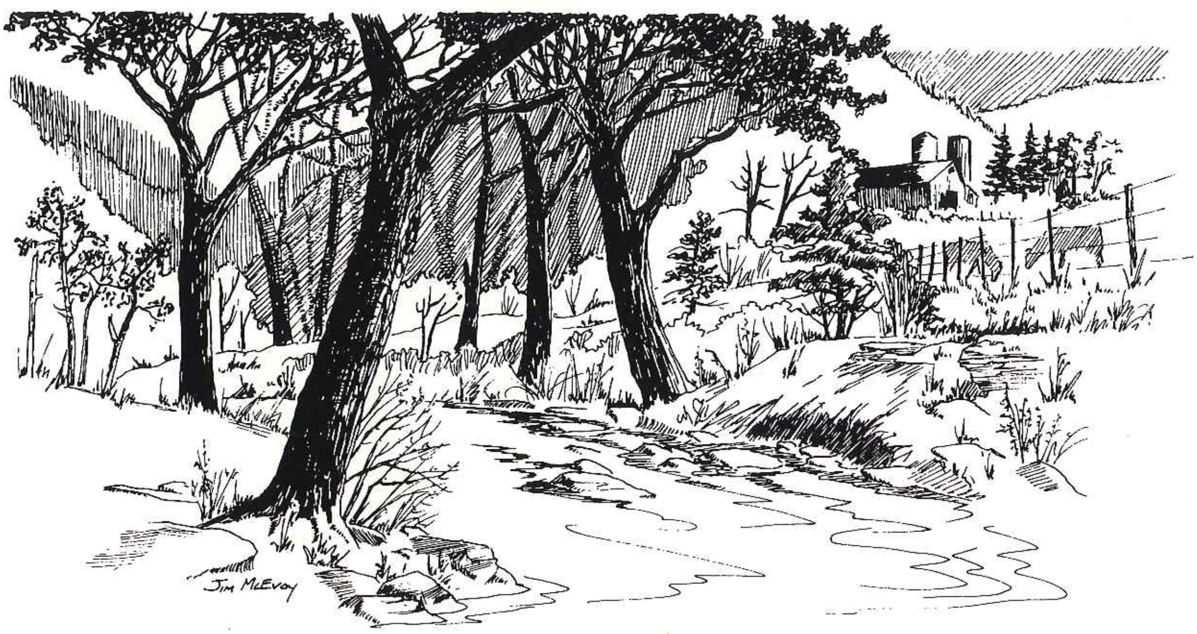
A Nonpoint Source Control Plan for the Waumandee Creek Priority Watershed Project



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

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

The Wisconsin Nonpoint Source Water Pollution Abatement Program

March 1990

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and

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EARTH YEAR
WISCONSIN
1970 April 22 1990

Publication WR-247-90

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Madison, Wisconsin 53707
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IN REPLY REFER TO: 2600

March 9, 1990

Mr. Leslie Winsand, County Board Chair
Buffalo County Courthouse
Alma, WI 54610

Dear Mr. Winsand:

It is my pleasure to approve A Nonpoint Source Control Plan for the Waumandee Creek Priority Watershed. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been approved by Buffalo County, as well as by the Wisconsin Department of Agriculture, Trade, and Consumer Protection. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abate Program necessary to support the project.

This approval letter also amends the nonpoint source control plan to the Buffalo-Trempealeau River Basin Areawide Water Quality Management Plan.

I appreciate the high degree of cooperation on this project with the County Land Conservation Department. I especially want to commend the County Conservationist, Gregg Stangel for his hard work. Protection of the trout streams, the Mississippi River Backwater Complex, and the resources at Merrick State Park are important goals for the county and the entire State of Wisconsin.

I look forward to our working together in carrying out the recommendations of the Waumandee Creek Priority Watershed Plan.

Sincerely,

C. D. Besadny
Secretary

Buffalo County
Land Conservation Department
Courthouse Annex
Alma, WI 54610
608-685-3560

February 9, 1990

Mr. C. D. Besadny, Secretary
Wisconsin Department of Natural Resources
101 S. Webster Street
P.O. Box 7921
Madison, Wisconsin 53707

Dear Mr. Besadny:

The Buffalo County Land Conservation Committee functioning as the Designated Lead Agency as appointed by the Nonpoint Source Pollution Abatement Section of the Wisconsin Department of Natural Resources, has assessed the water quality conditions of the Waumandee Creek Watershed.

Inventory results of the watershed has lead to the development of an implementation plan that 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 Waumandee Watershed. The implementation plan for the Waumandee Creek Priority Watershed has been reviewed by the public during a public hearing which was held on February 1, 1990.

The Land Conservation Committee has reviewed the implementation plan and approves of the goals and objectives as well as the procedures for implementing the project.

We would also like to request at this time that the Local Assistance and Nonpoint Source Grants for the Waumandee Watershed receive funding as outlined in the implementation plan. We would ask that the maximum advance amounts for both Local Assistance and Nonpoint Source Grants be awarded to Buffalo County immediately so that implementation of the watershed project can begin promptly.

Mr. C. D. Besadny
February 9, 1990
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Thank you for your cooperation in making the Waumandee Creek Priority Watershed a success.

Sincerely,

William Wojchik, Sr.

William Wojchik, Sr.
Chairman
Land Conservation Committee

WW:ds

cc: Mr. Mike Llewelyn

State of Wisconsin
Department of Agriculture, Trade & Consumer Protection
Howard C. Richards
Secretary
801 West Badger Road
P.O. Box 8911
Madison, WI 53708

February 27, 1990

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

Dear Mr. Baker:

The Department has had the opportunity to thoroughly review the Nonpoint Source Control Plan for the Waumandee Creek Priority Watershed Project. We hereby approve this watershed plan and look forward to assisting the Department of Natural Resources and Buffalo County in implementing this project. It is our understanding that the Buffalo County Board has approved the plan at their February 20 meeting.

I am especially pleased with the efforts by Jim Bachuber, Irene Olson, and others on your staff to assist DATCP watershed planner Keith Foye to develop a prototype rural implementation strategy chapter for this plan. Development of a standard implementation chapter was essential for DATCP to complete its responsibilities under the new administrative rules for this plan, as well as three other plans scheduled to be completed by March. The staff vacancies in the SWRM Section has made this ambitious schedule difficult, but attainable with the cooperation that has existed between the two agencies.

If I or any members of my staff can be of any further assistance please let me know.

Sincerely,

James A. Johnson, Director
Land and Water Resources Bureau
AGRICULTURAL RESOURCE MANAGEMENT DIVISION
(608) 267-9788

JAJ:KWF

cc: Nicholas Neher
Dave Jelinski
Mike Llewelyn

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

SUMMARY

INTRODUCTION

The Waumandee Creek Priority Watershed Project plan assesses the nonpoint sources of pollution in the Waumandee Creek Watershed and guides the implementation of nonpoint source control measures. These control measures are needed to meet specific water resources objectives for Waumandee Creek and its tributaries, as well as the adjacent Mississippi River backwater complex. Nonpoint sources of pollutants most commonly found in this watershed include: 1) polluted runoff from barnyards and feedlots; 2) sediment from cropland erosion; and 3) sediment from eroding streambanks. The purpose of this project is to reduce the amount of pollutants originating from nonpoint sources that reach surface water and groundwater within the Waumandee Creek Priority Watershed Project area.

The plan was prepared by the Wisconsin Department of Natural Resources (DNR), the Department of Agriculture, Trade, and Consumer Protection (DATCP), and the Buffalo County Land Conservation Department (LCD), with assistance from the University of Wisconsin-Extension. The DNR selected the Waumandee Creek Watershed as a priority watershed project through the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1985. It joined 32 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 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 DNR and DATCP. The Buffalo County LCD will administer the project on the local level with assistance from UW-Extension and the Soil Conservation Service (U.S. Department of Agriculture).

GENERAL WATERSHED CHARACTERISTICS

The Waumandee Creek Watershed drains 204 square miles of land in Buffalo County in western Wisconsin. The steep ridge and valley terrain conveys surface water into the Mississippi River and the backwater complex of wetlands associated with it, either by direct runoff or via Waumandee Creek and its tributaries. The Waumandee Creek Watershed was divided into 13 smaller drainage areas, called subwatersheds, for this planning effort (Figure 1).

Land use in the watershed, as shown in Table 1, is mainly agricultural, and is currently dominated by dairy farming. The watershed population is small -- approximately 3,300 people. About half of the population lives on farmsteads outside of incorporated areas. Less than one percent of the watershed land area is occupied by urban land uses.

Table 1. Land Use in the Waumandee Creek Watershed

Land Use	Percent of Watershed
Agricultural	55%
pasture, grazed woodlot (15%)	
cropland, grassland (40%)	
Woodland	41%
Urban	1%
Wetlands, surface water (Mississippi River backwater complex not included)	3%

WATER QUALITY

Streams throughout the watershed suffer from moderate to severe bank erosion, and extensive channelization has occurred in some portions. Streams that were at one time cold, clear, and lined with gravel riffles (conditions favorable for trout reproduction) have become blanketed with deposits of silt, sand, and muck. Elevated streambeds and increased runoff have resulted in downstream flooding and the loss of stream-side lands. It is suspected that the loss of streambank cover and stream-side vegetation have raised in-stream temperatures and have caused dissolved oxygen levels to fall. These degraded conditions are generally attributed to streambank damage resulting from cattle walking the streambed and banks.

All of the watershed's streams were assessed as to their current recreational and biological uses and their potential recreational and biological uses if nonpoint source pollutants were controlled. The following three creeks were identified as currently supporting good quality (Class III) cold water sport fisheries with strong potential for improvement to Class II trout fisheries: Weiland Valley Creek, upper Little Waumandee Creek, and Eagle Creek. The rest of the streams have varying levels of potential to support cold or warm water fisheries. The details of these assessments are discussed later in this watershed plan.

Also of concern are the effects of pollutants from nonpoint sources in the Waumandee Creek Watershed on the Mississippi River backwater complex situated at the outlet of the watershed. Both sediments and nutrients from the watershed settle into the backwater areas of the Mississippi River, destroying valuable wildlife habitat. Pollutants from nonpoint sources are filling in the ponds and wetlands of the backwater complex, and its lifeblood -- a well-oxygenated fresh water supply from Waumandee Creek -- is being degraded. These sources are also likely causing the high summer bacteria counts observed at Merrick State Park beach.

SOURCES OF POLLUTION

The Buffalo County LCD 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 creek was calculated. The amount of sediment reaching streams from eroding agricultural lands and streambanks was also determined. In the Waumandee Creek Watershed, about one-half of the sediment deposited in streams annually is derived from agricultural upland erosion. It is likely that fine sediments originating from upland fields are carried downstream and are filling in the ponds and wetlands of the backwater complex. The other half of the sediment reaching creeks originates from streambank erosion. These coarse sediments appear to be settling locally in creek bottoms.

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

1. <u>Barnyard Runoff Inventory Results</u>:

   - 331 barnyards were assessed
   - 62 barnyards were found to contribute 50% of the organic pollutants that reach creeks
   - 12 barnyards were identified as having the potential to adversely impact groundwater

2. <u>Manure Spreading Inventory Results</u>:

   - About 5,700 total acres have manure applied
   - 215 landowners apply manure
   - About 3,250 acres have high pollution potential
   - About 90 landowners spread on 15 or more acres which have high pollution potential

3. <u>Streambank Erosion Inventory Results</u>:

   - 300 miles were inventoried (25 streams)
   - Involves 195 landowners
   - 12,085 tons of sediment reach streams from eroding sites
   - There are 61 miles of eroding sites (20% of streambanks inventoried)
   - Weiland Valley Creek and Little Waumandee Creek have the highest rates of erosion per stream mile
   - 50% of sediment is from the Buell Valley, Middle, and Upper Waumandee subwatersheds

4. <u>Upland Sediment Inventory Results</u>:

   - 123,287 acres were inventoried
   - 12,096 tons of sediment are delivered to streams:
     - 55% from cropland
     - 30% from grazed woodlots
     - 12% from pastures
   - 10,500 acres contribute 50% of the sediment that reaches creeks (involves 280 landowners)
   - 50% of sediment is from the Buell Valley, Upper Little Waumandee, and Eagle Valley subwatersheds

POLLUTANT REDUCTION LEVELS

To improve water quality in Waumandee Creek, its tributaries, and the Mississippi River backwaters, this plan calls for:

1. a 50% reduction in the sediment reaching streams from agricultural lands

2. an 80% reduction in streambank sediment in the following creeks which have the potential to support Class II trout fisheries: Weiland Valley, upper Little Waumandee, and Eagle creeks

3. a 60% reduction in streambank sediment along all other creeks

4. the restriction of livestock from all perennial creeks where there is evidence of trampling, streambed damage, or erosion from livestock use

5. a 70% reduction in organic pollutants from barnyards in the following subwatersheds which have high quality creeks: Buell Valley, Upper Little Waumandee, and Eagle Valley subwatersheds

6. a 50% reduction in organic pollutants from barnyards in all other subwatersheds

7. a 70% reduction in organic pollutants from winter-spread manure on "unsuitable" acres in all subwatersheds.

MANAGEMENT ACTIONS

Management actions are described in terms of Best Management Practices (BMPs) 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 Best Management Practices. As shown in Table 2, cost share rates range from 50 to 70%.

The majority of pollutants that reach surface waters come from less than one-half of the farm operators in the watershed. All landowners eligible to receive cost share funds will be contacted by the Buffalo County Land Conservation Department during project implementation. All eligible sources of nonpoint pollutants must be controlled if a landowner wishes to participate in any aspect of the program.

The Buffalo County Land Conservation Department will assist landowners in applying Best Management Practices. 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. Participation in the program is voluntary.

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

1. Agricultural lands

   All agricultural lands contributing sediment to streams at a rate greater than 0.3 tons/acre/year will be eligible for cost sharing and must be brought down to a rate of 0.3 tons/acre/year. This involves an estimated 10,500 critical acres of cropland, or nine percent of the land in the watershed.

The Best Management Practices identified by the Buffalo County Land Conservation Department emphasize both improving farm management and controlling pollutants. Table 2 shows the eligible practices and cost share rates.

Table 2. Best Management Practices Eligible for Cost Sharing Through The Waumandee Creek Priority Watershed Project

Best Management Practice	State Cost-share Rate
Change In Crop Rotations	0%
Change From Cropland To Grassland	0%
Contour Farming	$ 6/acre
Strip Cropping	$12/acre
Field Strip Cropping	$10/acre
Field Diversions and Terraces	70%
Grassed Waterways	70%
Reduced Tillage (No Till)	$15/acre
Critical Area Stabilization	70% * +
Grade Stabilization Structures	70% +
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70% +
Fencing, single strand electric	$8/rod
Fencing, 2 strand electric	$10/rod
Fencing, 3 strand barb wire	$12/rod
Shoreline Buffers	70% * +
Barnyard Runoff Management	70%
Animal Lot Relocation	70% +
Manure Storage Facilities	70% **
Manure Spreading Management	0%
Livestock Exclusion from Woodlots	50%
Fencing, single strand electric	$5.50/rod
Fencing, 2 strand electric	$7/rod
Fencing, 3 strand barb wire	$8.50/rod

* 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.

