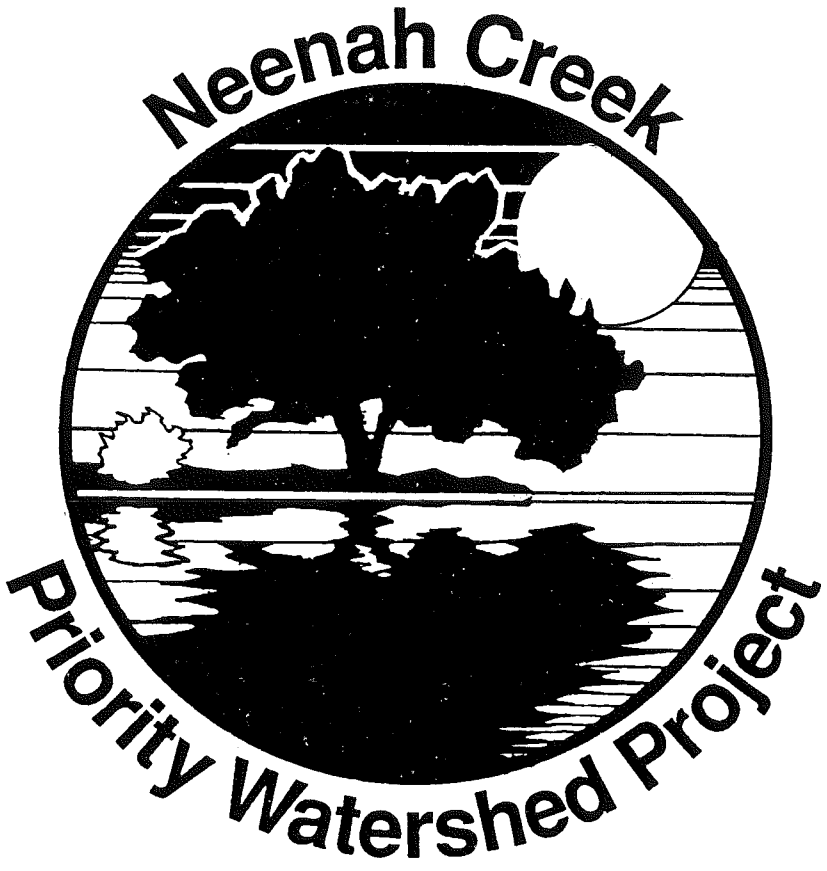
Nonpoint Source Control Plan for the Neenah Creek Priority Watershed Project



Prepared by the **Wisconsin Department of Natural Resources and Department of Agriculture, Trade, and Consumer Protection** in cooperation with the **Adams, Marquette, and Columbia County Land Conservation Departments.**

Watershed Plan Organization Information

Natural Resources Board
1994

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Rebecca Wallace, Chief, Nonpoint Source & Land Management Section

Wisconsin Department of Agriculture, Trade and Consumer Protection

Alan Tracy, Secretary
Nicholas Neher, Administrator, Division of Agriculture Resource Management
Dave Jelinski, Director, Bureau of Land and Water Resources
Keith Foye, Chief, Soil and Water Section

A NONPOINT SOURCE CONTROL PLAN FOR THE NEENAH CREEK PRIORITY WATERSHED PROJECT

The Wisconsin Nonpoint Source Water Pollution Abatement Program

July, 1994

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources and
The Department of Agriculture, Trade, and Consumer Protection
In cooperation with
The Adams, Marquette and Columbia County Land Conservation Departments

Publication WR-370-94

For copies of this document please contact:

Wisconsin Department of Natural Resources
Bureau of Water Resources Management
Nonpoint Source and Land Management Section
P.O. Box 7291
Madison, WI 53707

The Wisconsin 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 ACKNOWLEDGEMENTS

Author

Karen Rahmeier, Wisconsin Department of Natural Resources, Project Coordinator

Principal Contributors

Peggy Armstrong, Adams County Land Conservation Department
Kerrie Wheeler, Adams County Land Conservation Department
Mark Klish, Adams County Land Conservation Department
Donn Wright, Marquette County Land Conservation Department
Bill Buckley, Columbia County Land Conservation Department
Kyle Kidney, Columbia County Land Conservation Department
Suzanne Wade, UW Extension, Water Quality Specialist
Lynne Hess, Department of Agriculture, Trade & Consumer Protection
Andy Morton, Department of Natural Resources
Laura Herman, Department of Natural Resources, North Central District, Biologist
Randy Atkinson, Aquatic Resources, Lake Mason Improvement District
Scot Ironside, Fisheries Manager, DNR, Adams-Friendship

Editor

Sabrina D. Charney, Bureau of Water Resources, WDNR

Graphics/Maps

Geographic Services Section, WDNR

Word Processing

Word Processing Staff, WDNR

ACKNOWLEDGEMENTS

In addition to the people listed on the inside front cover of this plan, the author and principal contributors would like to acknowledge the contributions of the following people:

Rich Adamczak, Adams County LCD
Ken Baun, WDNR Nonpoint Source & Land Management Section
Carolyn Betz, Department of Natural Resources, Nonpoint Source & Land Mgmt. Section
Jeff Breuer, University of Wisconsin-Extension, Agricultural Agent, Adams County
Laura Chern, Department of Natural Resources, Groundwater Management Section
Kay Coates, Department of Natural Resources, North Central District
Lynn Hanson, Department of Natural Resources, Wildlife Mgmt., Horicon Area Office
Ralph Hemling, DATCP engineering technician, Richland Center
Cindy Hoffland, WDNR Bureau of Community Assistance
Pat Kaiser, Department of Natural Resources, Poynette Area, Wildlife Manager
Tim Larson, Department of Natural Resources, Poynette, Wildlife
Jim Leverance, Department of Natural Resources, Southern District, Lakes
Dave Marshall, Department of Natural Resources, Madison Area, Fisheries
Michelle Miller, Department of Agriculture, Trade and Consumer Protection
Clint Rudesill, University of Wisconsin-Extension, Agricultural Agent, Marquette County
Tom Ruzicki, Department of Natural Resources Bureau of Information Management
Ray Saxby, University of Wisconsin-Extension, Agricultural Agent, Columbia County
Terry Schenk, Department of Natural Resources, Southern District, Biologist
Kevin Shelley, University of Wisconsin–Extension, Nutrient & Pest Management Program
Bridget Waite, DNR, Nonpoint Source & Land Management Section
Rodney Walter, DNR Property Management
Richard Wedepohl, DNR Nonpoint Source & Land Management Section
Drew Zelle, DATCP engineering technician, Beaver Dam

State of Wisconsin
Department of Agriculture, Trade and Consumer Protection

Alan T. Tracy, Secretary

801 West Badger Road • PO Box 8911
Madison, WI 53708-8911

December 21, 1993

Mr. Bruce Baker, Director
Bureau of Water Resources Management
Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707

Dear Mr. Baker:

The Department of Agriculture, Trade, and Consumer Protection has reviewed the document titled Neenah Creek Priority Watershed Project: A Nonpoint Source Control Plan. Our comments had earlier been transmitted to your staff and our review reveals that these comments have been incorporated.

We look forward to assisting the Department of Natural Resources and the Land Conservation Committees and staff in Adams, Columbia, and Marquette Counties in implementing the project.

Please contact Lynne Hess (273-6206) if we can be of any further assistance in moving the project to implementation.

Sincerely,

Dave Jelinski, Director
Bureau of Land and Water Resources
DIVISION OF AGRICULTURAL RESOURCE MANAGEMENT
(608) 273-6411

cc: Becky Wallace, DNR, WR/2
Mark Klish, Adams County Conservationist
Kyle Kidney, Columbia County Conservationist
Donn Wright, Marquette County Conservationist
Keith Foye, DATCP

WISCONSIN
DEPT. OF NATURAL RESOURCES
George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

April 8, 1994

George Dixon, County Board Chair
Adams County
Box 287, Courthouse
Friendship, WI 53934

George

Dear Mr. Dixon:

I am pleased to approve the Neenah Creek Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Water Pollution Abatement Program. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. I am also approving this plan as an amendment to the Upper Fox River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Adams County staff that participated in preparing this plan. We look forward to assisting Adams County and the cities and villages in the watershed in the implementation of the Neenah Creek Priority Watershed Plan.

Sincerely,

George

George E. Meyer
Secretary

cc: Mark Klish - Adams County LCD
Andy Morton - SD
Dave Jelinski - DATCP
Becky Wallace - WR/2
Cindy Hoffland - CA/8
Karen Rahmeier - WR/2

WISCONSIN
DEPT. OF NATURAL RESOURCES
George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

April 8, 1994

Paul Wade, County Board Chair
Marquette County
480 Underwood Avenue
PO Box 147
Montello, WI 53949

Dear Mr. Wade:

I am pleased to approve the Neenah Creek Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Water Pollution Abatement Program. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. I am also approving this plan as an amendment to the Upper Fox River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Marquette County staff that participated in preparing this plan. We look forward to assisting Marquette County and the cities and villages in the watershed in the implementation of the Neenah Creek Priority Watershed Plan.

Sincerely,

George E. Meyer
Secretary

cc: Donn Wright - Marquette County LCD
Andy Morton - SD
Dave Jelinski - DATCP
Becky Wallace - WR/2
Cindy Hoffland - CA/8
Karen Rahmeier - WR/2

WISCONSIN
DEPT. OF NATURAL RESOURCES
George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

April 8, 1994

John H. Tramburg, County Board Chair
Carl Frederick Administration Building
400 DeWitt Street
Portage, WI 53901

Dear Mr. John Tramburg:

I am pleased to approve the Neenah Creek Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Water Pollution Abatement Program. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. I am also approving this plan as an amendment to the Upper Fox River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Columbia County staff that participated in preparing this plan. We look forward to assisting Columbia County and the cities and villages in the watershed in the implementation of the Neenah Creek Priority Watershed Plan.

Sincerely,

George

George E. Meyer
Secretary

cc: Robert J. Stoltenberg - LCC Chair
Kyle Kidney - Columbia County LCD
Andy Morton - SD
Dave Jelinski - DATCP
Becky Wallace - WR/2
Cindy Hoffland - CA/8
Karen Rahmeier - WR/2

Adams County

Department of Land Conservation
Box 287, Courthouse, Friendship, WI 53934 (608) 339-4268

December 22, 1993

Karen Rahmeier
WI D.N.R. WR/2
P O Box 7921
Madison, WI 53707

Dear Karen:

The Adams County Land Conservation Committee and Board of Supervisors has approved the Neenah Creek Priority Watershed Plan. The original signed resolution is attached.

$110,568 KR

At this time, we are requesting our Nonpoint Source Grant for the amount of ~~$304,894.00~~ to begin our first year of implementation. We would like to begin signing cost-share agreements by March 1, 1994. We understand that we cannot begin signing cost-share agreements until we have received the proper paperwork from the Department of Natural Resources.

If you need additional information, please contact us.

Sincerely,

Kerrie J. Wheeler
Kerrie J. Wheeler
Neenah Creek Watershed

Mark J. Klish
Mark J. Klish
County Conservationist

Resolution No. 109 1993

INTRODUCED BY: Land Conservation Committee

INTENT & SYNOPSIS: To adopt the Nonpoint Source Control Plan for the Neenah Creek Priority Watershed Project.

WHEREAS: the Neenah Creek Watershed was designated by the Department of Natural Resources in 1991 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS: the Adams County Land Conservation Committee and County Board of Supervisors had previously approved the project in 1991, and

WHEREAS: the County Land Conservation Department in cooperation with the Wisconsin Department of Natural Resources and the Wisconsin department of Agriculture, Trade and Consumer Protection conducted a detailed inventory of the land use within the watershed in 1992 and 1993, and

WHEREAS: this inventory resulted in the development of a detailed nonpoint source control plan for the watershed, and

WHEREAS: a number of public informational meetings have been conducted throughout the watershed, and

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

WHEREAS: the County wishing to receive cost sharing grants for landowners in the watershed must first adopt the Neenah Creek Watershed Plan.

NOW, THEREFORE, BE IT RESOLVED; By the Adams County Board of Supervisors that the Neenah Creek Watershed Nonpoint Source Priority Watershed Plan be adopted and the implementation of the plan begin as soon as possible.

FISCAL IMPACT: Costs to the County for implementation of this watershed plan are reimbursed 100% by the State.

Land Conservation Committee

Dated this 6 day of December, 1993

Glenn Licitar

Earl Taylor

Jerry Kotlowski

Larry Babcock

Roger Hilliard

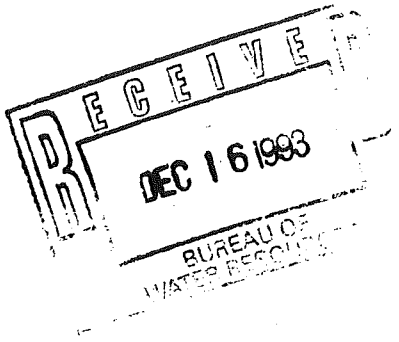
Adopted ✓
Defeated ____ by the County Board of Adams County this 21 day of December, 1993.

County Board Chairman

County Clerk

State of Wisconsin
County of Adams
This document is a full, true and correct copy of the original on file and of record in my office and has been compared by me
Attest ____ 19____
County Clerk

Land Conservation Department
480 Underwood Avenue
PO Box 147
Montello, WI 53949



16 December 1993

Karen Rahmeier
Nonpoint Source Section
Bureau of Water Resources Management
Department of Natural Resources
101 S. Webster Street
PO Box 7921
Madison, WI 537070-7921

Karen,

The Land Conservation Committee passed a resolution recommending the Neenah Creek Priority Watershed Plan to the county board on 7 December 1993.

The County Board passed a resolution accepting the Neenah Creek Priority Watershed Plan as drafted on 14 December 1993.

A signed and notarized resolution is enclosed.

I am requesting that the Marquette LCD be allowed at begin making cost-share agreements as soon as possible. I could start as early as 4 January 1994. Processing at the state level will probably require more time. Watershed staff are hoping to commence cost-share agreements no later than 1 March 1994.

I am also requesting that funds for financing watershed best management practices - as per tables 5-3b and 5-5b in the plan - be released for use as soon as possible.

$100,466 AR

Sincerely,

Donn R. Wright

Donn R. Wright
County Conservationist

ROLL CALL - COUNTY BOARD OF SUPERVISORS
MARQUETTE COUNTY, WISCONSIN

	ROLL CALL Yes	No
Borzick		/
Cacic		absent
Doege	/	
Ebert	/	
Furman	/	
Gohlke	/	
Goldsmith	/	
Johnston	/	
Lloyd	/	
Lueder	/	
Polk	/	
Sorenson		/
Sprain	/	
Wade	/	
Westphal		/
Zellmer, H.		/
Zellmer, R.	/	
TOTAL	12	4

DECEMBER Session, 1993

Resolution No. 67-93

First Reading December, 1993

Second Reading _____, 199___

ADOPTED LOST 1 absent

WHEREAS, the Neenah Creek Watershed was designated by the Department of Natural Resources in 1991 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 and the Wisconsin Department of Agriculture, Trade and Consumer Protection conducted a detailed inventory of the land use within the watershed in 1992, and

WHEREAS, the inventory resulted in the development of a detailed nonpoint source control plan for the watershed, and

WHEREAS, a number of public informational meetings have been conducted through the watershed, and an official public hearing was conducted on November 11, 1993, and

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

WHEREAS, the County wishing to receive cost sharing grants for landowners in the watershed must first adopt the Neenah Creek Watershed Plan.

NOW, THEREFORE BE IT RESOLVED, by the Board of Supervisors of the County of Marquette that the Neenah Creek Nonpoint Source Priority Watershed Plan be adopted and the implementation of the plan begin as soon as possible.

Introduced by:

Marvin Doege

Johnston

OFFICE OF THE COUNTY CLERK

Montello, Wis. December 16, 1993

I HEREBY CERTIFY that the attached is a true and correct copy of a resolution adopted by the Board of Supervisors of Marquette County, Wisconsin at a regular meeting of said Board held on the 14th day of December, 1993

Mary L. Sorensen
County Clerk

Columbia County
Land Conservation Department

Columbia County Agricultural Center - Box 485 - Portage, WI 53901
Phone (608) 742-2191

January 10, 1994

Karen Rahmeier
State of Wisconsin
Department of Natural Resources
Box 7921
Madison, WI 53707

Dear Karen:

Please find enclosed a certified resolution from Columbia County approving the Neenah Creek Priority Watershed Project Plan for implementation.

We are also requesting funding for implementation of best management practices listed in the plan. The request is for the full amount of $65,918.00 listed in the plan. This is a very firm request. We can not function efficiently or effectively with only a portion of the allocation as has transpired with other watershed projects.

Thank you for your attention and please call if you have any questions.

Sincerely,

Kyle Kidney

Kyle Kidney
Land Conservation Director

KK/kh

Enc.

RESOLUTION NO. 81-93

TO THE HONORABLE BOARD OF SUPERVISORS OF COLUMBIA COUNTY:

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

WHEREAS, Adams County, Marquette County, and Columbia County Land Conservation Departments have inventoried the Neenah Creek Watershed for animal waste and soil erosion pollution sources, and

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

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

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

WHEREAS, the draft watershed plan has been reviewed by the public during a public information hearing which was held on November 11, 1993, and

WHEREAS, the Land Conservation Committee has reviewed the Neenah Creek Priority Watershed Project final draft plan and recommends approval of the plan by the Board.

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

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

BE IT FURTHER RESOLVED that Columbia County reserves the right to request future amendments to the watershed plan in order to incorporate new cost sharing opportunities for landowners, to facilitate needed changes in technical standards and specifications, to extend sign-up periods, or to include other changes that may occur in future revisions to Administrative Rules NR-120.

Reuben Damm

Robert J. Stoltenberg

Kathleen M. Taylor

James R. Humphrey

Oluf Gunderson

AGRICULTURE AND LAND
CONSERVATION COMMITTEE

STATE OF WISCONSIN
ss
COUNTY OF COLUMBIA

I, Cathleen M. Lathrop, County Clerk in and for said County, do HEREBY CERTIFY that the above and foregoing is a true and correct copy of a Resolution adopted by the Columbia County Board of Supervisors at the meeting held on December 15, 1993.

Dated at Portage, Wisconsin, this 20th day of December, 1993.

County Clerk

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SUMMARY

Introduction

The Neenah Creek Watershed Project plan assesses the nonpoint sources of pollution in the Neenah Creek Watershed and guides the implementation of nonpoint source control measures. These control measures are needed to meet specific water resource objectives for Neenah Creek Watershed and its tributaries. The primary objective of the project is to reduce nonpoint source pollution delivered to the twenty-one lakes and to enhance and protect the water quality of streams in the Neenah Creek Watershed.

Nonpoint sources of pollution most commonly found in this watershed include: polluted runoff from barnyards and feedlots; sediment from cropland erosion, wind erosion, streambank and lakeshore erosion; runoff from winterspread manure, and infiltration of pollutants to groundwater. The purpose of this project is to reduce the amount of pollutants originating from nonpoint sources that reach surface water and groundwater within the Neenah Creek Watershed Project area.

This plan was prepared by the Wisconsin Department of Natural Resources (DNR), the Department of Agriculture, Trade, and Consumer Protection (DATCP), and the Adams, Marquette and Columbia County LCDs. The DNR selected the Neenah Creek Watershed as a priority watershed project through the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1992. It joined approximately 60 similar watershed projects statewide in which nonpoint source control measures are being planned and implemented. The Nonpoint Source Water Pollution Abatement Program was created in 1978 by the Wisconsin State Legislature. The program provides financial and technical assistance to landowners and local governments to reduce nonpoint source pollution.

The project is administered on the state level by the DNR and DATCP. The Adams, Marquette and Columbia County Land Conservation Departments will administer the project on the local level with assistance from the University of Wisconsin–Extension and the Soil Conservation Service (U.S. Department of Agriculture).

General Watershed Characteristics

The Neenah Creek Watershed (map 2-1) drains 169 square miles of land in Adams, Marquette and Columbia Counties in South Central Wisconsin. The watershed is part of the Upper Fox River Sub Basin (map 2-2). The Neenah Creek Watershed drains to the Fox River, which drains to Lake Michigan. The Neenah Creek Watershed was divided into 10 smaller drainage areas, called subwatersheds, for this planning effort.

Land use in the watershed, as shown in table S-1, is mainly agricultural and is currently dominated by dairy farming. The watershed population is stable — approximately 7,000 people. Most of the watershed population lives outside incorporated areas around lakes, in small enclaves of residential development or on farmsteads.

Table S-1. Land Use in the Neenah Creek Watershed

Land Use	Percent of Watershed
Agricultural	(42)
pasture	8
cropland	34
Grassland	
Woodlots	27
Developed	6
Wetlands[1]	14
Lakes	2
Roads, ditches, etc.	9

[1] These are estimates of wetland acres based on WINHUSLE inventory data. See wetland section in Chapter Two for a more comprehensive estimate of wetland acreage.
Source: DNR

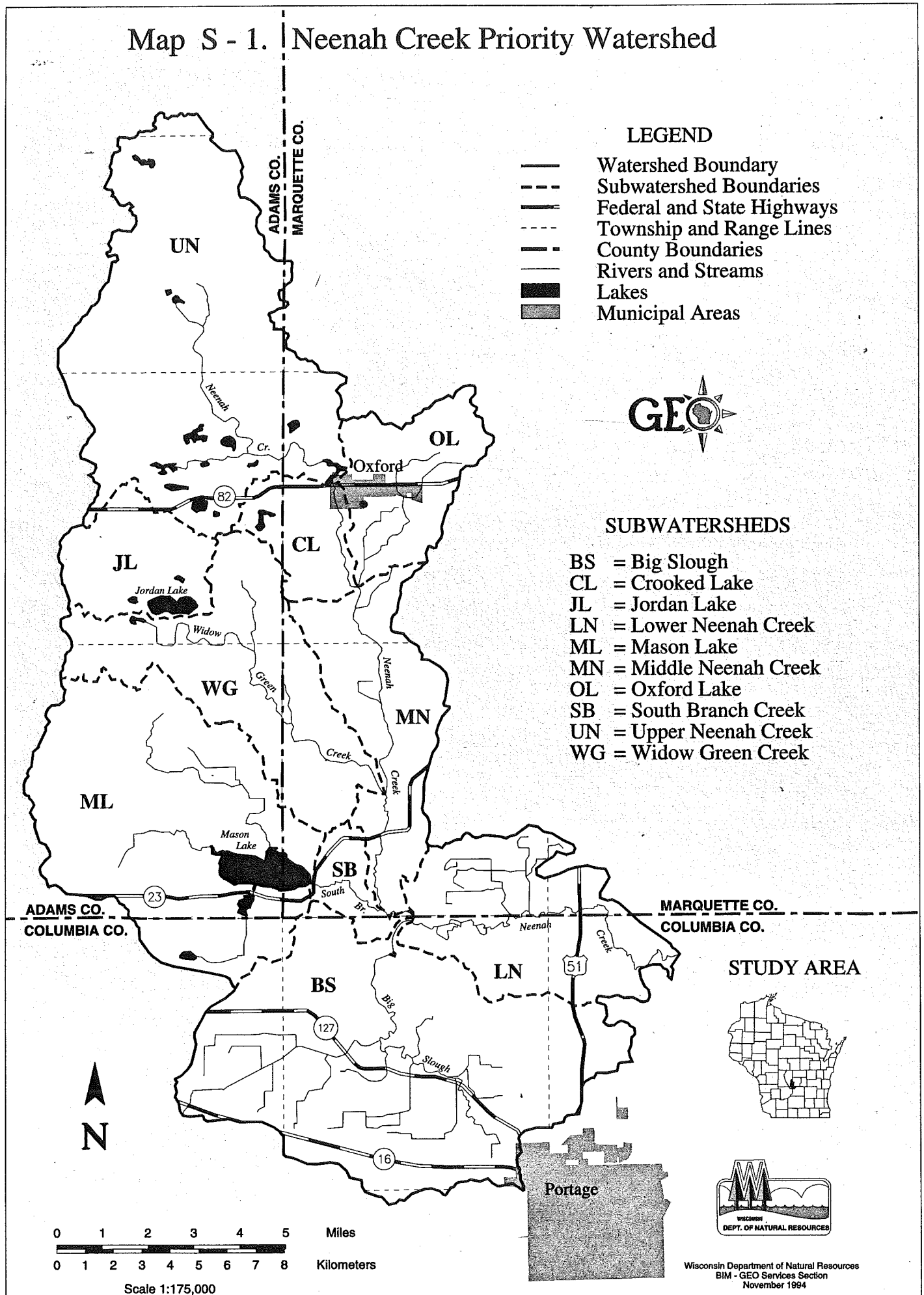
Water Quality

The Neenah Creek Watershed reservoir supports a warm and cold water sport fishery. The streams and lakes of the watershed are not reaching their highest potential use due to pollution from point and nonpoint sources. Eroding croplands, wind erosion, eroding streambanks, and improperly managed livestock operations are the major sources of nonpoint pollution in the watershed.

