is installed to make sure the practice has been adopted successfully. Success means the BMP benefits the participants operation (profitability included) as well as water quality.

Monitoring the adoption process involves two main steps: 1) evaluating I&E activities as they occur to determine if participants learned what staff hoped they would, and 2) determining if the I&E objectives are being achieved as a result of the I&E activities.

The techniques used in watershed projects to evaluate I&E activities include **informal discussions** with activity participants posing questions like: "Do you find the information in the newsletter helpful?", "Did you learn (featured lesson) from the demonstration", and "How can we improve future field days"; **surveys** which ask similar questions but do it confidentially; and **staff observations**: where staff poll their colleagues to find out how they think an activity went. These are all formative evaluation processes. This means staff will use the information they gather from these evaluations to improve each activity the next time it is offered.

When the activities associated with a particular objective are accomplished staff will conduct end evaluations (know as summative evaluations) to see if the objective itself was accomplished. The same techniques described above to evaluate activities can be used to evaluate objectives. Additional methods include **field observations**: Do staff see more farmers leaving buffer strips near intermittent waterways? Are local builders paying more attention to construction site erosion control? And **discussions with colleagues**: Does the local Ag agent think farmers are being successful with watershed BMPs? Do farmers on the advisory committee think their neighbors are learning from the project?

More formal ways to evaluate both activities and objectives are **phone surveys, focus groups**, and examining **performance records**. These methods are most useful when baseline data is available for comparisons. Nutrient management and tillage surveys are planned to provide baseline data for later performance record evaluations of these two practices.

Description of Information and Education Activities

Citizen Action Coalition: A group of watershed residents who volunteer time to help staff conduct watershed related activities.

Responsibility: Project managers
Frequency: Ongoing

Canoe trip: A short trip down a section of river that provides good contrast between healthy sections of channel and polluted sections. The trip is designed for local officials to cultivate support for water quality protection efforts. If this activity is successful, it may bear repeating with other audience like farmers, crop consultants and co-op employees, teachers, and youth groups.

Responsibility: Project manager Fond du Lac County, Area UWEX educator
Frequency: Spring 1999

Forum: A half day meeting between project staff and local town chairs, building inspectors, and developers to help staff start a working relationship with this audience. Staff will present information about the impact of construction site erosion on local water quality, construction site BMPs , and training opportunities at this forum.

Responsibility: Project managers, UWEX area educator, Local UWEX CRD agent
Frequency: Winter 1998

Demonstrations: sites hosted by local landowners that feature the successful BMP installations. Demonstration will be featured during watershed tours and, to the extent possible, remain open on an informal basis for interested landowners who happen to stop by. Existing BMPs outside the watershed project may be featured as demonstration sites, New demonstrations for this watershed will include:

- Stream buffers
- Streambank stabilization
- Manure storage

Responsibility: Project managers
Frequency: Two demonstrations will be promoted each year during years 1-3, with one per year during years 4-10

Direct Mail: Printed material mailed to select audiences to inform them about BMPs, cost sharing opportunities, or upcoming watershed events. Staff plan direct mailings to the following audiences.

- Eligible landowners - eligibility and staff contact notification.
- Growers - information about high residue management and buffers.
- Cash grain growers - information about buffer strips as a way to prevent sediment from reaching streams.
- Lake front property owners - information about managing lakefront property to protect water quality.
- Owners of eroding streambank footage - information about cost sharing.
- Farmers eligible for manure storage and/or barnyard improvements - information about cost sharing

Responsibility: Project staff
Frequency: Ongoing

Displays: Exhibits of photos and models (i.e. Carry-Creek, The Eviroscape Watershed, Groundwater Cross Section) displayed at community events to explain the watershed project, provide water quality information, create interest, recognize participants, and show results. Potential events include:

- Walleye weekend
- County fairs
- Local farm show(s)
- Field day events
- Watershed tours
- Stream ecology workshop

Responsibility: Project staff
Frequency: Staff plan to purchase Eviroscape in Summer 1998. Other displays will be ongoing

Field Days: Half day or day long educational events held at demonstration sites. Staff will plan field days to highlight buffer strips, nutrient management practices, high crop residue management practices, and rotational grazing.

Responsibility: Project staff, Local UWEX ag agents, UWEX NPM staff
Frequency: Two field days will occur each year during years 1-3, with one per year during years 4-10.

Information Packets: Folders that contain fact sheets for the following groups:

- Farmers - general information about the watershed program and how cost sharing works and specific information tailored to the BMPs each farmer interested in.
- Lakeshore property owners - information about lake friendly lawn care
- Builders and developers - information about construction site erosion
- Cash grain growers - information about buffer strips
- City officials - information about core elements of urban program

Responsibility: Project staff, UWEX area educator
Frequency: Ongoing

Landowner Lists: A register of all the landowners who are eligible for watershed cost sharing divided into separate lists for each of the following BMP eligibility groups: cattle crossings, stream bank erosion control, manure storage and barnyard improvement, buffers, conservation easements, and nutrient management. These lists will help staff quickly prepare direct mailings, assemble information packets, arrange and tract personal contacts, and assess progress toward sign-up goals. Staff will also prepare lists of co-op employees and crop consultants to enlist their help with nutrient management efforts, and a list of key officials who should receive the watershed newsletter.

Responsibility: Project staff
Frequency: Ongoing

Media Contacts: Writing news releases and working with local radio to advertise events and promote a better understanding of runoff pollution. Staff will seek special coverage to highlight high residue management and construction site erosion control.

Responsibility: Project managers
Frequency: Ongoing

Mini Tours: Similar to tours but involving fewer participants. Mini tours can be arranged on short notice for individual farmers, or small farmer groups. Mini tours are a more personal way for staff to show farmers how BMPs work.

Responsibility: Project staff
Frequency: Ongoing

Newsletters: Published 3 times per year, the newsletter will feature a theme for each issue and include a mix of standard articles from the UWEX archives and local features including interviews with local cooperators and updates on watershed events.

Responsibility: Project staff, UWEX area educator
Frequency: Ongoing, with 3 per year for years 1-3, and 2 per year for years 4-10

Nutrient Management Campaign: Because improving the way farmers manage nutrients is a critical step toward achieving project goals, staff will customize their approach to promoting nutrient management. Staff will informally poll co-op consultants, watershed farmers, and agency colleagues to develop a list of barriers preventing greater adoption of nutrient management. Simultaneously, staff will begin compiling an inventory that describes the degree to which local farmers already practice sound nutrient management. Staff will use the list of barriers to develop focused educational activities, and the inventory of current nutrient management practice to evaluate the rate at which farmers are improving their nutrient management.

Responsibility: Project managers
Frequency: Ongoing

Nutrient Management Meeting: A half day informational meeting for co-op employees and local independent crop consultants. Project staff will outline the process private sector employees should follow when preparing nutrient management plans for farmers receiving cost-sharing through the watershed. Staff will share their list of farmers eligible for nutrient management cost sharing to encourage private sector involvement in the project.