** Maximum cost share amount is $10,000 including no more than $5,000 for manure transfer equipment.

\+ With matching county cost sharing, the state share may be increased up to 80%.

2. Animal lots

The manure from barnyards that is carried in runoff needs to be controlled at about 190 of the 330 livestock operations. The highest level of control is needed for animal lots in the Buell Valley, Eagle Valley, and Upper Little Waumandee subwatersheds. Barnyards in these subwatersheds contributing more than five pounds of phosphorus will be eligible for cost sharing and need to be brought down to five pound level. A moderate level of reduction in organic pollutants is required for all other subwatersheds. Barnyards in these other subwatersheds which contribute more than 10 pounds of phosphorus will be eligible for cost sharing and will need to be brought down to the 10 pound level.

Twelve internally drained barnyards will be evaluated for groundwater pollution potential during the implementation phase of the project.

The cost of barnyard runoff control practices range from $4,000 to $14,000.

3. Manure-spreading

Waumandee Creek project participants who winter-spread manure on more than 15 acres of "unsuitable" land will be targeted for control measures. In this project "unsuitable" lands for winter manure spreading are those lands with greater than six percent slope or which are flood prone. The Buffalo County LCD 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 small number of the manure management plans may identify the need for manure storage facilities to prevent winter manure spreading on unsuitable lands.

In addition, Buffalo County is encouraged to enact a manure management ordinance implementing requirements outlined by DATCP.

4. Streambanks

All project participants must restrict livestock access to perennial creeks in the watershed where there is evidence of trampling along the bank, damaged streambeds, or eroded streambanks from livestock. An estimated 263,000 feet of streambank in the watershed will require restricted cattle access.

In addition, all participants with identified eroding sites along Weiland Valley, upper Little Waumandee, and Eagle creeks must reduce streambank erosion by 80%. Participants along all other creeks must reduce streambank erosion by 60%. Overall, approximately 8,371 tons of sediment or 431,000 feet of streambank must be controlled in the Waumandee Creek Watershed. The restriction of livestock access may achieve all or part of this goal. Land acquisition in the form of easements may be used in the following three critical subwatersheds: the Buell Valley, Eagle Valley and Upper Little Waumandee subwatersheds.

FUNDS NEEDED FOR COST SHARING, STAFFING, AND EDUCATIONAL ACTIVITIES

Grants will be awarded to Buffalo County by the DNR for cost sharing, staff support and educational activities. Table 3 includes estimates of the financial assistance needed to implement needed nonpoint source controls in the Waumandee Creek Watershed, assuming a 75% participation rate of eligible landowners.

Table 3. Cost Estimates for the Waumandee Creek Priority Watershed Project

Type of Source		Total Cost	State Share
Cost sharing:	Uplands management	$2,865,100	$1,980,000
	Streambank protection	$2,509,000	$1,756,000
	Animal waste management	$1,961,000	$1,372,800
	Subtotal	$7,335,100	$5,108,800
Buffalo County LCD Staffing		$1,313,300	(39 staff years)
Educational activities		$29,200	
	Total	$6,451,300	

PROJECT IMPLEMENTATION SCHEDULE

Project implementation is scheduled to begin in March, 1990. 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 practices can begin as soon as a landowner has signed a cost share agreement with the Buffalo County LCD.

INFORMATION AND EDUCATION

An information and education program will be conducted throughout the project period with the Buffalo County LCD having overall responsibility for the program. University of Wisconsin-Extension staff in the county and in the area office will provide assistance. This program will be most intensive during the first four years of the project and the activities will taper off during the rest of the project. The activities will include Best Management Practice demonstrations, tours, newsletters, and public meetings.

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. Progress in this area will be tracked by the LCD and reported to the DNR and DATCP quarterly.

2. Pollutant Reduction Levels - Reductions in nonpoint source pollutant loadings resulting from changes in land use practices will be calculated by the LCD and reported to DNR and DATCP at an annual review meeting.

3. Water Resources - Changes in water quality, habitat, and water resource characteristics will be monitored by the DNR during the first two years of implementation and at the end of the project period.

PREFACE

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

Tim Babros, former WDNR Fish Manager, Black River Falls
Roger Bannerman, WDNR, Nonpoint Source and Land Management Section, Madison
Ken Baun, WDNR, Nonpoint Source and Land Management Section, Madison
Sherry Beyer, former Buffalo County Land Conservationist
Professor Fred Copes, UW-Stevens Point
Carl Duley, UW-Extension, Buffalo County
Jack Eslien, former WDNR Water Resources Biologist, Western District, Eau Claire
Donald Grasser, WDNR, Black River Falls
Diane Hills, WDNR, Bureau of Endangered Resources, Madison
David M. Kennedy, WDNR, La Crosse
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John F. Sullivan, WDNR, La Crosse
Dorothy Synstad, Buffalo County Land Conservation Department
Jim Talley, WDNR, Black River Falls
Rick Weigle, WDNR, Bureau of Community Assistance Management, Madison

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CHAPTER I. INTRODUCTION

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

SECTION ONE:

INTRODUCTION TO THE WATERSHED PLAN

CHAPTER I. INTRODUCTION

A. THE WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT PROGRAM

The Wisconsin Nonpoint Source Water Pollution Abatement Program was created in 1978 by the State Legislature. Its goal is to improve and protect the water quality of streams, lakes, wetlands and groundwater by reducing pollutants originating from urban and rural nonpoint sources. Nonpoint sources of pollutants include: eroding agricultural lands, eroding streambanks and roadsides, runoff from livestock wastes, erosion from developing urban areas, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through runoff from rainfall or snowmelt, and seepage into the ground.

The program is summarized as follows:

1) The program is administered by the Department of Natural Resources (DNR) and the Department of Agriculture, Trade and Consumer Protection (DATCP). It focuses on critical hydrologic units called priority watersheds. The program is implemented through priority watershed projects.

2) A priority watershed project is guided by a plan prepared cooperatively by DNR, DATCP, and local units of government. The watershed plan assesses nonpoint and other sources of water pollution and identifies the Best Management Practices needed to meet specific water resource objectives. The plan guides the implementation of these practices in an effort to improve water quality in the watershed.

3) The implementation of a priority watershed plan is carried out by local units of government, usually a county or counties. Water quality improvement is achieved through the voluntary installation of nonpoint source controls called Best Management Practices and the adoption of ordinances. Landowners, land renters, counties, cities, and villages, towns, sanitary districts, and lake districts are eligible to participate.

4) Technical assistance is provided to aid in the design of the Best Management Practices. State level cost share assistance is available to participants to help offset the cost of installing these practices.

5) Informational and educational activities are utilized to encourage participation.

B. PRIORITY WATERSHED SELECTION

In 1985, the Waumandee Creek Watershed, located in Buffalo County in west central Wisconsin, was designated a priority watershed project under the Wisconsin Nonpoint Source Water Pollution Abatement Program. The Waumandee Creek Watershed is shown in relation to Buffalo County and the state of Wisconsin in Figure 1. It joined 32 other priority watershed projects statewide which encompass more than three million acres in which the improvement and protection of water resources through the control of nonpoint sources of pollutants is a priority for the DNR.

Priority watershed projects are identified based on the following criteria:

1. Severity of water pollution,
2. Relative importance of nonpoint sources contribution to pollution,
3. Willingness and capability of local units of government to carry out the necessary planning and plan implementation, and,
4. Public interest shown in nonpoint source water pollution abatement.

C. PRIORITY WATERSHED PROJECT PHASES

A priority watershed project involves two phases: planning and implementation.

1. Project Planning

Project planning, the first phase of this project, included the following information-gathering and evaluation steps:

a. Determination of the conditions and uses of streams, lakes and groundwater in the Waumandee Creek Watershed.

b. Inventory of the types of land uses and the severity of nonpoint sources pollutants which affect streams, lakes and groundwater.

c. Evaluation of the types and severity of other factors which affect water quality. Examples include discharges from municipal sewage treatment plants, and natural or endemic stream and groundwater conditions.

d. Determination of levels of nonpoint source control and in-field measures necessary to improve and/or protect water quality.

e. Preparation and approval of a priority watershed plan documenting the above evaluations, implementation procedures, and costs.

This document is a summary of the planning phase findings and management implications.

2. Project Implementation

The second phase, project implementation, will begin in the Spring of 1990 following a public hearing and the approval of this plan by the DNR, DATCP, and the Board of Supervisors for Buffalo County. Implementation steps include:

a. The DNR will enter into local assistance agreements with Buffalo County. These agreements provide the funds necessary to maintain the staff and resources required for plan implementation.

b. Eligible landowners will be contacted by the staff of the Buffalo County Land Conservation Department to determine their interest in voluntarily installing the Best Management Practices identified in the plan.

c. Cost share agreements will be signed by the landowner and the county which outline the practices, costs, cost share amounts, and schedule for the installation of management practices. The practices are scheduled for installation up to five years from the date of signing.

d. The DNR and DATCP will review Buffalo County's progress and will provide assistance throughout the life of the project. The DNR will monitor improvements in water quality resulting from the control of nonpoint sources of pollutants.

D. LEGAL STATUS OF THE NONPOINT SOURCE CONTROL PLAN

The nonpoint source control plan for the Waumandee Creek Watershed was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program as described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared under the cooperative efforts of DNR, DATCP, and Buffalo County.

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

This watershed plan is a part of the Buffalo-Trempealeau Areawide Water Quality Management Plan.

E. PLAN ORGANIZATION

This plan is divided into four parts. Following this introduction, Section Two comprises the watershed assessment in chapters II through VI. Chapter II, entitled "General Watershed Characteristics", provides an overview of the cultural and natural resource features pertinent to planning and implementation efforts for the priority watershed project. Chapter III, "Pollutant Sources Evaluation in the Waumandee Creek Watershed", discusses the types of nonpoint sources of pollutants identified as problems in the watershed, and their impacts on the Waumandee Creek and its tributaries as well as the backwaters of the Mississippi River.

Chapter IV, "Establishing Water Resource Objectives and Pollutant Reduction Goals", first describes the process used to define the condition of the surface water resources in relation to the nonpoint sources of pollutants that affect these waters. Then the chapter discusses the process used to establish the target levels for reducing the amount of nonpoint pollutants entering surface waters needed to meet the water resource objectives.

Chapter VI, "Watershed Project Management Actions", then describes how pollutant reduction goals can be put into action and translates pollutant reduction goals into the numbers of acres of upland, or feet of streambank, or barnyard operations that will require pollution control measures. It also identifies nonpoint pollutant sources eligible for funding under the Waumandee Creek priority watershed project. The assessment section concludes with Chapter VI, which provides more detailed discussions of water resource conditions, nonpoint pollutant sources, water resource objectives, and management actions for each individual subwatershed.

Section Three is a detailed program for implementation, and includes Chapters VII and VIII. Chapter VII describes the means by which Buffalo County will administer the project, estimates a local assistance and management practice cost share budget, and specifies a project tracking system. Chapter VIII provides an information and education strategy and budget estimate.

The fourth section is the evaluation plan for the project. It includes Chapter IX, which is an evaluation and monitoring strategy to determine the effectiveness of the project in achieving the water resource objectives.

There are also two appendices in this plan. Appendix A includes a discussion of the methods used to assess the water quality and nonpoint source conditions in the Waumandee Creek Priority Watershed Project.

Appendix B discusses surface water biological and recreational use classification.

SECTION TWO:

THE WATERSHED ASSESSMENT

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CHAPTER II. GENERAL WATERSHED CHARACTERISTICS

A. LOCATION

The Waumandee Creek Watershed is located in west-central Wisconsin in Buffalo County (Figure 1.) The watershed is a sub-basin of the larger Buffalo-Trempealeau River drainage basin. The Mississippi River flows in a southerly direction forming a boundary along the western portion of the Waumandee Creek Watershed and the watershed is bounded to the north and south by the Buffalo River and Trempealeau River watersheds, respectively. The Waumandee Creek Watershed drains 204 square miles or about 139,239 acres, which is nearly one-third of Buffalo County. Surface water in the watershed drains into the Mississippi River and its backwater complex of wetlands either directly or via Waumandee Creek,.

B. CULTURAL FEATURES

1. Governmental Units

The Waumandee Creek Watershed lies entirely within Buffalo County. Incorporated areas of the watershed include Buffalo City, the Village of Cochrane and small, mostly undeveloped, portions of Alma and Fountain City. All are located on the western edge of the watershed bordering the Mississippi River. Unincorporated areas include all or portions of 10 surrounding townships. Public lands within the watershed include Merrick State Park, Whitman Dam Wildlife Area, and portions of the Mississippi River Fish and Wildlife Refuge.

2. Population

The population of the Waumandee Creek Watershed is estimated to be 3,307 people (Table 4). Slightly less than half (44%) reside in incorporated areas. Fountain City and Cochrane have experienced slight population increases over the last decade, while Buffalo City has lost a small percentage (one percent) of its population. The remainder of the watershed population (56%) lives outside incorporated areas in small enclaves of residential development, or on farmsteads. Overall, Buffalo County has shown a slight population decline (one percent) since the last census, a trend consistent with other agricultural counties in Wisconsin.

Table 4. Waumandee Creek Watershed Population Estimates

Buffalo City	889	27%
Village of Cochrane	567	17%
Unincorporated areas and small portions of Alma and Fountain City	1,851	56%
Total	3,307	100%

Source: 1987 official estimates, DOA Demographic Services Center

3. Land Use

Land uses in the watershed are mostly rural. Agriculture and related open space account for 55% of the drainage area. Woodlands are abundant and cover 41% of the area. Urban land uses occupy less than one percent of the watershed. The remaining rural land uses include wetlands and surface water which comprise about three percent of the watershed area (Table 5).

Table 5. Land Use in the Waumandee Creek Watershed.

Land Use	Percent of Watershed
Agricultural	55%
pasture, grazed woodlot (15%)	
cropland, grassland (39%)	
farmstead (1%)	
Woodland	41%
Urban	1%
Wetlands, surface water (Mississippi River backwater complex not included)	3%

Buffalo County experienced major changes in land use following settlement in the 1840s. Forestry gave way to wheat production, which in turn was replaced by the currently predominant dairy industry. Currently 15% (18,265 acres) of the drainage area is used for grazing, and both pastures and woodlots are grazed. In addition to dairying, mixed livestock operations including beef cattle, swine, poultry and sheep are common in the watershed. Approximately 39% (48,121 acres) is in cropland and grassland. Alfalfa hay is the major crop produced in the watershed, however corn and soybean production have steadily increased over the years, with some intensive row cropping occurring on steep slopes. Farms in the Waumandee Creek Watershed are relatively large, with the average farm size 310 acres.