Segments of Neenah Creek were identified as currently supporting good quality Class III cold water trout fisheries with potential for improvement to Class II trout fisheries. The details of these assessments are discussed later in this watershed plan.

An assessment of groundwater quality was completed by sampling private wells for nitrate + nitrite and triazine. Results show that of the well samples collected, 11 percent had nitrate levels over the enforcement standard (health advisory level) of 10 milligrams per liter (mg/L), and 43 percent had nitrate levels between 2 mg/L, the preventative action limit, and 10 mg/L. Nitrate + Nitrite levels greater than the 2 mg/L preventative action limit show that human activities are affecting groundwater quality.

Map S - 1. Neenah Creek Priority Watershed



Well sampling for triazine showed that 2 percent of the samples collected had triazine levels over 3.0 micrograms per liter μg/L, which is the enforcement standard for atrazine plus its breakdown components, called metabolites. Triazines are a family of herbicides which include atrazine and its metabolites which when present in groundwater indicates groundwater contamination. Eighteen percent of the samples collected had triazine levels between 0.3 and 3.0 μg/L. The preventative action limit for triazine is 0.3 μg/L.

Sources of Water Pollution

The Adams, Marquette and Columbia County Land Conservation Departments collected data on all agricultural lands, barnyards, manure storage sites, and streambanks in the watershed. These data were used to estimate the pollutant potentials of these nonpoint sources. The amount of phosphorus carried in runoff from each barnyard to a receiving stream was calculated. The amount of sediment reaching streams from eroding agricultural lands and streambanks was also determined. In the Neenah Creek Watershed, about 92 percent of the sediment deposited in streams annually is derived from agricultural upland erosion. Four percent of the sediment reaching streams originates from streambank erosion. Approximately 4 percent of the total sediment is contributed from shoreline erosion.

The results of the investigations of nonpoint sources are summarized below:

Barnyard Runoff Inventory Results:

- 58 barnyards were assessed.
- These barnyards were found to contribute 1,964 pounds of phosphorus to surface waters, annually.

Streambank Erosion Inventory Results:

- 117 stream miles were inventoried
- 762 tons of sediment reach streams from eroding sites (4 percent of total sediment)
- There are 4.6 miles of eroding sites (4 percent of streambanks inventoried).

Shoreline Erosion Inventory Results:

- Four miles of lake shoreline were found to have either severe, moderate, or mild erosion from eroding sites.
- 698 tons of sediment are delivered to lakes, annually.
- 129 landowners have mild, moderate, or severe erosion sites.

Upland Sediment Inventory Results:

- 97,538 acres were inventoried.
- 15,637 tons of sediment are delivered to streams (92 percent of total sediment).
- 95 percent from cropland.

Wetland Inventory Results:

- 14,676 acres of wetlands inventoried.
- 8,575 acres of converted but restorable wetlands.

Pollutant Reduction Goals

Pollutant load reductions are developed according to activities needed to achieve the water quality objectives. The following is a summary of reductions to be targeted for the entire watershed.

Sediment Goal: Reduce overall sediment delivered by 40 percent. To meet this goal, the following is needed:

- 40 percent reduction in sediment reaching streams from agricultural uplands in all subwatersheds.
- 75 percent reduction in streambank sediment delivered to all streams and a 100 percent overall repair of streambank habitat in all subwatersheds.
- 75 percent reduction in shoreline sediment delivered to lakes.

Phosphorus and Organic Pollutant Goal: Reduce overall phosphorus load by 40 percent. To meet this goal, the following is needed:

- 75 percent reduction in organic pollutants from barnyards in all subwatersheds.
- 40 percent reduction in organic pollutants from winterspread manure on "unsuitable" acres in all subwatersheds.
- 30 percent reduction in phosphorus reaching lakes and streams from agriculture uplands in all subwatersheds.

Groundwater Goal:

- Proper abandonment of private wells no longer in use where other NPS control measures are implemented and cost-shared.
- Implementation of Nutrient and Pest Management practices on irrigated vegetable crops.

In addition, this plan calls for a restoration of 10 percent of degraded or prior converted wetlands.

Management Actions

Management actions are described in terms of best management practices (BMPs) that are needed to control nonpoint sources to the pollutant levels described above. Cost-share funds for installing pollutant control measures will be targeted at operations which contribute the

greatest amounts of pollutants. Cost-share funds will be available through the Wisconsin Nonpoint Source Water Pollution Abatement Program for certain BMPs. As shown in table S-2, cost-share rates range from 50 to 70 percent.

The Adams, Marquette and Columbia County Land Conservation Departments will contact all landowners who are eligible to receive cost-share funds during the project's implementation. All Category I sources of nonpoint pollutants must be controlled if a landowner wishes to participate in any aspect of the program. Category I represents the level of pollution control needed to achieve water quality goals in the watershed. Nonpoint sources in Category II contribute less of the pollutant load than those in Category I. They are included in cost sharing eligibility to further insure that water quality goals are met. Controlling sources in this category is not mandatory for a landowner to be funded for controlling other sources.

The Adams, Marquette and Columbia County Land Conservation Departments will assist landowners in applying BMPs. Practices range from alterations in farm management (such as changes in manure-spreading and crop rotations) to engineered structures (such as diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations.While the initial stages of this project are voluntary, it is important to understand that as of the late summer of 1993, an enforcement component to the Nonpoint Source Water Pollution Abatement Program has been authorized by the Wisconsin Legislature. This provides for regulatory actions at sites within project boundaries whose participation is critical to achieving water quality improvement goals of projects.

The following is a brief description of critical nonpoint pollutant sources, project eligibility criteria, and BMP design targets for the project.

Agricultural Lands

All agricultural lands having soil loss rates greater than "T" or contributing sediment to streams at a rate greater than 0.4 tons per acre per year will be classified as Category I for cost sharing and must be brought down to "T" and/or to a sediment delivery rate of 0.4 tons per acre per year. This involves an estimated 4,700 critical acres of cropland, or 39 percent of the upland sediment load in the watershed. Category II will include all lands contributing sediment to streams at a rate between 0.2 and 0.4 tons per acre per year. This involves 3 percent of the upland sediment in the watershed.

The BMPs identified by the Adams, Marquette and Columbia County Land Conservation Departments emphasize both improving farm management and controlling pollutants. Table S-2 shows the eligible practices and cost-share rates.

Animal Lots

The manure from barnyards that is carried in runoff needs to be controlled at about 13 of the 58 livestock operations. All barnyards contributing more than 50 pounds of phosphorus will be classified as Category I for cost sharing and need to be reduced to 15 pounds annually or less.

Table S-2. Best Management Practices Eligible for Cost Sharing Through the Neenah Creek Watershed Project

Best Management Practices	State Cost-Share Rate
Contour Farming	50% (flat rate: $6/acre)
Strip Cropping	50% (flat rate: $12/acre)
Field Diversions and Terraces	70%
Grassed Waterways	70%
Reduced Tillage (No Till)	$15/acre
Critical Area Stabilization	70% [1, 2]
Grade Stabilization Structures	70% [2]
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70% [2]
Shoreline Buffers	70% [1, 2]
Barnyard Runoff Management	70%
Animal Lot Relocation	70% [2]
Manure Storage Facilities	70% [3]
Proper Abandonment of Manure Storage Pits	50%
Livestock Exclusion From Woodlots	50%
Wetland Restoration*	70%
Nutrient and Pesticide Management	50%

[1] Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See "Management Actions" in this summary for areas where easements may apply.

[2] With a matching local share, the state share cost sharing level may be increased up to 80 percent.

[3] Maximum cost-share amount is $20,000 including no more than $15,000 for manure transfer equipment.

* Wetland restoration may include destruction of tile lines, construction of berms, and other practices as listed in NR120.

Category II barnyards, those which contribute between 15 and 50 pounds of phosphorus annually, will be eligible for cost sharing and will need to be reduced to 15 pounds annually, or less.

Manure Spreading

Approximately 500 acres of "unsuitable" land will be targeted as Category I for winterspread manure control measures (BMPs). These landowners have "suitability" ratios indicating that they are unlikely to have enough land to safely spread manure in the winter and are required to implement and adhere to a Soil Conservation Service (SCS) "590 Nutrient Management" plan. Category II landowners are those who are more likely to have enough land to spread their manure, but may still pose a threat to water quality. There are 6,000 acres in Category II. In this project "unsuitable" lands for winter manure spreading are those lands with greater than six percent slope or which are prone to flooding. The Adams, Marquette and Columbia County Land Conservation Departments will assist farm operators in preparing a management plan for proper manure spreading. A manure management plan identifies the proper spreading periods, application rates, and acceptable fields for manure spreading. A number of the manure management plans may identify the need for manure storage facilities to prevent winter manure spreading on unsuitable lands.

Streambanks

Project participants with identified sites eroding at greater than 60 tons per year per landowner will be Category I. Those with sites eroding between 18 and 60 tons per year per landowner, will be Category II. Overall, approximately 525 tons of sediment from streambanks are eligible for control in the Neenah Creek Watershed.

There will be an emphasis on controlling bank erosion and improving fish and wildlife habitat in all subwatersheds, to enhance water quality and recreational opportunities.

Shoreline

Shoreline erosion on the lakes in the Neenah Creek Watershed contributes 4 percent of the overall sediment delivered in the watershed.

Category I sites are those with severe shoreline erosion. Severe sites are those eroding at rates greater than 7 tons per year per landowner.

Category II sites are those with moderate erosion. Moderate sites are those eroding at rates between 3 and 7 tons per year per landowner.

Category III sites are those with mild erosion. Mild erosion sites are those eroding at rates less than 3 tons per year per landowner.

Funds Needed for Cost Sharing, Staffing, and Educational Activities

Grants will be awarded to Adams, Marquette and Columbia Counties by the DNR for cost sharing, staff support and educational activities. Table S-3 includes estimates of the financial assistance needed to implement needed nonpoint source controls in the Neenah Creek Watershed, assuming a 75 percent participation rate of eligible landowners.

Table S-3. Cost Estimates for the Neenah Creek Watershed Project

Eligible Activity	Total Cost[1]	State Share[1]
Cost Sharing	$1,935,255	$1,384,756
Easements	450,000	450,000
County Staffing	1,117,620	1,117,620
Educational Activities	31,020	31,020
Totals	$3,533,895	$2,983,396

[1] Estimates based on 75% participation.

Project Implementation

Project implementation is scheduled to begin in 1994. The first three years of implementation is the period for participants to sign cost-share agreements. There is a five-year period for practice installation. While an eligible landowner or operator has three years to determine whether to participate in the program, the installation of BMPs can usually begin as soon as a landowner has signed a cost-share agreement with the Adams, Marquette or Columbia County Land Conservation Departments.

Information and Education

An information and education program will be conducted throughout the project period with the Adams, Marquette and Columbia County Land Conservation Departments having overall responsibility for the program with Adams County taking the lead role. University of Wisconsin–Extension staff will provide assistance. This program will be most intensive

during the first three years of the project as landowners and local governments sign up for state cost sharing for pollution control. The program includes:

- A media campaign to inform the public about nonpoint source pollution and activities the public can do to reduce this type of pollution.

- More intensive educational activities, such as meetings, workshops, tours, and demonstration projects for landowners and local government officials who must adopt new pollution control techniques.

- Water quality newsletters that will inform farmers, local government officials, community groups, and concerned citizens about watershed activities, implementation processes, and pollution control methods.

- Educational activities and service projects to inform youth about water resource issues and help them develop a conservation ethic.

Further Information

If you want more information about the Neenah Creek Watershed Project, or a copy of the watershed plan, contact one of the following:

Andy Morton, Coordinator
Wisconsin Department of Natural Resources
Southern District Headquarters
Fitchburg, WI
275-3311 or 695-2764

Additional contact if needed

Peggy Armstrong
Adams County Land Conservation Department
Friendship, WI
339-4268

Donn Wright
Marquette County Land Conservation Department
Montello, WI
297-9175

Bill Buckley
Columbia County Land Conservation Department
Portage, WI
742-2191

Project Evaluation and Monitoring

The evaluation strategy for the project involves the collection, analysis, and reporting of information so that progress may be tracked in three areas:

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

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

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

CHAPTER ONE
Introduction, Purpose and Legal Status

Wisconsin Nonpoint Source Water Pollution Abatement Program

The Wisconsin State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program (NPS) in 1978. The goal of the NPS Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from and residential nonpoint sources. The 169-square mile Neenah Creek Watershed, located in Adams, Marquette and Columbia Counties, was designated a "priority watershed" in 1991 (map 1-1). The primary objective of this project is to reduce the amount of pollutants originating from nonpoint sources that reach surface water and groundwater within the Neenah Creek Watershed Project area.

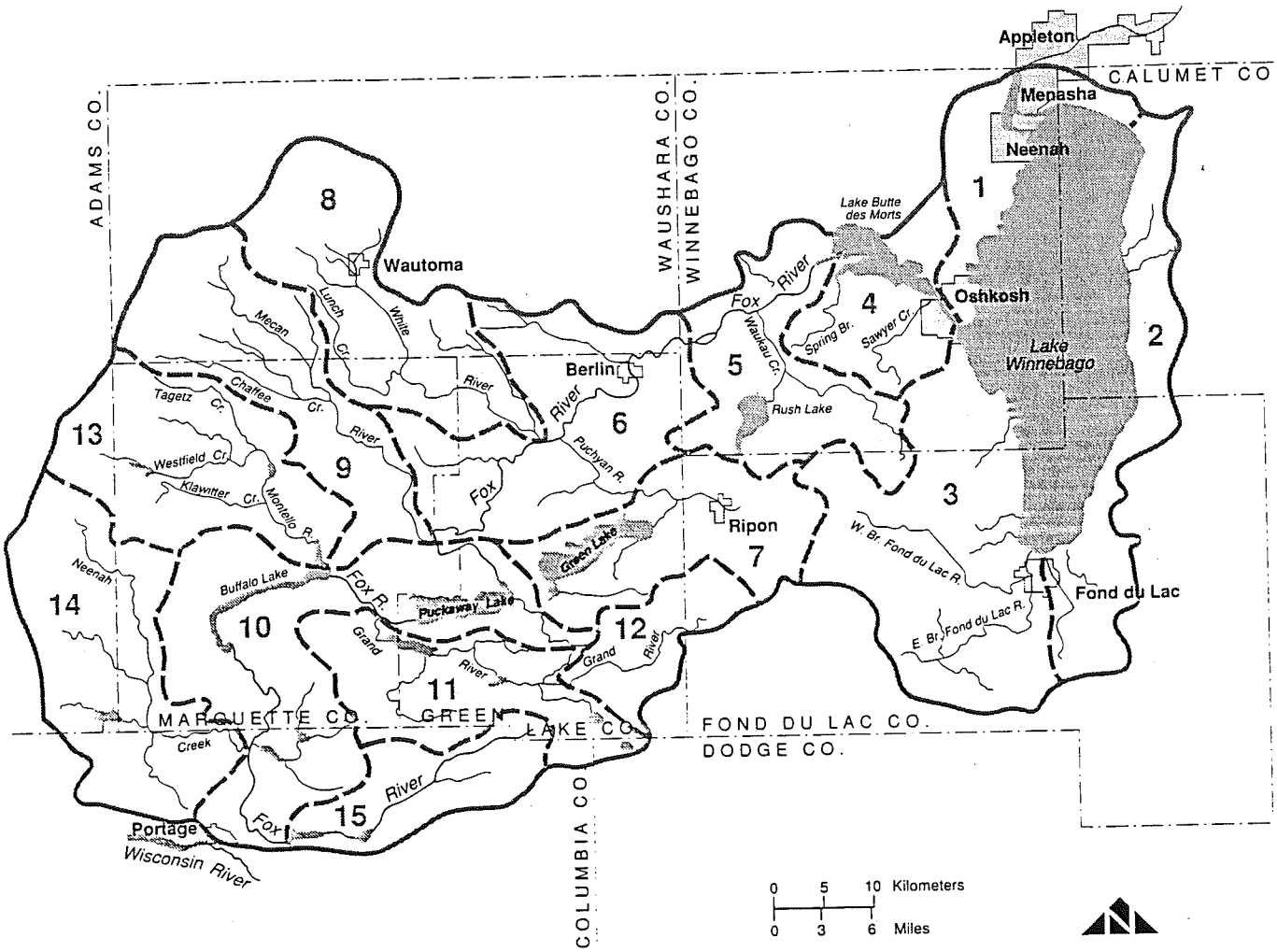
Nonpoint sources of pollution include eroding agricultural lands, streambanks, roadsides and developing residential areas, field application of manure, fertilizers and pesticides and runoff from livestock wastes and gullies. Pollutants from nonpoint sources are carried to the surface water or groundwater through the action of rainfall runoff, snowmelt, infiltration and wind erosion.

The following is an overview of the NPS Program:

- The DNR and DATCP administer the program which focuses on critical hydrologic units called priority watersheds. The program is implemented through priority watershed projects for which a plan is prepared.

- Local units of government implement the watershed project. Water quality improvement is achieved through implementation of nonpoint source controls (best management practices or BMPs) and adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, metropolitan Sewerage Districts, sanitary districts, lake districts, and regional planning commissions are eligible to participate. While the initial stages of this project are voluntary, it is important to understand that as of the late summer of 1993, an enforcement component to the Nonpoint Source Water Pollution Abatement Program has been authorized by the Wisconsin Legislature. This provides for regulatory actions at sites within project boundaries whose participation is critical to achieving water quality improvement goals of projects.

Map 1-1. Location of the Neenah Creek Watershed in the Upper Fox River Basin



Watersheds

1. UF01 Lake Winnebago North and West
2. UF02 Lake Winnebago East
3. UF03 Fond Du Lac River
4. UF04 Lac Butte Des Morts South
5. UF05 Fox River/Rush Lake
6. UF06 Fox River/Berlin
7. UF07 Big Green Lake
8. UF08 White River
9. UF09 Mecan River
10. UF10 Buffalo and Puckaway Lakes
11. UF11 Lower Grand River
12. UF12 Upper Grand River
13. UF13 Montello Creek
14. UF14 Neenah Creek
15. UF15 Swan Lake

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- Technical assistance is provided to aid in the design of BMPs. State level cost-share assistance is available to help offset the cost of installing these practices.

- Informational and educational activities are employed to encourage participation.

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

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the project began in 1992 and included the following information-gathering and evaluation steps:

1. Determine the conditions and uses of groundwater, streams, and lakes.

2. Inventory types of land uses and severity of nonpoint sources impacting streams and lakes.

3. Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions. This will be accomplished through the ongoing integrated resource management planning efforts in the Upper Fox River Basin.

4. Determine levels of nonpoint source pollution control and measures necessary to improve and/or protect water quality.

5. Prepare and gain approval for a priority watershed plan documenting the above evaluations, implementation procedures and costs.

Implementation Phase

The implementation phase begins following review of the priority watershed plan by the Neenah Creek Citizens Advisory Committee, the project team, a public informational hearing and approval by the DNR, the DATCP, and the Board of Supervisors for Adams, Marquette and Columbia Counties. This phase is characterized below:

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

- In the rural portions of the watershed, the Adams, Marquette and Columbia County Land Conservation Departments contact eligible landowners to determine their interest in voluntarily installing BMPs identified in the plan.

  In the urban portions of the watershed (Oxford and Briggsville), the DNR or its designee will contact local units of government to discuss actions to implement plan recommendations.

- For rural practices, the landowner and the county sign cost-share agreements outlining the practices, costs, cost-share amounts and a schedule for installation of BMPs. All practices are scheduled for installation up to five years from the date the agreement is signed. The DNR and local units of government sign similar agreements for urban practices.

Legal Status of the Nonpoint Source Control Plan

The Neenah Creek Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. This plan is subject to the amendment process under NR 120.08 (e) for substantive changes. The Department of Natural Resources will make determination if a proposed change will require a plan amendment. This plan was prepared under the cooperative efforts of the DNR, DATCP, the Adams, Marquette and Columbia County Land Conservation Departments, and the Neenah Creek Citizens Advisory Committee.

This plan is the basis for the DNR to enter into cost-share and local assistance grants and is used as a guide to implement measures to achieve desired water quality conditions. In the event that a discrepancy occurs between this plan and the statutes or the administrative rules, or if the statutes or rules change during implementation, the statutes and rules will supersede the plan.

Relationship Of The Nonpoint Source Control Plan To The Integrated Basin Management Plan

The Upper Fox River Basin is comprised of fifteen watersheds: Lake Winnebago North and West, Lake Winnebago East, Fond du Lac River, Lake Butte des Morts/South, Fox

River/Rush Lake, Fox River/Berlin, Big Green Lake, White River, Mecan River, Buffalo and Puckaway Lakes, Lower Grant River, Upper Grant River, Montello Creek, Neenah Creek, and Swan Lake. The basin drains portions of Waushara, Adams, Marquette, Columbia, Green Lake, Fond du Lac, Winnebago, Calumet and Dodge counties.

Recommendations contained in the Upper Fox River Basin Management Plan are incorporated in this priority watershed plan. Consequently, this nonpoint plan meets the requirements of Section 144.25 of the Wisconsin statutes requiring the DNR to develop loan integrated resource management strategy to protect or enhance fish and wildlife habitat, aesthetics, and other natural resources" for priority watersheds.

Relationship Of The Nonpoint Source Control Plan To The Stormwater Discharge Permit Program

Although the Neenah Creek Watershed has no large municipalities, there may be industrial sites or construction sites that fall under the Stormwater Discharge Permit Program.

The Stormwater Discharge Permit Program is a result of the 1987 amendments to the federal Clean Water Act. These amendments require permits for discharges of stormwater from municipalities with populations of 100,000 or more, certain industrial sites, and construction sites with ground disturbances of 5 or more acres.

Phase 1 of the program, which began in October, 1992, requires permits for municipalities with populations of 100,000 or more. Phase 2 of the program has yet to begin. In phase 2, it is likely that stormwater discharge permits will be required for municipalities with populations of less than 100,000. The EPA has not determined the population size of municipalities that will be required to be included in the next phase of the stormwater permit program, nor has it established a starting date for the next permitting phase. It is not known when a decision on these issues will be made, or when phase 2 win be implemented.

Some of the required activities of the municipal permit program are: to identify and locate existing stormsewer outfalls, check for illicite connections, develop a stormwater plan to deal with identified pollution problems, adopt a stormwater ordinance, and to monitor designated sites. Many of the activities that will be required as part of the EPA municipal permit are eligible for state funding through the Nonpoint Source Program.

Industrial permits will be required for those industries that are likely to introduce pollutants to stormwater runoff. Generally, industries that have outside material storage will be required to apply for industrial permits. Industries that fall under this requirement will be directed to submit a permit application to the Bureau of Waste Water in the DNR. Most of these industries have been notified of this permit requirement.

To deal with the issue of construction site erosion control on ground disturbances of 5 acres or more, a Memorandum of Understanding, or MOU, is being developed by the DNR, and the Department of Industry Labor and Human Relations, (DILHR). The agency responsibility for activities and types of construction has not been decided at this is time. The DNR, and the Department of Industry Labor and Human Relations are expected to have a final agreement on the Memorandum of Understanding some time in 1993 to resolve agency differences.

In order to fulfill the EPA permit requirements, as part of the MOU agreement, contractors will be directed to follow the erosion control guidance in the Wisconsin Construction Site Best Management Practice Handbook published by the DNR. Some of the other MOU conditions that satisfy the EPA requirements for the construction site erosion control permit program are: to provide an existing and planned future site map indicating planned erosion control practices that will be implemented on the site, a description of the type of development and construction that will occur on the site, a written description of the erosion control plan for the site, a description of the construction sequence, a maintenance schedule for erosion control devices on the site, the location of the site, and identification of the owner and developer of the construction site.

It is likely that ground disturbances of less than 5 acres will require permits . The EPA has not made a determination of size area of disturbance, or a date of initiating these requirements. In the future the EPA is likely to require stormwater management for new developments. As a part of the watershed plan, communities are strongly advised to devise stormwater management plans in developing areas.

Plan Organization

The remainder of this plan is divided into nine chapters. The contents of each chapter are described below:

Chapter Two. "Watershed Characteristics" is an overview of the cultural and natural resource features pertinent to planning and implementation efforts for the priority watershed project.

Chapter Three. "Water Resource Conditions, Nonpoint Sources and Water Resource Objectives" characterizes the existing and potential biological and recreational uses of surface waters. The results of the nonpoint source inventories and evaluations and water resource objectives are discussed.

Chapter Four. "Nonpoint Source Pollution Control Strategy" identifies the level of urban and rural nonpoint source control needed to meet the water resource objectives and identifies the decision criteria and the nonpoint sources eligible for funding under the priority watershed project.

Chapter Five. "Detailed Program for Implementation" describes the means in which the local units of government administer the project, and estimates a local assistance and management practice cost-share budget.