Responsibility: Project staff, Local UWEX ag agent(s)
Frequency: Winter 1998

One-on-one Contacts: Watershed staff will visit all eligible landowners to introduce themselves and explain the watershed program. During subsequent visits staff will try to develop a working relationship with each landowner to help them recognize runoff on their property, understand the effects of runoff on the environment, and recognize the efforts the landowner is already making to protect the environment. Extra effort will be made to get-to-know the owners of critical sites and other land that contributes significant amounts of nonpoint pollution since the cooperation of these individuals is essential to the success of the project.

Responsibility: Project staff
Frequency: Ongoing

Presentations: Mostly provided per request, presentations are an opportunity for staff to provide a community service, educate residents and school children about runoff pollution, and keep the watershed project on the minds of watershed residents and key public officials.

Responsibility: Project staff
Frequency: Ongoing

Project WET: A professional opportunity for local educators to learn about water quality curriculum.

Responsibility: Project manager Fond du Lac
Frequency: Summer 1992 and 2001

Recognition Banquet: An opportunity for staff to honor the conservation accomplishments of watershed participants. For the sake of balance, staff will also recognize the efforts of farmers in the watershed who were already farming in an environmentally sound fashion and therefore did not need to participate in the project.

Responsibility: Project managers
Frequency: Fall 2001

Scholarship: Every year the Fond du Lac County LCC provides a scholarship to send local youth to the Wisconsin Land and Water Conservation Camp. The watershed will cosponsor this effort by promoting the scholarship to Fond du Lac County youth.

Responsibility: Project staff (Fond du Lac County LCD)
Frequency: Annually

Signs of Success: Documenting the recovery of a field site through photographs and qualitative data collection before and after a BMP is installed. Reporting the finding to the watershed public through the newsletter and the media.

Responsibility: Project staff, DNR fish biologist
Frequency: Summer 2001

Steering Committee: A small group of project staff and interested citizens who will organize a volunteer stream monitoring program. Potential member may include: project managers, DNR biologist, CAC representative(s), state WAV coordinator, UWEX area educator. The committee will select a testing protocol and find volunteers to conduct the testing.

Responsibility: Project manager Fond du Lac County, Area UWEX educator
Frequency: Fall 1998 and ongoing

Stream Study: An activity designed for farmers to encourage them to take a second look at local streams. Participants will visit local streams and learn (in an interactive way) about life that lives in and depends on the water. To assure attendance, this event could be combined with a field day, demonstration, or watershed tour.

Responsibility: Project managers, UWEX area educator, DNR biologist
Frequency: Summer 2001

Tillage Campaign: Because improving the way farmers control upland sediment is a critical step toward achieving project goals, staff will customize their approach to promoting high residue management. Staff will contact farmers to learn what kind of cropping method they currently use, contact farmers, colleagues, and local agricultural business professionals to learn about the barriers preventing greater adoption of high residue management, and develop strategy of focused objectives and activities. The inventory of current cropping methods will serve as baseline data for comparison with later inventories.

Responsibility: Project manager Winnebago
Frequency: Ongoing

Tours: Pre-arranged, coordinated visits to the sites of demonstrations. Tours will be arranged for the following audiences:

- Farmers interested/eligible for manure storage and/or barnyard improvements
- Local officials (to show progress)
- CAC members

Responsibility: Project managers
Frequency: One per year for years 1-3, and one every other year for years 4-10

Volunteer Projects: Activities that improve the environment and also get local adults and youth involved in the watershed project. Conservation projects provide hands-on learning opportunities, especially for youth, and are an excellent way to generate media attention. Watershed staff plan the following projects:

- Project WET Workshops
- Storm Drain Stenciling
- River Clean Up
- River habitat improvements, i.e. bioengineering, lunker structures.

Responsibility: Project managers
Frequency: Annually

Table 8-1. Information and Education Budget and Staff Needs Per Year

Activity	Average Costs		Average Staff Hours			
			Per Year (Year 1-3)		Per Year (Year 4-10)	
	Per Year (Year 1-3)	Per Year (Year 4-10)	Fond du Lac	Winnebago	Fond du Lac	Winnebago
Citizen Coalition	$50	$50	60	0	48	0
Canoe Trip	$100 (1999 only)	---	24*	8	0	0
Demonstrations	$400 (2 per year)	$200 (1 per year)	32	16	16	8
Direct Mail	$400	$300	80	32	40	16
Displays & Signs	$900	$300	48	16	16	8
Field Days	$400 (2 per year)	$200 (1 per year)	96	48	48	24
Forum	$150 (1998 only)	---	40*	0	0	0
Info Packets	$50	$50	32	16	16	8
Media	---	---	80	32	40	16
Newsletter	$900	$400	96	24	48	8
Nutrient Meeting	$50 (1998 only)	---	24	24	0	0
Presentations	$50	$50	96	24	48	8
Project WET	---	---	40	0	40	0
Recognition Banquet	---	$500 (2001 only)	---	---	8	32
Stream Study	$100	$200	24	8	24	8
Tours	$200 (1 per year)	$100 (1 every-other year)	24	8	24	8
Volunteer Projects	$100	$100	120	24	120	24
Totals	**$3,900**	**$2,450**	**916**	**280**	**536**	**168**

Table 8-2a. Activity Schedule to Achieve Awareness and Knowledge Objectives [1]

Activity	Awareness Objectives			
	Aw 1	Aw 2	Aw 3	Aw 4
CAC	Ongoing			
Canoe Trip			Spring 99	
Demonstrations		Ongoing		
Direct Mail	Ongoing	Spring 98		
Displays	Ongoing			
Field Days				
Forum				
Info Packets		Annual	Annual	
List		Spring 98	Spring 98	
Media	Ongoing			
Mini Tours				
Newsletter	Ongoing	Ongoing	Ongoing	
Nutrient Campaign				
Nutrient Meeting				
One-on-one	Ongoing			
Presentations	Ongoing		Ongoing	
Project WET				
Recognition Picnic				
Scholarship	Annual			
Signs-of-Success				
Steering Committee				Fall 98
Stream Study				Summer 99
Tillage Campaign				
Tours				
Volunteer Projects	Annual			

[1] Annual: Indicates the activity will occur at least once each year.
Ongoing: Indicates the activity will occur multiple times each year.
1a: Inform rural and urban watershed residents, and local youth, about runoff pollution and what they can do to prevent it. Inform watershed residents about the ecological, recreational and economic value of clean streams, wetlands and lakes.
1b: Inform all eligible landowners how cost-sharing can help them install a conservation practice on their property and who their contact is for more information.
1c: Inform local county and city government officials about the watershed program. Keep them up-to-date of progress.
1d: Initiate a long term water quality monitoring effort to evaluate water quality trends in watershed streams and lakes.