4. Public Water Sources

The source of all potable water in the watershed is groundwater. The communities of Cochrane and Fountain City operate municipal water systems. The remainder of the watershed population relies upon individual, privately-owned water systems.

Fountain City and the Village of Cochrane operate the only municipal wastewater treatment facilities in the Waumandee Creek Watershed. Buffalo City is unsewered; the community treats its waste with private on-site septic systems, as do the remainder of watershed residents. An industrial wastewater treatment system is operated by the Wisconsin Dairies Cooperative in the community of Waumandee.

Figure 1: Waumandee Creek Watershed and Subwatersheds

C. PHYSICAL SETTING

1. Precipitation

The frequency, duration and quantity of precipitation influences surface water and groundwater, soil moisture content, runoff characteristics and the physical condition of waterways. The Waumandee Creek Watershed lies in the temperate continental zone which is characterized by cold, snowy winters and hot, humid summers. Average annual precipitation for the basin is about 31 inches; the majority falls in the form of thunderstorms during the growing season (May-September). About 40 inches of snow (four to five inches of rain when melted) falls during a typical winter. Runoff averages nine inches per year.

2. Topography

The Waumandee Creek Watershed is part of the unglaciated Driftless Area. In general, topography is characterized by an upland plateau dissected by a maze of steep ridges, deep narrow valleys and numerous small streams. The ridges rise 400 feet or more above the valley floors. This system of ridges and valleys (which are called coulees) makes the area's terrain some of the roughest in the state. In contrast, the western edge of the watershed bordering the Mississippi River contains an extensive lowland system of sloughs and bottomland hardwoods (which is called the backwater complex).

3. Soils

Most of the basin is underlain by soils derived from sedimentary rocks. Bedrock consists mainly of Cambrian sandstones and Prairie du Chien dolomite. Outcroppings of bedrock are common throughout the area. Nearly all of Buffalo County is covered by a layer of loess (silt glacial deposits spread over the county by westerly winds following the glaciation of surrounding lands). In valley areas, loess, alluvium (material deposited by running water) and colluvium (rock and soil accumulated at the base of a slope) form the uppermost deposits. These materials, in addition to bedrock, are the parent materials for many of the soils in the basin.

The predominant soils in the Waumandee Creek Watershed are silty soils of the rolling limestone uplands, and steep stony and rocky land. The characteristic short steep slopes in the watershed have a high potential for soil loss. Stream terraces along the Mississippi River in the vicinity of Cochrane and Buffalo City, and along valley bottoms, are composed of sandy, loamy, well-drained soils. Soils of overflow bottom lands (such as the backwater areas of the Mississippi River) are loamy alluvial and poorly drained.

D. WATER RESOURCES

1. Streams

Thirteen subwatersheds drain the land area within the Waumandee Creek Watershed. Eleven of the subwatersheds drain into the Waumandee via feeder creeks and tributaries. Runoff from the other two subwatersheds, Alma Mill and Rose Valley, flows directly into the Mississippi River (see Table 6, Table 7, and Figure 1).

Table 6. Subwatersheds of the Waumandee Creek Watershed

Symbol	Subwatershed Name	Figure No.	Page No.
AM	Alma Mill	3	43
BU	Buell Valley	4	49
DA	Danuser Valley	5	55
EA	Eagle Valley	13	87
GA	Garden Valley	6	59
RS	Irish-Waters	7	63
HN	Jahns Valley	9	71
LW	Lower Waumandee	12	83
MW	Middle Waumandee	10	75
RO	Rose Valley	3	43
SC	Schoepp Valley	11	81
UL	Upper Little Waumandee	8	67

Approximately 150 miles of streams and creeks drain the Waumandee Creek Watershed, providing numerous recreation opportunities for anglers, canoeists, hunters, and trappers. Many of these waters are spring-fed. A few creeks have escaped severe degradation and support coldwater fisheries maintained through regular stocking by local clubs and the DNR. Recent stream surveys estimate 40 miles of trout water exist in the watershed (Niebur, et al., 1989). Many more streams have the potential to support trout fisheries if nonpoint source pollutants are controlled and instream habitat is restored.

Mainstem segments and the larger tributaries of the watershed contain some warmwater sport fish communities but are generally dominated by forage fish species. These streams suffer moderate to severe bank erosion, and in some portions are extensively channelized. Good bottom substrate in many areas has been blanketed with deposits of silt, sand and muck. As the stream system receives sediment loads from uplands and eroding stream banks, downstream segments have generally become shallower, wider and warmer, and more likely to overflow their banks.

2. Lakes

Lakes are not a common feature of the driftless landscape; only a few large ponds are present in the Waumandee Creek Watershed. These ponds may contain seasonal populations of various sport fish species, however their shallow depths make them subject to winterkill conditions. Two of the ponds, Bensel and Czechville, function mainly as sediment catch basins where Waumandee Creek drops its silt load during periods of high flows. Lizzie Paul Pond is a seepage pond with a relatively small drainage area. All three ponds discharge into the backwater complex of the Mississippi River.

3. Wetlands

Approximately 5,000 acres of productive backwater and associated sloughs, bays and bayous bordering the Mississippi River are included in what is commonly referred to as the Mississippi River backwater complex, located along the southwest border of the Waumandee Creek Watershed. The backwater complex contains diverse fish habitat and is a critical spawning, rearing, dwelling and over-wintering area for fish and wildlife. These expansive wetland areas play an important role in the ecology of the Mississippi River system.

The portion of the backwater complex in the vicinity of Fountain City Bay receives most of the water carried by Waumandee Creek, as well as the pollutant load associated with it. As mentioned earlier, Bensel and Czechville Ponds play an important role in reducing sediment inputs to the backwater area, however the capacity of these ponds is limited. The backwater complex will continue to serve as an important fish and wildlife resource of the Mississippi provided freshwater inflows to it are maintained. This function is critical to maintaining oxygenated water and aquatic habitat in the backwater complex.

Table 7. Perennial Surface Waters in the Waumandee Creek Watershed

Surface Water	Length (mi.)	Subwatershed[1]
Waumandee Creek (mainstem)	28.8	
A. Above CTH EE	8.0	BU
B. Above confluence with Little Waumandee Creek	6.0	GA
C. Below confluence with Little Waumandee to Czechville Pond	14.0	ML, LW
Waumandee Creek Tributaries		
Buell Valley Creek	0.8	BU
Weiland Valley Creek	2.3	BU
Bohlinger Valley Creek	2.4	BU
Danuser Creek	5.8	DA
Dascher Valley Creek	0.8	DA
Rieckes Valley Creek	1.0	DA
Hesch Valley Creek	2.9	GA
Irish Valley Creek	5.1	RS
Waters Valley Creek	1.9	RS
Yeager Valley Creek	3.3	MW
Schoepp Valley Creek	5.2	SC
Oak Valley Creek	1.5	LW
Becker Valley Creek	1.6	LW
Little Waumandee Creek (mainstem)	15.5	
A. Above CTH E	10.5	UL
B. Below CTH E	5.0	MW
Little Waumandee Creek Tributaries		
Wolf Valley Creek	2.1	UL
Schmidt Valley Creek	1.3	UL
Jahns Valley Creek	5.3	HN
Schultz Valley Creek	1.1	MW
Florin Valley Creek	3.3	GA
Eagle Creek (mainstem)	13.5	EA
Eagle Creek Tributaries		
Joos Valley Creek	3.8	EA
Baertch Valley Creek	0.7	EA
Mississippi River Tributaries		
Belvidere Valley Creek	(dry-run)	RO
Rose Valley Creek	6.4	RO
a. above impoundment	1.4	
b. below impoundment	5.0	
(Cochrane Ditch)	5.0	
Ponds		
Czechville Pond	100 acres	LW
Bensel Pond	81.0 acres	LW
Lissie Paul Pond	44.0 acres	RO
Mississippi River Backwater Complex	>5,000 acres	Receives inflow from AM, RS, LW, EA

[1] See Table 6 for subwatershed names.

4. Groundwater

An aquifer is an underground rock or soil formation that contains water. Two major aquifers are the sources of most of the drinking water for the watershed residents. The bottom lands along the Mississippi River and Waumandee Creek contain a sand and gravel layer that holds groundwater. This layer varies in thickness from 20 to 80 feet or more. Common soils found in these locations are the Plainfield, Burkhardt, and Sparta series. These soils are sandy and allow for very quick infiltration of surface waters to the groundwater. In higher areas, in the main stem of Waumandee Creek, the soils become more silty. In general, these areas are well drained, and provide little attenuation of surface water contaminants before reaching the groundwater.

A sandstone layer made up of several geologic formations forms the bedrock layer which contains the second aquifer. This layer has been called simply the Cambrian sandstone layer (Kammerer, 1984). This is the most commonly used aquifer for the drinking water in the watershed. On the ridge tops in Buffalo County this bedrock layer is commonly within five feet of the surface, and, in places, is exposed at the surface. Along the valley bottoms, the soil layer is much deeper (20 to 80 feet or more) before reaching the top of the bedrock. The sandstone layer may be up to 800 feet in depth.

The predominant soils in the uplands are the Dubuque and Fayette series. These soils are more silty to clayey in texture (when compared to the soils of the floodplains and valley bottoms). The slopes of these soils can be gentle on the ridge tops (zero to six percent), or very severe on the ridge sides (25% or more). Although the heavier texture of these soils can provide some protection to the groundwater from infiltrating contaminants, the thin soil depths reduce the soil's attenuation capability.

Most of the values describing groundwater quality that were found in references are not specific to the watershed area. The values presented in Table 8 are from various sources and describe the groundwater quality in Buffalo County.

A general description of the quality of the sandstone aquifer can be found in the United States Geological Survey Water Resources Investigations Report titled An Overview of Ground-water Quality Data in Wisconsin (Kammerer, 1984). This sandstone layer encompasses a large area of western Wisconsin from Barron County in the north to the southern boundary of the state. The water is generally quite hard, although the dissolved solids, chlorides, and sulfate levels were below the state's drinking water standards. Iron concentrations can be an aesthetic problem in this aquifer. Of the 454 wells sampled in the Cambrian sandstone layer throughout western Wisconsin, 25% of the wells exceeded the drinking water standard for iron. Nitrate concentrations were monitored in 413 wells throughout the Cambrian sandstone layer. Less than 10% of these wells had nitrate levels exceeding the 10 mg/l (milligrams per liter) state standard.

Table 8. Summary of Groundwater Quality Data Available for Buffalo County

Information Source	Results	Comments
Grade A Dairy Farm Well Water Quality Survey Wis. Dept. of Ag. April, 1989	6 samples for pesticides: 0 detections 6 samples for nitrate: average: 3.2 mg/l range: 0.6 - 7.5 mg/l	all samples in Buffalo Co. aquifer unknown
Ground-Water Quality Atlas of Wisconsin U.S. Geological Survey 1981	11 nitrate samples: avg.= 0.7 mg/l; range: 0/0 to 4.1 mg/l 14 iron samples: avg.= 1,620 ug/l; range: 40 to 120,000 ug/l	all samples in Buffalo Co. Sandstone aquifer
Wis. Groundwater Coordinating Council Annual Report to the Legislature August, 1985	3 nitrate samples: 2 > 10 mg/l	all samples in Buffalo Co. private water supply wells aquifer unknown
Nitrate Levels in Small Public Systems of Wisconsin Wis. DNR 1980	77 nitrate samples: 3 > 10 ml/l average = 2.0 mg/l	all samples in Buffalo Co. between 1979-80; aquifer unknown

The data shown indicate that nitrate contamination of the groundwater may not be a widespread problem in Buffalo County or the Waumandee Creek Watershed. However, caution should be used in when arriving at this conclusion. First, sampling in Buffalo County has been sparse and there is not a good data base to make a determination on the current condition of the groundwater. Second, the combination of the thin soils and sandstone bedrock present a situation where contaminants on the land surface can easily be carried into the groundwater from infiltrating water. Because of these conditions, nonpoint pollutants such as fertilizers, pesticides, and livestock wastes have high potentials for infiltrating to the groundwater. A discussion of critical sites and eligibility for cost sharing is included in Chapter VII: "Rural Implementation Strategy".

E. ENDANGERED AND THREATENED RESOURCES

1. Background

Information on endangered resources was obtained from the DNR Bureau of Endangered Resources. It should be noted that comprehensive endangered resource surveys have not been completed for the entire Waumandee Creek Priority Watershed Project area. Since data files may be incomplete, the absence of records for known occurrences for any species does not preclude the possibility of their presence in the project area.

2. Threatened and Endangered Species

A wildlife inventory was sponsored by the Great River Environmental Action Team (GREAT), during the years of 1975-1979 (Fremling et al., 1979) Migratory bald eagles (Haliaeetus leucocephalus) and peregrine falcons (Falco perigrinus) (both listed as federally endangered species) and ospreys (Pandion halietus) (a state endangered species), were sighted in the Whitman Dam Wildlife Area of the Mississippi River backwater complex. Bureau of Endangered Resources data files indicate the great egret (Casmerodius albus) nests on the wildlife area, and the red-shouldered hawk, Buteo lineatus, has been sighted in the area. Both are threatened species in Wisconsin. Goldeye fish (Hiodon alosoides), a rare and endangered species in Wisconsin, occurs in the Mississippi River along the south end of the backwater complex. Forster's tern (Sterna forsteri), also an endangered species in Wisconsin, occurs in the Mississippi River sloughs, north of the levee in Pool #5. Black buffalo fish (Ictiobus niger) is a threatened species in Wisconsin and occurs in the same location.

3. Other Species of Concern

Several "species of concern" in Wisconsin occur in or near the Waumandee Creek Watershed. These are species about which some problem of abundance or distribution is suspected but not yet proven. The purpose of this category is to focus attention on certain species before they become endangered or threatened. Villous prairie clover (Petalostemum villosum) occurs near Fountain City, and the pugnose minnow (Notropis emiliae) and the mud darter (Etheostoma aspringene) occur in Fountain City Bay and in various Mississippi River sloughs bordering the southwest end of the Waumandee Creek Watershed. The American eel (Anguilla rostrata) occurs in Mississippi River Pool #5, but does not spawn in Wisconsin. The weed shiner (Notropis texanus) and pirate perch (Aphredoderus sayanus) occur in the lower portion of Waumandee Creek in the reach below its confluence with Eagle Creek. The weed shiner also occurs in the Mississippi River sloughs and in Pool #5.

4. Natural Areas

Several natural areas of state significance are located in the Mississippi River backwater complex near Fountain City Bay. These are tracts of land or water which exhibit pristine pre-settlement conditions and/or contain unique plant and animal communities. The Montana Ridge Prairie Natural Area is a 15 acre non-designated natural area which supports a dry prairie community composed of an interesting complement of native species. It is located in the Buell Valley subwatershed.