Chapter Six. "Information and Education Program" describes techniques and activities for increasing awareness and understanding of water resources in the watershed, principles of nonpoint source pollution, best management practices, and the priority watershed project in general.

Chapter Seven. "Integrated Resource Management Program" presents the strategy for involving DNR resource management programs (fisheries management, wildlife, etc.) in the nonpoint source pollution abatement efforts in the Neenah Creek Watershed.

Chapter Eight. "Project Tracking" discusses the means for assessing the amount of nonpoint source control gained through installation of best management practices.

Chapter Nine. "Water Quality Monitoring and Evaluation" presents strategy and a schedule for monitoring streams and lakes to determine the water quality impacts of implementing nonpoint source controls.

CHAPTER TWO
General Watershed Characteristics

Location

The Neenah Creek Watershed is a 169-square-mile (108,000 acres) drainage basin located immediately northwest of the city of Portage in South Central Wisconsin (map 2-1). The city of Portage is at a major hydrologic divide, with everything south and west flowing to the Mississippi River, out to the Gulf of Mexico and everything east flowing north to Lake Michigan, out the St. Lawrence River to the Atlantic Ocean. Hence, Neenah Creek Watershed is one of the western-most watersheds that drains east to the Atlantic Ocean.

The following is a brief overview of the watershed's cultural and natural resource features.

Cultural Features

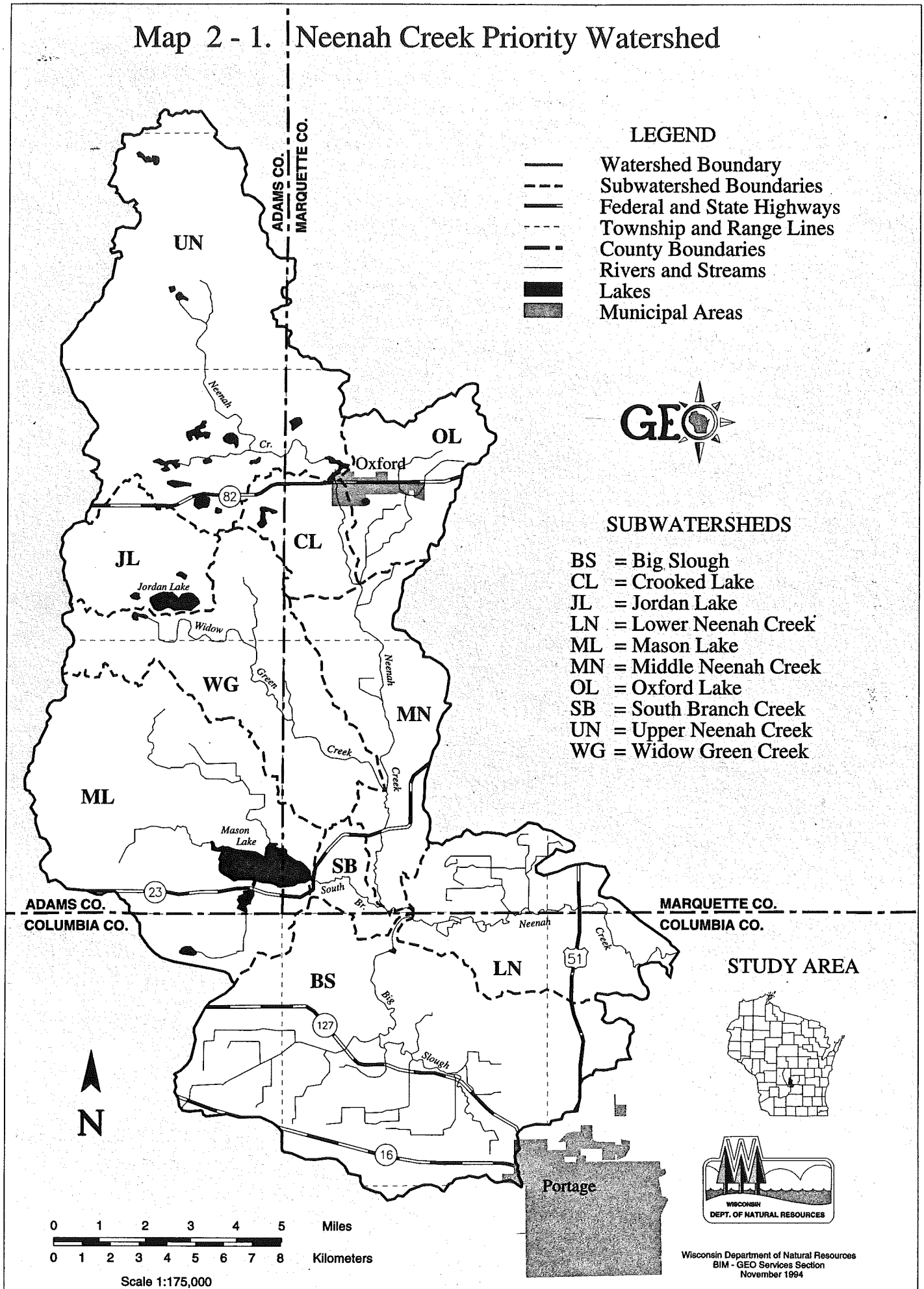
Civil Divisions

The Neenah Creek Watershed lies within Adams (45%), Marquette (25%) and Columbia (30%) Counties. Incorporated areas in the watershed include the village of Oxford and the unincorporated community of Briggsville. The main public land within the watershed is the DNR owned Neenah Creek Fishery Area. There are also three County Parks, on Deep Lake, Lake Mason and Patrick Lake, as well as three public campgrounds.

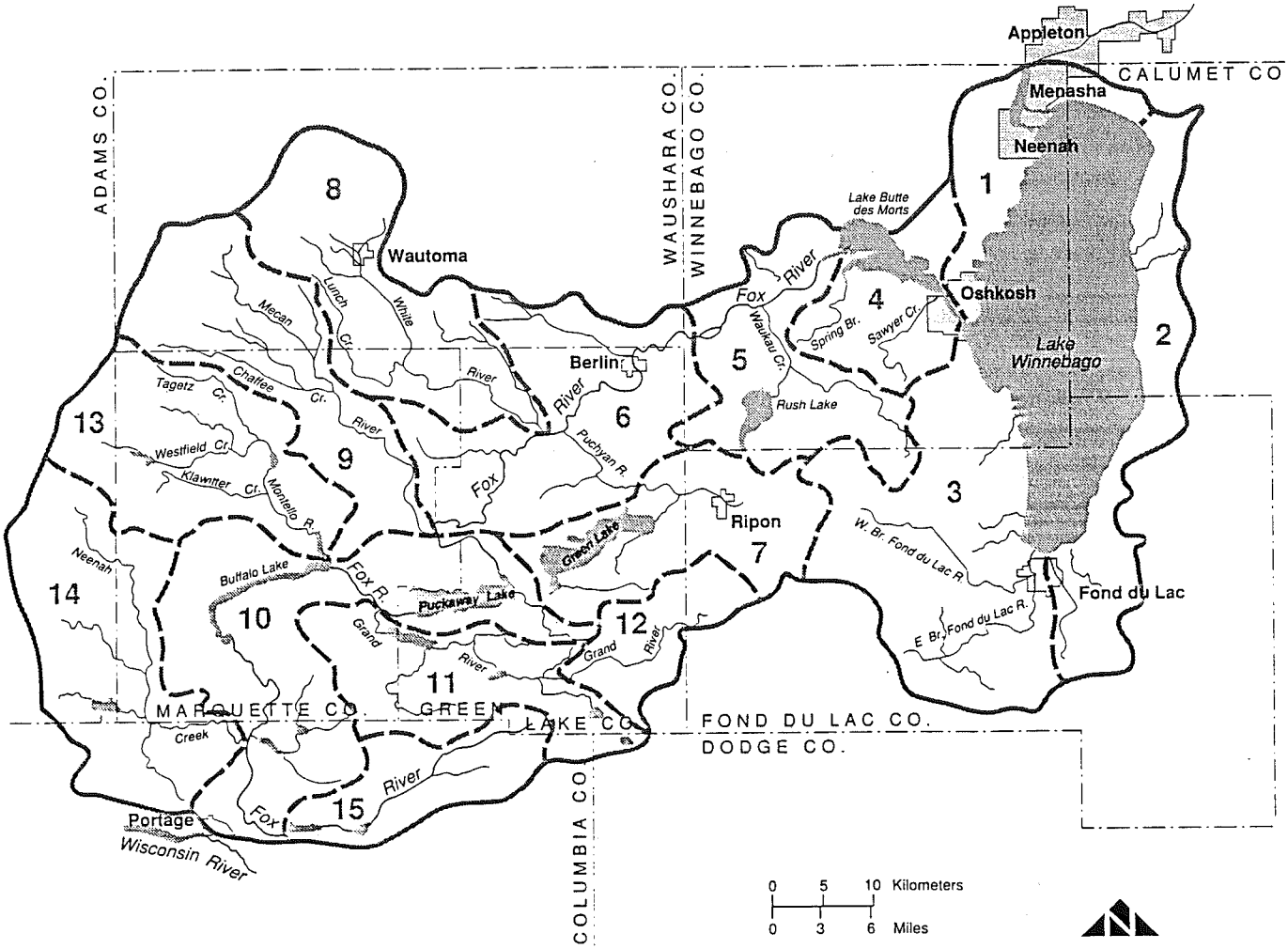
Population Size and Distribution

The Neenah Creek Watershed population is estimated to be about 7,000 persons. Most of the watershed population lives around the lakes and in rural unincorporated areas. Current population growth rates in the area are relatively stable with growth in Adams County, a slight decline in Marquette County and no significant change in Columbia County. Taken watershed-wide, however, the population has increased by 7% over the past ten years.

Map 2 - 1. Neenah Creek Priority Watershed



Map 2-2. Upper Fox River, Central Sub Basin



Watersheds

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12. UF12 Upper Grand River
13. UF13 Montello Creek
14. UF14 Neenah Creek
15. UF15 Swan Lake

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Land Uses

Rural Land Uses predominate in the watershed with pockets of moderately dense residential areas around most of the 21 lakes. Agriculture is the most important land use, comprising 42 percent. Woodlands are abundant and cover 27 percent of the land area. Developed land uses occupy less than 6 percent of the watershed (table 2-1).

Table 2-1. Summary of Land Uses in the Neenah Creek Watershed

Land Uses	Acres	Percent
Agricultural	(45,553)	(42)
pasture	8,327	8
cropland	37,226	34
Woodland	29,444	27
Developed[1]	5,538	6
Wetlands[2]	15,102	14
Lakes	1,635	2
Roads, ditches, etc.	9,718	9

[1] Includes residential and farmstead areas.

[2] 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 acreages.

Source: DNR & LCD

Irrigated vegetable crop production is widespread in the southern portion of the watershed with 21percent of the cropland acres being artificially drained. Groundwater is near the surface in much of the watershed, including numerous natural springs.

Sanitary Sewer Service

Sanitary sewer service is available only in the village of Oxford. Wastewater generated by the remainder of the watershed residents is disposed of through private on-site systems.

Water Supply Service

Water supplies used in the Neenah Creek Watershed are obtained from groundwater sources. There are two principal aquifers lying beneath the watershed from which groundwater is obtained. Water obtained from these aquifers is pumped from individual private wells.

Natural Resource Features

Climate and Precipitation

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

Topography

The relief in the region is largely controlled by glacial features. Much of the Neenah Creek Watershed is located within the central plains region. The glacial drift in this area formed a belt of terminal moraine having irregular hills that rise 50 to 75 feet above the general level of the plain, and basins which are today swamps and natural lakes.

Geology and Soils

The geology of the Neenah Creek watershed consists of Precambrian age (4.5 billion to 600 million years) granite overlain by a thick, flat Cambrian age (600 to 500 million years) sandstone layer. The bedrock is covered with sand and gravel deposited by glaciers approximately 1 million years ago during the Pleistocene age. The effect of the glaciers moving across the area and reworking sediment is reflected in the varied topography of the area. The western boundary of the watershed is a high ridge of unsorted sand and gravel deposited at the furthest extent of the glacier. This end moraine, named the Johnstown moraine, is a surface water and groundwater divide. Water flowing east off the moraine flows into the Fox River; water flowing off the moraine to the west flows into the Wisconsin River.

During the Pleistocene, glacial meltwater accumulated in Lewiston Lake which had it's outlet through the Baraboo Hills to the south. Around 25,000 years ago, the outlet was dammed by

ice and glacial Lake Wisconsin was formed west of the Johnstown moraine and the Neenah Creek watershed. Meltwater from glaciers deposited more sand east of the moraine in former Lewiston Lake which became a bay to Lake Wisconsin. After the glacier retreated and the ice dam at the east end of Devil's Lake melted, the water in Lake Wisconsin and Lewiston Bay drained and the Wisconsin River was created about 8,000 years ago. The thick sands which accumulated in the lake during this time form the Central Sand plain.

Soils along Neenah Creek are deep, well-drained to poorly drained sands over silty clay and silty clay loam subsoils over lake-laid sand, silt and clay. West of Neenah Creek in the area of the Johnstown end moraine, soils are well drained with sandy subsoils over glacial till. Along Widow Green tributary and near Lake Mason and Big Springs, the soils are deep, very poorly drained, over organic subsoils and sand.

Surface Water Resources

Land drainage patterns in the Neenah Creek Watershed are delineated as 10 individual subwatersheds. All convey surface water directly or via tributaries to the Neenah Creek Watershed. Major tributaries, associated streams, wetlands, lakes and subwatershed divides are shown in map 2-1.

Subwatersheds in the Neenah Creek Watershed

Upper Neenah	(UN)
Oxford Lake	(OL)
Crooked Lake	(CL)
Jordan Lake	(JL)
Widow Green	(WG)
Middle Neenah	(MN)
Mason Lake	(ML)
South Branch	(SB)
Lower Neenah	(LN)
Big Slough	(BS)

Neenah Creek Watershed Lakes

There are 21 lakes in the Neenah Creek Watershed. The shallow lakes and the human-made flowage lakes suffer from dense aquatic vegetation and some have also experienced winterkills in the past. Winterkills are no longer a problem due to aeration systems which have been installed. Mason Lake is the largest. Both Mason Lake and Jordan Lake are heavily used.

The lakes offer a diverse recreational resource, including picnicking, boating (weeds permitting) and year-round fishing and vacationing.

Streams

Perennial streams, which have a combined length of about 117 miles, maintain at least a small continuous flow throughout most of the year. The Neenah Creek is the longest perennial stream in the watershed, with Widow Green Creek (also known as O'Keefe) Big Slough and Peppermill Creek being other named streams.

The floodwaters and wetlands surrounding the Big Slough offer excellent wildlife habitat, and are frequently used for waterfowl hunting.

While the Neenah Creek supports a warm water sport fishery, several subwatersheds contain cold water streams including classified trout waters. Many sections of the streams are not reaching their highest potential use due to pollution from nonpoint sources. Eroding croplands and streambanks and improperly managed livestock operations are the major sources of nonpoint pollution in the watershed.

Intermittent streams flow only when there is runoff or when groundwater discharge is highest. Intermittent waterways are the headwaters of many of the larger perennial streams. Their small size makes them particularly susceptible to nonpoint source pollution. If pollution sources are reduced, however, their dynamic nature does allow rapid improvement.

Wetlands

Wetlands are valuable natural resources. They provide 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 Neenah Creek floodplain. Floodplain wetlands support furbearers and water fowl populations and may provide seasonal habitat for sport fish.

A wetland and wildlife habitat inventory was done to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration. The focus of the inventory was on wetlands that are presently in, or have been in the past, degraded through drainage, grazing, cropping, or other activities causing water storage loss, build up of sediments, and drainage to vegetation. Appendix A describes methods used in the inventory. Data were gathered from Soil Conservation Service maps, air photos, and the DNR wetland inventory maps. Guidelines for wetland restoration, which will be a component of this project, are outlined in Chapter Four.

Groundwater Resources

Groundwater pumped from aquifers in the watershed meets most of the domestic, livestock, and irrigation needs in Adams, Marquette and Columbia Counties.

Regional Aquifers

Groundwater is the main source of drinking water in the Neenah Creek Watershed. Groundwater is stored underground in pore spaces and cracks in soil and rock layers. Soil and rock layers which hold groundwater are called aquifers. In an aquifer, all the pore spaces and cracks are filled or saturated with groundwater. A municipal or private well is a pipe through which groundwater is pumped from an aquifer to the land surface.

Since 1936, the State of Wisconsin has required well drillers to document well construction and rock and soil layers encountered during well installation. Information from geologic logs, driller construction reports and Wisconsin Geological and Natural History Survey (WGNHS) reports for Adams (Clayton, 1987) Marquette (Lippelt and Hennings, (1981) and Columbia (Harr et. al., 1978) counties is summarized below. Principle aquifers within the watershed are the glacially deposited sand and gravel which is underlain by the Cambrian sandstone aquifer. There are a few wells which reach the Precambrian granite although it is not used as a supply of groundwater.

Private wells in the Cambrian sandstone aquifer range from 64 to 416 feet in depth and yield between 10 and 1,000 gallons per minute. Wells in the sand and gravel aquifer range in depth from 33 to 325 feet. Depth to water ranges from 10 feet above the land surface (artesian or flowing wells) to 210 feet below the surface. Artesian wells and springs are present in areas where the groundwater is confined by a low permeability layer such as a clay lens. The clay lenses occur throughout the glacially deposited sediments. Wells installed in the sand and gravel yield between 5 and 500 gallons per minute.

Direction of Groundwater Flow

Local groundwater flow in the Neenah Creek Watershed roughly mirrors the topography of the land surface and flows "downhill" or downgradient toward Neenah Creek. Regional groundwater flow in the watershed is southeast toward the Fox River. In the southern part of the watershed near the Big Slough, the groundwater is close to the land surface and the water table, the top or surface of the groundwater within the aquifer, is flat. In the Big Slough area, groundwater flow is affected by irrigation, generally flowing to the nearest ditch.

Groundwater Quality

Groundwater quality in the Neenah Creek Watershed is generally considered good. As part of the Water Quality Appraisal Report. 187 and 179 private well samples were collected and analyzed for nitrate + nitrite and atrazine, respectively. Atrazine is the most widely used pesticide in Wisconsin and is a possible human carcinogen. Nitrate contaminated groundwater is the cause of methemoglobinemia or blue baby syndrome in infants and can cause abortions in cattle at levels as low as 20 parts per million. Sources of nitrate to groundwater can include manure, fertilizer (farm and lawn), septic systems, and stormwater

runoff from streets. Samples analyzed for nitrate + nitrite showed concentrations ranging from not detected to 35.4 parts per million or (35.4 milligram per liter (mg/L)). One milligram per liter is equivalent to one drop of water in a 10-gallon fish tank. The groundwater enforcement standard (ES) for nitrate is 10 mg/L. The ES and PAL may seem like small numbers, however, groundwater standards are based on laboratory studies which show that low levels of nitrate in water cause severe health problems. Nitrate + nitrite concentrations above 2 mg/L exceed the states preventive action limit (PAL).

Enforcement Standard (ES) Health Advisory Level: The concentration of a contaminant at which the enforcing agency, either the Department of Industry, Labor & Human Relations, the DATCP, or DNR, must take action.
Preventative Action Limit (PAL): A lower concentration of a contaminant than the Enforcement Standard, the PAL is a warning that human activities are affecting groundwater quality.

Twenty-one samples (11 percent) exceeded 10 mg/L and eighty-one (43 percent) of the samples exceeded 2 mg/L. The 43percent of the samples exceeding the 2 mg/L PAL limit can not be attributed to a specific source of nitrate but are undoubtedly the result of accumulative effects of the sources listed above.

Concentrations of triazine in the Neenah Creek Watershed ranged from not detected to 4.7 micrograms per liter (μg/L) (or 4.7 parts per billion (ppb)). One microgram per liter is comparable to one drop in 10,000 gallons (a small swimming pool). Four samples (less than 2 percent) exceeded the ES (health advisory level) of 0.3 mg/L while thirty-three samples (18 percent) had detects of triazine. As with nitrate + nitrite analytical results, no specific source of contamination is indicated by the results, but they are undoubtedly the result of accumulative effects of land use practices.

In August, 1993 an Atrazine Prohibition Area was proposed for designation in the Big Slough Subwatershed. The area covers portions of 9 sections (2,560 acres) in the town of Lewiston. The use of atrazine may be prohibited in this area, if approved. Reder to table 2.2 for well sampling results.

Table 2-2. Well Sampling Results: Neenah Creek Watershed

TRIAZINE						
Subwatershed	Number of Triazine Samples less than 0.3 µg/l		Number of Triazine Samples between 0.3 and 3.0 µg/l		Number of Triazine Samples greater than 3.0 µg/l	
Upper Neenah	29		6		0	
Oxford Lake	3		0		0	
Crooked Lake	3		1		0	
Jordan Lake	12		2		0	
Widow Green	16		1		0	
Middle Neenah	20		0		0	
Mason Lake	21		3		0	
South Branch	0		1		0	
Lower Neenah	9		5		0	
Big Slough	29		14		4	
Totals	142	79%	33	18%	4	2%

NITROGEN						
Subwatershed	Number of Nitrogen Samples less than 2.0 mg/l		Number of Nitrogen Samples between 2.0 and 10.0 mg/l		Number of Nitrogen Samples greater than 10.0 mg/l	
Upper Neenah	25		13		6	
Oxford Lake	2		1		0	
Crooked Lake	1		2		1	
Jordan Lake	6		9		0	
Widow Green	4		5		2	
Middle Neenah	11		8		1	
Mason Lake	8		19		0	
South Branch	0		1		0	
Lower Neenah	4		8		2	
Big Slough	24		15		9	
Totals	85	45%	81	43%	21	11%

No samples were collected for coliform bacteria or hazardous substances such as volatile organic compounds. Coliform bacteria can be a drinking water problem where septic systems or barnyards are located uphill from a private well. Bacteria can enter the drinking water supply along the well casing of improperly constructed and located wells. Wells with high levels of bacteria can be rehabilitated.

Volatile organic compounds generally enter a well from nearby leaking underground gasoline or other fuel storage tanks. Once these compounds are in the groundwater they are difficult to clean up. In general, the contaminated wells have to be abandoned and a new well drilled to an uncontaminated and usually deeper aquifer.

See figure 2-1, Groundwater Schematic.

Potential Groundwater Quality Problems

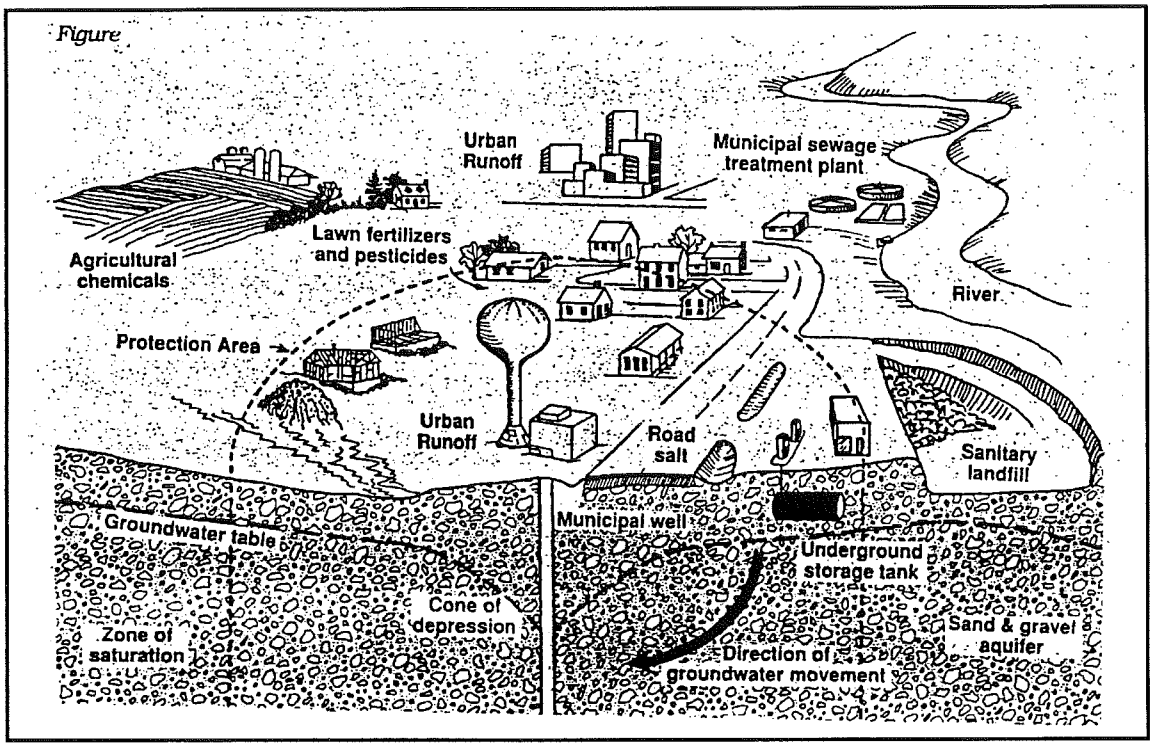
DNR Publication SW-144, The Wisconsin Remedial Response Site Evaluation Report (December 1991) lists superfund sites, solid and hazardous waste disposal sites, leaking underground storage tank sites and reported spill sites. See the section in Chapter Four that describes other pollutant sources for more detail.