Table 8-2b. Activity Schedule to Achieve Sediment Control Objectives [1]

Activity	Sediment Control Objectives						
	Sed 1	Sed 2	Sed 3	Sed 4	Sed 5	Sed 6	Sed 7
CAC							
Canoe Trip							
Demonstrations	Annual						Fall 98
Direct Mail	Summer 98			Annual			Ongoing
Displays							
Field Days	Fall 01						
Forum			Wt 98				
Info Packets			Annual				
List					Spring 98		Spring 98
Media	Ongoing		Ongoing				
Mini Tours	Annual	Annual			Annual		
Newsletter	Ongoing	Ongoing		Ongoing	Ongoing		Ongoing
Nutrient Campaign							
Nutrient Meeting							
One-on-one	Ongoing				Ongoing		
Presentations							
Project WET							
Recognition Picnic	2001						
Scholarship							
Signs-of-Success		Annual					Annual
Steering Committee							
Stream Study		2001					
Tillage Campaign	Spring 98						
Tours		Fall 98				Fall 98	Fall 98
Volunteer Projects							

[1] Annual: Indicates the activity will occur at least once each year.
Ongoing: Indicates the activity will occur multiple times each year.

2a: At least 50% of eligible dairy farms will adopt high residue cropping systems or establish buffers.
2b: Farmers will improve their understanding of streams. They will become aware of the characteristics of healthy streams, the value of healthy streams, the reasons why local streams are degraded, and the BMPs available to improve local streams.
2c: Local town chairs and building inspectors will be encouraged to enforce construction site erosion control.
2d: Lake shore residents will be aware of the environmental hazards associated with lakeshore development and understand when a building permit is required.
2e: Farmers will limit unrestricted cattle access to streams.
2f: Farmers will be informed about intensive rotational grazing.
2g: Landowners with eroding streambanks will take steps to reduce this source of sediment to local streams by 25%.

Table 8-2c. Activity Schedule to Achieve Nutrient Reduction Objectives [1]

Activity	Nutrient Management Objectives		
	Nut 1	Nut 2	Nut 3
CAC			
Canoe Trip			
Demonstrations	Fall 99		
Direct Mail			Summer 98
Displays			
Field Days			
Forum			
Info Packets			
List			
Media			
Mini Tours			
Newsletter	Ongoing	Ongoing	Ongoing
Nutrient Campaign	Summer 98		
Nutrient Meeting	Winter 98		
One-on-one			Ongoing
Presentations			
Project WET			
Recognition Picnic			
Scholarship			
Signs-of-Success			
Steering Committee			
Stream Study			

[1] Annual: Indicates the activity will occur at least once each year.
Ongoing: Indicates the activity will occur multiple times each year.

3a: Farmers will improve their nutrient management planning skills so they know what nutrient management is, how it can save them money and protect water quality, and who they can call on for assistance with nutrient management planning.

3b: Local crop consultants and co-op employees will understand how cost sharing for nutrient management works through the watershed program.

3c: Farmers with livestock will improve their manure management. Farmers who are eligible for barnyard improvements and/or manure storage will understand how cost sharing works.

APPENDIX A:
Current Condition of Surface Waters in the Fond du Lac River Priority Watershed

Surface Water (Size/Length)	Existing Biological Use	Potential Biological Use	Potential Use Attainment	General Comments
Anderson Creek (0-0.2)	FAL (B) WWSF	Enhance WWSF	Partially Meeting	NPS, HAB, FLOW, TURB, MACROPHYTES
Anderson Creek (0.2-5.0)	LFF	SAME	Partially Meeting	NPS, HAB, FLOW, INTER
Campground Creek (0-5.0)	FAL (B) WWSF	Enhance WWSF	Partially Meeting	CL, SB, PSB, BY, HAB, TURB, NPS
Campground Creek (5.0-8.0)	FAL (A) CWSF	Enhance CWSF	Partially Meeting	CL, SB, PSB, BY, HAB, TURB, NPS
East Branch Fond du Lac (0-14.5)	FAL (B) WWSF	Enhance WWSF	Partially Meeting	NPS, CARP, BAC, HAB, SED, TURB
Fond du Lac River (0-2.0)	FAL (B) WWSF	Enhance WWSF	Partially Meeting	NPS, PSI, CE, URB, CARP, HAB, SUB, TURB, TOX
Mosher Creek (0-0.2)	FAL (B) WWSF	Enhance WWSF	Partially Meeting	PSI, CE, URB, CARP, NPS, HAB, TURB, FLOW
Mosher Creek (0.2-3.0)	LFF	SAME	Partially Meeting	PSI, CE, URB, CARP, NPS, HAB, TURB, FLOW
Parsons Creek (0-4.3)	FALT (A)	Enhance FALT (A)	Partially Meeting, ERW (2.0mi)	HAB, FLOW, NPS, BANK EROSION
Sevenmile Creek (0-11.0)	LFF	Enhance to FAL	Partially Meeting	FLOW, HAB, ALGAE, D.O., URB, NPS, WETLAND, MACROPHYTES
Van Dyne Creek (0-1.0)	FAL (B) WWSF	Enhance WWSF	Partially	NPS, HAB, TURB, URB, SED, FLOW, TEMP, D.O.,
Van Dyne Creek (1.0-8.0)	LFF	SAME	Partially	NPS, HAB, TURB, URB, SED, FLOW, ALGAE, TEMP, D.O.

APPENDIX A. Continued..

Surface Water (Size/Length)	Existing Biological Use	Potential Biological Use	Potential Use Attainment	General Comments
West Branch Fond du Lac River (0-26.0)	FAL (B) WWSF	Enhance WWSF	Partially	HM, NPS, HAB, TURB, FLOW, URB, CONSTRUCTION
Unnamed Creek Rogersville (0-2.5)	LFF	SAME	Partially	NPS, HAB, FLOW, TEMP, D.O., SED
Unnamed Creek Rosendale (0-1.0)	FAL (C)	SAME	Partially	NPS, HAB, TEMP, D.O., SUB, SED, URB
Unnamed Creek Rosendale (1.0-6.0)	LFF	SAME	Partially	NPS, HAB, FLOW, TEMP, D.O., CL, TURB, HM, URB, WETLAND
Unnamed Streams/Creeks	73 miles of un-named streams			Most of these are drainage ditch(s) used to drain land for agricultural purposes
Lake Winnebago (137,708 acres)	21'max depth	N/A	N/A	Largest fishable Lake Sturgeon fishery in North America, Algae, Rec. Use, NPS, URB
Raspberry Lake (11 acres)	14'max depth impoundment	N/A	N/A	Impoundment, P, NUTS, ALGEA, MACROPHYTES, NPS

APPENDIX B:
Fish Shocking Data for the Fond du Lac River Priority Watershed Project

Stream: Sevenmile Creek	**Location:** At Veilbig Road Crossing (Upstream)		**Length:** 215 m
Date: 07/25/96	**Segment/Reach:** #1	**Crew:** Sorge, Hazuga, Paz	
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Blacknose Dace	*Rhinichthys atratulus*	31	Tolerant
Bluegill	*Lepomis machrochirus*	16	WW Sport Fish
Bluntnose Minnow	*Pimephales notatus*	5	Tolerant
Brook Stickleback	*Culaea inconstans*	2	Tolerant
Central Mudminnow	*Umbra limi*	51	Tolerant
Central Stoneroller	*Campostoma anomalum*	8	Intolerant
Common Shinner	*Luxilus cornutus*	227	Tolerant
Creek Chub	*Semotilus atromaculatus*	51	Tolerant
Fathead Minnow	*Pimephales promelas*	23	Tolerant
Green Sunfish	*Lepomis cyanellus*	5	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	8	Intolerant
Johnny Darter	*Etheostoma nigrum*	8	Tolerant
Largemouth Bass	*Micropterus salmoides*	6	WW Sport Fish
White Sucker	*Catostomus commersoni*	16	Tolerant
Yellow Perch	*Perca flavescens*	3	WW Sport Fish
TOTAL		**460**	