Kieselhorse Bay Cottonwoods Natural Area and Whitman Bottoms Floodplain Forest State Natural Area are both state-significant resource areas located in the Mississippi River backwater complex.

CHAPTER III. POLLUTANT SOURCE EVALUATION IN THE WAUMANDEE CREEK WATERSHED

A. INTRODUCTION

The first part of this chapter presents an overview of nonpoint sources of pollutants and their impacts on water resource conditions in the Waumandee Creek Watershed. A more detailed discussion of water quality conditions, nonpoint source control needs, and corresponding management actions for each subwatershed follows later in Chapter VI. The second part of this chapter identifies and discusses other potential sources of water pollutants in the watershed.

B. THE EFFECT OF NONPOINT SOURCE POLLUTANTS ON SURFACE WATERS IN THE WAUMANDEE CREEK WATERSHED AND THE MISSISSIPPI RIVER BACKWATERS

1. Introduction to Pollutant Evaluation

Nonpoint sources of pollutants are significant contributors of sediment, nutrients, and other pollutants to most of the creeks and ponds in the Waumandee Creek Watershed, as well as the Mississippi River backwaters. These pollutants are contributing to a decline in water quality and degradation of aquatic habitats. Under certain conditions, they have the potential to have localized adverse impacts on groundwater quality. The nonpoint sources of pollutants which were inventoried for this project and the means for evaluating their impacts on surface and groundwater resources are discussed in Appendix A, "Watershed Assessment Methods".

Rural nonpoint sources investigated included 1) barnyard runoff, 2) upland sediment delivery, 3) streambank erosion, and 4) runoff from areas winter-spread with livestock manure. The relative amount of sediment and phosphorus entering surface waters from these sources was determined.

2. Sediment and Nutrient Load Impacts

Sediment (and attached nutrients) was identified as having the most widespread and significant impact on water resources in the watershed. The delivery of phosphorus from barnyard runoff is a useful indicator of organic and oxygen-demanding substances entering surface waters. By reducing the quantity of these pollutants that reach surface and groundwater, additional quantities of other substances which degrade water quality, such as heavy metals, pesticides, and bacteria, will also be diminished.

While urban runoff can contribute to sediment and other pollutants in localized areas, the urban area in the Waumandee watershed is very small (about one percent of the entire watershed, which is less than 500 acres) and was not included in analysis of nonpoint source impacts.

For water resource appraisal purposes, the headwater tributaries in the watershed have been identified as potentially capable of supporting trout fisheries if nonpoint pollution is controlled. While some headwater creeks of the Little Waumandee are limited by low flow, most creeks in the Waumandee Creek Watershed suffer from sedimentation derived primarily from streambank erosion. Sediment has blanketed the streambeds, filling in pools and riffles, and degrading reproductive habitat for cold water fish species and associated fauna. An elevated stream bottom has resulted in flooding during high flows along lower portions of the Waumandee.

Unrestricted cattle have extensively trampled streambanks and stream bottoms along 20% of the streams in the watershed. Creeks are also locally affected by organic loads from livestock waste runoff. It is suspected that the loss of cover and vegetation, along with a shallower streambed and the presence of oxygen-demanding organic matter, have caused in-stream temperatures to increase and dissolved oxygen levels to fall. High bacteria counts have been recorded regularly during the summer months at Merrick State Park Beach, downstream of the outlet of Waumandee Creek. These conditions indicate that nonpoint pollutants are significantly affecting stream water quality in the Waumandee Creek Watershed. Streambank erosion and degradation of the stream corridor are suspected to have an adverse impact on riparian (stream-side) wildlife habitat as well.

The effects of nonpoint source pollutants on water resource conditions are evident not only in the receiving creeks of the Waumandee Creek Watershed, but in the Mississippi River backwater complex at the outlet of the watershed as well. Nonpoint pollutants carried down through the watershed empty and settle into the backwaters area of the Mississippi River, destroying the valuable habitat that supports high quality recreational opportunities and wildlife habitat. Sediment deposition studies have shown dramatic increases in sediment depth in Bensel and Czechville ponds (Figure 1), where much of the suspended sediment carried by Waumandee Creek drops out before reaching the backwaters area (Personal communication, John Sullivan, DNR Mississippi River Water Quality Specialist, La Crosse). However, the capacity of these ponds is limited.

The sediments and nutrients derived from upland sources in the Waumandee Creek Watershed do reach the backwater complex in volumes great enough to fill in fish spawning areas and smother bottom fauna, especially in the upper portions of the Fountain City Bay area. Sediment deposits have partially blocked fresh flow into the backwater area, resulting in stagnation. Nutrient loads have stimulated excessive plant and algal growth, which in turn contribute to winter oxygen depletion (Fremling, et. al. 1979).

It has been shown that a well-oxygenated fresh water supply from Waumandee Creek is a vital component of the proper functioning of the Mississippi River backwater complex (Fremling et.al. 1979). It is important that this fresh water source be protected and maintained, which means reducing the sediment and nutrient loads the Waumandee inherits as it drains the watershed.

C. NONPOINT SOURCE INVENTORY RESULTS

1. 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 creeks of the Waumandee Creek Watershed. Livestock operations comprised of 330 animal lots are a source of 5,202 pounds of phosphorus, based on a 10-year, 24-hour rainfall event. Most of the oxygen-demanding pollutants and nutrients associated with these operations drain via concentrated flow to creeks and wetlands. Twelve animal lots are internally drained and may require further investigation to determine susceptibility for groundwater contamination under these circumstances. The results of this inventory are listed in Table 9.

2. Upland sediment

Intensive agricultural practices have caused considerable amounts of eroded soil to reach streams, ponds and wetlands in the Waumandee Creek Watershed. Chemical fertilizers (containing nitrogen and phosphorus), herbicides, and pesticides are carried along with runoff, however these constituents were not evaluated in this project. Upland erosion is the major source of the fine sediments that are carried downstream, beyond individual subwatershed boundaries, which ultimately affect the ponds and Mississippi River backwaters at the outlet of the Waumandee Creek Watershed.

Upland sediment sources were evaluated for the entire watershed (193 square miles). The results of this inventory are summarized in Table 10. An estimated 623,103 tons of soil erode annually from croplands, pastures, woodlots, grassland, and other "open areas". About two percent of this amount (12,096 tons/year) are delivered directly to wetlands, streams, or ponds in the watershed. This would be the equivalent of 1,200 dump-trucks lined up, end-to-end from Alma to Cochrane, annually dumping their loads into Waumandee Creek and the Mississippi River backwaters.

Heavy grazing in areas where livestock are pastured compacts the soil and reduces organic cover, which in turn reduces water infiltration and retention. Pastured woodlands with high livestock densities comprise only five percent of the land area in the watershed, but contribute 30% of the sediment delivered to surface waters from upland sources. In contrast, unpastured woodlands comprise 41% of the land area and contribute only about one percent of the sediment load. Croplands are the source of 55% of the sediment delivered to surface waters.

The greatest amount of eroded soil from uplands that reaches streams originates in the Eagle Valley, Upper Little Waumandee, and Buell Valley subwatersheds. These three subwatersheds contribute over half of the total sediment load which reaches the Waumandee Creek system from upland sources.

Table 9. Inventory Results: Barnyard Runoff[1]

Subwatershed	Number of Barnyards	Total Phosphorus (lbs)	% Watershed P Load	Number of Internally Drained Yards
Alma Mill	5	77.2	3%	0
Buell Valley	35	636.6	12%	1
Danuser Valley	25	430.6	8%	0
Eagle Valley	42	846.3	16%	4
Garden Valley	60	663.4	13%	0
Irish-Waters	28	280.2	5%	0
Jahns Valley	12	209.9	4%	0
Lower Waumandee	24	378.1	7%	3
Middle Waumandee	37	421.0	8%	3
Rose Valley	24	490.5	9%	1
Schoepp Valley	13	201.9	4%	0
Upper Little Waumandee	25	568.9	11%	0
Total	330	5204.6	100%	12

[1]Based on ARS Model for 10-year, 24 hour rainfall
P = Phosphorus

3. Streambank erosion

Streambank erosion contributes nearly as much sediment to surface waters as upland erosion in the Waumandee Creek Watershed. Approximately 150 miles of streams were evaluated along both banks, for a total of approximately 300 miles of streambanks. Significant erosion has occurred and/or aquatic habitat and water quality were degraded along 61 miles of streambank, or 20% of all streambanks inventoried. The number of miles of degraded streambank includes sites on one or both sides of the stream. An estimated 12,085 tons of sediment are eroding into streams annually at these sites, much of it attributed to damage by cattle.

The largest volumes of sediment are eroded from the mainstem of the Waumandee and Little Waumandee Creek (53% of the total streambank sediment load). However many of the headwater tributaries to these creeks exhibit higher loading rates per stream mile than the mainstem segments. (See Table 11 for streambank erosion inventory data.) Three subwatersheds (Buell Valley, Middle Waumandee, and Upper Little Waumandee) supply over 50% of the total watershed sediment load from eroding streambanks. The Eagle Valley, Irish-Waters and Danuser Valley subwatersheds also contribute significant amounts.

Stream channelization, extensive livestock grazing along streambanks and spring areas, and cropping to the edges of streams are all common practices in the watershed. These activities have reduced stream-side vegetation and bank stability, have augmented streambank erosion, and have resulted in raised streambeds (from deposited sediment) in downstream sections. Streambank erosion can also result from natural conditions such as beaver activity, treefalls, and the stream itself as it continues to meander.

4. Runoff from areas winter-spread with livestock manure

The 214 livestock operations which were inventoried in the Waumandee Creek Watershed produce an estimated 142,000 tons of manure during the six-month period from late fall through mid-spring. This is the period when areas spread with livestock wastes have the greatest potential to become pollutant sources.

The most significant water quality problems associated with the land-spreading of livestock manure occur when wastes are spread on "critical" areas such as steeply sloped frozen ground, land in floodplains, or areas with shallow depth to groundwater. Estimates indicate livestock manure is spread on 3,264 "critical" acres from which runoff has a high potential to convey pollutants to both surface waters and groundwater.

It was estimated that approximately 5,685 acres, or five percent of the watershed, are needed to spread the manure generated during this period. Together, the operators of livestock operations own about enough suitable land (5,598 acres) to safely spread animal wastes. However, a combination of factors including climate, soil condition, malfunctioning equipment and other unpredictable situations result in spreading on unsuitable (critical) areas. In addition, individual landowners may not have enough suitable land to properly spread livestock wastes.

Table 10. Inventory Results: Upland Sediment Delivery

Subwatershed		Cropland	(%)	Farmstead	(%)	Grassland	(%)	Pasture	(%)	Woodlot	(%)	Grazed Woodlot	(%)	Commercial/ Residential	(%)	Developing	(%)	Open Water	(%)	Wetland	(%)	Totals
Alma Mill	Acres	875	35%	28	1%	133	5%	153	6%	1,252	50%	17	1%	29	1%	0	0%	0	0%	8	0%	2,495
	Soil Loss	4,516	70%	0	0%	0	0%	1,334	21%	0	0%	596	9%	0	0%	0	0%	0	0%	0	0%	6,447
	Sediment	111	69%	3	2%	0	0%	27	17%	1	0%	4	3%	16	10%	0	0%	0	0%	0	0%	162
Buell Valley	Acres	5,215	41%	178	1%	129	1%	1,455	11%	4,459	35%	1,349	11%	12	0%	0	0%	0	0%	0	0%	12,797
	Soil Loss	28,722	27%	0	0%	0	0%	16,770	16%	0	0%	60,213	57%	0	0%	0	0%	0	0%	0	0%	105,704
	Sediment	755	39%	24	1%	0	0%	259	14%	10	1%	864	45%	1	0%	0	0%	0	0%	0	0%	1,913
Danuser Valley	Acres	3,305	40%	104	1%	43	1%	1,043	13%	3,179	38%	609	7%	3	0%	0	0%	0	0%	33	0%	8,319
	Soil Loss	15,601	28%	0	0%	0	0%	9,860	18%	0	0%	29,630	54%	0	0%	0	0%	0	0%	0	0%	55,090
	Sediment	257	35%	13	2%	0	0%	163	22%	7	1%	301	40%	3	0%	0	0%	0	0%	0	0%	745
Eagle Valley	Acres	7,164	37%	209	1%	36	0%	1,901	10%	8,572	45%	1,020	5%	32	0%	0	0%	0	0%	265	1%	19,199
	Soil Loss	53,737	46%	0	0%	0	0%	14,187	12%	0	0%	48,203	42%	0	0%	0	0%	0	0%	0	0%	116,128
	Sediment	1,474	55%	24	1%	0	0%	342	13%	8	0%	831	31%	11	0%	0	0%	0	0%	0	0%	2,690
Garden Valley	Acres	4,301	48%	112	1%	60	1%	988	11%	3,277	36%	171	2%	71	1%	2	0%	0	0%	8	0%	8,990
	Soil Loss	15,628	55%	0	0%	0	0%	5,401	19%	0	0%	7,643	27%	0	0%	0	0%	0	0%	0	0%	28,672
	Sediment	374	63%	16	3%	0	0%	66	11%	16	3%	104	18%	15	3%	0	0%	0	0%	0	0%	591
Jahn's Valley	Acres	1,745	29%	45	1%	83	1%	659	11%	2,925	48%	589	10%	4	0%	0	0%	0	0%	0	0%	6,050
	Soil Loss	8,217	22%	0	0%	0	0%	4,303	11%	0	0%	25,404	67%	0	0%	0	0%	0	0%	0	0%	37,924
	Sediment	175	40%	6	1%	0	0%	46	10%	3	1%	207	47%	1	0%	0	0%	0	0%	0	0%	436
Lower Waumandee	Acres	4,513	30%	111	1%	165	1%	1,506	10%	4,920	33%	409	3%	80	1%	50	0%	0	0%	3,127	21%	14,881
	Soil Loss	26,468	54%	0	0%	0	0%	5,229	11%	0	0%	17,625	36%	0	0%	0	0%	0	0%	0	0%	49,322
	Sediment	697	69%	12	1%	0	0%	79	8%	12	1%	204	20%	2	0%	0	0%	0	0%	0	0%	1,006
Middle Waumandee	Acres	4,987	41%	158	1%	16	0%	899	7%	5,566	46%	251	2%	9	0%	0	0%	0	0%	297	2%	12,183
	Soil Loss	19,608	56%	0	0%	0	0%	4,033	11%	0	0%	11,676	33%	0	0%	0	0%	0	0%	0	0%	35,316
	Sediment	437	74%	21	4%	0	0%	73	12%	15	3%	37	6%	4	1%	0	0%	0	0%	0	0%	587
Rose Valley	Acres	4,792	42%	138	1%	267	2%	855	7%	4,156	36%	291	3%	470	4%	194	2%	101	1%	184	2%	11,448
	Soil Loss	18,415	52%	0	0%	0	0%	4,712	13%	0	0%	12,164	34%	0	0%	0	0%	0	0%	0	0%	35,292
	Sediment	504	59%	16	2%	0	0%	90	11%	17	2%	196	23%	28	3%	1	0%	0	0%	0	0%	852
Irish-Waters Valley	Acres	2,893	42%	76	1%	23	0%	855	12%	2,748	40%	322	5%	7	0%	0	0%	0	0%	15	0%	6,939
	Soil Loss	17,101	45%	0	0%	0	0%	5,666	15%	0	0%	15,429	40%	0	0%	0	0%	0	0%	0	0%	38,196
	Sediment	433	60%	9	1%	0	0%	89	12%	4	1%	185	25%	5	1%	0	0%	0	0%	0	0%	726