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites, and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners who volunteer to participate in the program. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.40, Wis. Stats., have been blended to produce a cultural resource management program which is compatible both to preserving cultural sites and to implementing the watershed project.

There are a few known archaeological sites within the Neenah Creek Watershed. These areas will need special consideration when structural best management practices are being considered. Settling basins, manure storage structures, and streambank or shoreline shaping and riprapping are likely practices that may impact archaeological sites. As discussed above, state and federal laws require preservation of archaeological resources within the framework of the NPS Program.

Figure 2-1. Groundwater Schematic



The Neenah Creek Watershed Project will address these concerns with the following procedures:

1. Adams, Marquette and Columbia Counties will obtain inventory maps from the regional Wisconsin State Historical Society office, and will plot sites on topographic maps. Counties will also obtain a supply of landowner questionnaires from the historical society which will be used to identify additional non-inventoried sites.

2. Landowners' questionnaires will then be sent to the State Historical Society for determination of archaeological significance. In addition, landowners will have their lands evaluated by county staff for the need to conduct an archaeological survey (essentially compare property with known archaeological site locations). The historical society will determine the need for additional, extensive surveys. The counties and the DNR District NPS Program coordinator will also be involved in this determination.

3. If the inventory or questionnaire does reveal an archaeological site and the proposed best management practice may impact the site, an archaeological survey conducted by a qualified archaeologist will need to be completed. The survey will assess the potential of the practice to significantly impact the site. Alternative BMPs may need to be considered both before and after the results of the survey.

4. A cost-share agreement is signed before the survey is conducted. In certain instances a survey may reveal a significant archaeological site which precludes the installation of a particular BMP at that specific site. Cost-share agreements will contain language which nullifies or partially nullifies the cost-share agreement based on the final results of the archaeological survey. It is the responsibility of the county to include on the cost-share agreement such language.

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 that comprehensive endangered resource surveys have not been completed for the entire Neenah Creek Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources may be present in the watershed.

In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and so are not in the lists below.

Rare Species

Rare species are tracked by Wisconsin's Natural Heritage Inventory of the Bureau of Endangered Resources. Species tracked by the inventory include those that are listed by the U.S. Fish and Wildlife Service or by the state of Wisconsin.

Wisconsin Endangered Species

Any 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:

Amemone multifida var hudsoniana	Hudson Bay Anemone (plant)
Eleocharis quadrangulata	Angle-Steemed Spike-Rush (plant)
Sistrurus catenatus catenatus	Eastern Massasauga (snake)
Tyto alba	Barn Owl (bird)
Ophisaurus attenuatus	Western Slender Glass Lizard (lizard)
Plethobasus cyphyus	Bullhead (mussel)

Wisconsin Threatened Species

Any species which appears likely, within the foreseeable future, on the basis of scientific evidence, to become endangered. Wisconsin threatened species within the watershed are:

Buteo lineatus	Red-Shouldered Hawk (bird)
Vireo bellii	Bell's Vireo (bird)
Notropis anogenus	Pugnose Shiner (fish)
Opuntia fragilis	Brittle Prickly-Pear (plant)
Poa paludigena	Bog Bluegrass (plant)
Polytaenia nuttallii	Prairie Parsley (plant)
Quadrula metanevra	Monkeyface (mussel)

The following threatened species occur in the general area just outside the boundaries of the Neenah Creek watershed. If these species' preferred habitats occur within this watershed, then these species may also be present:

Carex prasina	Drooping Sedge (plant)
Clemmys insculpta	Wood Turtle (turtle)
Cypripedium candidum	White Lady's-Slipper (plant)
Lepomis megalotis	Longear Sunfish (fish)
Lythrurus umbratilis	Redfin Shiner (fish)
Macrhybopsis aestivalis	Speckled Chub (fish)
Simponaias ambigua	Salamander Mussel (mussel)
Speyeria idalia	Regal Fritillary (butterfly)
Tofieldia glutinosa	False Asphodel (plant)

Wisconsin Special Concern Species

Any species about which some problem of abundance or distribution is suspected in Wisconsin, but not yet proven. The purpose of this category is to focus attention on certain species **before** they become endangered or threatened. Wisconsin special concern species within the watershed are:

Notropis texanus	Weed Shiner (fish)
Cardamine pratensis var palustris	Cuckoo Flower (plant)
Scleria triglomerata	Tall Nut-Rush (plant)
Eleocharis olivacea	Capitate Spike-Rush (plant)
Erimyzon sucetta	Lake Chubsucker (fish)
Ammodramus savannarum	Grasshopper Sparrow (bird)
Dolichonyx oryzivorus	Bobolink (bird)
Lasmigona compressa	Creek Heelsplitter (mussel)
Spizella pusilla	Field Sparrow (bird)

The following rare species occur in the general area just outside the boundaries of the Neenah Creek watershed. If these species' preferred habitats occur within this watershed, then these species may also be present:

Ammocrypta clara	Western Sand Darter (fish)
Asplenium trichomanes	Maidenhair Spleenwort (plant)
Etheostoma microperca	Least Darter (fish)
Ischnura hastata	Citrine Forktail (dragonfly)
Platantherea hookeri	Hooker's Orchid (plant)
Rhexia virginica	Meadow Beauty (plant)
Pleurobema sintoxia	Round Pigtoe (mussel)
Scleria verticillata	Low Nut-Rush (plant)
Diplazium pycnocrpon	Glade Fern (plant)

Natural Areas

Natural areas are sites that contain high quality examples of natural communities. The following natural areas have been identified in the Neenah Creek Watershed. The natural communities found at each area are also listed.

State Natural Areas

Brooks Bluff (dry prairie)
Summerton Bog (northern wet forest , southern sedge meadow, calcareous fen, southern dry forest)

Natural Areas

Armchair Lake (lake (shallow, soft seepage), northern sedge meadow, open bog, oak barrens)
Corning-Weeting Lakes and Bog (northern wet forest, southern sedge meadow, shrub-carr, alder thicket)
Crass Pond (lake (shallow, hard seepage), calcareous fen, shrub-carr, northern mesic forest)
Crooked Lake Wetlands (emergent aquatic, southern sedge meadow, calcareous fen)
Kaiser Prairie (wet-mesic prairie, mesic prairie)
Levee Road Floodplain Woods (floodplain forest)
Lewiston Sedge Meadow (southern sedge meadow)
New Chester Floating Sedges (lake (shallow, soft, seepage), northern sedge meadow)

Oxford Ridge and Kettle Complex (lake (shallow, soft, seepage), emergent aquatic, northern sedge meadow, southern dry forest, northern dry forest)
Pasque Flower Prairie (dry prairie)
Red-Pien Rock Woods (northern wet forest, southern sedge meadow, southern dry forest, northern dry-mesic forest, dry prairie, oak barrens)
Wood Duck Springs (spring pond, northern sedge meadow, springs and spring runs (hard))

If specific locational or other information is needed about these species or natural communities, contact the Bureau of Endangered Resources, DNR. **Please note** that the specific location of endangered resources is sensitive information. Exact locations **should not** be released or reproduced in any publicly disseminated documents.

CHAPTER THREE
Water Quality Conditions, Water Quality Objectives and Nonpoint Sources

Introduction

Topics covered in this chapter include:

- major nonpoint source pollutants
- establishment of water quality objectives
- results of nonpoint source inventories
- individual subwatershed's general characteristics
- amount of pollutant control necessary to achieve desired water resource conditions
- other potential pollutant sources

Major Nonpoint Source Pollutants

Nonpoint sources of pollution are responsible for the degraded conditions of the lakes and streams in this watershed. Excessive amounts of sediment, nutrients, and bacteria degrade the water quality causing unbalanced fish communities with depressed populations and limited diversity. In this watershed the two most serious pollutants are manure and sediment. These are discussed below.

Sediment

Sediment adversely impacts the water resources in many ways. Sediment in high concentrations abrades fish gills making the fish more susceptible to disease. It also fills in pools and covers up fish spawning habitat. Further, suspended sediment causes the water to be warmer in the summer. This reduces the dissolved oxygen content, in that warm water cannot hold as much oxygen as cold water. The sources of sediment in this watershed are wind erosion, upland erosion from croplands, stream-bank erosion, and shoreline erosion. Heavy or long term sediment deposits are less problematic in upland streams of the watershed, particularly in the northern part of the watershed. This is due to the fact that the gradients and higher velocities tend to scour streams of sediment and therefore do not result

in long-term habitat destruction caused by channelization or heavy sediment deposits. Instead, stream-bank erosion is the most common form of habitat destruction.

Manure

Manure contains several components that adversely affect water quality and aquatic life. Manure entering a stream breaks down, resulting in depletion of the oxygen. Oxygen is needed by fish and other aquatic life to survive. Also, manure contains nitrogen which can form ammonia in the streams and lakes. High concentrations of ammonia are toxic to fish and other aquatic life. The nutrients in manure (including nitrogen and phosphorus) also promote nuisance algae and weed growth in the streams and lakes. Finally, the bacteria found in livestock manure is harmful to livestock drinking the water and to humans using the water for recreation. The major sources of manure in this watershed are runoff from barnyards and runoff from improperly field-spread manure.

Slopes and narrow valleys present special manure management problems, because many barnyards and manure-spreading sites are located in close proximity to streams or on slopes. In either case, organic loading to streams is often significant.

Nitrates

Groundwater with nitrate levels greater than 10 milligrams per liter (mg/l) exceed state groundwater standards. At this level it is recommended that infants not consume the water because the nitrate interferes with the ability of the blood to carry oxygen. High nitrate concentrations in the drinking water are also linked to spontaneous abortions in livestock. The most likely sources of nitrates in the groundwater in this watershed are nitrogen fertilizers and manure applied to croplands. See groundwater discussion in Chapter Two.

Water Quality Conditions and Recreational Uses

Water Resources Summary

The Neenah Creek Priority Watershed consists of 169 square miles, or roughly 108,000 acres, distributed as follows:

48,600 acres Adams County (45%)
27,000 acres Marquette County (25%)
32,400 acres Columbia County (30%)

The Neenah Creek Priority Watershed is a sub-basin of the larger Fox River Drainage Basin. The topography of the area is characterized by little relief. Marshes and wetlands predominate with upland hardwoods common in the upper reaches of the watershed.

The watershed is mostly rural and agricultural. There is one incorporated village — Oxford — and several unincorporated communities. There are no identified point sources of pollution. Nonpoint sources are related to land use practices. Agricultural land use is primarily croplands, and use intensity varies with location.

Among the areas where nonpoint source pollution is showing its greatest effects include the Mason Lake area in Adams County where barnyards and feedlots, and subsequent stream-bank erosion, are common. Another area of concern is that part of the watershed lying in Columbia County and near the Columbia-Marquette county line. This area has a preponderance of ditched waterways. Networks of ditches lead to Lower Neenah Creek, Big Slough, and tributaries of Big Slough. Significant tracts of marsh and wetlands have been converted for agricultural use. The so-called "muck" farms are common and represent a particular concern for nutrient, pesticide, and sediment runoff.

The primary stream resource is Neenah Creek. The primary lake resource is Lake Mason. Neenah Creek is a trout fishery for the upper half its 43-mile length. The water quality and potential of Neenah Creek is influenced by the dam at Oxford and the effects of nonpoint source pollution. Nonpoint sources are also damaging the water quality of Lake Mason and other lakes which have recently experienced effects of excessive farm fertilization.

In summary, this is a watershed characterized by the preponderance of wetlands and marshlands which, in many ways, represent its greatest resource. Nonpoint source pollution is present and affects many areas of the watershed, with primary concern centered at the Columbia-Marquette county line southward, and the Adams County-Mason Lake area.

The flat, marshy nature of this watershed, particularly the southern portion, makes its water resources vulnerable to the continued effects of nonpoint source pollution and the related conversion of wetlands to farmland.

Streams

Streams are of low gradient and are susceptible to periodic flooding. Prevailing stream bottom substrate ranges from clay and sand in upper Adams and Marquette counties to a high organic content silt in Columbia County. There are six significant streams, totaling 117 stream miles with 25 miles classified as trout waters.

Named streams include: Neenah Creek, Widow Green Creek, South Branch Creek and Big Slough. Neenah Creek is the predominant stream in the watershed. This 43-mile creek runs roughly 3/4 of the length of the entire watershed and through four of the 10 subwatersheds. Streams will be described in more detail in subwatershed descriptions later in this chapter. See Appendix A for information on biotic index.

Lakes

There are 21 significant natural lakes and impoundments ranging in size from 5 to 855 acres within the Neenah Creek Priority Watershed Project area. They include: Amey Pond, Big Springs Ponds, Crooked Lake, Deep Lake, Emrick Lake, Goose Lake, Hill Lake, Jordan Lake, Mason Lake, McDougal Lake, McGinnis Lake, Neenah Lake, Oxford Pond, Patrick Lake, Peppermill Lake, Sache Lake, Weeting Lake and Wolf Lake. See map 2-1.

The lakes in the Neenah Creek Watershed are set in the Central Plain geographical province, a considerable portion of which was once a part of the glacial Lake Wisconsin (Klick and Threinen, 1966). This ancient lake bed is now a flat, sandy plain. The other major surface geological formation within the basin is pitted out-wash, which contains lakes formed by glacial ice blocks.

The lakes in the watershed will be described in more detail in the subwatershed descriptions later in this chapter.

Recreational Uses

The watershed's streams, wetlands and lakes offer diverse recreational opportunities. Popular activities are fishing and canoeing on the streams and lakes. Other popular activities are wildlife observation, hiking, hunting and trapping.

The many wetlands and marshlands throughout the Neenah Creek Priority Watershed provide a valuable recreational and biological resource and buffer streams and lakes from effects of surrounding agricultural land use. The wetlands serve as stop-over sites for migratory waterfowl and sandhill cranes. Many of the lakes are home to several species of waterfowl, fish and furbearers. Trout, gamefish and panfish are present making recreational fishing possible.

Neenah Creek is a trout fishery for the upper half of its 43-mile length. The water quality and potential of Neenah Creek is influenced by the dam at Oxford and the effects of nonpoint source pollution.

Water Quality Objectives

With assistance from the Adams, Marquette and Columbia county staff and the DATCP, the DNR has developed water quality objectives. Objectives were identified for each subwatershed and are listed in the following subwatershed descriptions. Details of objective development can be found in the Neenah Creek Priority Watershed Appraisal Report (Schenck and Herman, 1992). See table 3-1.

Following are terms used for stream and lake objectives:

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

- **Enhancement**: Enhancement refers to 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 warm-water fishery whose diversity could be enhanced, the objective focuses on changing those water quality conditions which keep it from achieving its full biological potential.

- **Restoration**: Restoration refers to upgrading the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warm-water game fish, but no longer does. This objective seeks to improve conditions allowing viable populations of forage and warm-water game fish species to become re-established.

The water quality conditions needed to support the objectives for streams and lakes are the basis for determining the type and level of nonpoint source control to be implemented under the priority watershed project.

The lakes water quality goal for the Neenah Creek Watershed Project is to protect and improve water quality and decrease siltation. Phosphorus, one of the main nutrients in farm runoff affecting water quality, plays an important role in algal and macrophyte production. Pollutant control measures should be designed to reduce phosphorus loading to the lakes as well as to the streams. Sources of sediment loading should also be reduced, helping to establish more natural flora and macrophytes in the lakes. Landowner participation will play a major role in the reduction of silt and phosphorus in the project area.

Water quality goals for the streams involve improvements through remediation of nonpoint sources of pollution. In some areas, existing dams could possibly be removed. In others, there is a need to correct land use practices which are causing nutrient and sediment loading. Other goals include purchasing some wetlands areas to be set aside for preservation or, at the very least, limit the future channelization of some wetlands. Some streams simply need better access. All of this would help improve the fishery. Upgrading the fish habitat is more realistic in some places than in others.

Following are abbreviations for designated biological uses in the subwatershed discussions.

COLD = Cold-water Communities include surface waters capable of supporting a community of cold-water fish and other aquatic life or serving as a spawning area for cold-water fish species.
WWSF = Warm-water Sport Fish Communities include surface waters capable of supporting a community of warm-water sport fish and/or serving as a spawning area for warm-water sport fish.
WWFF = Warm-water Forage Fish Communities include surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF = Limited Forage Fish Communities

Discussions also include the "class" of trout streams based on the publication "Wisconsin Trout Streams" [DNR Publ. 6-3600(80)] and Outstanding/Exceptional Resource Waters, Wisconsin Administrative Code NR 102.20 and NR 102.11.

Class I trout streams are high quality, and populations are 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.

See table 3-1 for a summary of the water resource conditions and objectives for the Neenah Creek Watershed.

Table 3-1. Water Resources Conditions and Objectives for Lakes and Major Streams—Neenah Creek Watershed

Subwatershed	Waterbody	Length (mi.) or Acreage	Beneficial Uses Existing	Potential	Extent of Use (mi.)	Problems/Threats	Pollutant or Limiting Factor	Reduction Required
Big Slough(BS)	Big Slough	8.0 mi.	WWSF/Boating	same	all	SED,MIG Loss of Wetlands	DCH,CL,PSB Private Owner	High
	Unnamed Tribs.	~5.3 mi.	LFF	WWFF	all	HAB,NUT, SED,DO	DCH,CL	High
Crooked Lake(CL)	Crooked Lake	64 acres.				DAV		
	Neenah Cr.	3.0 mi.	Trout III	Trout II	all	TEMP,FERT, MIG	HM,CL,URB,Fox R.	Moderate
Jordan Lake(JL)	Jordan Lake	213 acres				BAC		
Lower Neenah Creek(LN)	Neenah Cr.	~9.1 mi.	WWSF/Boating	same	all	SED,FAD, MIG	CL,PSB,SB,PCB,Fox R.	Moderate
Mason Lake(ML)	Big Spring Cr.	1.8 mi.	Trout I Unclass	same WWSF	1 mi. 0.8 mi.	SED,FERT, HAB,DO	RS,BY,CL,CON,PSB,SB	High
	Mason Lake	855 acres				NPS,HAB, TURB,WK, DAV,FLOW	BY,CL,PSB,SB	High
	Unnamed Cr.	3.3 mi.	LFF	Cold	all	SED,HAB, FLOW	DCH,CL,PSB,SB	High
	Unnamed Trib.	1.0 mi.	WWFF	Trout II	all	HAB,SED,TEMP,FLOW	DCH,SB,CL,PSB,HM	Moderate
Middle Neenah Creek(MN)	Neenah Creek	~8.4 mi.	Trout III WWSF	Trout II Trout III	~4.1 mi. ~4.3 mi.	SED,TEMP, MIG	CL,SB,PSB,HM FOX R.	Moderate

Table 3-1. Continued.

Subwatershed	Waterbody	Length (mi.) or Acreage	Beneficial Uses Existing	Beneficial Uses Potential	Extent of Use (mi.)	Problems/Threats	Pollutant or Limiting Factor	Reduction Required
Oxford Lake(OL)	Oxford Lake	14 acres				unknown		
S. Branch Neenah Creek(SB)	S.Br.Neenah Cr.	3.2 mi.	WWSF	same	all	SED,MIG	CL,Fox R.	Low
Upper Neenah Creek(UN)	Deep Lake	35 acres						
	Goose Lake	81 acres				WK,FLOW DAV		
	McGinnis Lake	33 acres				DAV,WK		
	Neenah Cr.	7.4 mi.	Trout I	same	all	SED,MIG	CL,HM	High
	Parker Lake	59 acres				DAV,FLOW		
	Peppermill Cr.	1.6 mi.	WWFF	same	all	SED,TEMP, FERT	CL,HM	Moderate
	Peppermill Lake	100 acres				WK,DAV, FLOW		
Widow Green Creek(WG)	Unnamed Trib	n/a	Cold	same	all	HAB,FLOW	-	Low
	Widow Green Cr.	12.0 mi.	Trout II	same	5.3 mi.	SED,TURB, TEMP,HAB	BY,CL,PSB,SB	High
			WWSF	same	4.2 mi.	Loss of Wetlands	Private Owner	
			WWFF	same	2.5 mi.			

Table 3-1. Continued.

LEGEND—ABBREVIATIONS:

Stream Classifications

Cold= Cold water community; includes surface waters that are capable of supporting cold water fish and other aquatic life or serving as a spawning or nursery area for warm water fish.

WWSF= Warm water sport fish communities; includes surface water capable of supporting a community of warm water sport fish or serving as a spawning or nursery area for warm water sport fish.

WWFF= Warm water forage fish communities; includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.

LFF= Limited forage fishery; (intermediate surface waters); includes surface waters 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.

WATER RESOURCES SUMMARIES

Problem or Threat

BAC - Bacteriological Contamination
CL - Chlorine Toxicity
DO - Dissolved Oxygen
FAD - Fish Advisory
FLOW - Stream Flow or Water Level Fluctuations (unnatural)
HAB - Habitat (lack of cover, sediment, scouring, etc.)
HM - Heavy Metal Toxicity
MIG - Fish Migration Interference
NH^3 - Ammonia Toxicity
NUT - Nutrient Enrichment
ORG - Organic Chemical Toxicity
PCB - PCB Bioaccumulation
pH - pH (fluctuations or extreme high or low)
PST - Pesticide/Herbicide Toxicity
SED - Sedimentation
TEMP - Temperature (fluct. or extreme high or low)
TOX - General Toxicity Problems
TURB - Turbidity
DAV - Dense Aquatic Vegetation
WK - Winterkill

Cause or Limiting Factor

BDAM - Beaver Dam
CM - Cranberry Marsh
DCH - Ditched
DRDG - Dredging
Gr. Pit - Gravel Pit
HM - Hydrologic Modification
IRR - Irrigation
LF - Landfill
NMM - Non-metallic Mining
NPS - Unspecified Nonpoint Sources
BY - Barnyard Run-off
CL - Cropland Erosion
CON - Construction Site Erosion
PSB - Streambank Pasturing
SC - Sediment Contamination
PWL - Woodlot Pasturing
RS - Roadside Erosion
SB - Streambank Erosion
URB - Urban Stormwater Run-off
WD - Wind Erosion
PSM - Point Source, Municipal Discharge
PSI - Point Source, Industrial Discharge
SS - Storm Sewer

Subwatershed Discussions

Upper Neenah Subwatershed (UN) (Listed North to South)

Subwatershed Description

The Upper Neenah subwatershed is 34 square miles in New Chester, Jackson, Oxford and Westfield townships, or 20 percent of the total watershed area. The UN subwatershed contains eleven named lakes — Deep, Emrick, Hill, McDougall, Goose, McGinnis, Neenah, Patrick, Parker, Peppermill and Wolf lakes — and two creeks — Peppermill and Upper Neenah. Refer to map 3-1.

Streams

Peppermill Creek is a short (1.6 miles) creek originating from spring flow at the upper end of Peppermill Lake (T15N, R7E, S12) and flowing due east until joining Neenah Creek just north of County Highway EE. The stream averages 11 feet in width.