APPENDIX B. Continued

Stream: East Branch Fond du Lac River	**Location:** At CTH D (Upstream)	**Length:** 132 m
Date: 07/25/96	**Segment/Reach:** #1	**Crew:** Sorge, Paz, Hazuga

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicators**
Blackside Darter	*Percina maculata*	5	Intolerant
Bluntnose Minnow	*Pimephales notatus*	8	Tolerant
Central Mudminnow	*Umbra limi*	15	Tolerant
Central Stoneroller	*Campostoma anomalum*	20	Intolerant
Common Shinner	*Luxilus cornutus*	296	Tolerant
Creek Chub	*Semotilus atromaculatus*	7	Tolerant
Fathead Minnow	*Pimephales promelas*	16	Tolerant
Freshwater Drum	*Aplodinotus grunniens*	11	Rough Fish
Green Sunfish	*Lepomis cyanellus*	14	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	36	Intolerant
Johnny Darter	*Ethestoma nigrum*	4	Tolerant
Pearl Dace	*Semotilus margarita*	0	Intolerant
Log Perch	*Percina caprodes*	5	Intolerant
Rock Bass	*Ambloplites rupestris*	8	WW Sport Fish
Yellow Perch	*Perca flavescens*	2	WW Sport Fish
White Sucker	*Catostomus commersoni*	4	Tolerant
TOTAL		**446**	

APPENDIX B. Continued

Stream: East Branch Fond du Lac River	**Location:** At CTH Y (Upstream)	**Length:** 140 feet
Date: 08/13/96	**Segment/Reach:** #2	**Crew:** Sorge, Leverance, Vollrath

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Bluegill	*Lepomis macrochirus*	20	WW Sport Fish
Common Carp	*Cyprinus carpio*	10	Rough Fish
Creek Chub	*Semotilus atromaculatus*	6	Tolerant
Common Shinner	*Luxilus cornutus*	27	Tolerant
Freshwater Drum	*Aplodinotus grunniens*	7	Rough Fish
Green Sunfish	*Lepomis cyanellus*	15	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	1	Intolerant
Central Mudminnow	*Umbra limi*	20	Tolerant
Northern Pike	*Esox lucius*	1	Sport Fish
Largemouth Bass	*Micropterus salmoides*	1	WW Sport Fish
Yellow Perch	*Perca flavescens*	6	WW Sport Fish
White Sucker	*Catostomus commersoni*	24	Tolerant
TOTAL		**138**	

Stream: East Branch Fond du Lac River	**Location:** At STH 151 (Upstream)	**Length:** 110 m
Date: 07/23/96	**Segment/ Reach:** #3	**Crew:** Sorge, Hazuga, Leverance

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Blacknose Dace	*Rhinichthys atratulus*	14	Tolerant
Brook Stickleback	*Culaea inconstans*	9	Tolerant
Common Shinner	*Luxilus cornutus*	6	Tolerant
Creek Chub	*Semotilus atromaculatus*	16	Tolerant
Central Mudminnow	*Umbra limi*	7	Tolerant
Fathead Minnow	*Pimephales promelas*	1	Tolerant
Pearl Dace	*Semotilus margarita*	6	Intolerant
Southern Redbelly Dace	*Phoxinus erythrigaster*	18	Intolerant
TOTAL		77	

APPENDIX B. Continued

Stream: West Branch Fond du Lac River	**Location:** At CTH T (Upstream)	**Length:** 285 m
Date: 07/24/96	**Segment/Reach:** #1	**Crew:** Sorge, Leverance, Hazuga

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Black Bullhead	*Ictaluras melas*	21	Sport Fish
Bluntnose Minnow	*Pimephales notatus*	2	Tolerant
Central Mudminnow	*Umbra limi*	2	Tolerant
Central Stoneroller	*Campostoma anomalum*	41	Intolerant
Common Shinner	*Luxilus cornutus*	815	Tolerant
Creek Chub	*Semotilus atromaculatus*	36	Tolerant
Fantail Darter	*Etheostoma flabellare*	40	Tolerant
Freshwater Drum	*Aplodinotus grunniens*	8	Rough Fish
Grass Pickerel	*Esox americans*	1	CW Sport Fish
Green Sunfish	*Lepomis cyanellus*	11	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	197	Intolerant
Johnny Darter	*Etheostoma nigrum*	6	Tolerant
Log Perch	*Percina caprodes*	160	Intolerant
Northern Pike	*Esox lucius*	2	CW Sport Fish
Rock Bass	*Ambloplites rupestris*	32	WW Sport Fish
Walleye	*Stizostedion vitreum vitreum*	1	WW Sport Fish
White Sucker	*Catostomus commersoni*	45	Tolerant
Yellow Bullhead	*Ictaluras natalis*	5	WW Sport Fish
Yellow Perch	*Perca flavenscens*	21	WW Sport Fish
TOTAL		**1,452**	

APPENDIX B. Continued

Stream: West Branch Fond du Lac River		**Location:** At Esterbrook Road (Upstream)	**Length:** 120 m
Date: 08/13/96	**Segment/Reach:** #2	**Crew:** Sorge, Molter, Leverance	
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Black Bullhead	*Ictalurus melas*	2	WW Sport Fish
Central Mudminnow	*Umbra limi*	6	Tolerant
Central Stoneroller	*Campostoma anomalum*	2	Intolerant
Common Shinner	*Luxilus cornutus*	15	Tolerant
Creek Chub	*Semotilus atromaculatus*	13	Tolerant
Green Sunfish	*Lepomis cyanellus*	1	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	70	Intolerant
Log Perch	*Percina caprodes*	26	Intolerant
Northern Pike	*Esox lucius*	3	CW Sport Fish
White Sucker	*Catostomus commersoni*	6	Tolerant
Yellow Bullhead	*Ictalurus natalis*	4	WW Sport Fish
Yellow Perch	*Perca flavescens*	5	WW Sport Fish
TOTAL		**153**	

APPENDIX B. Continued

Stream: West Branch Fond du Lac River	**Location:** At Townline Road (Upstream)		**Length:** 252 m
Date: 07/24/96	**Segment/Reach:** #3	**Crew:** Sorge, Hazuga, Leverance	