Subwatershed		Cropland	(%)	Farmstead	(%)	Grassland	(%)	Pasture	(%)	Woodlot	(%)	Grazed Woodlot	(%)	Commercial/ Residential	(%)	Developing	(%)	Open Water	(%)	Wetland	(%)	Totals
Schoepp's Valley	Acres	1,403	31%	50	1%	49	1%	532	12%	2,401	53%	39	1%	0	0%	0	0%	0	0%	60	1%	4,534
	Soil Loss	8,501	61%	0	0%	0	0%	3,972	29%	0	0%	1,437	10%	0	0%	0	0%	0	0%	0	0%	13,910
	Sediment	206	60%	7	2%	0	0%	72	21%	3	1%	54	16%	0	0%	0	0%	0	0%	0	0%	342
Upper Little Waumandee	Acres	5,611	36%	198	1%	313	2%	1,076	7%	6,954	45%	1,276	8%	23	0%	1	0%	0	0%	0	0%	15,452
	Soil Loss	40,423	40%	0	0%	0	0%	7,848	8%	0	0%	52,831	52%	0	0%	0	0%	0	0%	0	0%	101,102
	Sediment	1,259	62%	20	1%	0	0%	146	7%	10	0%	610	30%	0	0%	1	0%	0	0%	0	0%	2,046
Total	Acres	46,804	38%	1,407	1%	1,317	1%	11,922	10%	50,409	41%	6,343	5%	740	1%	247	0%	101	0%	3,997	3%	123,287
Total	Soil Loss	256,937	41%	0	0%	0	0%	83,315	13%	0	0%	282,851	45%	0	0%	0	0%	0	0%	0	0%	623,103
Total	Sediment	6,682	55%	172	1%	2	0%	1,451	12%	107	1%	3,595	30%	86	1%	2	0%	0	0%	0	0%	12,096

Table 11. Inventory Results: Streambank Erosion

Subwatershed*	Inventoried Stream Length** (feet)	Eroded Sites** Total Length (feet)		Total Sediment Loss (tons/year)	Sediment Loading Rate (tons/stream mile)
Buell Valley Subwatershed	175,240	31,198	18%	2,315	139
Waumandee Creek	93,622	14,703	16%	1,425	161
Weiland Valley Creek	28,170	6,491	23%	600	225
Buell Valley Creek	14,930	1,969	13%	200	142
Bohlinger Valley Creek	38,518	8,035	21%	90	25
Danuser Valley Subwatershed	138,968	30,212	22%	1,342	102
Danuser Creek	109,320	23,638	22%	1,216	117
Dascher Valley Creek	18,758	4,990	27%	84	47
Rieckes Valley Creek	10,890	1,584	15%	42	40
Eagle Valley Subwatershed	243,454	42,348	17%	1,342	58
Eagle Creek	171,714	30,157	18%	890	55
Joos Valley Creek	51,650	11,021	21%	439	90
Baertch Valley Creek	20,090	1,170	6%	13	7
Garden Valley Subwatershed	156,984	32,170	20%	884	60
Waumandee Creek	90,914	17,086	19%	786	91
Florin Valley Creek	34,460	2,714	8%	51	16
Hesch Valley Creek	31,610	12,370	39%	47	16
Irish-Waters Subwatershed	104,910	31,075	30%	1,285	129
Irish Valley Creek	79,110	19,621	25%	1,152	154
Waters Valley Creek	25,800	11,454	44%	132	54
Jahns Valley Subwatershed	81,888	24,209	30%	401	52
Lower Waumandee Subwatershed	126,590	23,672	19%	196	16
Waumandee Creek	80,960	5,900	7%	129	17
Oak Valley Creek	28,900	14,187	49%	56	20
Becker Valley Creek	16,730	3,585	21%	11	7
Middle Waumandee Subwatershed	199,216	44,299	22%	1,840	98
Little Waumandee Creek	75,546	28,298	37%	1,542	216
Waumandee Creek	60,350	4,507	7%	135	24
Yeager Valley Creek	27,560	2,940	11%	89	27
Schultz Valley Creek	28,140	4,212	15%	71	34
Screechowl Creek	7,620	4,342	57%	3	4
Rose Valley Subwatershed	40,000	2,876	7%	109	29
Schoepp Valley Subwatershed	88,154	25,683	29%	426	51
Upper Little Waumandee Subwatershed	232,804	36,678	16%	1,945	88
Little Waumandee Creek	200,600	30,805	15%	1,931	102
Schmidt Valley Creek	8,844	1,335	15%	12	1
Wolf Valley Creek	23,360	4,538	19%	1	14
TOTAL	1,588,208	324,420	20%	12,085	40

* Alma Mill Subwatershed not inventoried.
** Length includes both banks.

D. ADDITIONAL POTENTIAL SOURCES OF WATER POLLUTION

1. Introduction

This section describes several activities in the Waumandee Creek Watershed, other than nonpoint sources of pollutants, which have the potential to affect surface or ground waters. The activities listed below are all regulated by the State of Wisconsin through the Department of Natural Resources. Unlike nonpoint sources of pollutants, there are required conditions that must be met and which are defined in a permit issued for each facility. These regulations are established so that the water quality impacts from each operation are minimized. If the conditions are being met, it is likely that there are no significant water quality concerns at the site.

2. Municipal Wastewater Treatment Facilities

Village of Cochrane. The wastewater treatment facility for this community consists of two seepage ponds which discharge to groundwater. The village has been in compliance with its discharge permit for the past several years. This permit is scheduled to be renewed in 1989, and there will likely be a requirement for additional groundwater monitoring. At this time, there is no evidence that the facility is causing surface or groundwater impacts. The design capacity of this facility is adequate for the foreseeable future.

Village of Fountain City. The treatment system for the village is a rotating biological disk unit with a primary and a final clarifier. The sludge is anaerobically digested before land spreading. Effluent from the plant is discharged to the Mississippi River. The plant has been meeting its permit limits and there are no major concerns for the facility. The design is adequate for the foreseeable future.

3. Industrial Wastewater Treatment Facilities

Wisconsin Dairies Cooperative. This plant produces cheeses and other whey products. It is located near the unincorporated community of Waumandee. The permit for this plant covers the discharge of non-contact cooling water, condensate of whey and aerated lagoon effluent, as well as the land spreading of solid wastes. The aerated lagoon receives process waste waters. Waumandee Creek receives the discharge from the non-contact cooling waters, condensate of whey, and the aerated lagoon effluent. In recent months there have been two minor BOD (Biochemical Oxygen Demand) violations of the permit. Recommendations for improved operations and maintenance of the plant have been made by DNR, and these recommendations were scheduled to be carried out in the fall of 1989. It is expected that these measures will prevent any further permit violations.

4. Landfills

Town of Lincoln. This landfill is located in section 31 of Town 22 North, Range 11 West, within the Jahns Valley Subwatershed. The landfill is licensed to receive only municipal wastes. The soils at the site are generally a heavy loam/clay texture, which provide some protection to the groundwater from potential leachate. As is the case with many town landfills, it is likely that this site receives agricultural chemical containers that have not been properly rinsed before disposal. There is a potential that these chemicals could affect surface or groundwater quality. Also, there has been some concern that runoff from the landfill that enters a nearby trench may be infiltrating groundwater. There has been no groundwater monitoring at this site. This landfill is scheduled to be closed no later than July, 1991.

Town of Waumandee. This landfill is located within the Middle Waumandee Subwatershed on County Highway E, one mile east of State Highway 88 (T21N, R11W, S29). This site is licensed to receive only municipal waste and does not have any groundwater monitoring requirements. The soils at the landfill site are generally of a heavy clay texture. This operation is scheduled to close no later than July, 1991.

City of Fountain City: This landfill is located in section 25 of Town 20 north, range 12 west within the Lower Waumandee River Subwatershed. Municipal waste from Fountain City and from Milton Township is received at this site. Most of the waste is now buried, however burning was common in the past, although it was not allowed in the permit. There has been no groundwater monitoring at this site and there is concern that the sandy soils at the site would not attenuate contaminated leachate from the landfill. This site will be closed by July, 1991.

Village of Cochrane: This site is near the Village of Cochrane, which is in the Rose Valley Subwatershed. It is located near the floodplain of the Mississippi River on sandy, alluvial soils. Because of the unsuitable nature of the site's location, this landfill is scheduled to cease operation in 1989 or early 1990. The landfill receives only municipal wastes from the village.

Dairyland Power: This landfill is owned by Dairyland Power Company and receives the fly ash from the coal power generating plant at Alma. Extensive groundwater monitoring is on-going at the site as required by the landfill's permit. The site has been substantially in compliance with the permit. Elevated levels of sulphate, iron, and boron were measured in monitoring wells near a runoff collection pond over the past several years. There is some question as to whether the monitoring well is leaking and surface runoff is flowing down the well casing, or whether the elevated parameters in the well are the result of the collection pond leaks. Measures necessary to address this situation have not been determined. This landfill is not scheduled for closure in the near future.

CHAPTER IV. ESTABLISHING WATER RESOURCE OBJECTIVES AND POLLUTANT REDUCTION GOALS

A. ESTABLISHING WATER RESOURCE OBJECTIVES

1. Surface and Groundwater Objectives

Site-specific surface water quality objectives form the basis for determining the levels of pollutant control the priority watershed project seeks to achieve. Groundwater objectives are less site-specific and generally are related to the maintenance of water quality at a level necessary to meet state standards.

2. Water Quality and Resource-Use Objectives

Water quality and resource-use objectives were developed by DNR staff with assistance from the Buffalo County Land Conservation staff and DATCP. The following objectives were identified based on water resource appraisal information (see Appendix A) and general knowledge of watershed resources:

a. The current condition of each water resource in the project area. Factors considered include: water quality and aquatic habitat, types of recreational use, and wildlife habitat. The condition of the water resource is described in terms of the type of fishery, recreational use, or wildlife use currently supported. (See Appendix B for an explanation of fishery and recreational use classifications.)

b. Factors threatening and/or degrading the water resource. (For example: sedimentation, low dissolved oxygen levels, bacteria, nuisance aquatic plants, high in-stream temperatures, and lack of habitat.)

c. The "new" condition or "potential" use of each water resource if pollutants and/or threats were removed or reduced. (For example: when sediments are sufficiently reduced, in-stream conditions may improve to the extent that a stream which supported a warmwater sport fishery may change classification to a Class III cold water trout fishery.) The extent to which pollutants are controllable was also considered.

Water resource objectives were then developed for surface water resources in the watershed based on the "new" or "potential" condition identified for each resource (See Figure 2, Water Surface Objectives Map). Where the condition of a creek has the potential for substantial improvement, water resource objectives aim to **change** the existing fishery or recreational use in a positive direction. Where substantial improvement over present conditions is not possible, water resource objectives aim to **maintain and enhance** existing uses supported by the creek, pond or backwater area. Water resource objectives for each subwatershed are discussed in Chapter VI of this plan.

B. ESTABLISHING POLLUTANT REDUCTION GOALS

1. Levels of Pollutant Control

The next step in the project planning process after setting water resource objectives was to determine the level of pollutant reduction necessary to attain the "new" or desirable resource condition or use. For this project, pollutants include sediment, organic matter, nutrients (including phosphorus), and bacteria. Pollutant reduction goals were determined for each of the four categories of nonpoint source pollutants which were inventoried: rural upland sediment, streambank erosion, barnyard runoff, and runoff from areas winter-spread with livestock manure.

Two levels of pollutant control were set: "moderate" and "high". Levels of pollutant reduction were based on the potential for water quality improvement in major creeks, wetlands, and ponds in each subwatershed, as well as the overall effect of pollutant reduction on the Mississippi River backwaters. Sites contributing pollutant loads which were below target reduction levels are not eligible for cost sharing.

Based on water resource objectives, some creeks required a "high" level of pollutant control, whereas others required a more "moderate" level of control. Where objectives for creeks included improving a Class III coldwater trout fishery to a Class II coldwater trout fishery, the nonpoint source control level needs were agreed to be "high". A high level of pollutant control applied to Weiland Valley, upper Little Waumandee, and Eagle creeks. All other creeks and water resources would be subject to a moderate level of nonpoint source control to meet the water resource objectives.