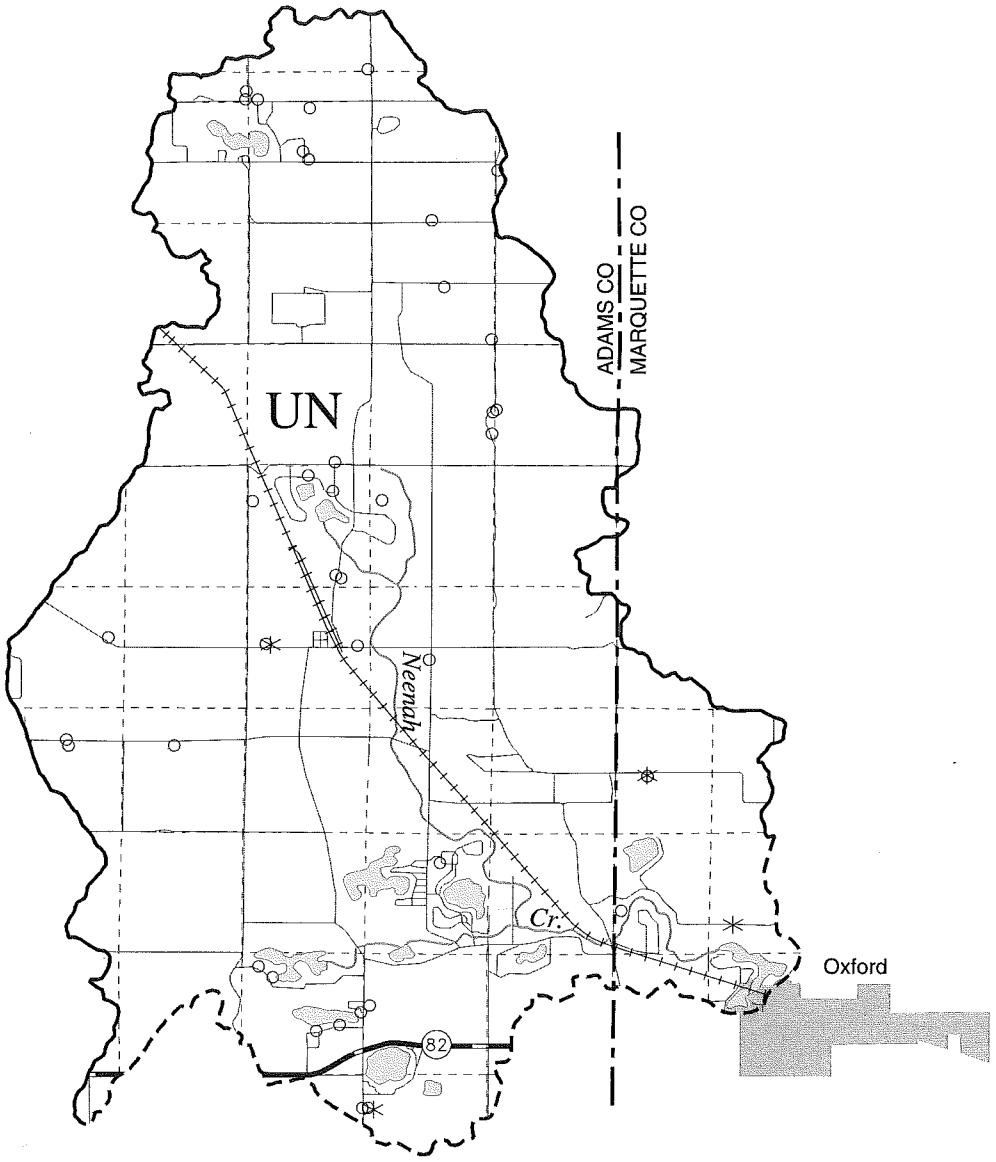
Upper Neenah Creek (T15N, R8E, S18) is delineated as that section upstream of Neenah Lake. It originates from springs and lake drainage. With its southeasterly flow, Upper Neenah Creek is joined by Peppermill Creek and then impounded at Oxford to form Neenah Lake. This section of stream averages 8.5 feet wide and is 7.4 miles long.

Water Quality Conditions - Streams

Peppermill Creek contains a diverse fishery composed of cold- and warm-water fish. During a recent water quality appraisal, numerous intolerant species were recovered. Macroinvertebrate indices ranges from good to excellent. Habitat assessments were good. It is clear with a firm bottom substrate composed primarily of sand, with gravel and rubble common. Water quality is judged excellent with the exception of possible low dissolved oxygen levels in some of the impoundments where macrophyte growth is common.

Peppermill was de-classified as trout water because numerous impoundments have increased water temperatures beyond the optimum trout range. One impoundment was created by an improperly installed culvert. Agricultural effects include siltation and increased fertilization. Thermal constraints, however, continue to be the limiting factor regarding potential trout reclassification. Due to the already high number of impoundments, the resource objectives include removing the impoundments to improve water temperature and to minimize effects of agriculture and other nonpoint sources (NPS). This would help preserve the diverse forage fishery already there.

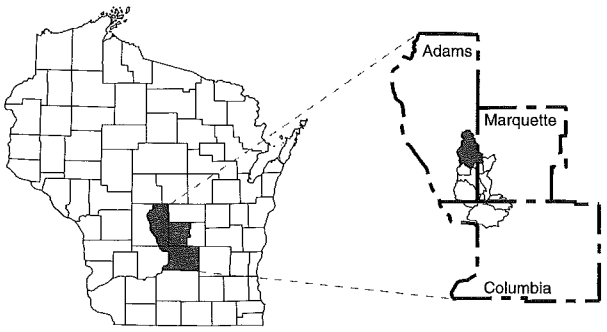
Map 3 - 1. Upper Neenah Creek (UN) Subwatershed



LEGEND

- Well
- Barnyard
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Road
- Railroad
- County Boundary
- Section Line
- River or Stream
- Open Water
- Municipal Area

STUDY AREA



N

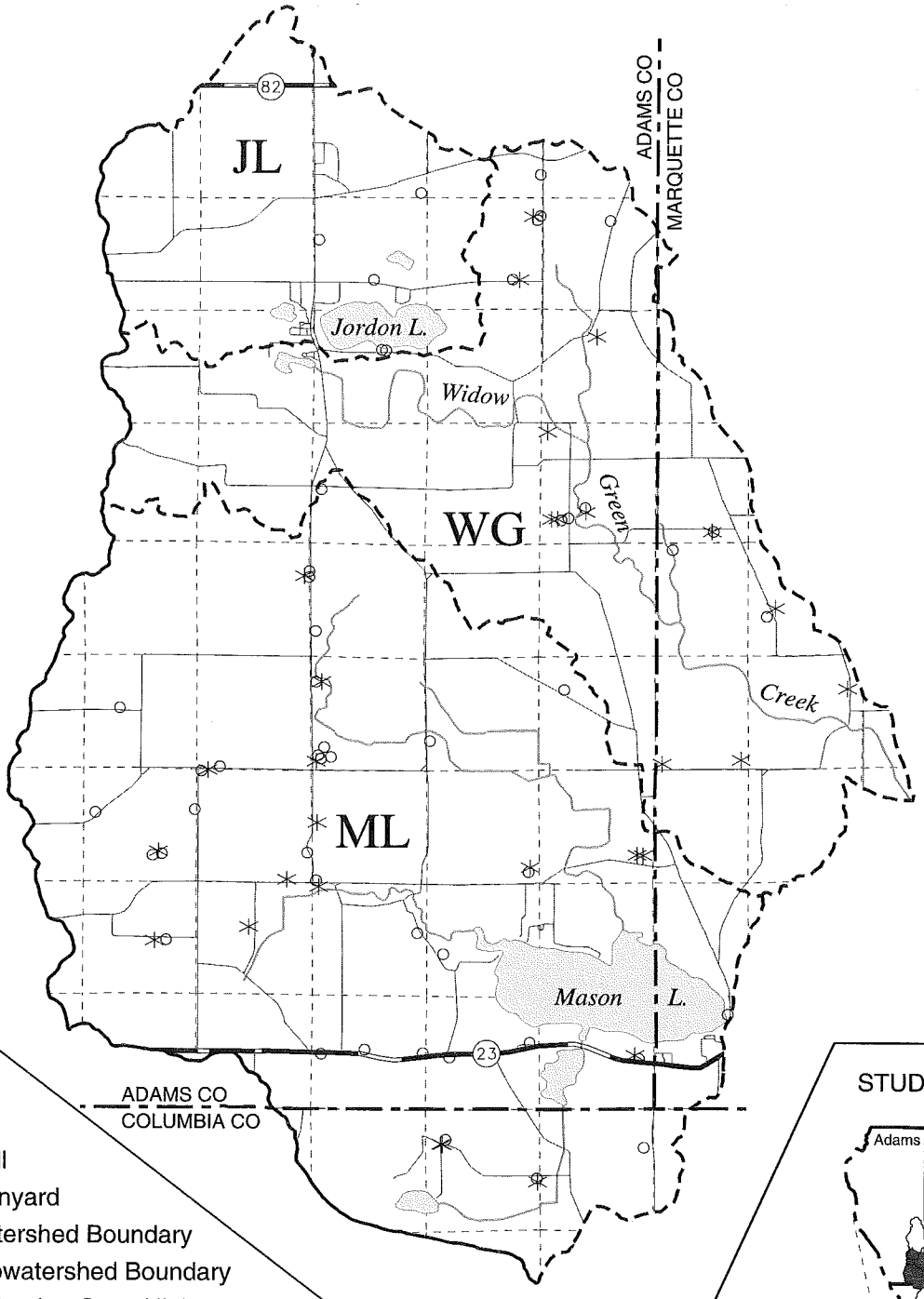
0 1 2 3 4 Miles

0 1 2 3 4 5 6 Kilometers

Scale 1:100,000

Wisconsin Department of Natural Resources
BIM - GEO Services Section
March 1994

Map 3 - 2. Jordon Lake (JL), Widow Green Creek (WG) and Mason Lake (ML) Subwatersheds

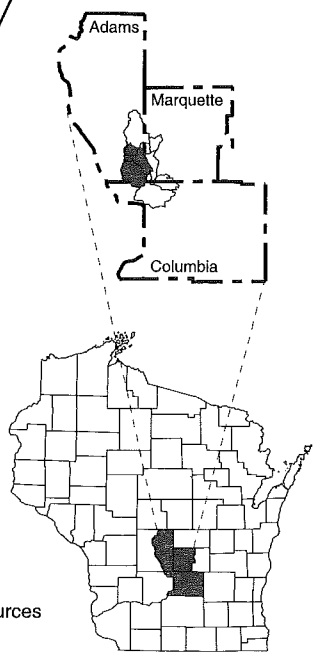


LEGEND

- Well
- Barnyard
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Road
- Railroad
- County Boundary
- Section Line
- River or Stream
- Open Water
- Municipal Area

N

STUDY AREA



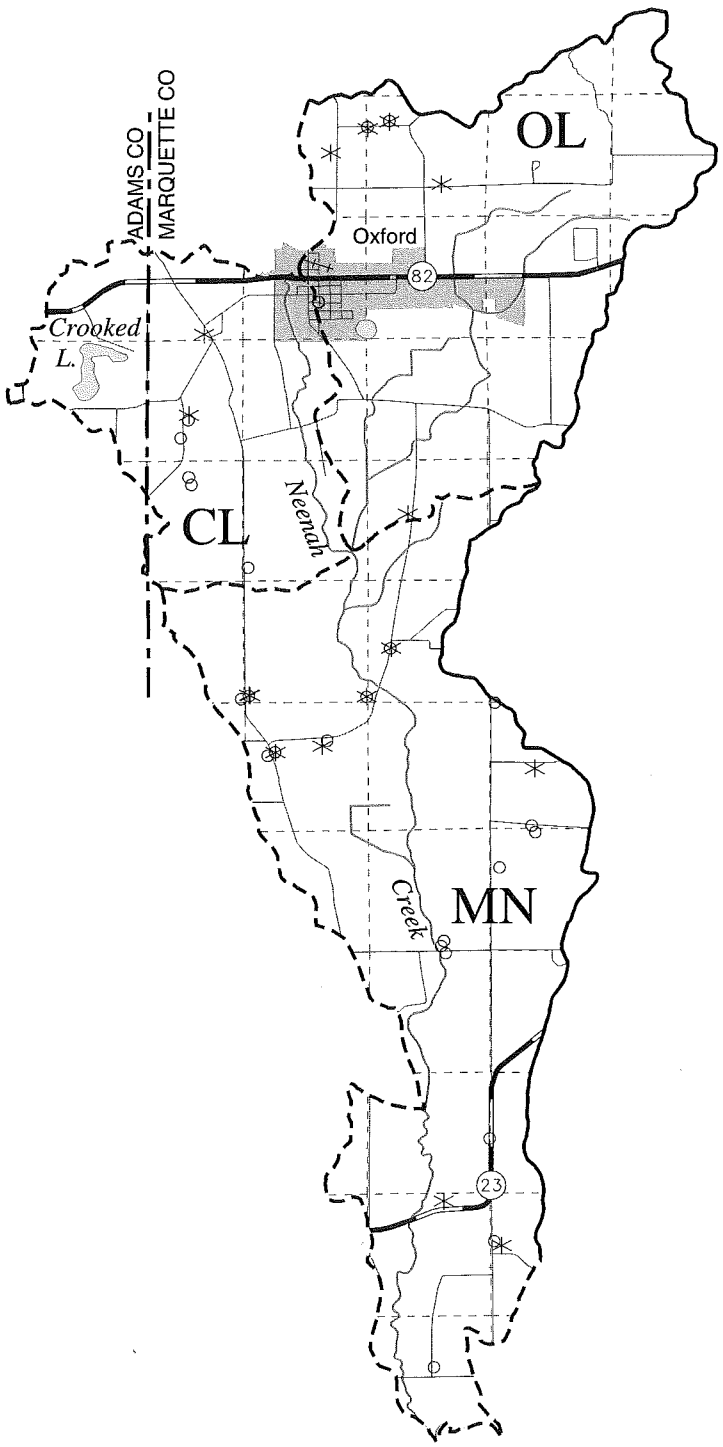
0 1 2 3 4 Miles

0 1 2 3 4 5 6 Kilometers

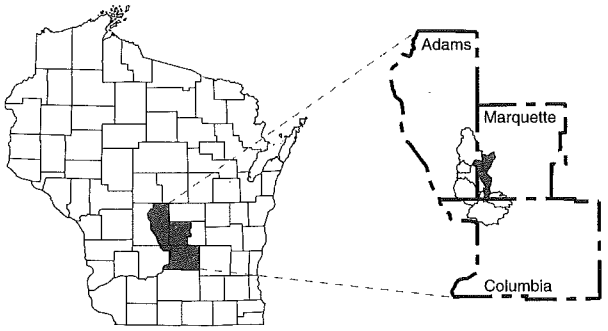
Scale 1:100,000

Wisconsin Department of Natural Resources
BIM - GEO Services Section
March 1994

Map 3 - 3. Oxford Lake (OL), Crooked Lake (CL) and Middle Neenah Creek (MN) Subwatersheds



STUDY AREA



LEGEND

- Well
- Barnyard
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Road
- Railroad
- County Boundary
- Section Line
- River or Stream
- Open Water
- Municipal Area

N

GEO

Wisconsin Department of Natural Resources
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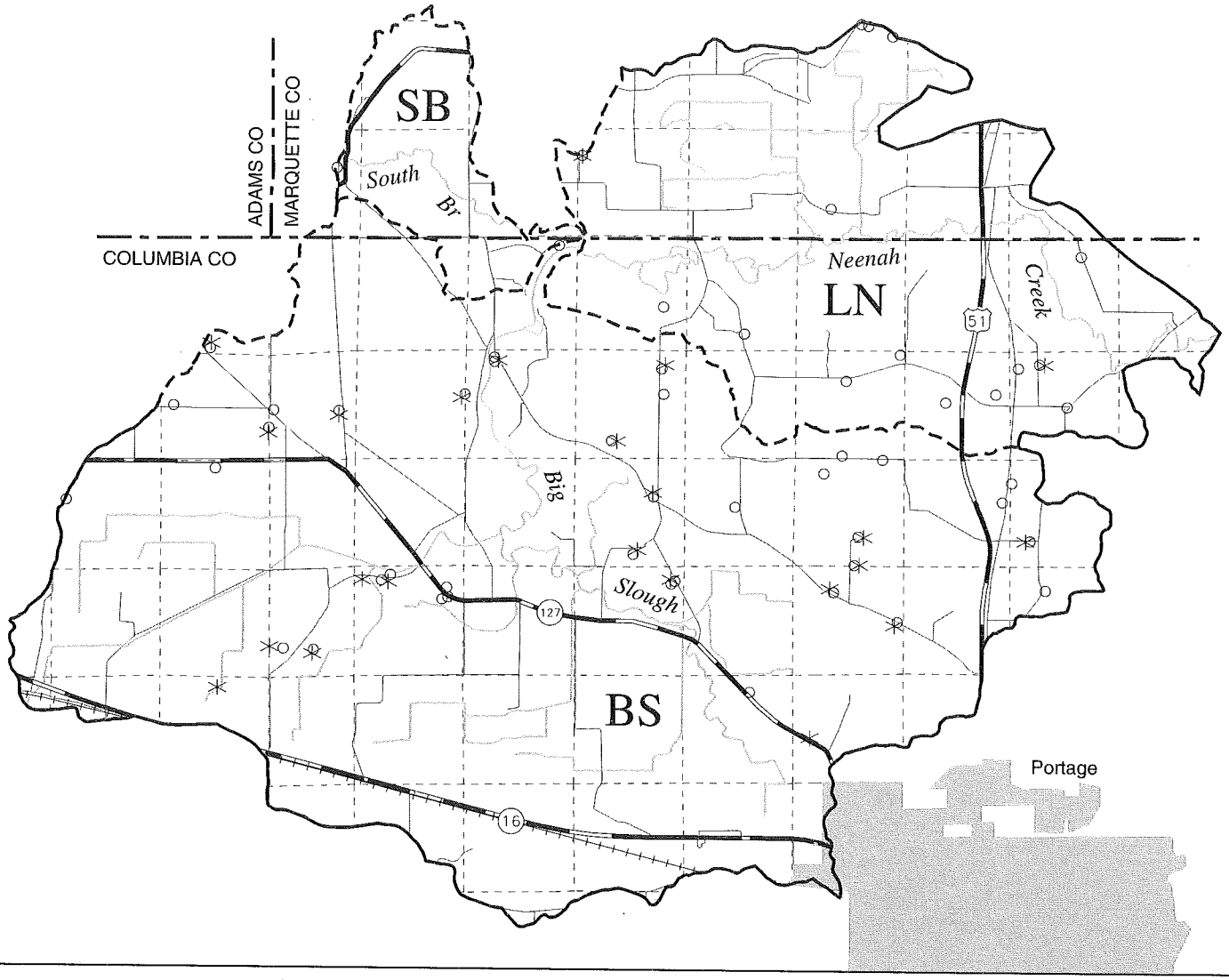
March 1994

0 1 2 3 4 Miles

0 1 2 3 4 5 6 Kilometers

Scale 1:100,000

Map 3 - 4. South Branch Creek (SB), Lower Neenah Creek (LN), and Big Slough (BS) Subwatersheds



LEGEND

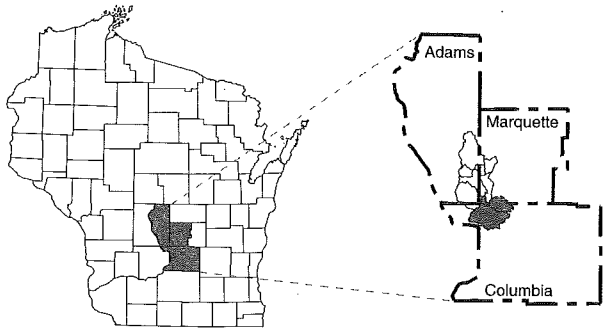
- Well
- Barnyard
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Road
- Railroad
- County Boundary
- Section Line
- River or Stream
- Open Water
- Municipal Area

0 1 2 3 4 Miles

0 1 2 3 4 5 6 Kilometers

Scale 1:100,000

STUDY AREA



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GEO

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March 1994

Upper Neenah Creek is classified as Class I trout water for its entire length in the Upper Neenah subwatershed. Fish surveys reveal a variety of species, from brown trout to tolerant warm-water species such as green sunfish. Neenah Lake serves as a source of recruitment for these warm-water species. Habitat assessment results were good. Macroinvertebrate biotic indices varied from good to excellent. Bottom substrate is mostly sand with clay, gravel and rubble common. Macrophyte growth is light. Water quality is excellent.

Agricultural land use of this portion of the stream, compared to others, is low. The majority of the basin is in marsh or upland hardwoods. Regarding agricultural impacts, two areas of concern are temperatures in Peppermill Creek and NPS pollution. This is considered the finest brown trout stream of Adams County. Although less affected by NPS pollution than other areas of the watershed, it has perhaps more to lose and is more susceptible if those effects are not reduced. There are already numerous species of tolerant warm-water fish which compete with the trout for resources. If trout habitat is degraded, even slightly in areas with siltation and increased ambient temperatures, trout recruitment and subsequent survival may decline until other species come to dominate.

Lakes

This subwatershed contains Deep Lake, Goose Lake, McGinnis Lake, Neenah Lake, Parker Lake, Patrick Lake, McDougall Lake, Emrick Lake, Hill Lake, Peppermill Lake and Wolf Lake. See descriptions below.

Water Quality Conditions - Lakes

Deep Lake (T15N, R7E, S15) is a 35-acre lake with a maximum depth of 47 feet. Largemouth bass, bluegills, pumpkinseed, rock bass, green sunfish, yellow perch, rainbow trout and brown trout make up the fishery. Mallards and teal use this area for nesting. Eurasian water milfoil has been found at the boat landing on this lake, but plants still need to be verified.

Emrick Lake (T15N, R8E, S7) is a 37-acre lake with a maximum depth of 79 feet. This is a small, deep, landlocked kettle lake in the terminal moraine northwest of Oxford. Largemouth bass and panfish constitute the fishery. Water quality is suitable to sustain trout. Waterfowl make moderate use of the lake in spring and fall with fair numbers of geese among the visitors (DNR, 1963).

Goose Lake (T15N, R7E, S10, 11) is an 81-acre lake with a maximum depth of 18 feet. Northern pike, largemouth bass, bluegills, pumpkinseed, and bullheads make up the fishery. Periodic winterkills have occurred on this lake but are now prevented, due to an aeration system. Abundant aquatic vegetation causes recreational use problems. Marsh furbearers are present. Waterfowl use the lake during the migration periods and mallard and blue-winged teal nesting have been reported (DNR, 1966). Eurasian water milfoil has been found on this lake, with other plants still needing verification.

McDougall Lake (T15N, R7E, S11, 14) is a human-made 8.5 acre lake with a maximum depth of 8 feet. Largemouth bass, bluegills, pumpkinseed, rockbass and bullheads make up

the fishery. Marsh furbearers are present and waterfowl use the lake during the migration periods (DNR, 1966).

McGinnis Lake (T16N, R7E, S27) is 33 acres with a maximum depth of 25 feet. Largemouth bass, bluegills, pumpkinseed, and yellow perch make up the fishery (DNR, 1966). Excessive plant growth and algae blooms limit fishing and recreation potential. Eurasian water milfoil has been found on this lake. Winterkills have taken place on McGinnis Lake. An aeration system has been installed to help alleviate the low oxygen winter situations.

Neenah Lake (T15N, R8E, S8, 17) is also known as Oxford Mill Pond. It covers 61 acres and is 15 feet deep at the maximum. Neenah Lake is an irregular impoundment of Neenah Creek at Oxford. Bass, panfish, northern pike and rainbow trout make up the fishery. Weeds in shallow bays present a problem to fishing and boating. Waterfowl frequent the lake in spring and fall and at least three species have been observed nesting there (DNR, 1963).

Parker Lake (T15N, R7E, S14, 23) is 59 acres with a maximum depth of 30 feet. Largemouth bass, bluegills, pumpkinseed, black crappie, yellow perch, bullheads make up the fishery. A carp eradication project took place in 1965. A fluctuating water level and excessive vegetation appear to be the major use problems. Ducks may use this lake during spring and fall migrations (DNR, 1966).

Patrick Lake (T16N, R7E, S9, 10) is 50 acres with a maximum depth of 10 feet. It supports northern, largemouth bass and panfish.

Peppermill Lake (T15N, R7E, S15) is a 100-acre impoundment of Peppermill Creek. It has a maximum depth of 9 feet. The fishery consists of northern pike, largemouth bass, bluegills, crappies, pumpkinseed, rock bass, bullheads and forage minnows (DNR, 1966). Winterkill situations have taken place on Peppermill Lake. An aeration system has been designed and should be installed in 1993.

Wolf Lake (T15N, R7E, S11) is 49 acres and 47 feet deep at its deepest point. Brown trout (planted), largemouth bass, bluegills, pumpkinseed, green sunfish, yellow sunfish, yellow perch, rock bass and black crappie, make up the fishery. Mallards reportedly raise broods at the lake and other waterfowl use this lake during spring and fall migrations (DNR, 1966). The state DNR owns 32 acres adjoining this lake. This includes roughly 1,320 feet of shoreline frontage.

Nonpoint Source Pollutants

- The Upper Neenah subwatershed contains 4 (inventoried) animal lots which contribute 133 pounds of phosphorus, annually. This represents 7 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Upper Neenah Subwatershed is 10 tons, annually, or less than one percent of the entire upland sediment load. Lakeshore erosion is the major source of sediment in this subwatershed, contributing 60 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Upper Neenah subwatershed is 487 tons, annually, or 34 percent of the entire streambank/lakeshore load.

Water Resource Objectives

Minimize effects of agriculture and other nonpoint sources. Maintain trout habitat.

Oxford Lake Subwatershed (OL)

Subwatershed Description

The Oxford Lake subwatershed is 9 square miles located centrally in eastern Oxford Township. It makes up roughly 5 percent of the total priority watershed area. The subwatershed contains one lake, Oxford, and a few unnamed tributaries of Neenah Creek. Refer to map 3-2.

Streams

There was no stream monitoring conducted in OL. Much of the stream is channelized.

Lakes

Oxford Lake (T15N, R8E, S16,17) covers 13.6 acres and is 49 feet deep maximum.

Water Quality Conditions - Lakes

Oxford Lake is a small, deep, landlocked kettle lake, possibly a remnant of the old glacial lake, the bed of which it occupies. Largemouth bass and panfish compose the fishery.