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Black Bullhead	*Ictalurus melas*	18	WW Sport Fish
Bluegill	*Lepomis macrochirus*	10	WW Sport Fish
Central Mudminnow	*Umbra limi*	72	Tolerant
Central Stoneroller	*Campostoma anomalum*	2	Intolerant
Common Shinner	*Luxilus cornutus*	24	Tolerant
Creek Chub	*Semotilus atromaculatus*	46	Tolerant
Fantail Darter	*Etheostoma flabellare*	1	Tolerant
Freshwater Drum	*Aplodinotus grunniens*	14	Rough Fish
Green Sunfish	*Lepomis cyanellus*	3	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	43	Intolerant
Log Perch	*Percina caprodes*	18	Intolerant
Northern Pike	*Esox lucius*	6	CW Sport Fish
Pumpkinseed	*Lepomis gibbosus*	1	WW Sport Fish
Rock Bass	*Ambloplites rupestris*	4	WW Sport Fish
White Sucker	*Catostomus commersoni*	32	Tolerant
Yellow Bullhead	*Ictalurus natalis*	5	WW Sport Fish
Yellow Perch	*Perca flavescens*	184	WW Sport Fish
TOTAL		**483**	

APPENDIX B. Continued

Stream: W. Branch Fond du Lac River	**Location:** Above habitat @ Townline Road (Upstream)	**Length:** 150 m
Date: 07/24/96	**Segment/Reach:** #4	**Crew:** Sorge, Leverance, Hazuga

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Bluegill	*Lepomis macrochirus*	7	WW Sport Fish
Black Bullhead	*Ictalurus melas*	2	WW Sport Fish
Central Mudminnow	*Umbra limi*	18	Tolerant
Central Stoneroller	*Campostoma anomalum*	2	Intolerant
Common Shinner	*Luxilus cornutus*	80	Tolerant
Creek Chub	*Semotilus atromaculatus*	54	Tolerant
Freshwater Drum	*Aplodinotus grunniens*	11	Rough Fish
Green Sunfish	*Lepomis cyanellus*	2	WW Sport Fish
Hornyhead Chub	*Nocomis biguttatus*	40	Intolerant
Log Perch	*Percina caprodes*	9	Intolerant
Pumpkinseed	*Lepomis gibbosus*	1	WW Sport Fish
White Sucker	*Catostomus commersoni*	15	Tolerant
Yellow Bullhead	*Ictalurus natalis*	1	WW Sport Fish
Yellow Perch	*Perca flavescens*	30	WW Sport Fish
TOTAL		**272**	

Stream: Un-named tributary to W. Branch Fond du Lac River	**Location:** At STH 26, North of Rosendale (Upstream)	**Length:** 100 feet
Date: 08/15/96	**Segment/Reach:** #1	**Crew:** Sorge, Leverance

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Brook Stickleback	*Culaea inconstans*	Abundant	Tolerant
Central Mudminnow	*Umbra limi*	Abundant	Tolerant
Creek Chub	*Semotilus atromaculatus*	Abundant	Tolerant
Fathead Minnow	*Pimephales promelas*	Abundant	Tolerant
Pearl Dace	*Semotilus margarita*	Abundant	Intolerant
Southern Redbelly Dace	*Phoxinus erythrogaster*	Abundant	Intolerant
White Sucker	*Catostomus commersoni*	Abundant	Tolerant

This un-named tributary to W. Branch was shocked with a backpack shocker, we shocked approximately 100 feet and found so many forage fish that it would have taken several hours to shock just 50 feet. The Reason for not counting was due to the inability to shock to a riffle area to process fish, therefore we had no way of making sure that we were not counting the same fish twice.

APPENDIX B. Continued

Stream: Parsons Creek	**Location:** At Hickory St. (Hobb's Woods Co. Park) (Upstream)		**Length:** 144 m
Date: 07/23/96	**Segment/ Reach:** #1	**Crew:** Sorge, Leverance, Hazuga	
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Blackside Darter	*Percina maculata*	1	Intolerant
Blacknose Dace	*Rhinichthys atratulus*	52	Tolerant
Central Stoneroller	*Campostoma anomalum*	2	Intolerant
Creek Chub	*Semotilus atromaculatus*	7	Tolerant
Common Shinner	*Luxilus cornutus*	2	Tolerant
Fathead Minnow	*Pimephales promelas*	13	Tolerant
Fantail Darter	*Etheostoma flabellare*	1	Tolerant
Green Sunfish	*Lepomis cyanellus*	2	Very Tolerant
Johnny Darter	*Etheostoma nigrum*	1	Tolerant
Pearl Dace	*Semotilus margarita*	115	Intolerant
White Sucker	*Catostomus commersoni*	7	Tolerant
TOTAL		**203**	

APPENDIX B. Continued

Stream: Parsons Creek	**Location:** @ Lost Arrow Road (Upstream)		**Length:** 108 m
Date: 08/13/96	**Segment/Reach:** #2	**Crew:** Sorge, Leverance, Molter	
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Bluegill	*Lepomis macrochirus*	1	WW Sport Fish
Blacknose Dace	*Rhinichthys atratulus*	22	Tolerant
Blackside Darter	*Percina maculata*	1	Intolerant
Common Shinner	*Luxilus cornutus*	204	Tolerant
Creek Chub	*Semotilus atromaculatus*	37	Tolerant
Fathead Minnow	*Pimephales promelas*	3	Tolerant
Golden Shinner	*Notemigonus crysoleucas*	1	Tolerant
Green Sunfish	*Lepomis cyanellus*	19	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	18	Intolerant
Johnny Darter	*Ethestoma nigrum*	9	Tolerant
Pearl Dace	*Semotilus margarita*	33	Intolerant
White Sucker	*Catostomus commersoni*	84	Tolerant
TOTAL		**432**	

Stream: Parsons Creek	**Location:** @ STH 175 (Upstream)		**Length:** 156 feet
Date: 08/15/96	**Segment/Reach:** #4		**Crew:** Sorge & Leverance
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Blacknose Dace	*Rhinichthys atratulus*	13	Tolerant
Brook Stickleback	*Culaea inconstans*	7	Tolerant
Central mud minnow	*Umbra limi*	6	Tolerant
Central Stoneroller	*Campostoma anomalum*	21	Intolerant
Common Shinner	*Luxilus cornutus*	2	Tolerant
Creek Chub	*Semotilus atromaculatus*	47	Tolerant
Fathead Minnow	*Pimephales promelas*	7	Tolerant
Green Sunfish	*Lepomis cyanellus*	8	Very Tolerant
Johnny Darter	*Etheostoma nigrum*	20	Tolerant
TOTAL		**131**	

APPENDIX B. Continued

Stream: Tributary to Parsons Creek	**Location:** Church Road (Upstream)		**Length:** 265 feet
Date: 08/15/96	**Segment/Reach:** #5		**Crew:** Sorge & Leverance
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
NO FISH were found in 265 feet of shocking, overall water quality seems to be excellent, good HBI, temperature and D.O. were great at 10.5'C and 10.4 mg/l., there was also lots of water cress present, thus evident of strong groundwater recharge. Habitat is fine with lots of pools and riffles, and substrate is dominated by course sands, gravel, and cobble.			

Stream: Campground Creek	**Location:** At River Road (Upstream)		**Length:** 50 m
Date: 08/15/96	**Segment/Reach:** #1		**Crew:** Sorge & Leverance
Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Brook Stickleback	*Culaea inconstans*	3	Tolerant
Shocked approximately 50 meters of stream and only found three Brook Sticklebacks, this reach of stream is plagued by high temps and low d.o., when we shocked this reach at 12:35- 13:30 the temp./d.o. was 19.0'C and 0.9 mg/l. Sedimentation, excessive plant and algae growth all appear to be limiting aquatic life within this reach of stream.			