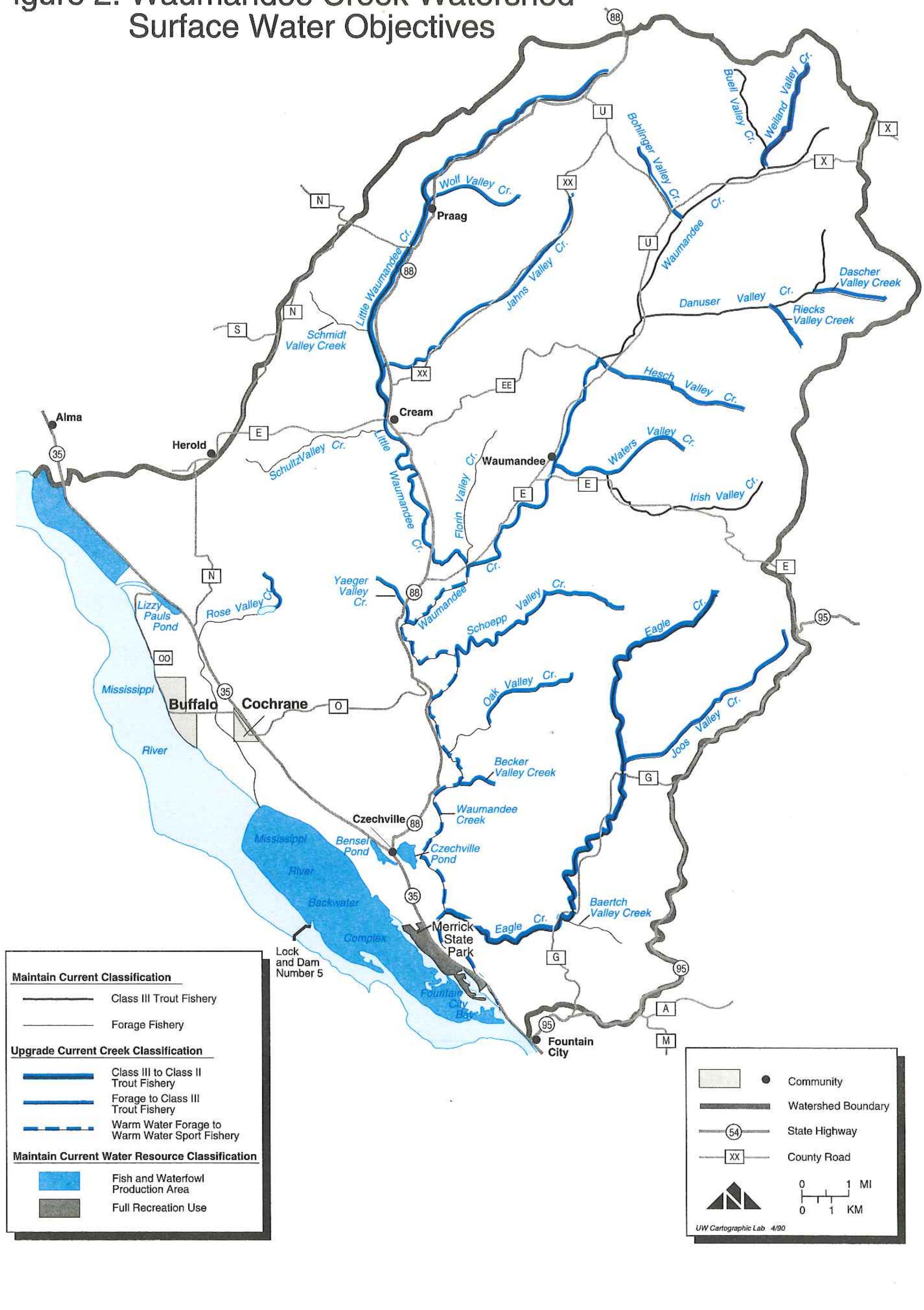
2. Goal Setting Rationale

Pollutant reduction goals for barnyard runoff were set for each subwatershed. The main concern is the effect of barnyard runoff on oxygen levels in receiving stream segments. A secondary concern is the cumulative effect of nutrients and bacteria delivered into the Mississippi River backwaters. Streambank sediments were identified as having localized effects on streambed habitat and water quality, therefore reduction goals were specified for each creek for this nonpoint source category. Since upland erosion was identified as the major source of the finer sediments that are carried down the watershed and accumulate in the ponds and Mississippi backwaters at the outlet of the Waumandee Creek Watershed, a blanket reduction goal for upland erosion control was applied to the entire watershed. Reduction goals for livestock wastes spread on "unsuitable" land were also applied to the entire watershed, since the geographic distribution of fields generally ignores subwatershed boundaries. (See Chapter VI for a discussion of pollutant reduction goals for each subwatershed.)

3. Streambanks Sediment Reduction Goals

Where streambank objectives for creeks required a "high" level of control, project participants located along these creeks would be required to reduce streambank erosion (as measured in tons/year) by 80%. On all other creeks, the minimum requirement would be to reduce streambank sediment (as measured in tons/year) by 60%. These criteria will be applied on a landowner basis; that is, an 80% or 60% reduction must be attained by each participant.

Figure 2: Waumandee Creek Watershed Surface Water Objectives



4. Upland Sediment Reduction Goals

For the purpose of retarding the sediment in-fill rate of the ponds and backwaters at the outlet of the Waumandee Creek Watershed, upland sediment reduction goals were targeted at 50% for all subwatersheds. This applies to all agricultural lands, including croplands, pastures, and grazed woodlots.

5. Organic Reduction

Where objectives for creeks required a "high" level of control of organic matter, all participants in the subwatershed would be required to attain a 70% reduction in organic loading from barnyards to creeks. For the rest of the subwatersheds, a reduction of 50% of the organic load from barnyards was targeted.

It was determined that 70% of the organic load from "unsuitable" acres winter-spread with livestock manure would need to be controlled across the entire Waumandee Creek Watershed. "Unsuitable" was defined as croplands on flood-prone soils, or on slopes greater than six percent. Organic reduction analyses were not conducted for individual subwatersheds because of the cases where landowners use spreading sites in two or more subwatersheds, or where livestock waste originating in one subwatershed is spread on fields in another subwatershed.

C. DEVELOPING A MANAGEMENT STRATEGY

The final step in the planning process was the development of a strategy to control nonpoint pollutant sources. Management actions were developed which take into consideration the water resource objectives, pollutant sources, reduction goals, and the tools available to the Department and DATCP in cooperation with the Buffalo County Land Conservation Department staff.

CHAPTER V. WATERSHED PROJECT MANAGEMENT ACTIONS

A. INTRODUCTION

1. The Development of Management Actions

As mentioned at the end of Chapter IV, watershed project management actions were developed, based on pollutant reduction levels and several other factors. These management actions involve the scheduling and implementation of tools aimed at obtaining the levels of nonpoint source pollutant control necessary to achieve water resource goals. The actual numbers of agricultural acres, barnyards, or feet of streambank that will require the installation of Best Management Practices correspond to the percentages of sediment or nutrient reductions called for each subwatershed discussed in the plan.

2. Pollutant Source Eligibility

Landowner eligibility for the cost sharing of these practices will depend on whether pollutant loads from their lands in each nonpoint source category fall into the established pollutant reduction ranges. All eligible sources must be controlled if a landowner wishes to participate in any aspect of the program. Sites contributing pollutant loads below the target reduction levels are not eligible for cost sharing.

3. Best Management Practices

Management actions are carried out through the installation of practices determined to be the most effective controls of nonpoint pollutants in the Waumandee Creek Watershed. These actions range from alterations in farm management (such as changes in manure spreading and instituting crop rotations) to the installation of engineered structures (such as diversions, sediment basins and manure storage facilities). They generally are tailored to specific landowner situations. The Buffalo County Land Conservation Department will assist owners, managers, and renters of agricultural lands in applying Best Management Practices. Not all recommended practices are eligible for cost sharing. Chapter VII of this plan contains detailed information on practice implementation.

B. SOURCE ELIGIBILITY FOR COST SHARED CONTROL MEASURES

1. Streambanks

<u>Livestock access.</u> All sites will be eligible for cost sharing where there is evidence of trampling along the streambank, streambed damage, or streambank erosion from livestock. An estimated 263,000 feet of streambank will require restricted cattle access, involving approximately 280 landowners.

In addition, landowners who wish to participate in any other aspect of the program such as barnyard controls must also restrict livestock access if evidence of trampling exists.

Restricting livestock access may not always require complete streambank fencing. As discussed in the implementation program section of this plan, other measures may be taken to confine livestock to other areas of the farm.

Streambank erosion. In addition to livestock access restrictions, all participants with identified eroding sites must reduce streambank erosion by 80% along Weiland Valley, upper Little Waumandee, and Eagle creeks. Participants along all other creeks must reduce streambank erosion by 60%. Overall, approximately 8,371 tons of sediment must be controlled in the entire watershed.

These criteria are applied on a landowner basis; that is, a 60- or 80 percent reduction must be obtained from each participant. The restriction of livestock access may achieve all or part of this goal. An estimated 431,000 feet of streambank will require streambank protection measures in the watershed.

Easements. Easements may be used in the Buell Valley, Eagle Valley, and Upper Little Waumandee subwatersheds along creeks that have the potential to become Class II fisheries. Sites within these subwatersheds must qualify as key spring areas, or areas with evidence of streambank habitat degradation such as trampling, slumping, or active erosion.

2. Uplands

Upland erosion. A 50% reduction in sediment from eroding fields was targeted for agricultural lands. This translates into bringing all lands which are contributing sediment to streams at a rate greater than 0.3 tons/acre/year down to 0.3 tons/acre/year. Ideally, if sediment from all these lands is controlled, reduction goals and water resource objectives can be met. This will include an estimated 10,500 "critical" acres of cropland, or nine percent of the rural land in the watershed.

For practical purposes, all fields delivering more than 0.3 tons/acre/year of sediment will be combined for each landowner. This figure will be the total amount of sediment which must be controlled on the farm in order to received cost share funds from the watershed project. A landowner may be able to meet the overall sediment reduction goal for his/her farm by applying controls to fields with sediment delivery rates below the identified target control level of 0.3 tons/acre/year. The best way to meet the individual's sediment reduction goals will be determined during the farm planning process.

Gully erosion. Sites with gullies greater than five feet vertical depth are mandatory for control. Sites are eligible for gully erosion control if 1) there is evidence of bare soils and active gully erosion and 2) the gully is directly connected to a perennial stream by channelized flow.

Practices used must be consistent with the expenditure limits and impoundment volume limits outlined in the administrative rules. (See Section Three, Project Implementation, for more details.) The eligibility criteria set for upland sediment controls need not apply to gullies.

3. Barnyard Runoff

Externally drained lots. A high level of control of organic loading is required for all participants in the Buell Valley, Eagle Valley, and Upper Little Waumandee subwatersheds. This corresponds to a design target of five pounds of phosphorus for these subwatersheds. All barnyards contributing more than five pounds of phosphorus will be eligible for cost sharing and must be brought down to the five pound level. This will involve about 53 of the 330 livestock operations draining to creeks in the Waumandee Creek Watershed.

A moderate level of reduction in organic loading is required for all other subwatersheds. This corresponds to a design target of 10 pounds of phosphorus for participants in these subwatersheds. This will involve about 113 livestock operations.

Phosphorus reduction must be approached by applying incremental levels of control to barnyards to achieve reduction goals. This means that if target levels can be achieved for a barnyard through the installation of a diversion alone, eligibility for cost sharing will be limited to that practice. If goals are not met using a diversion, more intensive and expensive practices may be applied incrementally to attain reduction goals.

Internally drained lots. Information on the 12 internally drained barnyards in the watershed will be reviewed by DATCP, DNR, and Buffalo County to determine specific management actions.

4. Manure Management

Winter-spreading. Project participants who winter-spread manure on more than 15 acres of "unsuitable" land are eligible for a manure management plan. The plan must reduce the acres of "unsuitable" winter-spread lands to 15 acres. If this cannot not be accomplished with a manure management plan, then the landowner is eligible for a manure storage system. Landowners receiving cost share funds for a storage system may not spread on any "unsuitable" lands during the winter months. "Unsuitable" lands are those lands which are greater than six percent in slope or are flood-prone, as defined in the USDA-SCS-Wisconsin Technical Guide #633 (December 1986). This will involve approximately 90 landowners. The actual spreading sites and acres that are considered unsuitable must be confirmed at the time of landowner contact during implementation. (See Chapter VIII for implementation details.)

The Buffalo County LCD will assist operators in preparing a management plan for proper manure spreading which may identify the need for manure storage facilities.

Ordinances. Buffalo County is encouraged to enact a manure management ordinance which implements requirements outlined by DATCP. This ordinance will not be required for grant eligibility.

CHAPTER VI. DISCUSSIONS OF WATER RESOURCE CONDITIONS, NONPOINT POLLUTANT SOURCES, WATER RESOURCE OBJECTIVES AND MANAGEMENT ACTIONS BY INDIVIDUAL SUBWATERSHEDS

A. INTRODUCTION

This chapter presents the following five items for each of the 12 subwatersheds in the Waumandee Creek Watershed. The names and locations of subwatersheds are listed in Table 6 and are shown in Figure 1. The items are:

1) A subwatershed description.

2) A discussion of water resource conditions. (See Appendix A for a discussion of how creeks, ponds and backwater areas were inventoried and conditions were assessed.)

3) A discussion of the nonpoint sources of water pollutants in the subwatershed. (See Appendix A for a discussion of how nonpoint sources were inventoried and evaluated.)

4) A statement of water resource objectives for each perennial creek and pond, and the Mississippi River backwaters. The water quality conditions needed to support the objectives for surface water resources are the basis for determining the type and level of nonpoint source control to be implemented under the priority watershed project. (See Chapter IV for a discussion of how water resource objectives were determined.)

5) A description of the nonpoint source control needs. These control needs are in the form of estimates of the reductions in rural nonpoint sources required to meet water quality and recreational use objectives and the management actions necessary to achieve these reductions. The reduction strategies target the control of sediment and phosphorus from both upland and streambank sources, based on the types of water resources receiving these pollutants. (See Chapter IV for a discussion of how specific levels of nonpoint source pollutant reduction were determined.)

B. MISSISSIPPI RIVER BACKWATER COMPLEX

1. Description

The Mississippi River backwater complex is located at the base of the Waumandee Creek Watershed, in the floodplain and river bottoms of the Upper Mississippi River. (Figure 1.) It is situated between the main channel of the Mississippi River and the western border of the Lower Waumandee Subwatershed and includes the Fountain City Bay area. Although the backwater complex is not a subwatershed of the Waumandee Creek Watershed, its consideration as a hydrologic unit is important, since it receives much of the pollutant load delivered from the watershed to the Mississippi River. The backwater complex receives inflow from the Czechville and Bensel ponds, the Cochrane Ditch, local surface runoff, and the Mississippi River. Wetland areas and sloughs bordering the western portion of the Alma Mill Subwatershed are included in this area.

2. Water Resource Conditions

The backwater complex provides diverse terrestrial and aquatic habitat, and is classified (for appraisal purposes) as a fish and waterfowl production area. The backwaters consist of floodplain forest, isolated marshes, and running side channels from the main-channel Mississippi River. The extensive system of well-oxygenated side channels and adjacent sloughs provides good habitat for fish and wildlife. However sediment from the Waumandee Creek Watershed, as well as reduced water inflows due to engineering modifications involving channelization and diking, have reduced the quality and quantity of fish and wildlife habitat in the backwaters over the years (Fremling et. al. 1979). Sediment is destroying fish spawning areas and smothering bottom fauna. In addition, nutrients have enriched the system, stimulating plant and algal growth such that stagnation and oxygen depletion occurs in many areas because of high respiration and decomposition rates (Fremling et. al. 1979).

Black crappie, bluegill and northern pike are the most common game fish in the backwaters area. Rough fish are dominated by carp and freshwater drum. Waterfowl and other birds that use or live in the backwaters area are numerous and varied. Many species of mammals and reptiles are also common.

The resources of the backwaters are used extensively by hunters, anglers, nature observers, and other recreationists. The Fountain City Bay portion of the backwater complex includes the 1400 acre Whitman Dam Wildlife Area, which is managed by the State and is open to the public for hunting and other recreational activities. Merrick State Park borders the lower eastern shore and is a popular recreational facility. The swim beach at the park is often closed in the summertime due to high fecal coliform counts. Department investigations indicate bacterial loadings to Fountain City Bay surrounding Merrick State Park are attributed to nonpoint pollutant sources located further upstream in the Waumandee Creek Watershed. Additional investigation into this problem may be needed.