Water Resource Objectives

There are no major use problems on this lake. The lake has some aesthetic value and harbors waterfowl in spring and fall (DNR, 1963).

Nonpoint Source Pollutants

- The Oxford Lake subwatershed contains 5 (inventoried) animal lots which contribute 29 pounds of phosphorus, annually. This represents 1 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Oxford Lake subwatershed is 2432 tons, annually, or 16 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 100 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Oxford Lake subwatershed is 4 tons, annually, or less than 1 percent of the entire streambank/lakeshore load.

Crooked Lake Subwatershed (CL)

Subwatershed Description

The Crooked Lake subwatershed is 5 square miles in eastern Jackson and western Oxford townships. Crooked Lake subwatershed represents 3 percent of the total priority watershed area. The subwatershed contains one lake, Crooked, and a 2.5-mile stretch of Neenah Creek. Refer to map 3-2.

Streams

The portion of Neenah Creek in this subwatershed (T15N, R8E, S29) includes that section between the outlet at Neenah Lake, just north of the County Highway A intersection. Direction of flow is due south. Average stream width is 31 feet. A series of drainage ditches are tributary at the southernmost boundary of the subwatershed.

Water Quality Conditions - Streams

This entire section of Neenah Creek is classified as Trout III. Carp eradication has taken place in the past. Fish surveys indicate a highly diverse fishery ranging from intolerant cold water species to very tolerant warm-water species. Macroinvertebrate biotic indices range from poor to fair, likely due to increased temperatures, siltation, and decreased habitat. Habitat assessments were fair and good. Water quality is good, except for high average temperatures (for trout). Macrophyte growth is common and increased over that of the upper creek.

Neenah Creek is impounded in Oxford, forming Neenah Lake (a.k.a. Oxford Mill Pond, see lake description in Upper Neenah subwatershed). This is the only dam on the creek and is owned by White Coal Company. It is apparent that this impoundment has a substantial effect on trout habitat and potential. Above it, Neenah Creek is Class I and considered the premier trout water of the area. Below it, Neenah Creek is considered marginal Class III. Clearly,

temperature is limiting trout below the dam. Also observed were siltation and increased macrophyte growth. These may be attributed to the combined effects of more agricultural intensity and possible urban runoff from the village of Oxford.

Improving from trout Class III to Class II is a realistic and obtainable improvement through remediation of nonpoint sources of pollution. With dam removal, restoration to Class I may ultimately be achieved. Resource objectives include: 1) consider removing the dam, and 2) remediate agricultural practices contributing to nutrient and sediment loading (NPS).

Lakes

Crooked Lake (T15N, R7E, S24) is a 48-acre lake with a maximum depth of 56 feet.

Water Quality - Lakes

Crooked Lake's fishery includes northern pike, largemouth bass, bluegills, pumpkinseed, green sunfish, black crappies, yellow perch and bullheads. Waterfowl use this area for reproduction (DNR, 1966).

Excessive aquatic vegetation has been a concern in recent years (NCD DNR water quality files). Wetland restoration may help water quality of Crooked Lake.

Nonpoint Source Pollutants

- Crooked Lake subwatershed contains 1 (inventoried) animal lot which contributes 16 pounds of phosphorus, annually. This represents 1 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Crooked Lake subwatershed is 460 tons, annually, or 3 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 96 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Crooked Lake subwatershed is 20 tons, annually, or 1 percent of the entire streambank/lakeshore load.

Water Resource Objectives

Consider removing the dam at Oxford. Remediate agricultural practices contributing to nutrient and sediment loading.

Jordan Lake Subwatershed (JL)

Subwatershed Description

The Jordan Lake subwatershed is 7 square miles and is located entirely in Jackson Township. Its area is roughly 4 percent of the total watershed area. The JL subwatershed contains one named lake, Jordan Lake, and no major streams. Refer to map 3-3.

Lakes

Jordan Lake (T15N, R7E, S34)is a 213 acre lake, the second largest in the watershed. It has a maximum depth of 82 feet.

Water Quality Conditions - Lakes

Jordan Lake's fishery is made up of brown trout (stocked), northern pike, largemouth bass,. bluegills, pumpkinseed, black crappie, yellow perch and bullheads. Marsh furbearers are present. Ducks and common loons are present during the migration periods, and dabbler species nest at the lake (DNR, 1966). This lake has a natural water level fluctuation of several feet.

Wetlands, particularly on the eastern shore, need to be protected to help improve northern pike spawning. An easement on the currently undeveloped eastern shore is recommended to protect the lake. Runoff from lawn fertilizers is believed to be a problem on this lake. Shoreline buffers are recommended to help reduce the amount of fertilizers reaching the lake. A lake protection plan would help address this issue.

Nonpoint Source Pollutants

- The Jordan Lake subwatershed contains no (inventoried) animal lots.
- The upland sediment delivery in the Jordan Lake subwatershed is 372 tons, annually, or 2 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 94 percent of the sediment load in the subwatershed.
- Sediment delivered from streambanks and lakeshores in the Jordan Lake subwatershed is 22 tons, annually, or 2 percent of the entire streambank/lakeshore load.

Water Resource Objectives

Reduce runoff from lawn fertilizers. Install shoreline buffers. Develop and implement a lake protection plan. Consider purchasing an easement on the undeveloped east shore to protect northern pike spawning area on east shore.

Widow Green Creek Subwatershed (WG)

Subwatershed Description

The Widow Green Creek (also known as O'Keefe Creek) subwatershed is 18 square miles, or 11 percent of the total priority watershed area. WG contains parts of Jackson, New Haven, Oxford and Douglas townships, with the subwatershed's center located just south of where the four townships meet. It spreads across parts of Marquette and Adams counties. The subwatershed contains almost no lakes (none are named) and one creek, Widow Green. It does, however, contain Widow Green Marsh as well as several other large tracts of marsh and wetland. Refer to map 3-3.

Streams

Widow Green Creek is a tributary to Neenah Creek. It originates south of Jordan Lake and flows southeasterly 12 miles before joining Neenah Creek in Marquette County. Average width is 8 feet in Adams and 17 feet in Marquette County.

Water Quality Conditions - Streams

Widow Green Creek has bottom substrate primarily of sand and silt, with gravel, rubble and cobble. The upper 5.3 miles are classified as Class II trout water. The lower half contains warm-water forage and sport species. Fish surveys indicate trout are present but limited to areas of springs. The remainder of the fishery is composed mostly of tolerant warm-water species such as green sunfish. Macroinvertebrate ratings are variable due to nonpoint effects and the presence of spring water flow.

During a recent ecological appraisal, habitat assessments ranged from fair to good. Water quality is characterized as average with conductivity and total phosphorus up slightly from surrounding waters.

The trout potential of this creek has likely been realized due to thermal limitation. The surrounding marsh and wetlands serve to buffer stream temperatures (as well as water quality). Therefore, a significant water temperature reduction from improved farming practices will probably not be seen. However, areas of trampled banks and general stream-bank erosion are common and as severe as any place in the watershed. Their remediation would improve the class II fishery. The majority of these situations are located at Gale Avenue, downstream 1-2 miles.

It is apparent that the most beneficial water resource of this subwatershed are the extensive marshes and wetlands. Though the fishery may be improved, the greatest overall benefit is derived from the aesthetic and biological importance of the wetlands.

The resource objectives are to 1) purchase wetlands and marshlands to be set aside for preservation (WM), and 2) remediate farming practices contributing to nutrient and sediment loading (NPS).

The DNR Bureau of Research, in conjunction with DNR Fisheries Management and DNR Nonpoint Source have conducted sampling at three sites along Widow Green Creek since 1991. Currently fish species, habitat, temperature, dissolved oxygen, turbidity, and conductivity are routinely sampled. More extensive sampling may be done in the future.

Nonpoint Source Pollutants

- The Widow Green subwatershed contains 14 (inventoried) animal lots which contribute 764 pounds of phosphorus, annually. This represents 39 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Widow Green subwatershed is 1186 tons, annually, or 8 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 91 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Widow Green subwatershed is 121 tons, annually, or 8 percent of the entire streambank/lakeshore load.

Water Resource Objectives

Purchase wetlands and marshlands to be set aside for preservation. Remediate agricultural practices contributing to nutrient and sediment loading.

Middle Neenah Subwatershed (MN)

Subwatershed Description

The Middle Neenah subwatershed is 13 square miles entirely in Marquette County, occupying southern Oxford and northern Douglas townships. It constitutes roughly 7 percent of the total priority watershed area. This subwatershed contains about 8 miles of Neenah Creek and contains no lakes. Refer to map 3-2.

Streams

Middle Neenah Creek (T14, R8E, S33) is roughly outlined as that portion between Fox Drive and County Hwy. P. The direction of flow is due south. Average stream width is 31 feet. Widow Green Creek is a tributary (that enters at T14N, R8E, S21) as well as several drainage ditches.

Water Quality Conditions - Streams

This 8.1-mile section of Neenah Creek is classified as Class III trout water. Fish surveys indicate a highly diverse fishery, from intolerant cold-water to very tolerant warm-water species. Biotic indices range from fair to very good. Habitat assessments here range from

fair to good. Water quality is generally good except for high average temperatures (for trout). Bottom substrate is mostly sand with silt, clay and gravel present.

Surrounding land use is agricultural. Areas of trampled banks and general bank erosion are reported. Drainage ditches join between County Hwys. P and A. Temperature and siltation levels are higher than in Upper Neenah Creek. Temperature change can be attributed to the impoundment at Oxford. Siltation is likely caused by farming, with agricultural land use increasing substantially over Upper Neenah Creek.

The fish manager considers this stretch of the stream to be a marginal Class III. Class II is attainable given the few limiting factors. Resource goals include: 1) consider dam removal; 2) correct agricultural practices contributing to nutrient and sediment loading (NPS).

Nonpoint Source Pollutants

- The Middle Neenah subwatershed contains 9 (inventoried) animal lots which contribute 182 pounds of phosphorus, annually. This represents 9 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Middle Neenah subwatershed is 3085 tons, annually, or 20 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 99 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Middle Neenah subwatershed is 35 tons, annually, or 2 percent of the entire streambank/lakeshore load.

Water Resource Goals

Consider dam removal at Oxford. Remediate agricultural practices contributing to nutrient and sediment loading.

Mason Lake Subwatershed (ML)

Subwatershed Description

The Mason Lake is the third largest subwatershed, at 28 square miles, or 17 percent of the total priority watershed area. ML subwatershed is almost totally in New Haven Township, with its westernmost and southern tips spreading into Douglas and Newport townships, respectively. A small piece extends into the town of Lewiston. This subwatershed contains the largest lake in the watershed, Mason Lake, and several tributaries including Big Spring Creek. Amey Pond, adjacent to Mason Lake, also lies in this subwatershed. Refer to map 3-3.

Streams

Big Spring Creek is the primary stream resource in this subwatershed. It's spring-fed and flows southeasterly into Mason Lake (at T14, R7E, S26). The creek originates from a 3-acre spring pond. It is dammed at roughly its half-way point in the village of Big Spring where it forms the 7-acre Big Spring Pond. On average, the stream is 17 feet wide, with the stretch below the pond substantially wider than that above.

There are also two unnamed creeks studied in this subwatershed. One is a tributary to Big Spring Creek, and the other flows into Morris Cove (T14N, R7E, S26) of Mason Lake.

Water Quality Conditions - Streams

The upstream portion of Big Spring Creek, upstream of the dam, is classified Class I trout water, while downstream is unmanaged for trout. Although it is short (1.8 miles), it has potential to be a better Class I trout stream than it now is. Previous fish survey indicate a naturally reproducing population of brook trout including some large specimens. Because it is spring-fed, the stream has good water quality characteristics. The fish community is dominated by intolerant species. The variable biotic indices are attributed to site-specific non-point effects. Habitat assessment is only fair due to an abundance of silt and limited fish habitat of instream macrophyte beds and overhanging banks. Riffles are uncommon. The bottom substrate is primarily clay and silt with some gravel in the upper reaches.

The sampling site, near the junction of Golden Avenue and County Hwy. G, is a problem area. Excessive silt (up to 2 feet) and macrophyte growth were observed. There are several intense barnyards directly adjacent to pastures. Stream-bank erosion is common in these areas. Road work during the appraisal period contributed to sediment load. This is the only access point to the upper creek area and is fenced off across the stream.

Big Spring Pond suffers from excessive macrophyte and algae growth throughout the summer. The sedimentation rate in the pond is high as evidenced by the decreasing average depth, now roughly 1-2 feet. Dissolved oxygen levels were observed to drop to 3 ppm, exceeding water quality standards for a cold water classification and effectively forcing fish upstream. Water temperatures are raised quite a bit in the pond, which is considered unsuitable for trout downstream.

Because water quality from the pond has been degraded, resource objectives should include considering removing the dam. Preliminary goals for Big Spring Creek include: 1) reducing agricultural sediment and nutrient inputs in the identified problem areas (NPS), 2) improving fish habitat (FM), 3) improving access (FM), and 4) consider removing the dam.

There is a small, unnamed tributary to Big Spring Creek (T14N, R7E, S27). About one mile long, the spring-fed creek flows southerly and joins Big Spring Creek just south of Golden Ave. Its average width is 3-4 feet and average depth about 1/2 foot. Its bottom is firm and experiences aquatic macrophyte growth in wide areas. The creek now supports cold-water forage fish with some trout in the lower reaches likely.

Intolerant fish and macroinvertebrate species dominate. Water quality is good. Habitat rating is only fair owing to the shallow nature of the stream and the lack of instream cover. The primary beneficial use is providing forage for the trout of Big Spring Creek. It may also serve as a trout refuge and nursery. But this creek is affected by farming similar to Big Spring Creek. A small impoundment upstream of the sampling site suffers from excessive macrophyte growth and likely contributes to higher downstream temperatures.

While lack of cover and low flow may prohibit trout from continuously occupying the upper sections of stream, the lower reaches could possibly support a more stable population. The resource objective should be to remediate agricultural practices loading sediment and nutrients (NPS). This would enhance the creek's ability to support a more diverse, cold water forage fishery as well as a resident trout population.

Another unnamed creek flows southerly into the Morris Cove of Lake Mason. Although long (3.3 miles) and draining a relatively large basin, the creek is small, shallow and averages 3-4 feet wide with low flow. Bottom sediment is mostly silt. This creek has numerous channels throughout and supports a limited forage fishery.

Few numbers and species of forage fish were recovered in a limited survey of the upper stretch, most likely due to lack of habitat from excessive siltation. The species which were recovered were tolerant ones. Further fish sampling should be conducted at other locations to confirm the characterization. Macroinvertebrate indices are good despite heavy siltation perhaps due to the cold, spring fed nature of the water. Habitat ratings are poor. Water chemistry characteristics are good. This creek's potential is as a cold water forage fishery, with agricultural impacts being the limiting factors.

Much of this creek is utilized as agricultural drainage. The creek is channelized in places and contains heavy silt loads. It was assumed in the past that this creek carried significant nutrient and sediment loads to the Morris Cove of Lake Mason since that cove has experienced problems with algae and macrophyte growth. Though the presence of large amounts of sediments was obvious, nutrient levels were found to be of average values. Spring runoff nutrient sampling is recommended to confirm nutrient loading to Mason Lake. The resource objectives for this creek are to: 1) reduce agricultural practices contributing to sediment and nutrient inputs (NPS), 2) limit future channelization (NPS).

Lakes

Big Spring Millpond covers a 7 acre area. This spring fed area drains into Mason Lake. Big Spring Millpond and dam have prevented much of the silt and nutrients from entering Lake Mason. These hydraulic characteristics of the past are now limited by the increased depth of silt of the millpond and decreased retention time of water passing through it (Atkinson, 1992).

Mason Lake (T14N, R7E, S25, 26, 35, 36) and (T14N, R8E, S30, 31) is the largest lake in the watershed. Its area is 855 acres with a maximum depth of 10 feet. A control structure is used to maintain the lake level.

Water Quality Conditions - Lakes

Mason Lake has a diverse fishery including northern pike, largemouth bass, bluegills, pumpkinseed, black crappie, yellow perch, yellow bass, black bullheads and carp. Muskrat are present. Although some dabbler ducks nest at the lake, the majority are present during their migration periods (DNR, 1966).

A study done on Green Lake (DNR, 1981) concluded that the 60-70,000 geese present contribute roughly 5 percent of the phosphorus load to the lake. Because Mason Lake freezes sooner than Green Lake, the 5 percent estimate is likely to be high for Mason Lake.

Turbidity, aquatic vegetation and carp are the major recreational use problems on this lake. Excessive plant growth and algae blooms limit fishing and recreation potential. Eurasian water milfoil (Myriophyllum spicatum) is found throughout much of the lake (Coates, 1992). It would be beneficial to eliminate this exotic plant and to re-establish native vegetation in many areas of the lake. Current management concerns involve the effects of eutrophication.

The local lake association has been active in assisting the DNR in various projects and recognizes the need for control of nutrient sources to the lake. The agricultural watershed surrounding the lake is the most likely source of nutrient and sediment loading to the lake. In a survey of Mason Lake landowners, the number one problem of Mason Lake was the abundance of plants and excessive nutrients (Atkinson, 1992). Long-term protection of the watershed is listed as top priority (Atkinson, 1992).

There is a chronological history of Mason Lake available in the appraisal report. The report, compiled in 1992, documents the biologists' activities on Mason Lake and the resulting lake characteristics from 1932 to 1991.

During construction of a new dam, in late March, 1993, the dam at Briggsville burst. Water levels dropped a few feet before the break was filled. Water quality impacts are unknown, but are probably minor or insignificant. The new dam was completed in 1993 and will be capable of manipulating water levels on Mason Lake.

Since the Neenah Creek Appraisal Report was written (1992), the dam at Big Spring has been removed and the lake drawn down (Spring 1993).

Nonpoint Source Pollutants

- The Mason Lake subwatershed contains 13 (inventoried) animal lots which contribute 242 pounds of phosphorus, annually. This represents 12 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Mason Lake subwatershed is 4606 tons, annually, or 29 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 87 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Mason Lake subwatershed is 676 tons, annually, or 47 percent of the streambank/lakeshore watershed load.

Water Resource Objectives

Reduce agricultural sediment and nutrient inputs in the identified problem areas.
Improve fish habitat.
Improve public access.
Consider removing the dam at Big Spring.
Limit future stream channelization.
Consider changing Mason Lake Association to a Lake District.

South Branch Neenah Creek Subwatershed (SB)

Subwatershed Description

The South Branch Neenah Creek subwatershed is the smallest of the 10. It is made up of only 3 square miles, or 2 percent of the total Neenah Creek Priority Watershed area. SB lies in the southwestern corner of Douglas Township, with a small, southern piece of the subwatershed entering into Lewiston Township. The main water resource of SB is the section of South Branch Creek from its source at Mason Lake (T14N, R8E, S31), flowing east until it joins Neenah Creek near the Columbia-Marquette county line. There are no lakes in this subwatershed, but the land is marshy near Briggsville (T14N, R8E, S32).

Streams

S. Branch Neenah Creek is short (3.2 miles), but wide. Its average width is 43 feet. The bottom consists mostly of silt. It is classified as warm-water sport fishery and was treated in 1970 for carp eradication.

Water Quality Conditions - Streams

Fish surveys indicate a presence of warm-water sport, rough, and forage species in S. Branch Neenah Creek. Macroinvertebrate indices are poor as to be expected where silt is the dominant substrate. Habitat rating was good. Water chemistry results pointed out the following:high average temperatures, low dissolved oxygen,high pH, and low alkalinity.

Because this is a short stream which originates from Mason Lake, water quality characteristics are primarily dictated by the lake. Resource objective is to maintain and increase the current diversity of warm-water sport fishes. This may best be accomplished by stabilizing or reversing the trophic status of the lake itself.

Nonpoint Source Pollutants

- The South Branch subwatershed contains no (inventoried) animal lots.
- The upland sediment delivery in the South Branch subwatershed is 193 tons, annually, or 1 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 97 percent of the sediment load in the subwatershed.
- Sediment delivered from streambanks and lakeshores in the South Branch subwatershed is 5 tons, annually, or less than one percent of the entire streambank/lakeshore load.

Water Resource Objectives

Maintain and increase the current diversity of warm-water sport fishes.

Lower Neenah Subwatershed (LN)

Subwatershed Description

The Lower Neenah subwatershed contains the easternmost tip of the Neenah Creek Priority Watershed where Neenah Creek joins the Fox River (T13N, R9E, S4). Straddling the Marquette-Columbia county line, the LN subwatershed has portions in four townships — Douglas, Lewiston, Moundville and Fort Winnebago. LN is 15 square miles in area, or 9 percent of the total priority watershed area. It contains no lakes, and Lower Neenah Creek is the only named stream, while there are several unnamed tributaries and channels. Refer to map 3-4.

Streams

Lower Neenah Creek is that portion (9.1 miles) downstream of the confluence of S. Branch Neenah Creek. Flow is easterly along the Columbia-Marquette county line until joining the Fox River. There the stream is wide and sluggish. Average width is 50 feet. Tributaries include the South Branch of Neenah Creek, Big Slough and several drainage ditches.

Two unnamed creeks were also studied, one at T14N, R8E, S35, and the other at T14, R8E, S36. The former is the main channel of a networked drainage system. Both flow southerly joining Neenah Creek at the Columbia-Marquette county line. Gradient and flow are low. Average width is between 6-8 feet.

Water Quality Conditions - Streams

Fish surveys of Lower Neenah Creek show a warm-water fishery with several "nuisance" species such as carp present, but not abundant. Carp eradication took place in 1970 as part of

the Upper Fox River Project. Classification for the creek's fishery is warm-water sport. Low numbers of brown trout were recovered in the upper portions of this section of creek. Historical biotic indices are fair. No recent data are available for water chemistry and habitat assessments. Monitoring emphasis was placed on Middle and Upper Neenah Creek and sampling stations were not chosen for this lowest section of the stream. Bottom substrate is mostly silt.

Much of the shoreline in this area has been left in natural cover. Wetland tracts are common. Also common are drainage ditches and so-called "muck" farms. These most likely contribute greatly to sediment and nutrient loads in Neenah Creek.

The potential of this section of stream is as an improved warm-water sport fishery. Limiting factors include rough fish recruitment from the Fox River. Also inhibiting fish habitat is excess siltation and lack of instream cover. Resource objectives should include: 1) correct farming practices causing sediment and nutrient loading (NPS), and 2) control sediment and nutrient inputs from tributaries (NPS) (see S.Branch Neenah Creek).

Regarding the two unnamed creeks, a recent fish survey recovered only a limited number of forage species, mostly tolerant. Habitat assessment was poor because of heavy silt and the channelized nature of the stream. Macroinvertebrate index was poor. Water chemistry revealed low average dissolved oxygen and high nitrate plus nitrite values indicating possible fertilizer run-off. Silt in places is 1-2 feet in depth. Macrophytes are abundant. Bottom substrate is silt in both creeks. The streams are unclassified but support a limited warm-water forage fishery.

Primary water quality concerns relate to the influx of sediments and nutrients these and other ditches carry to Neenah Creek. Resource objectives include: 1) limiting future channelization (NPS), and 2) remediation of agricultural practices contributing to sediment and nutrient loading (NPS).

Nonpoint Source Pollutants

- The Lower Neenah subwatershed contains 1 (inventoried) animal lot which contributes 36 pounds of phosphorus, annually. This represents 2 percent of the barnyard-related phosphorus for the entire watershed.

- The upland sediment delivery in the Lower Neenah subwatershed is 171 tons, annually, or 1 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 68 percent of the sediment load in the subwatershed.

- Sediment delivered from streambanks and lakeshores in the Lower Neenah subwatershed is 80 tons, annually, or 6 percent of the entire streambank/lakeshore load.

Water Resource Objectives

Remediate agricultural practices causing nutrient and sediment loading. Control sediment and nutrient inputs from tributaries (see South Branch Subwatershed) Limit future stream channelization.

Big Slough Subwatershed (BS)

Subwatershed Description

The largest and southernmost subwatershed, Big Slough is 37 square miles, or 22 percent of the total priority watershed area. It lies almost entirely in Columbia County, with a large center section in Lewiston Township and other parts east in the town of Newport and west in Fort Winnebago. Running through this subwatershed is an 8-mile tributary to Neenah Creek called Big Slough. It has several of its own unnamed tributaries. While the Wisconsin River lies just to the south, Big Slough flows from south to north, to Neenah Creek, which ultimately joins the Fox River, another northerly flowing stream. While there are no lakes, large wetland areas exist throughout the basin. Refer to map 3-4.

Streams

As previously stated, Big Slough is tributary to Neenah Creek. It flows northerly about 8 miles in Columbia County before joining Neenah Creek near the Marquette-Columbia county line. It originates in a swampy area (T13, R8E, S35) and is of very low gradient throughout. The lower 2 miles are sufficiently wide to allow for boating. Width of Big Slough proper averages 520 feet with maximum depth about 10 feet. It is the major boating and fishing resource of the area.