APPENDIX B. Continued

Stream: Tributary to Campground Creek	**Location:** At River Road (Upstream)	**Length:** 100 m
Date: 08/15/96	**Segment/ Reach:** #2	**Crew:** Sorge & Leverance

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Brook Stickleback	*Culaea inconstans*	51	Tolerant
Blacknose Dace	*Rhinichthys atratulus*	3	Tolerant
Fathead Minnow	*Pimephales promelas*	38	Tolerant
Pearl Dace	*Semotilus margarita*	56	Intolerant
TOTAL		**148**	

This section of stream has great substrate (boulder, cobble, and gravel), its also has intense ag on the east bank and CRP on the west bank. There is a large fork in the stream approx. 120 m upstream of river road. Bank erosion is a problem in the wooded corridor of the stream, clay shelves are also present in areas were severe erosion is happening. According to one of the landowners he stated " there are large annual runs of White Suckers and Northern Pike every spring." There HBI Score came back at a 4.880, the sample was dominated by a specie of chironomidae *(Diamesa spp.)*, it made up 77% of the total number of individuals.

Stream: Campground Creek	**Location:** At CTH Y (Upstream)	**Length:** 120 feet
Date: 08/23/96	**Segment/ Reach:** #3	**Crew:** Sorge, Leverance, Vollrath

Common Name	**Scientific Name**	**# of Individuals**	**W.Q. Indicator**
Bluegill	*Lepomis macrochirus*	1	WW Sport Fish
Blacknose Dace	*Rhinichthys atratulus*	124	Tolerant
Bluntnose Minnow	*Pimephales notatus*	29	Tolerant
Brook Stickleback	*Culaea inconstans*	39	Tolerant
Central Mudminnow	*Umbra limi*	33	Tolerant
Central Stoneroller	*Campostoma anomalum*	146	Intolerant
Common Shinner	*Luxilus cornutus*	591	Tolerant
Creek Chub	*Semotilus atromaculatus*	90	Tolerant
Fathead Minnow	*Pimephales promelas*	115	Tolerant
Green Sunfish	*Lepomis cyanellus*	20	Very Tolerant
Hornyhead Chub	*Nocomis biguttatus*	7	Intolerant
\Johnny Darter	*Etheostoma nigrum*	25	Tolerant
Southern Redbelly Dace	*Phoxinus erythrogaster*	2	Intolerant
Pearl Dace	*Semotilus margarita*	174	Intolerant
White Sucker	*Catostomus commersoni*	46	Tolerant
TOTAL		**1,442**	

APPENDIX C:
Common Best Management Practices

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

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

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

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.

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.

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

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.

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

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.

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

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

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

Intensive Grazing Management (Rotational Grazing). Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a period of recovery of the vegetative cover. Rotational grazing systems can correct existing pasturing practices that result in degradation and should replace the practice of summer dry-lots when this practice results in water quality degradation.

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

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

Manure Storage Facility. A structure for the storage of manure for a period of time to reduce the impact of manure as a NPS 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.

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.

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.

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.

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

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

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

APPENDIX D:
1977 Fish Survey Data from the East and West Branches of the Fond du Lac River System

Computer I. D. Code	Common Name	Scientific Name
110	Central Mudminnow	*Umbra limi*
121	Northern Pike	*Esox lucius*
128	Central Stoneroller	*Campostoma anomalum*
134	Common Carp	*Cyprinus carpio*
136	Brassy Minnow	*Hybognathus hankinsoni*
142	Hornyhead Chub	*Nocomis biguttatus*
146	Emerald Shinner	*Notropis atherinoides*
168	Bluntnose Minnow	*Pimephales promelas*
151	Common Shinner	*Notropis cornutus*
165	Northern Redbelly Dace	*Phoxinus eos*
169	Fathead Minnow	*Pimephales promelas*
173	Creek Chub	*Semotlius atromaculatus*
175	Pearl Dace	*Semotilus corporalis*
194	White Sucker	*Catostomus commersoni*
203	Silver Redhorse	*Moxostoma anisurum*
205	Golden Redhorse	*Moxostoma erythrurum*
206	Shorthead Redhorse	*Moxostoma macrolepidotum*
221	Black Bullhead	*Ictalurus melas*
222	Yellow Bullhead	*Ictalurus natalis*
227	Tadpole Madtom	*Noturus gyrinus*
260	Burbot	*Lota lota*
290	Brook Stickleback	*Culaea inconstans*
310	Rock Bass	*Ambloplites rupestris*
311	Green Sunfish	*Lepomis cyanellus*
340	Johnny Darter	*Ethestoma nigrum*
343	Yellow Perch	*Perca flavenscens*
344	Logperch	*Percina caprodes*
346	Blackside Darter	*Percina maculata*
348	River Darter	*Percina shumardi*
350	Walleye	*Stizostedion vitreum vitreum*

BIBLIOGRAPHY

Ball, Joe. 1982. *Stream Classification Guidelines for Wisconsin.* Wisconsin Department of Natural Resources, Madison, Wisconsin.

Becker, G.C. 1983. *Fishes of Wisconsin.* The University of Wisconsin Press, Madison, Wisconsin.

Cahow, Jim. 1995. *Guidelines for Conducting Signs of Success (S.O.S.) Monitoring in Wisconsin Priority Watersheds.* Wisconsin Department of Natural Resources.

Fassbender, R.L., L.M. Nelson. 1975. *Surface Water Resources of Winnebago County. Lake and Stream Classification Project.* Wisconsin Department of Natural Resources. Madison, Wisconsin.

Fix, Steven. 1990. *Upper Fox River Basin: Water Quality Management Plan.* Wisconsin Department of Natural Resources. Madison, Wisconsin. (WDNR, PUBL WR-225-90).

Hilsenhoff, W.L. 1982. *Using a Biotic Index to Evaluate Water Quality of Streams.* Wisconsin Department of Natural Resources, Technical Bulletin No. 132. Madison, Wisconsin.

Hilsenhoff, W.L. 1987. An Improved Biotic Index of Organic Pollution.

Hilsenhoff, W.L. 1988. Rapid Field Assessment of Organic Pollution With a Family-Level Biotic Index.

Hilsenhoff, W.L. 1994. G3648, Aquatic Insects of Wisconsin; Keys to Wisconsin Genera and Notes on Biology, Habitat, Distribution, and Species. University of Wisconsin- Madison.

Hynes, H.B.N. 1970. The Ecology of Running Waters. University of Toronto Press, Toronto.

Kapur and Associates, Inc. July 1995. Comprehensive Water Study, Village of Oakfield, WI.

Lyons, J., L. Wang, and T.D. Simonson. 1995. An Index of Biotic Integrity (IBI) for Coldwater Streams in Wisconsin (Draft5).

Lyons, J. 1996. Bureau of Fish Research, Wisconsin Department of Natural Resources. Personal communications.

Newport, T.T. 1962. Geology and Groundwater Resources of Fond du Lac County, Wisconsin, USGS Water-supply Paper 1604.