3. Pollutant Sources

Waumandee Creek and the Cochrane Ditch deliver a cumulative load of fine suspended sediments and nutrients to the Mississippi River backwater complex.

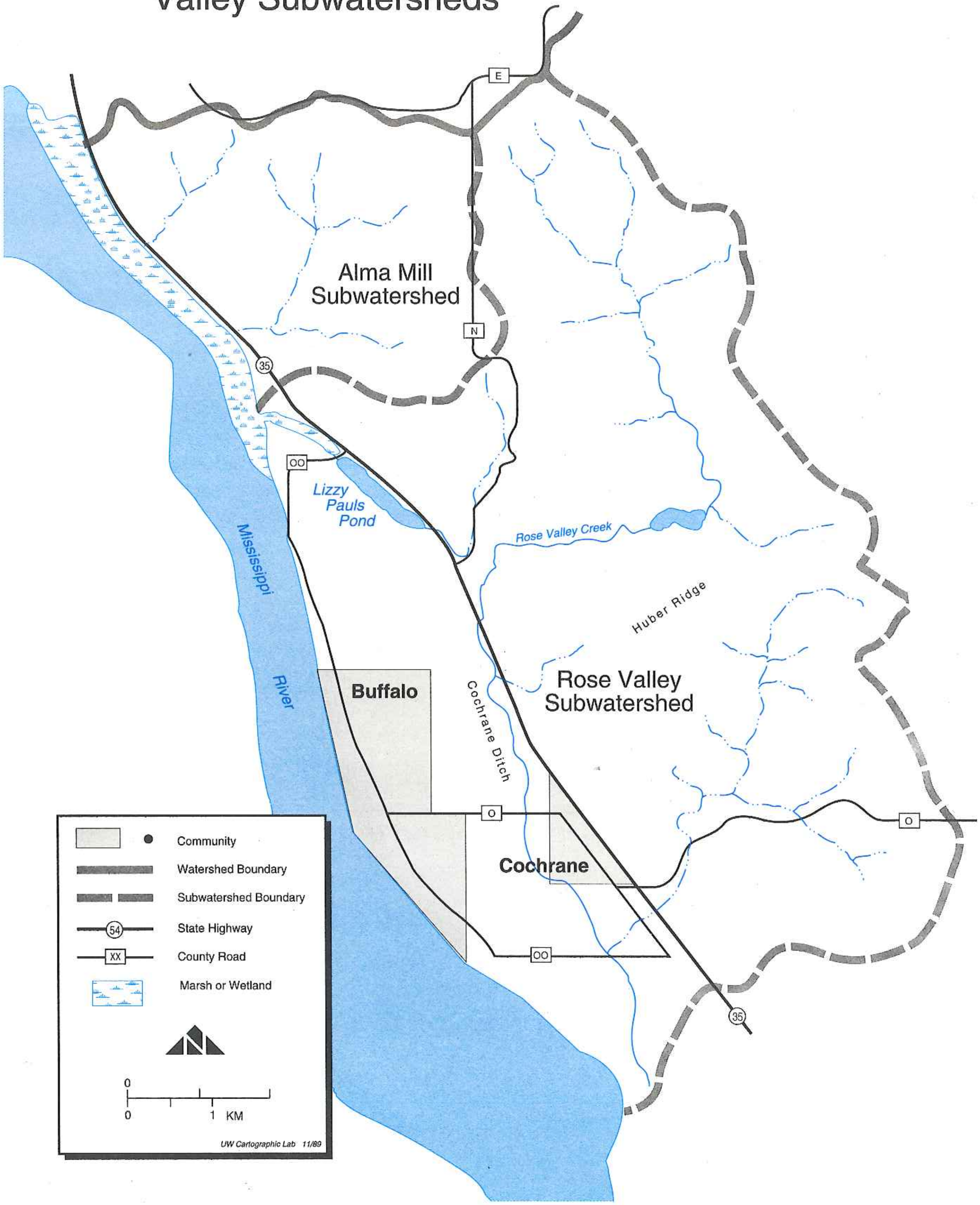
4. Water Resource Objectives

The water resource objectives for the backwater complex are to maintain and protect water quality in the Mississippi River backwaters by reducing sediments and nutrients from the Waumandee Creek Watershed.

5. Reduction Goals and Management Actions

The pollutant reduction goal is to reduce upland sediments (and attached nutrients) derived from the Waumandee Creek Watershed by 50%. Agricultural lands contributing sediment to streams at a rate greater than 0.3 tons/acre/year must be brought down to the 0.3 tons/acre/year level. This will amount to approximately 10,500 acres in the watershed.

Figure 3: Alma Mill and Rose Valley Subwatersheds



C. ALMA MILL SUBWATERSHED

1. Description

The Alma Mill Subwatershed is bordered to the west by the Mississippi River. County Highway N straddles the ridge that forms its eastern boundary. The Alma Mill Subwatershed drains directly to the Mississippi River via the backwater complex north of Lizzie Pauls Pond (Figure 3). The subwatershed is situated south of the city of Alma and includes a small, sparsely populated section of the municipality. Alma Mill Subwatershed covers about 2,500 acres, or two percent of the entire Waumandee Creek Watershed.

2. Water Resource Conditions

Two unnamed dry runs within the watershed channel runoff during storm events and snowmelt. In-stream biological uses were not assessed.

3. Pollutant Sources

Rural lands in the watershed (mainly cropland and pastures), contribute approximately 145 tons of the sediment deposited each year into the Mississippi River backwater complex via surface runoff. Commercial and residential land uses contribute an estimated 10% (about 16 tons) of the subwatershed upland sediment load. It is likely that much of this sediment is delivered directly to the Mississippi River backwaters during storm events. Streambank erosion was not surveyed.

Alma Mill Subwatershed contains five animal lots which are the sources of an estimated 77 pounds of phosphorus during a 10-year, 24-hour rainfall. This phosphorus is an indication of the organic and oxygen-demanding substances which are delivered to the creek. While this is a relatively small amount compared to other subwatersheds, it is important to note that this organic load is channeled directly into the Mississippi River backwater area during runoff events, contributing to eutrophication (over nourishment) of the backwaters.

4. Water Resource Objectives

The water resource objectives are to maintain and protect water quality in the Mississippi River backwaters by reducing sediments and nutrients from the Alma Mill Subwatershed.

5. Reduction Goals and Management Actions

The pollutant reduction goals for Alma Mill Subwatershed are to:

a. Reduce upland sediment delivered to the Mississippi River backwaters by 50%. Agricultural lands contributing sediment to streams at a rate greater than 0.3 tons/acre/year must be brought down to the 0.3 tons/acre/year level. This amounts to 128 acres in the Alma Mill Subwatershed.

b. Reduce sediments from channel and gully erosion as much as possible.

c. Reduce the "top" 50% of organic loading from barnyard runoff. Two barnyards contribute approximately 50% of the organic load (94 pounds) in the Alma Mill Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" land. Landowners who winter-spread manure on more than 15 "unsuitable" acres must reduce "unsuitable" spreading acreage down to 15 acres.

D. ROSE VALLEY SUBWATERSHED

1. Description

The Rose Valley Subwatershed is a 4,700 acre drainage area located along the western border of the Waumandee Creek watershed adjacent to the Mississippi River, south of the Alma Mill Subwatershed (Figure 3). Highway 35 bisects the subwatershed into two distinct geographic areas. To the east lie the coulee region's characteristically steep ridges which are drained by long narrow valleys, and to the west, a narrow band of sandy glacial outwash gently slopes to the Mississippi River and associated wetlands. Buffalo City and the Village of Cochrane are located in the western portion of the subwatershed.

The municipalities of Cochrane (567 people) and Buffalo City (889 people) contain nearly one-half the population of the Waumandee Creek Watershed. However, commercial and residential activities utilize only four percent of the land area in Rose Valley Subwatershed, or 470 acres. Most development is topographically confined to the level outwash area west of the bluffs. By far, the greatest amount of urban development is occurring in this subwatershed. About two percent (194 acres) of the subwatershed land area is under development, and this is the highest rate of all subwatersheds in the Waumandee Creek Watershed.

2. Water Resource Conditions

Surface waters include Rose Valley Creek, Belvidere Valley Creek, Lizzie Paul Pond, and Rose Valley Pond.

Rose Valley Creek originates in numerous springs and seeps in the northeastern corner of the subwatershed and drains most of the Belvidere Valley. It is classified as a warm water forage fishery. A potential exists for fishery improvement above an impoundment known as Rose Valley Pond. For approximately one mile downstream of this point, the creek suffers from sedimentation (the bottom substrate is 100% sand). West of Highway 35, Rose Valley Creek becomes the "Cochrane Ditch". This lower portion is an extensively channelized conduit which flows between Buffalo City and Cochrane into the Fountain City Bay area of the Mississippi River backwater complex.

Belvidere Valley Creek is a dry-run above Highway 35. It has carved out a 20-30 foot rock-bottomed canyon as it drains a valley east of Cochrane during runoff events. It flows into the Cochrane Ditch at Highway OO.

Lizzie Paul Pond is a seepage pond in the northwest corner of the subwatershed. The 44-acre spring-fed pond provides inflow to the backwater area of the Mississippi River. The pond has approximately two miles of public frontage along Highway 35. Northern pike, perch and bullheads are the dominant species, although the pond has a history of winterkill.

3. Pollutant Sources

Although the subwatershed contains two communities, 91% of the land area is used for agricultural purposes. Grazed woodlots cover only three percent of the land area but contribute 23% of the sediment reaching surface waters (196 tons annually). Cropland contributes 59%, or 504 tons annually.

An estimated seven percent of the streambank along Rose Valley Creek is eroded, trampled by livestock or slumping. Eroding sites in Rose Valley Creek contribute 109 tons of sediment annually to surface waters. It appears that some streambank erosion may be partly attributed to high volume discharge from the impoundment at Rose Valley Pond. Streambank erosion in Belvidere Creek and the Cochrane Ditch were not evaluated.

The Rose Valley Subwatershed contains 24 animal lots which are the source of 491 pounds of phosphorus during a 10-year, 24-hour rainfall, which is an indication of organic and oxygen-demanding substances which reach surface waters. Six of the 24 lots generate 50% of the organic pollution. Most of the barnyards are concentrated in the headwaters area of Rose Valley and affect reaches of Rose Valley Creek above the Cochrane Ditch.

4. Water Resource Objectives

The water resource objectives for the Rose Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwaters by reducing sediment and nutrients delivered by creeks, ponds and drainage ways.

b. Improve the physical and biotic condition of the upper portion of Rose Valley Creek in order to change the classification from a warm water forage fishery to a Class III trout fishery.

c. Maintain the current warm water forage fishery in the lower portion of Rose Valley Creek below the impoundment. Improve the physical and biotic condition of the creek to enhance the fishery.

d. Maintain and protect quality and quantity of discharge to the Mississippi River backwaters from Lizzie Paul Pond.

5. Reduction Goals and Management Actions

The pollutant reduction goals for Rose Valley Subwatershed are to:

a. Reduce the upland sediment contribution to Rose Valley Creek and the Mississippi River backwaters by 50%. Agricultural lands throughout the Waumandee Creek Watershed contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 674 acres in Rose Valley Subwatershed.

b. Reduce streambank erosion in Rose Valley Creek by 60% and control gully erosion in Belvidere Valley. Restrict livestock from Rose Valley Creek and its tributaries where there is evidence of trampling along the bank, streambed damage, or streambank erosion from livestock. An estimated 2,016 feet of stream will require restricted cattle access in this subwatershed. Overall, 60% of streambank sediments or approximately 66 tons need to be controlled along Rose Valley Creek and its tributaries.

c. Reduce the "top" 50% of organic loading from barnyard runoff to Rose Valley Creek and Mississippi River backwaters. Six barnyards produce one-half of the organic load (252.5 pounds) in the Rose Valley Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" land. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

E. BUELL VALLEY SUBWATERSHED

1. Description

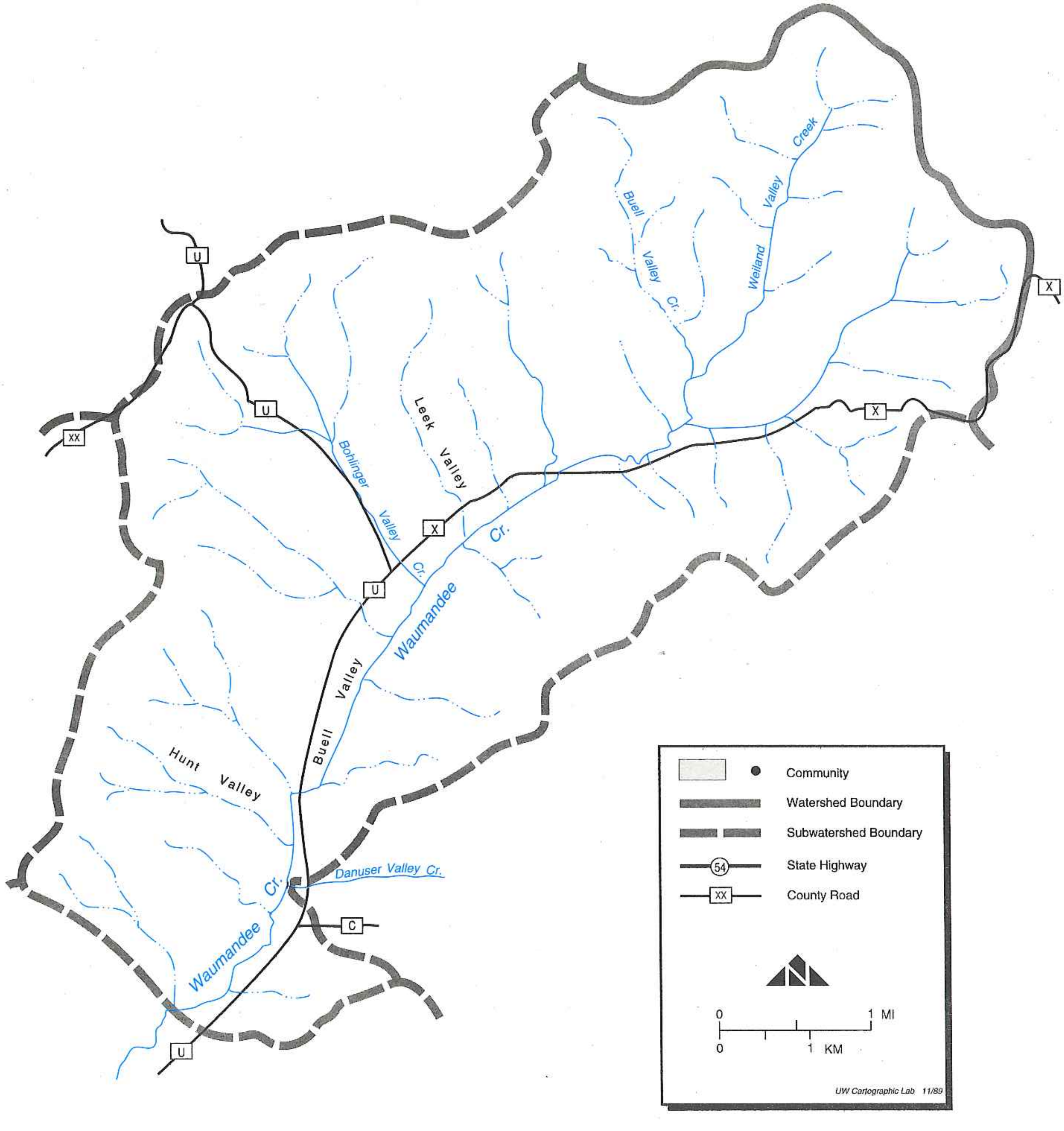
Buell Valley Subwatershed is located in the northern portion of the Waumandee Creek Watershed (Figure 4). The subwatershed drains approximately 13,000 acres, which is 10% of the entire Waumandee Creek Watershed, and contains a large portion of the headwaters area of Waumandee Creek.