Also studied was the major un-named tributary (T13N, R8E, S16) that joins the upper reaches of Big Slough. The flow is easterly and it joins Big Slough east of Adney Road. It is heavily channelized and fed by numerous drainage ditches. Width is roughly 8 feet, and bottom substrate is silt. Gradient and flow are very low. There is a limited forage fishery present.

Water Quality Conditions - Streams

Big Slough is a warm-water fishery with a potential for improvement. Bottom substrate is of sand and "muck." The fishery is warm-water with a historical carp problem. Carp are probably at "nuisance levels." Panfish are overabundant and stunted. The fish manager would like this to be managed as a panfishery.

Stream sampling stations were upstream of the Big Slough itself. Habitat was judged to be poor. Macroinvertebrate indices were poor. There was low average dissolved oxygen. Of primary water quality concern in this subwatershed is the preponderance of ditched waterways. Large tracts of wetlands have been converted to cropland or other farming use,

and therefore, significant nutrient and sediment inputs are made to Big Slough and eventually to Neenah Creek.

Preliminary water resource objectives here are three-fold: 1) correct agricultural practices causing sediment and nutrient loading (NPS), 2) increase wetland holdings to maintain wildlife habitat and biodiversity, and 3) improve panfishery (FM).

In the unnamed tributary, fish communities at sampling sites consist almost exclusively of tolerant and very tolerant species. Macroinvertebrate index was poor. At one sampling site, no invertebrates were recovered (perhaps due to pesticide runoff). Habitat has been judged fair. High conductivity values and nitrate plus nitrite values were measured indicating possible agricultural fertilizer runoff. Silt is up to 1-2 feet deep in places.

So-called "muck" farms are common throughout the area. Extensive tracts of wetlands have been converted for farming. Drainage ditches criss-cross the area. Resource objectives are: 1) remediate agricultural practices contributing to sediment, nutrient and pesticide runoff (NPS), and 2) minimize future ditching (NPS).

Nonpoint Source Pollutants

- The Big Slough Subwatershed contains 13 (inventoried) animal lots which contribute 562 pounds of phosphorus, annually. This represents 29 percent of the barnyard related phosphorus for the entire watershed.

- The upland sediment delivery in the Big Slough Subwatershed is 3122 tons, annually, or 20 percent of the entire upland load. Upland erosion is the major source of sediment in this subwatershed, contributing 100 percent of the sediment load in the subwatershed.

- Most of the streams in the Big Slough subwatershed are ditched and dredged. Although there is erosion from these practices, estimates of sediment loading were not made.

Water Resource Objectives

Remediate agricultural practices contributing to sediment, nutrient and pesticide loading. Increase wetland holdings to maintain wildlife habitat and biodiversity. Improve panfishery. Minimize future ditching.

Results of Nonpoint Source Inventories

Barnyard Runoff

Runoff carrying a variety of pollutants from barnyards and other livestock feeding, loafing, and pasturing areas is a significant source of pollutants in the streams of the Neenah Creek Watershed. Livestock operations comprised of 58 (inventoried) animal lots are a source of 1964 pounds of phosphorus per year (table 3-2). Most of the oxygen-demanding pollutants and nutrients associated with these operations drain via concentrated flow to creeks and wetlands. An additional 20 animal lots drain to closed depressions and add nutrients to groundwater.

Table 3-2. Barnyard Inventory Results: Neenah Creek Watershed

Subwatershed	Number of Barnyards	Total Phosphorous[1] (lbs)	Percent Watershed Phosphorus Load
Upper Neenah (UN)	2	133	7
Oxford Lake (OL)	5	29	1
Crooked Lake (CL)	1	16	1
Jordan Lake (JL)	0	0	0
Widow Green (WG)	14	764	39
Middle Neenah (MN)	9	182	9
Mason Lake (ML)	13	242	12
South Branch (SB)	0	0	0
Lower Neenah (LN)	1	36	2
Big Slough (BS)	13	562	29
Totals	58	1964	100

[1] Based on Annual Phosphorus Loads
Sources: Adams, Marquette and Columbia County LCD(s), DNR and DATCP

Upland Sediment

Intensive agricultural practices have caused considerable amounts of eroded soil to reach streams, ponds, and wetlands in the Neenah Creek Watershed over time, with most probably occurring since the 1940s. Upland erosion is the major source of the sediments that are carried downstream, beyond individual subwatershed boundaries.

Upland sediment sources were evaluated through sampling of the entire watershed (169 square miles). The results of this inventory are summarized in tables 3-3 and 3-4. An estimated 15,637 tons of soil per year are delivered to wetlands or streams in the watershed from uplands (of this, 14,800 comes from cropland). An additional 167 tons/year are delivered from grassland, pastures, and woodlots. Uplands are the source of 92 percent of the sediment delivered to surface waters. The remaining eight percent of sediment delivered comes from streambank and shoreline erosion. Figure 3-1 and table 3-4 summarize upland sediment loading by land use for all subwatersheds. Figure 3-2 represents Neenah Creek land use and cropped acres.

Table 3-3. Tons of Upland Sediment Delivered

Subwatershed	Tons/Year	Percent
Upper Neenah (UN)	10	0
Oxford Lake (OL)	2,432	16
Crooked Lake (CL)	460	3
Jordan Lake (JL)	372	2
Widow Green (WG)	1,186	8
Middle Neenah (MN)	3,085	20
Mason Lake (ML)	4,606	29
South Branch (SB)	193	1
Lower Neenah (LN)	171	1
Big Slough (BS)	3,122	20
Totals	15,637	100

Based on WINHUSLE model
Sources: Adams, Marquette and Columbia County LCD(s), DNR and DATCP

Figure 3-1. Summary of Upland Sediment Loading by Land Use: All Subwatersheds

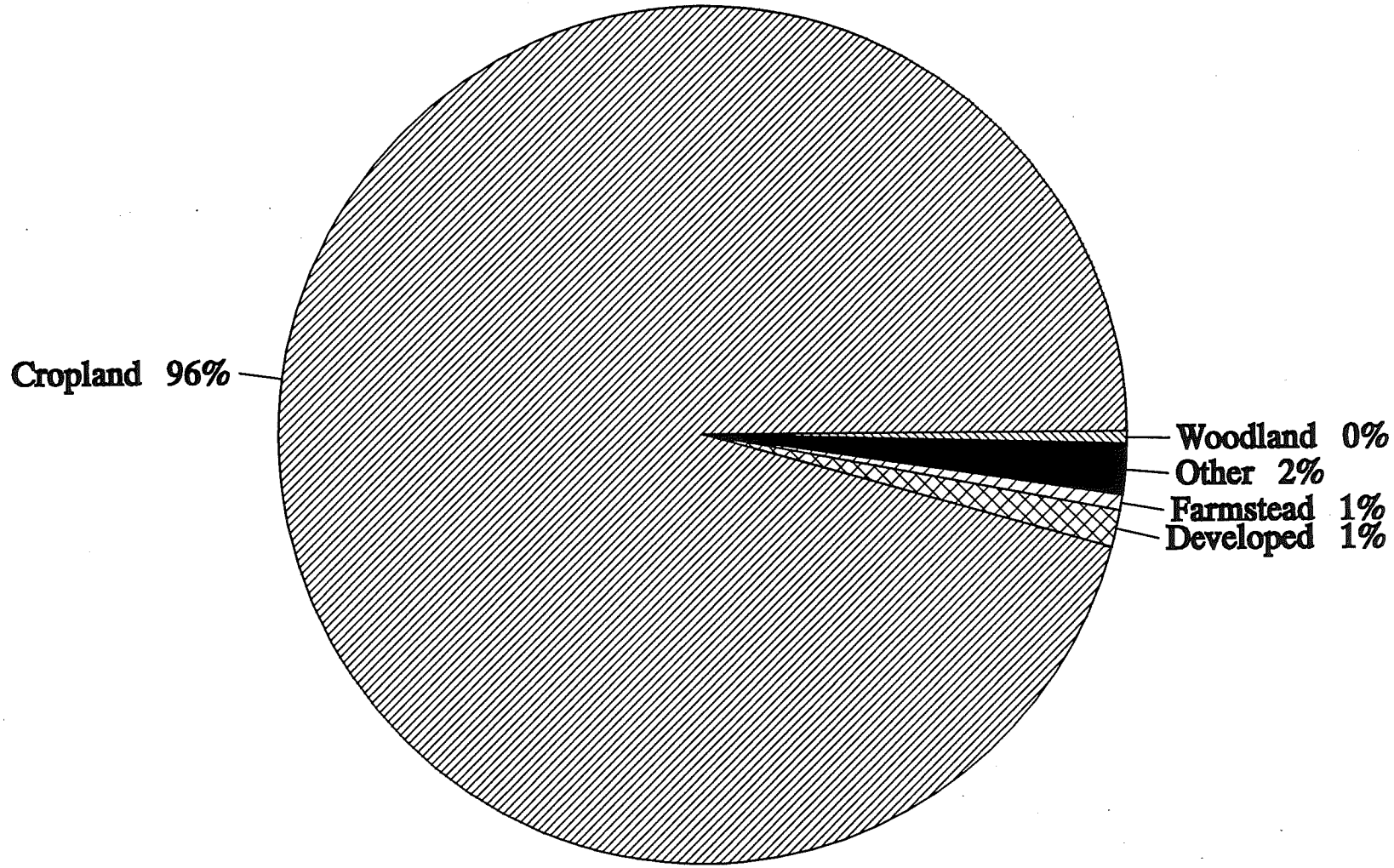
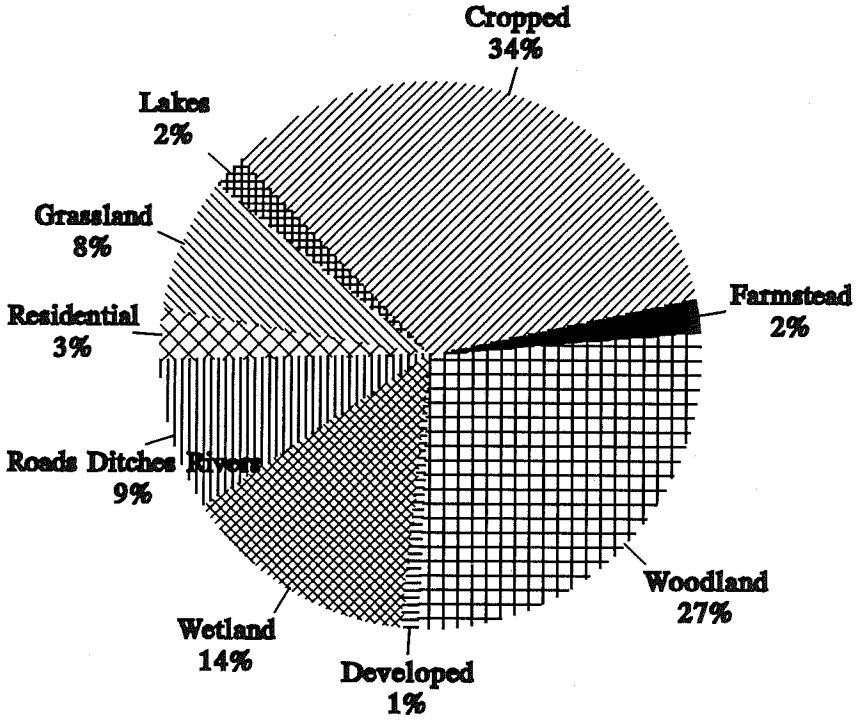
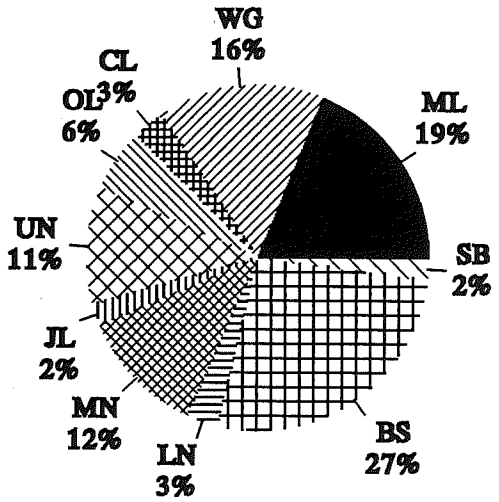


Figure 3-2. Neenah Creek Land Use and Cropped Acres



Land Use (Total) by Acres



Distribution of Cropped Acres

Table 3-4. Land Use and Sediment Delivery in Neenah Creek

	Cropped	%	Grass	%	Residential	%	Developed	%	Wetland	%	Woodland	%	Farmland	%	Lakes	%	Other	%	Total	%
Upper Neenah	3,949	20	2,747	14	2,307	11	248	1	663	3	9,625	48	161	1	426	2	72	0	20,198	19
	10	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
Oxford Lake	2,236	44	452	9	94	2	223	4	376	7	1,572	31	55	1	14	0	46	1	5,068	5
	2,213	91	0	0	7	0	150	6	24	1	2	0	34	1	0	0	1	0	2,432	16
Crooked Lake	1,018	45	151	7	66	3	60	3	336	14	620	27	20	1	64	3	0	0	2,335	2
	308	67	0	0	6	1	36	8	13	3	68	15	4	1	0	0	24	5	460	3
Jordan Lake	661	15	1,127	26	253	6	44	1	103	2	1,961	45	59	1	213	5	145	3	4,566	4
	90	24	1	0	5	0	5	0	1	0	0	0	0	0	0	0	270	76	372	2
Widow Green	6,028	53	1009	9	56	0	0	0	1124	10	2947	26	162	1	0	0	2	0	11,328	11
	1,181	100	1	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	1,187	8
Middle Neenah	4,485	57	375	5	12	0	16	0	1,483	19	1,398	18	135	2	0	0	11	0	7,915	7
	2,993	97	0	0	1	0	22	1	35	1	0	0	34	1	0	0	0	0	3,085	20
Mason Lake	7,189	47	840	6	185	1	0	0	647	4	5,424	35	221	1	918	6	0	0	15,424	14
	4,560	99	0	0	45	1	0	0	1	0	1	0	0	0	0	0	0	0	4,607	29
South Branch	708	33	247	12	44	2	10	0	873	41	224	10	37	2	0	0	0	0	2,143	2
	170	88	0	0	0	0	0	0	14	7	0	0	8	4	0	0	0	0	193	1
Lower Neenah	936	19	166	3	52	1	0	0	2,164	44	1,533	31	80	2	0	0	0	0	4,931	5
	157	92	0	0	0	0	0	0	3	2	1	0	9	5	0	0	0	0	170	1
Big Slough	10,016	42	1,213	5	252	1	104	0	7,333	31	4,140	18	572	2	0	0	0	0	23,630	22
	3,118	100	0	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	3,123	20
TOTAL	37,226	34	8,327	8	3321	3	705	1	16,102	14	29,444	27	1,502	2	1,635	2	276	0	97,538	91
	14,800	95	2	0	68	0	217	1	91	0	74	1	89	1	0	0	295	2	15,637	100
Roads, Ditches, Rivers not inventoried with WINHUSLE																			9,718	9
TOTAL LANDUSE																			107,256	100

Shaded Area = ACRES
White Area = SEDIMENT DELIVERED (TONS/YEAR)

- "Grass" includes CPR, hay, natural, pasture
- "Developed" includes industrial, mining, commercial
- "Wetland" includes wildlife habitat
- "Other" includes recreational, public, irrigated cropland

- **All numbers are based on the WINHUSLE model.**

Source: DNR, Adams, Marquette and Columbia County LCD's.

Streambank Erosion

Streambank erosion contributes 4 percent of the total sediment to surface waters in the Neenah Creek Watershed. Approximately 117 miles of streams were evaluated. Significant erosion has occurred and/or aquatic habitat and water quality were degraded along approximately 5 miles (4%) of streambank. An estimated 762 tons of sediment are eroding into streams annually. Streambank erosion may be higher during periods of ditch cleaning. Stable streambanks are very important for habitat. See table 3-5 for streambank inventory results.

Shoreline Erosion

There are 21 named lakes in the Neenah Creek Watershed, with approximately 30 miles of shoreline. Shoreline erosion is estimated to contribute 698 tons annually to the lakes, which is 4 percent of the total sediment delivered to surface waters. See table 3-9 for inventory results. While the inventory does not identify shoreline erosion as a major sediment problem, there may be areas where shoreline habitat is being affected where erosion is severe.

Winter-Spreading of Manure

Manure spread on frozen or saturated ground is a significant water quality problem in this watershed. The water quality concern happens in the spring when manure has not been incorporated into the soil, surface water runoff is high, and manure is carried to lakes and streams. Preliminary calculations indicate that at least 10,000 to 18,000 pounds of elemental phosphorus (23,000 to 41,000 pounds P205) are applied to frozen fields in this watershed annually. This calculation assumes an average 65-head dairy operation with 40 replacement stock, and 180 days of manure production. Calculated pounds of phosphorus produced is based on The Livestock Waste Facilities Handbook. Although the amount of phosphorus runoff in the spring cannot be easily predicted, it is assumed to be a significant pollutant.

The percentage of the manure, and hence phosphorus, spread in the winter that reaches surface waters is unclear. Scientific opinion ranges from 25 percent to 75 percent delivery rate. Even on 2-5 percent slopes when buffers are present some manure is assumed to reach surface waters. As a rough estimate, phosphorus loading from winterspread manure is usually thought to be at least as great as from barnyards or uplands. Landowners are strongly encouraged to follow a nutrient management plan, and all livestock owners are eligible for cost-sharing to have a nutrient management plan written.

See figure 3-3 for summary of nonpoint sources of sediment and phosphorus in Neenah Creek Watershed. Table 3-7 shows phosphorus loading by land use in lake watersheds and table 3-8 shows sediment loadings by subwatershed.

Table 3-5. Streambank Erosion

Subwatershed	Total Length (feet)	Degraded Length (E+T+S)(feet)	Percent Degraded	Total Sediment Loss (t/yr)	Sediment from Agricultural Impact (t/yr)	Percent Sediment Impact by Livestock Access	Length Trampled (feet)	Percent Trampled
Upper Neenah	63,360	785	1	191	84	44	0	0
Oxford Lake	45,440	0	0	0	0	0	0	0
Crooked Lake	56,920	222	0	2	0	0	100	0
Jordan Lake	No Streams							
Widow Green	68,640	2,645	4	124	114	38	2,471	4
Middle Neenah	141,396	8,379	6	35	0	0	6,850	5
Mason Lake	64,416	11,500	18	318	233	73	1,800	3
South Branch	29,832	200	1	5	0	0	0	0
Lower Neenah	86,568	790	1	80	0	0	0	0
Big Slough	63,360	0	0	0	0	0	0	0
Totals	619,932	24,521	4	755	431	50	11,221	2

Adams County—inventoried ditched areas (80-90% of problems). Marquette and Columbia Counties did not include ditches.

Figure 3-3. Nonpoint Sources of Sediment and Phosphorus of Neenah Creek Watershed

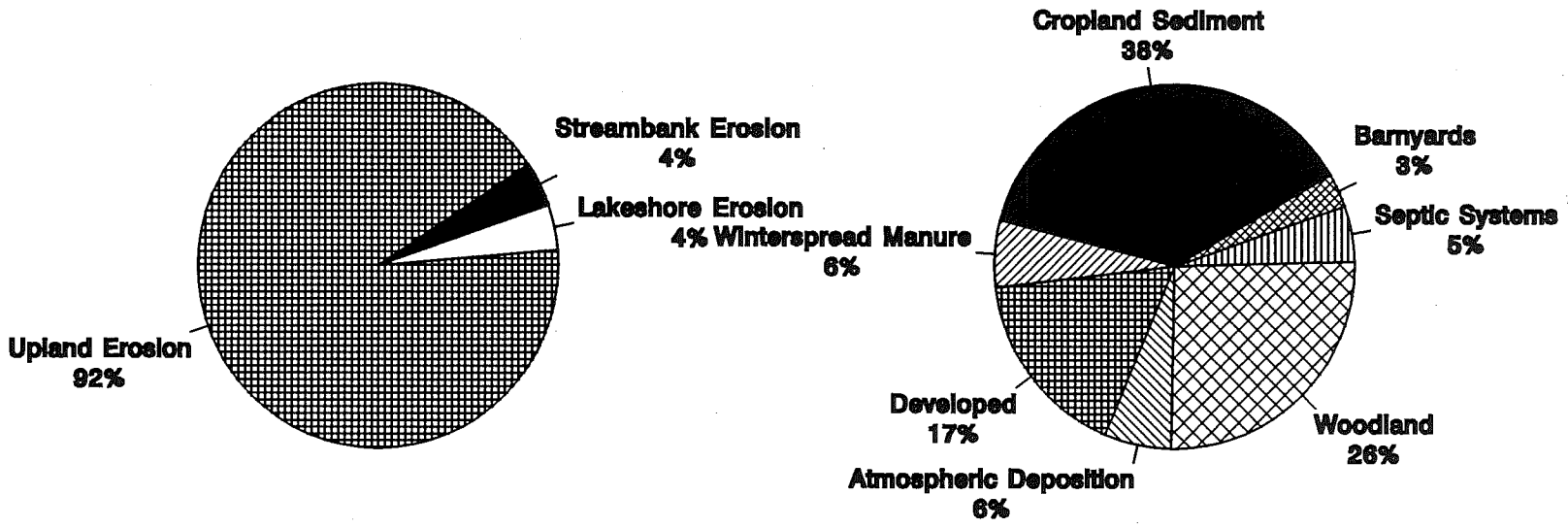


Table 3-7. Phosphorus Loading by Land Use in Lake Subwatersheds Only

Subwatershed	Annual P Loading Barnyards (lbs)	%	Annual P Loading Cropland (lbs)	%	Annual P Loading Streambanks and Shoreline (lbs)	%	Annual P Loading Woodland	%	Annual (P) Loading Developed (lbs)	%	Annual P Loading Winterspread Manure (lbs)	%	Total P Loading Septic Systems (lbs)	%	Total P Loading Atmospheric Deposition (lbs)	%	Total P Loading (lbs)	%
Upper Neenah	133	3	570	11	5	0	1925	37	1916	37	145	3	308	6	240	5	5242	100
Jordan Lake	0	0	216	21	0	0	392	38	223	21	0	0	106	10	106	10	1043	100
Mason Lake	242	4	4144	61	7	0	1085	16	139	2	582	9	200	3	428	6	6827	100
Totals	375	3	4930	38	12	0	3402	26	2278	17	727	6	614	5	774	6	13,112	100

Table 3-8. Sediment Loading by Subwatershed

Subwatershed	Uplands (tons)	%	Streambanks (tons)	%	Shoreline (tons)	%	Total (tons)
Upper Neenah	10	2	191	38	296	60	497
Oxford Lake	2432	100	6	0	4	0	2442
Crooked Lake	460	96	2	0	18	4	480
Jordan Lake	372	94	0	0	22	6	394
Widow Green	1186	91	122	9	0	0	1307
Middle Neenah	3085	99	35	1	0	0	3120
Mason Lake	4606	87	358	6	358	7	5282
South Branch	193	97	5	3	0	0	198
Lower Neenah	171	68	80	32	0	0	251
Big Slough	3122	100	0	0	0	0	3122
TOTAL	15,637	92%	798	4%	698	4%	17,133

Note: Percents are calculated by row, not by column.

Table 3-9. Shoreline Erosion Inventory Results: Neenah Creek Watershed

Erosion Level	Subwatershed	% of Total Shoreline	Total Sediment Loss (tons/year)
Severe erosion	ML	30%	358
Moderate erosion	UN	10%	296
Mild erosion	OL,CL,JL	5%	44
Totals			698

Residential and Urban Nonpoint Sources

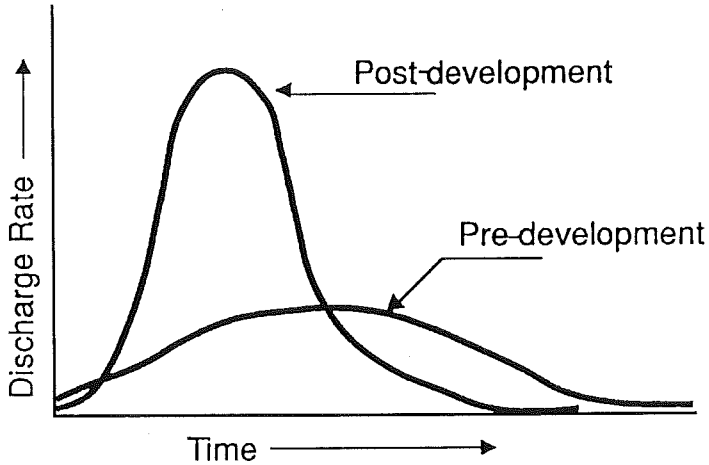
Residential Nonpoint Sources. Neenah Creek watershed is predominantly rural, but includes the village of Oxford and the unincorporated community of Briggsville. Residential and developed areas account for only 4% of the total land use. However, the loadings from developed areas and septic systems may contribute up to 22% of the total phosphorus. Control of residential pollution will be achieved primarily through information and education activities. To support these activities, a general description of urban and residential nonpoint sources of pollution is included.