Robert E. Lee and Associates, Inc. 1986. Water Treatment and Supply Study Project Report for the City of Fond du Lac.

Rowe, Maureen. 1997. Bureau of Wildlife Management. Wisconsin Department of Natural Resources. Personal Communications.

Stuntebeck, Todd D. 1995. "Evaluating Barnyard Best Management Practices in Wisconsin Using Upstream-Downstream Monitoring". U.S. Geological Survey, Water Resources Division. Fact Sheet FS-221-95. Madison, WI

Weber, J.J., P.T. Schultz, L.T. Kernen, and C.W. Threinen. 1969. Surface Water Resources of Fond du Lac County. Wisconsin Department of Natural Resources. Madison, Wisconsin.

Weaver, T. R., J.M. Bahr, M.P. Anderson, 1990. Groundwater Geochemistry and Radionuclide Activity in the Cambrian-Ordovician Aquifer of Dodge and Fond du Lac Counties, Wisconsin. Technical Completion Report Project Number G1458-02, University of Wisconsin Water Resource Center.

Wisconsin Department of Natural Resources. 1995. "DNR Research". PUBL-RS-914-95. Monona, WI.

Wisconsin Department of Natural Resources. 1986. Eldorado Wildlife Area Master Plan, Concept Element. Madison, Wisconsin.

Wisconsin Department of Natural Resources. 1989. "Winnebago Comprehensive Management Plan". Federal Aid Project FW-19-P-1. Oshkosh, Wisconsin.

Wisconsin Department of Natural Resources. 1995. "Wisconsin Lakes". PUB-FM-800. Madison, Wisconsin.

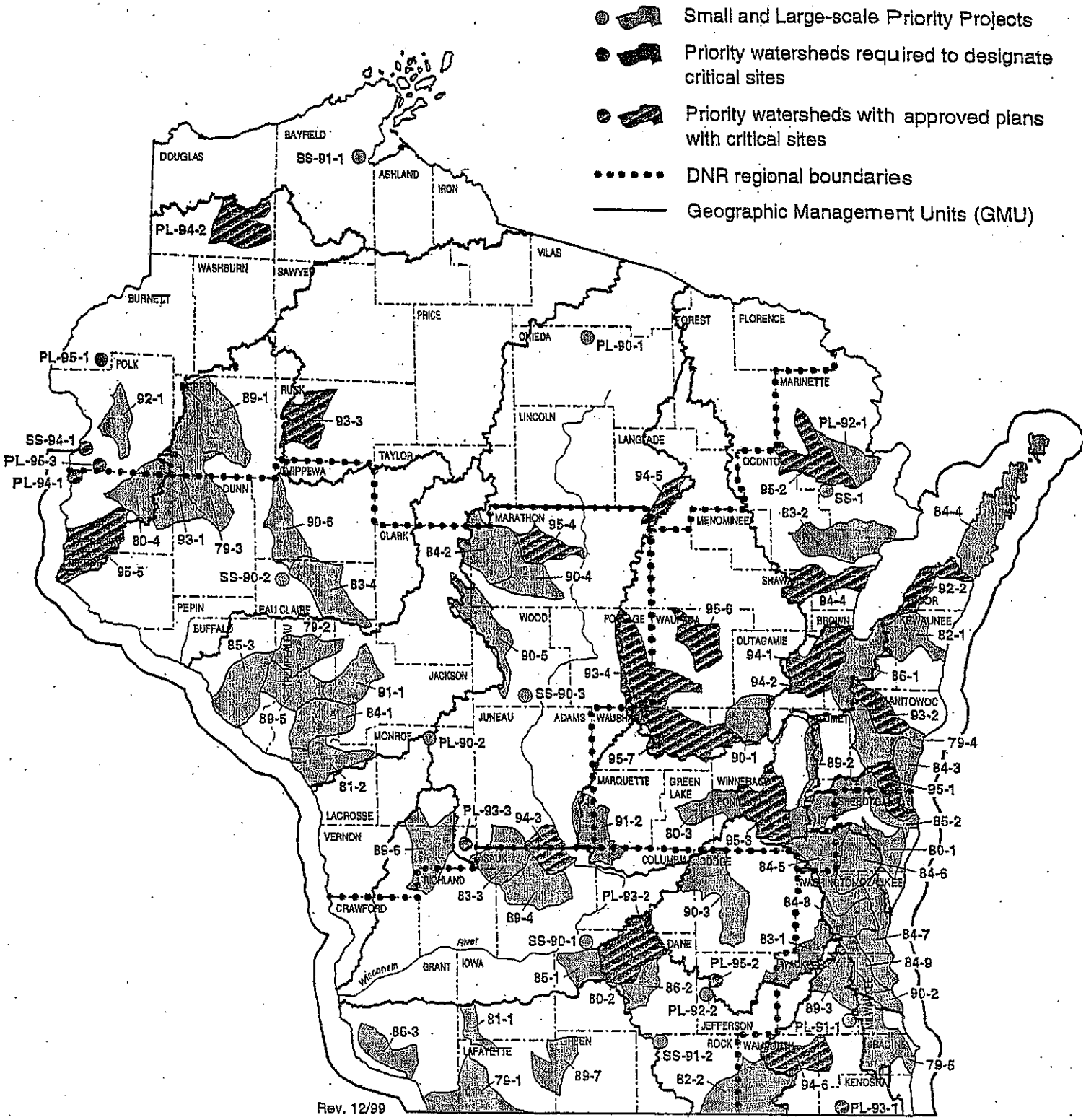
Wisconsin Department of Natural Resources, October, 1995. Wisconsin Remedial Response Site Evaluation Report, PUBL-SW-504-95 (REV).

Wisconsin Department of Natural Resources, D.N., Daniel. United States Geological Survey.

E.W., Henrich. Drainage Area Data For Wisconsin Streams, Open-File Report 83-933.

United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 1994. Mosher-Anderson Creek Watershed, Watershed Plan and Environmental Assessment. Madison, Wisconsin

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

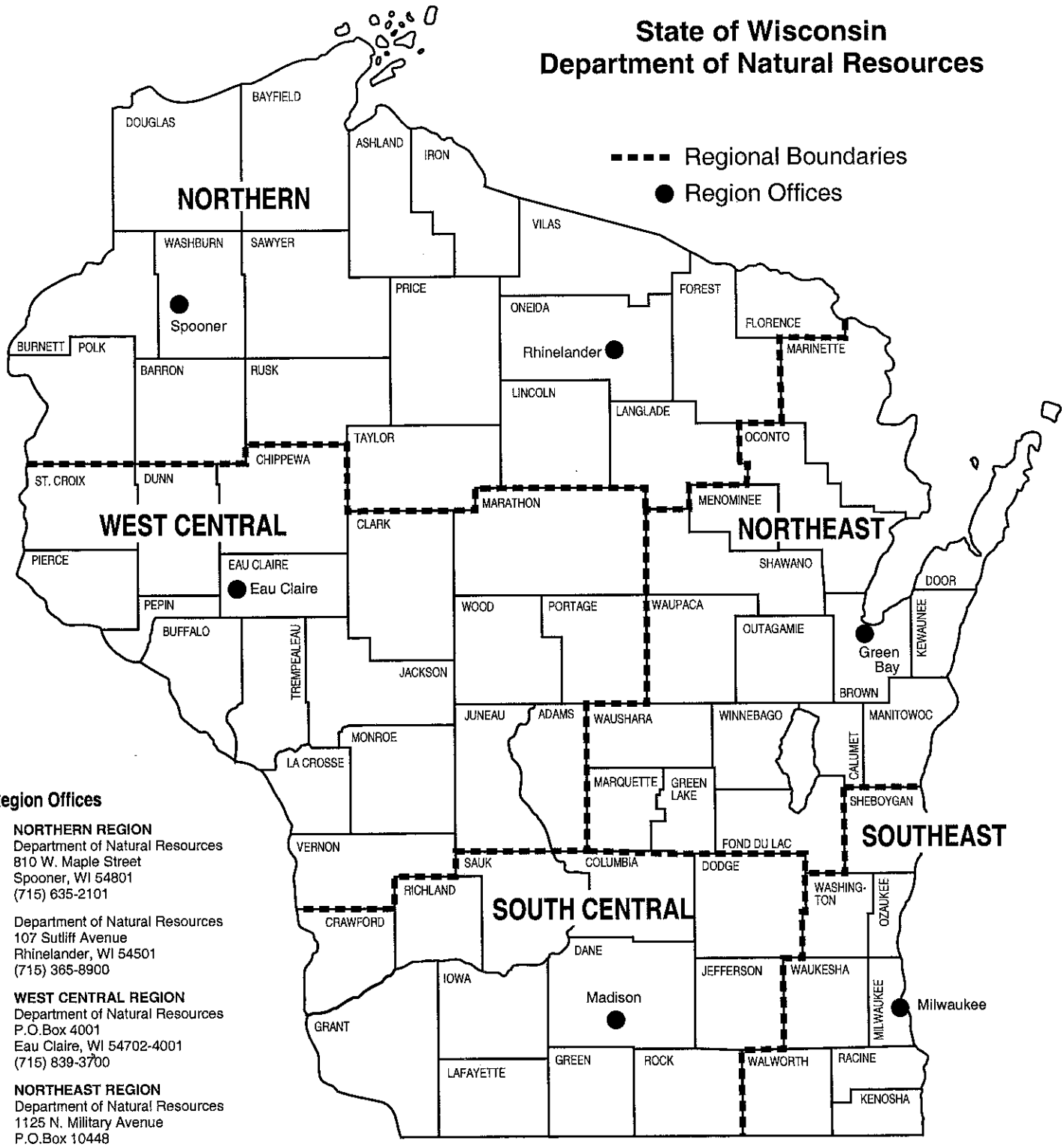
Year Selected-Map Number	Small-scale Priority Watershed Project	County(ies)
SS-1	Bass Lake ♦	Marinette
SS-90-1	Dunlap Creek	Dane
SS-90-2	Lowes Creek	Eau Claire
SS-90-3	Port Edwards - Groundwater Prototype ♦	Wood
SS-91-1	Whittlesey Creek	Bayfield
SS-91-2	Spring Creek	Rock
SS-94-1	Osceola Creek	Polk

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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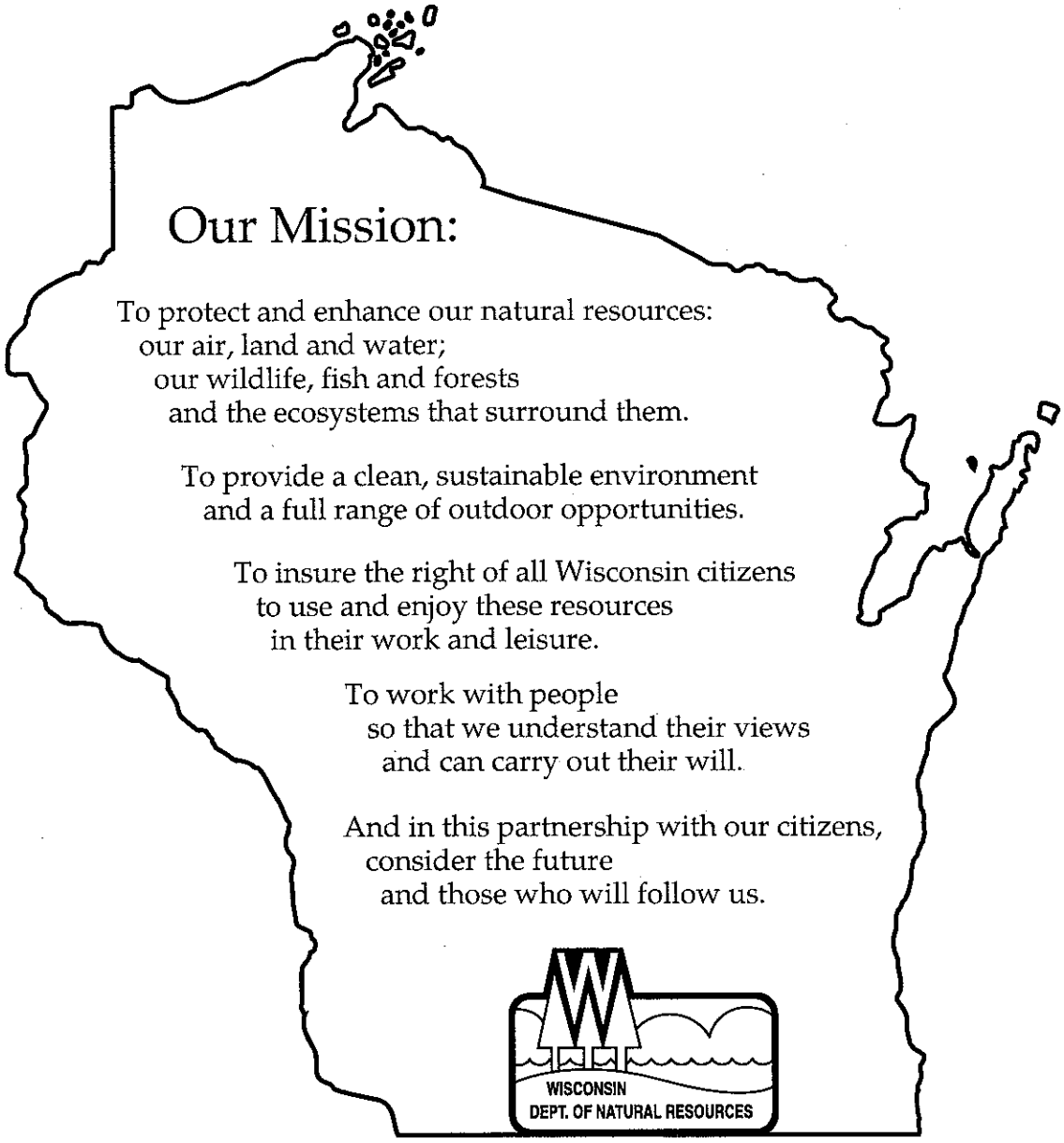

Our Mission:

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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PUB-WT-705 2001