Residential runoff carries a variety of pollutants to surface water. Some pollutants are specific to residential runoff while others are also found in runoff from agricultural areas. Pollutants found primarily in residential runoff include heavy metals (lead, copper, zinc, cadmium and chromium) and a large number of toxic organic chemicals (PCBs, aromatic hydrocarbons, esters and many others). Other substances in residential runoff that are also found in runoff from rural areas include sediment, nutrients, bacteria and other pathogens, and pesticides.

Runoff from residential areas also affects stream characteristics. For example, as pavement and rooftops prevent rainwater and snowmelt from soaking into the ground, water runs off the surface at a much higher rate. Streams crest sooner and at much higher levels than prior to residential development. See figure 3-4 for hydrographics illustrating pre- and post-development stream flow rates. Consequently, in some areas groundwater recharge is reduced and dry-weather stream flows decrease to below minimum levels needed to sustain fish and aquatic life.

In effect, residential runoff produces "flashy" streams with temperatures and chemical characteristics which limit animal life and recreational uses. Streambank erosion may increase as high and low flow extremes occur. Flooding of adjacent property may also occur.

Figure 3-4. Pre- and post-development hydrographs



In addition to these typical residential nonpoint sources, there are numerous other sources which need additional attention, including construction site erosion, and in-place contamination resource extraction industries. Each of these represent potential causes of lake use impairment. All of these factors, many of which are addressed by WPDES stormwater permit requirements, undoubtedly contribute, in varying degrees, to lake use impairment.

Residential Land Use

Highways, commercial areas, and high density residential areas are the greatest collectors of sediment, lead, and zinc on a per acre basis. Medium density residential areas are less important sources of sediment and lead, but are significant sources of pesticides, bacteria, and household or automotive maintenance products dumped into ditches and storm sewers. Low density residential areas, particularly in the lakeshore areas, are important where the improper use and disposal of pesticides, fertilizers, and automotive maintenance products may occur.

The potential for lawn care chemicals to be carried by runoff from shoreline areas and nearby drainage ways to the lakes is a concern. Most lawns are groomed to the edge of the water and many are devoid of plants. Fertilizers and herbicides appear to be commonly used in those areas with direct drainage to the lakes. These factors undoubtedly contribute to lake use impairment.

In general, the pollutants in residential runoff depend on the configuration of "source areas." Source areas—characterized by streets, parking lots, rooftops and lawn areas—are present in different proportions depending on the type of land use. For example, residential areas contain more lawn area than commercial areas, while commercial areas have more rooftop, street, and parking lot surfaces. Lawns can be important sources of fertilizers and pesticides. Rooftop areas are important sources of zinc and atmospheric pollutants. Their connection is to surface water either directly through storm sewers or indirectly across lawns, down streets or ditches depending on the use of downspouts, grassed areas, drain tiles, etc. Streets in large urban areas are sources of significant amounts of lead, cadmium, sediment, and other pollutants, depending on their condition and the amount of traffic.

Stormwater Conveyance

Stormwater is most commonly conveyed to streams and lakes through a combination of storm sewers, roadside ditches, grassed swales, and/or detention ponds. Storm sewers transport runoff rapidly with no "pretreatment" or filtering of the runoff before it enters streams. Properly designed grassed swales generally transport lesser amounts of runoff because of infiltration, and vegetation serves to remove some pollutants from the runoff before it flows into lakes, streams, or storm sewer systems.

Construction Site Erosion

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 (including ditches) resulting from sedimentation can cause localized flooding. Importantly, water quality improvements occurring through implementation of nonpoint source control practices for existing residential areas can be negated by these pollution sources.

Predicting rates of construction site erosion is difficult. However, erosion rates exceeding 75 tons/acre/year can occur. This rate of erosion is greater than what occurs on the most severely eroding croplands and is 65 times the sediment loading rate from existing commercial and industrial areas.

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

Pollutant Reduction Goals

Pollutant load reductions are developed according to activities needed to achieve the water quality objectives. The following is a summary of reductions to be targeted for the entire watershed.

Sediment Goal: Reduce overall sediment delivered by 40 percent. To meet this goal, the following is needed:

- 40 percent reduction in sediment reaching streams from agricultural uplands in all subwatersheds.
- 75 percent reduction in streambank sediment delivered to all streams and 100 percent overall repair of streambank habitat in all subwatersheds.

Phosphorus and Organic Pollutant Goal: reduce overall phosphorus load by 40 percent. To meet this goal, the following is needed:

- 75 percent reduction in organic pollutants from barnyards in all subwatersheds.
- 40 percent reduction in organic pollutants from winterspread manure on "unsuitable" acres.
- 30 percent reduction in phosphorus reaching streams from agricultural uplands in all subwatersheds.

Groundwater Goal: Proper abandonment of private wells no longer in use where other NPS control measures are implemented and cost-shared.

- Implementation of Nutrient and Pest management practices on irrigated vegetable crops.

In addition, this plan calls for a restoration of 10 percent of degraded or converted wetlands.

Other Pollution Sources

This section describes pollution sources that have an impact on water quality in the Neenah Creek Watershed, but which are beyond the scope of this project. Control of these pollution sources occurs through other state and county regulatory programs, as described below.

Municipal and Industrial Point Sources of Pollution

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface water resources. The village of Oxford and the Oxford Federal Correctional Institute have municipal wastewater treatment plants that discharge to surface water. Chapter 147, Wis. Stats., requires any person discharging pollutants into the waters of the state to obtain a Wisconsin Discharge Elimination System (WPDES) Permit.

Village of Oxford Wastewater Treatment Plant

The village of Oxford WWTP discharges to Neenah Creek. Treatment of wastewater is through a stabilization lagoon with sand filters, built in 1980. It is operating well within its design capacity, serving 446 people in 1990. It was designed to serve 850 people.

Federal Correctional Institute - Oxford

This WWTP discharges to groundwater. Treatment of wastewater is through lagoons, built in 1986.

Refer to the Upper Fox River Areawide Water Quality Management Plan for additional details on municipal and industrial pollution sources.

Status of the NR 217, the Point Source Phosphorus Effluent Limitation Rule

The Phosphorus Rule was passed in June, 1992 by the DNR Board. It was approved by the legislature in Fall, 1992. The Rule requires both municipal and industrial point sources with surface water discharge points to remove phosphorus from their effluents to 1.0 ppm. Industries that generate 60 pounds of phosphorus per month and municipalities that generate 150 pounds per month must comply. It will take 3–8 years before all facilities are on line. The Oxford wastewater treatment plant (Neenah Creek Watershed) generated less than the required 150 pounds per month, and so will not be covered under NR 217.

Failing Septic Systems

Septic systems consist of a septic tank and a soil absorption field. Septic systems fail due to soil type, location of system, poor design or poor maintenance. Although septic systems are common within the Neenah Creek Watershed, the majority of soils throughout the watershed are not suitable for conventional septic tank absorption systems. Unsuitable soils allow for a greater potential of developing water quality problems.

There are a variety of soils in the watershed and this information is general and not all-inclusive. There are small areas scattered within the watershed where the soils have a moderate permeability rate. However, the majority of soils in the watershed tend to have an excessive permeability rate with poor filtration such as the sands, sandy loams or loamy

sands, or a slow permeability rate and/or a high water table such as the peats, mucks and silts. Septic systems located within these groups of soils can contribute to the pollution of both groundwater and surface water. Pollutants from septic system discharges include nitrates, bacteria, viruses and hazardous materials from household products.

The Wisconsin fund is a Private Sewage System Replacement Grant Program offering financial assistance designed to help eligible homeowners and small business operators offset the costs of replacing a failing septic system. The program is administered by each county's Zoning Department. The grant program applies to principle residences and small businesses built prior to July 1, 1978 and is subject to income and size restrictions. Seasonal homes are not eligible for participation in this program. Columbia County has been using the Wisconsin Fund since 1979; Adams County has been using it since 1992; and Marquette County has opted not to use the Wisconsin Fund. Interested individuals should contact their local Zoning Department for more information.

Solid Waste Disposal Sites

There are no active landfills in the watershed, but there are several abandoned landfills in Oxford and Lewiston townships.

Sites listed as Waste Disposal Sites are from the DNR's "Registry of Waste Disposal Sites in Wisconsin" (February, 1990) which lists known solid and hazardous waste disposal sites. The list includes active, inactive and abandoned sites. Inclusion on the list does not mean that environmental contamination has occurred, is occurring, or will occur in the future. The registry is a source of general information as to the location of waste disposal sites in Wisconsin. See table 3-10.

Table 3-10. Waste Disposal Sites (February, 1990)

Site Name	Location
John Barth Landfill	Lewiston
Donald Schwanz Property	Lewiston
Brakebush Brothers	Oxford
Wisconsin DNR	Oxford
Village of Oxford	Oxford

Petroleum Storage: Leaking Underground Storage Tank (LUST) Sites

There are no Superfund sites in the Neenah Creek Watershed.

Active Leaking Underground Storage Tank (LUST) sites are listed in table 3-11. Sites listed are currently in some phase of investigation or cleanup and are on the "List of Active Leaking Underground Storage Tanks" (April 13 1992).

Table 3-11. Leaking Underground Storage Tanks (April, 1992)

Site Name	Location	Status	Substance
Mason Station	Briggsville	Investigation	Unknown Hydrocarbons
Oxford Elem. School	Oxford	Investigation	Unleaded Gasoline
Riesen Family Restaurant	Oxford	No Action	Unknown Hydrocarbons

Remedial Action - Cleanup in progress.
No Action - No action taken yet.
Investigation - Field investigation of source and extent of contamination underway.
Unknown - No status report at time of printing.

Other Contaminated Sites

Spills listed below, from the "Spills Summary Report", (DNR April 30, 1991), include spills reported to the DNR only. Locations of the spills are approximate in most cases.

The Wisconsin Remedial Response Site Evaluation Report (PUBL-SW-144-91) also has the Inventory of Sites or Facilities Which May Cause or Threaten to Cause Environmental Pollution and the Spills Program List which includes sites or facilities identified under the Hazardous Substance Spill Law. See table 3-12.

Table 3-12. Spills (April, 1991)

Location	Action	Substance
Oxford	Clean Up	Morphaline
Oxford	Investigation	Ammonium phosphate
Oxford	Investigation	Gasoline
Oxford	Investigation	Fuel Oil
Oxford	Investigation	Disel Fuel

No Action - No on-site investigation.
Investigation - On-site assessment to confirm release, identify potential responsible parties, assess environmental harm and direct potential responsible party to take action.
Cleanup - WDNR hired cleanup contractor.

Wind Erosion

Wind erosion is a major problem in this watershed. According to the Adams County Erosion Control Plan (1987) an average of 2.0 T/A/Y soil is lost due to water erosion while 4.3 T/A/Y is the average soil loss due to wind erosion. Of the townships in the watershed, New Chester has the worst wind erosion problem, losing 5.3 T/A/Y to wind but only 2.7 T/A/Y to water erosion.

Damages caused by wind erosion include on-site damages to crops. In 1984 an estimated 10% of total cropland and 23% of irrigated cropland were damaged, with financial losses estimated at $857,371. Off-site damages also occur. For example, blowing soil and decreased driver vision is blamed for several automobile accidents.

Wind-eroded soil is also a water quality problem. According to "Wind Erosion Impacts on Water Quality in the Sand Plain of Central Wisconsin" (Oberhofer, 1993), "wind erosion is perceived to be a major contributor to the area's water quality problems. Wind eroded soil is periodically deposited in the extensive network of drainage ditches..."

The study collected wind blown debris deposited in drainage ditches. Surface water grab samples were also taken. Results include the following: a) 85,440 pounds of soil per acre of stream surface were deposited in one of the study ditches following a wind event, b) total phosphorus concentrations ranged from 0.200 to 7.25 mg/l in surface water grab samples, and c) 19 different pesticides were present in the drainage ditches.

Sand and Gravel Mining

There is a sand and gravel extraction pit in Jackson Township, Adams County.

Land Application of Municipal and Industrial Wastes

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

Land application of municipal and industrial sludge is regulated under NR 204 and NR 214 respectively which require a WPDES permit, site criteria, minimum distances from wells, application rates to ensure that environmental and public health concerns such as proper soil types, depth to groundwater, distance from surface water, and the type of crop to be grown on sludge amended fields are taken into consideration when the DNR approves agricultural fields for sludge application.

Compost

The Columbia County Recycling Center applies "compost" to designated lands via a DNR permit. Most of the municipalities (cities, villages and townships) have mandatory recycling

where pre-sorting recyclables reduces the total volume of trash. The trash is digested and becomes "compost" suitable for land application. Plastics and other undigested large objects are removed through a series of screens prior to land application.

The compost is tested regularly for nutrients, metals and other materials. If the compost meets stringent DNR permit requirements, it is applied to nearby fields where field corn will be planted. The nutrients are utilized by the corn. The soils are also routinely tested for adverse affects.

This innovative digesting and composting process may become more widely used in the future as landfill space becomes more difficult to find. This process represents a unique type of "nutrient management" and protection of water quality.

The city of Portage also has a digester. It has test plots and they monitor soil conditions and potential groundwater affects.

Atmospheric Phosphorus and Nitrogen

Due to human practices which disturb land and encourage wind erosion or point source air emissions, phosphorus and nitrogen become suspended in the air, often being attached to sediment particles. The concentrations of phosphorus and nitrogen vary regionally. As noted on figure 3-3, these nutrients can settle out and may be a significant source of nutrients to surface waters. Some of the BMPs used in this watershed project will help to reduce atmospheric phosphorus and nitrogen contributions.

Agricultural Chemicals

As mentioned in the Water Resource portion of Chapter Three and in the nutrient and pest management portion of Chapter Four, chemicals applied to agricultural lands may be degrading water quality and may not be improved through this watershed project.

Agricultural and Household Clean Sweeps

To help reduce excess chemicals on farms and in residential homes, the DATCP sponsors "Clean Sweep" days. On these days people are encouraged to bring their excess hazardous chemicals to specific sites, and the DATCP pays for disposal. Both Adams and Columbia Counties have held agricultural and household clean sweeps and intend to hold more.

Geese

Geese are abundant in the Neenah Creek Watershed. Although no monitoring was done in this watershed to determine phosphorus loading to surface waters by geese, an extensive study was done on Green Lake in Green Lake County in 1978.

Geese density and watershed topography are presumed to be similar between Green Lake and the Neenah Creek Watershed, particularly on Mason Lake and other areas where geese are a major concern.

The Green Lake Study concluded that the 60-70,000 geese present contribute roughly 5% of the phosphorus load to the lake. Because Mason Lake freezes sooner than Green Lake, the 5% estimate is likely to be high for Mason Lake.

Several management practices were tried; none were very successful. Practices tried include: a) aeration on Grand River Marsh, to keep water open into January and to draw geese away from the lake; b) open-water hunting on Green Lake; and c) extended hunting season.

DNR staff conclude that phosphorus loading due to geese is insignificant in the Neenah Creek Watershed, and that BMPs to reduce the phosphorus loadings have not been shown to be effective.

CHAPTER FOUR
Recommended Management Actions: Control Needs and Eligibility for Cost-Share Funding

Introduction

This chapter describes the management actions developed to meet the pollution reduction goals established during the water resource appraisal process. (See page 86 for a summary of identified pollutant reduction goals.) Also, the criteria which determine the eligibility of each pollutant source for cost-share funding through the nonpoint source program are described in this chapter.

Management Categories

Nonpoint source control needs are addressed by assigning "management categories" to each major type of nonpoint source pollution (barnyards, manure spreading, upland fields, streambank and shoreline erosion or streambank habitat degradation sites). Management categories define which nonpoint sources are eligible for financial and technical assistance under the priority watershed project. Categories are based on the amount of pollution generated by a source, and the feasibility of controlling the source. Management category eligibility criteria are expressed in terms of **tons of sediment** delivered to surface waters from eroding uplands, streambanks and lakeshores; **pounds of phosphorus** delivered annually to surface waters from barnyards; **the ratio of manure produced to of suitable acres** available for land-spreading; and the **feet of streambank trampled** by cattle. A definition of each management category is given below. Following this are the criteria used to define the management categories for each pollutant source.

The criteria used to define these management categories must be confirmed at the time that the county staff visit on-site. A source may change management categories depending on the conditions found at the time of the site visit. A management category may be revised up to the point that a landowner signs a cost-share agreement. Any sources, created by a landowner, requiring controls after the signing of a cost-share agreement must be controlled at the landowner's expense for a period of ten years.

Management Category I

Nonpoint sources included in this category contribute a significant amount of the pollutants impacting surface waters. A reduction in their pollutant load is essential for achieving the water quality objectives in the watershed project.

Nonpoint sources in Category I are eligible for funding and/or technical assistance under the priority watershed project. As a condition of funding, all sources in Management Category I must be controlled if a landowner wishes to participate in any aspect of the watershed project.

Management Category II

Nonpoint sources in this category collectively contribute less of the pollutant load than those in Management Category I. These nonpoint sources are identified and included in cost-sharing eligibility to further insure that water quality objectives for pollutant controls are met. Nonpoint sources in this category are eligible for funding and/or technical assistance under the priority watershed project. Controlling sources in this category is not mandatory for a landowner to be funded for controlling other sources.

Management Category III

Nonpoint sources of pollution in this category do not contribute a significant amount of the pollutants impacting surface waters and are not eligible for funding and/or technical assistance under the priority watershed project. Other Departmental programs (e.g. wildlife and fisheries management) can, if warranted, assist county project staff to control these sources as implementation of the integrated resource management plan for this watershed. Other federal programs may also be applicable to these lands.

Conclusions from the Neenah Creek Watershed Water Resource Appraisal Report (Herman and Schenck, 1992) indicate that the control of barnyard runoff is critical to the success of this project. While reduction of sediment from all sources is a goal of the project, phosphorus reduction will be the primary objective of this project.

Criteria for Eligibility and Management Category Designation

Croplands And Other Upland Sediment Sources

Upland Erosion: As mentioned, upland erosion represents 92 percent (15,637 tons) of the total sediment load to streams in the watershed. A 40 percent reduction in sediment from eroding fields is targeted for agricultural lands. This translates into bringing all lands that are contributing sediment to streams at a rate greater than .4 tons/acre/year down to

.4 tons/acre/year. On average, soil loss is roughly 5-10 times sediment delivery. To be in Category I, landowners' fields must be contributing greater than .4 tons/acre/year of sediment and/or soil loss greater than "T". The average sediment delivery rate for all subwatersheds is 0.16 tons/acre/year, and ranges from .02 to .63. This category will control an estimated 4700 acres of cropland, and 39 percent of the watershed's upland sediment load.

An additional 6 percent of the sediment load delivered to the stream will be controlled through Category II, Category II includes those landowners with fields delivering sediment at a rate between .2 and .4 tons/acre/year. See table 4-1.

Table 4-1. Upland Sediment Erosion Eligibility Criteria in the Neenah Creek Watershed

Upland Erosion					
Management Category Control	Eligibility Criteria Sediment Delivery * (tons/acre/year)	Soil/Loss (tons/acre/year)	Percent Control	Tons Controlled	Acres Controlled
I	>. 4 •	or > T	39%	6098	4610
II	between .2 and .4	< T	6%	938	NA
III	< .2	—	—		

Source: DNR, Adams, Columbia, Marquette County LCDs
• Ranges from 8 to 75% by subwatershed. Based on WINHUSLE model run at 50% participation.
* By field

See table 4-2 for Rural Uplands Targeted for Sediment Control

Gully Erosion

Gully erosion has not been identified as a significant problem in this watershed, therefore, only a cursory field inventory of gully erosion was done. Any significant gullies identified during implementation will be evaluated to determine if they are critical sediment sources and eligible for cost sharing. Gullies identified through this process will be Category II for eligibility, and must meet criteria: in table 4-3.

Table 4-2. Rural Uplands Targeted for Sediment Control

Subwatershed	Total Load Inventoried (tons/yr)	Cropped Acres	Management Category I		Management Category II		Estimated Control (%)
			Control (tons/yr)	Control (%)	Control (tons/yr)	Control (%)	
Upper Neenah	589	3,949	155	26	0	0	26
Oxford Lake	2380	2,236	1249	52	0	0	52
Crooked Lake	752	1,018	120	16	93	12	22
Jordan Lake	356	661	269	75	37	11	80
Widow Green	2724	6,028	607	22	327	12	28
Middle Neenah	8183	4,485	2198	27	781	9	32
Mason Lake	6011	7,189	3114	52	248	4	54
South Branch	242	708	112	46	16	7	49
Lower Neenah	13,164	936	8879	67	na	na	67
Big Slough	3846	10,016	319	8	na	na	8
Totals	na	37,226	na	39%	na	6	42%

- The estimated control is assumed to be one half of the Category II fields and all of the Category I fields, based on WINHUSLE model and 50% participation.
- Due to the routing techniques of the model, total sediment is not additive by subwatershed.

Table 4-3. Gully Erosion Criteria in the Neenah Creek Watershed

Management Category Control	Eligibility Criteria
I	none
II	sites with: 1)gully depths of at least 3 vertical feet; 2)bare soils and evidence of active erosion; 3)direct connection with streams and lakes via channelized flow during runoff events; and 4)reasonable access to necessary machinery.

Animal Lot Runoff

To achieve the water quality objectives in the Neenah Creek Watershed Project, the phosphorus and other pollutants contained in animal lot runoff must be controlled at a high level (see tables 4-4 to 4-6). There are 58 inventoried livestock operations in the watershed that drain to surface water. Operations that contribute over 50 pounds of phosphorus to surface water per year are classified as Category 1. Thirteen barnyard segments fall into this category. Reducing the phosphorus contribution from each barnyard in Category 1 to 15 pounds of phosphorus would yield 74% reduction. All barnyards must reduce the

phosphorus load to 15 pounds or less to be eligible for cost sharing and meet the pollution reduction goal.

There are another 13 operations that produce between 15 and 50 pounds of phosphorus annually and are classified as Category 2. Reducing the phosphorus contribution in Category 2 to 15 pounds per barnyard will yield 10 percent reduction. Only low-cost practices such as roof gutters and clean water diversions are eligible for cost sharing for Category 2.

Landowners receiving cost sharing for animal lot runoff (Waste Management System, SCS Std. 312) are required to do a nutrient management plan (SCS Std. 590) for their operation. They are eligible for 50% funding to do so. Eligible Nutrient and Pest Management practices include the development of both nutrient management (SCS Std. 590) and pest management (SCS Std. 595) plans, soil testing and crop scouting.

If the animal lot runoff system does not include waste collection, handling or storage, it is exempt from the nutrient management plan requirement. Such systems could consist of clean water diversion work such as: Roof Runoff Management (588), Livestock Exclusion (472), Clean Water Diversion (362).

Internally Drained Animal Lots

Twenty internally drained yards were identified in the Neenah Creek Watershed. Initial determinations of eligibility for internally drained animal lots will be based on the same phosphorus loading and design target criteria as lots that drain to surface water. Based on this criteria, it is estimated that 15 animal lots meet Category 1 criteria and 2 lots meet Category 2 criteria. High amounts of phosphorus indicate potentially high amounts of nitrates and, therefore, the likelihood of groundwater contamination.

Actual need for BMPs will be determined by county watershed staff. This determination will be based on threat to groundwater pollution from manure due to depth to water table, soil texture, depth to and type of bedrock, and other site conditions. Where the potential for impact to groundwater caused by an internally drained lot is uncertain, field investigations may be conducted jointly by the county project staff, water resource management investigators from the Department's Southern District Office, and staff from DATCP.

Table 4-4. Barnyards Targeted for Runoff Control

		Management Category I			Management Category II			Category III
Subwatershed	Total Phos. (lbs)	Yards (#)	Control (lbs)	Control (%)	Yards (#)	Control (lbs)	Control (%)	Yards (#)
Upper Neenah	133	1	128	96%	0	0	0	1
Oxford Lake	29	0	0	0	0	0	0	5
Crooked Lake	16	0	0	0	1	9	56%	0
Jordan Lake	0	0	0	0	0	0	0	0
Widow Green	764	3	704	94%	0	0	0	11
Middle Neenah	182	3	116	64%	1	5	3%	6
Mason Lake	242	2	105	43%	4	81	33%	10
South Branch	0	0	0	0	0	0	0	0
Lower Neenah	36	0	0	0	2	21	58%	0
Big Slough	562	4	393	70%	5	82	14%	8
Totals	1964	13	1446	74%	13	198	10%	41

Table 4-5. Animal Lot Runoff Eligibility Criteria—Neenah Creek Watershed

Management Category	Phosphorus Load per Barnyard	Number of Barnyard Segments	Pounds Reduced	Percent Reduction
I	greater than 50 lbs	13	1445	74%
II	between 15 and 50 lbs	13	200	10%
III	less than 15 lbs	41	NA	NA