2. Water Resource Conditions

Many small and intermittent tributaries drain the side valleys of the subwatershed and empty into Waumandee Creek. The mainstem of the Waumandee flows the length of Buell Valley down to Highway EE, where it exits the subwatershed. Perennial feeder creeks of the headwaters include Weiland Valley Creek (stream #17-1), Bohlinger Valley Creek (stream #19-7) and Buell Valley Creek (stream #8-16). Buell Valley Creek is a tributary of Weiland Valley Creek.

The mainstem of Waumandee Creek above Highway EE is classified as Class III trout fishery. Macro-invertebrate samples indicate fairly good water quality, although fish habitat is poor. The channel has been straightened in some sections, banks have little cover or shading, and a blanket of sediment covers most of the stream bed. These factors have lead to flashy flow conditions and high in-stream temperatures.

Figure 4: Buell Valley Subwatershed



Bohlinger Valley Creek is classified as a warm water forage fishery, while Buell Valley Creek supports a Class III trout fishery. Ditching has removed spring seepage areas in both creeks. Many of the pools and riffles of the original bottom substrate have been filled in with sediments, leading to high stream temperatures and low dissolved oxygen levels.

Weiland Valley Creek drains the Montana Ridge and much of the headwaters of Waumandee Creek. It has high gradients, cool water influenced by spring flows, and fairly good sand and rubble substrate, although portions of it have been channelized. Based on a 1989 fish survey, this creek currently supports a Class III trout fishery and has the potential for improvement. It was identified as one of three creeks in the Waumandee Creek Watershed which have the potential to support a Class II trout fishery.

Sedimentation and bank instability appear to be greater problems along tributaries than along the mainstem in this subwatershed. Fish and habitat surveys indicate that in the lower portions of side tributaries, bottom substrate is over 50% sand, and stream channels have been widened considerably. These conditions are not conducive to fish reproduction. However in upper portions of headwater tributaries that have steep gradients and high water velocities, water quality and bottom substrate remain fairly good, despite high sediment loss from streambanks and nearby agricultural lands.

3. Pollutant Sources

The cultivation of farmland to the edge of the stream is commonplace along the mainstem of the Waumandee. The rate of erosion on cropland is moderate (5.5 tons/acre/year) compared with other subwatersheds, however, the Buell Valley Subwatershed contributes the third largest upland sediment load (1,913 tons) of all subwatersheds to the Waumandee Creek system. (In comparison, the Eagle Valley Subwatershed supplies the largest upland sediment load: 2,690 tons/acre/year.) The Buell Valley Subwatershed ranks fourth in terms of contributing acreage. Pastures on steep slopes and grazed woodlots contribute about 60% of the sediment load from upland sources in the subwatershed, and the remainder results from eroding cropland.

Streambanks in the Buell Valley Subwatershed contribute the largest share of streambank sediment (2,315 tons) to the entire Waumandee system of any of the subwatersheds. This amounts to 21% of the streambank sediment load for the entire Waumandee Creek Watershed. The Buell Valley Subwatershed has an average streambank erosion rate of 139 tons of sediment per stream mile, which is higher than any other subwatershed. About 18% of the streambanks in the subwatershed are eroding, trampled, or slumping. The mainstem of Waumandee Creek supplies the majority of the subwatershed streambank sediment load. The land adjacent to the creek is mainly in cropland and woodland. Streambanks along tributaries have been extensively trampled by cattle. Weiland Valley Creek has a very high streambank erosion rate: 200 tons/mile with eroding, trampled, or slumping sites on 22% of its streambanks.

Buell Valley Subwatershed contains 35 animal lots which are the source of approximately 634 pounds of phosphorus during a 10 year, 24 hour rainfall, which is an indication of the organic and oxygen-demanding substances delivered to the creeks in the subwatershed. Barnyard operations in the Buell Valley Subwatershed generate the third largest phosphorus load -- 12% of the entire Waumandee Creek Watershed phosphorus load. One barnyard alone contributes 99 pounds of phosphorus, or 16% of the subwatershed load. Most of the animal lots appear to be located in basins that drain to the mainstem of Waumandee Creek.

4. Water Resource Objectives

The water resource objectives for Buell Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients delivered from upstream portions of the Waumandee Creek Watershed.

b. Waumandee Creek (mainstem above Highway EE): Maintain the current Class III cold water trout fishery. Improve the physical and biotic condition of the creek to enhance the fishery.

c. Bohlinger Valley Creek: Improve the physical and biotic condition of the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

d. Buell Valley Creek: Maintain the current Class III trout fishery. Improve the physical and biotic condition of the creek to enhance the fishery.

e. Weiland Valley Creek: Improve the physical and biotic condition of the creek in order to change the classification from a Class III coldwater trout fishery to a Class II trout fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for Buell Valley Subwatershed are to:

a. Reduce upland sediment contribution by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year throughout the Waumandee Creek Watershed. This amounts to 1,615 acres in Buell Valley Subwatershed.

b. Reduce streambank erosion along Weiland Valley Creek by 80% (480 tons). Reduce streambank erosion along all other creeks by 60% (1,029 tons). Restrict livestock from creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion from livestock. An estimated 16,736 feet of streambank will require restricted cattle access.

c. Reduce the "top" 70% of organic loading from barnyard runoff along Weiland Valley Creek. Reduce the "top" 50% of organic loading from barnyards along all other creeks. Six barnyards produce one-half the organic load (306 pounds) in Buell Valley subwatershed.

d. Control 70% of the livestock wastes spread on "unsuitable" land. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor along the Waumandee mainstem to stabilize streambanks.

f. Protect wetlands and spring areas by installing practices such as fencing.

F. DANUSER VALLEY SUBWATERSHED

1. Description

The Danuser Valley Subwatershed is located in the northeastern headwaters of the Waumandee Creek Watershed (Figure 5). The Montana Ridge forms the eastern drainage divide, while the subwatershed is bounded to the west by the Buell Valley Subwatershed and to the south by the Garden Valley Subwatershed. Surface water drains to Danuser Creek, which flows westerly, emptying into Waumandee Creek as it exits the subwatershed. Highway CC parallels Danuser Creek from its northeastern headwaters down to the community of Montana. The Danuser Valley Subwatershed drains 8,319 acres, or seven percent of the Waumandee Creek Watershed.

2. Water Resource Conditions

Danuser Creek drains most of the land area in the subwatershed. It is supplemented by the perennial tributaries of Dascher Valley (stream # 28-13) and Rieckes Valley (stream #32-1) creeks.

Danuser Creek is approximately six miles long and originates in the northeast portion of the subwatershed along the Montana Ridge. It is currently classified as a warm water forage fishery. According to a 1987 habitat survey, the stream gradient is high and the substrate is generally good along the mainstem, despite heavy streambank erosion and channelization along some reaches. Good flow, monitored at 4.5 cubic feet per second (cfs) near the confluence of Danuser Creek and Waumandee Creek, offers potential for fishery improvement.

Dascher Valley Creek and Rieckes Valley Creek are small tributaries of Danuser Creek which are classified as warm water forage fisheries. Low flow has enabled sediments to collect and fill in pools and riffles. The potential for improvement is limited.

3. Pollutant Sources

Runoff from pasture and grazed woodlot supplies 62% (464 tons/year) of the sediment reaching Danuser Creek and its tributaries from upland sources. Eroding croplands provide 35% of the load, or 257 tons/year.

Danuser Valley Subwatershed has the third highest rate of streambank erosion (102 tons/stream mile). It contributes 12% of the entire Waumandee Creek Watershed streambank erosion load (1,342 tons/year). Much of the erosion along the mainstem of Danuser Creek is occurring at sites where cultivated land extends to the edge of the creek.

Danuser Valley Subwatershed contains 25 animal lots which are the source of 431 pounds of phosphorus during a 10-year, 24-hour rainfall, which is an indication of the organic and oxygen-demanding substances entering the creek. Five barnyards scattered throughout the watershed are contributing over 50% of this load.

4. Water Resource Objectives

The resource objectives for Danuser Valley Subwatershed are to:

a. Reduce the sediment loads delivered to the Mississippi River backwater complex further downstream.

b. Danuser Creek: Maintain the current Class III cold water trout fishery. Improve the physical and biotic condition of the creek to enhance the fishery.

c. Dascher Valley Creek and Rieckes Valley Creek: Improve the physical and biotic condition of the creeks in order to upgrade the warm water forage fisheries to Class III trout fisheries.

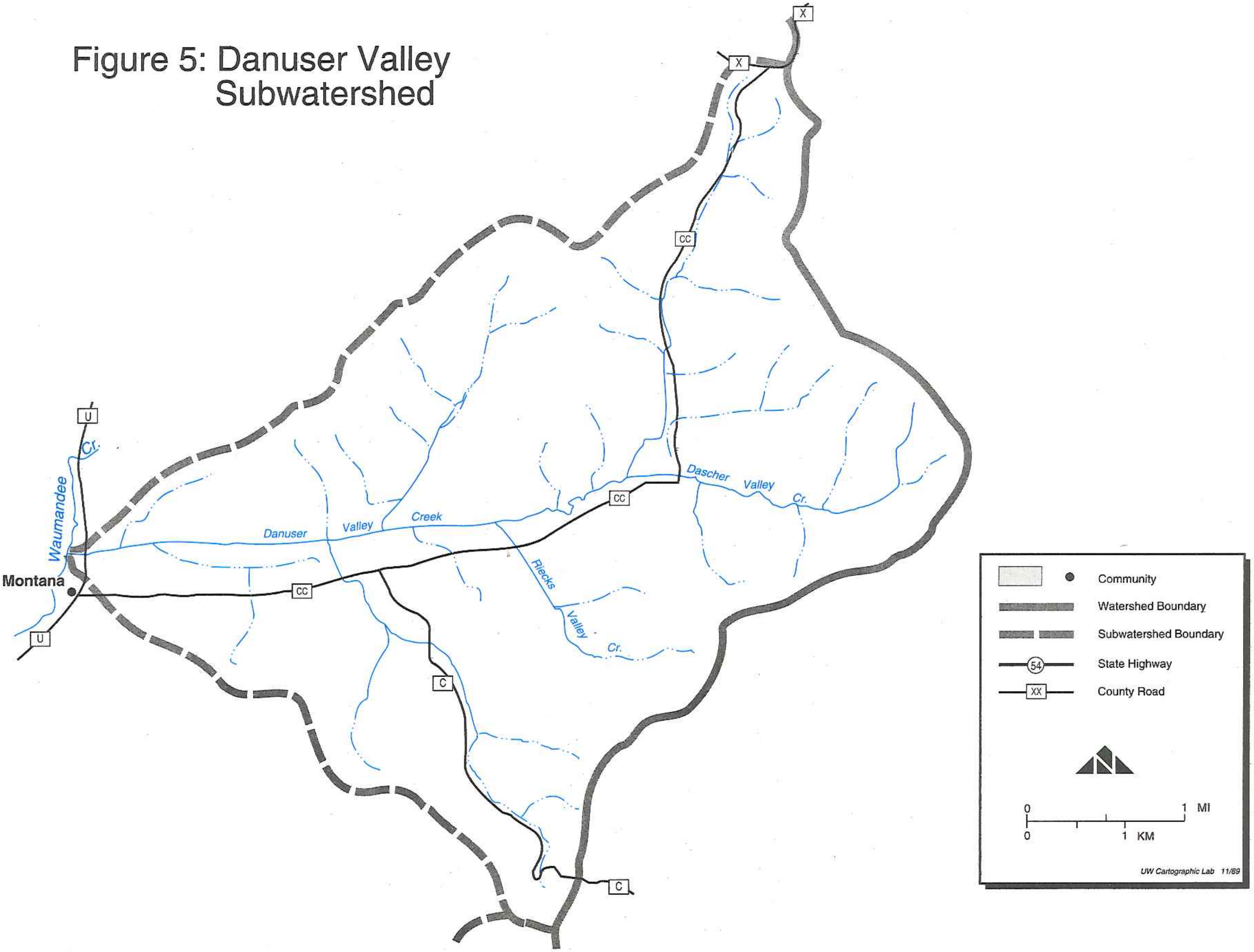
5. Reduction Goals and Management Actions

The pollutant reduction goals for Danuser Valley Subwatershed are to:

a. Reduce upland sediment sources by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 715 acres in the Danuser Creek Subwatershed.

b. Reduce streambank erosion in all creeks by 60% (805 tons). Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion from livestock. An estimated 16,692 feet of streambank will require restricted cattle access.

Figure 5: Danuser Valley Subwatershed



c. Reduce the "top" 50% of organic loading from barnyard runoff to all creeks.

d. Control 70% of livestock wastes spread on "unsuitable" land. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to stabilize streambanks.

f. Protect wetlands and spring flow areas with practices such as fencing.

G. GARDEN VALLEY SUBWATERSHED

1. Description

The Garden Valley Subwatershed drains the midsection of the Waumandee Creek Watershed via a portion of the mainstem of the Waumandee Creek (Figure 6). The subwatershed includes two smaller headwater areas known as Florin Valley and Hesch Valley. The Garden Valley Subwatershed covers 8,990 acres or seven percent of the Waumandee Creek Watershed. The unincorporated community of Waumandee is located within its drainage area.

2. Water Resource Conditions

Waumandee Creek flows the length of the Garden Valley Subwatershed, a distance of approximately 15 miles. Florin Valley Creek (stream #29-2) and Hesch Valley Creek (stream #2-5bc) both drain side valleys for approximately three miles. Technically, Florin Valley Creek is a tributary of Little Waumandee Creek. Hesch Valley Creek is a perennial tributary of Waumandee Creek.

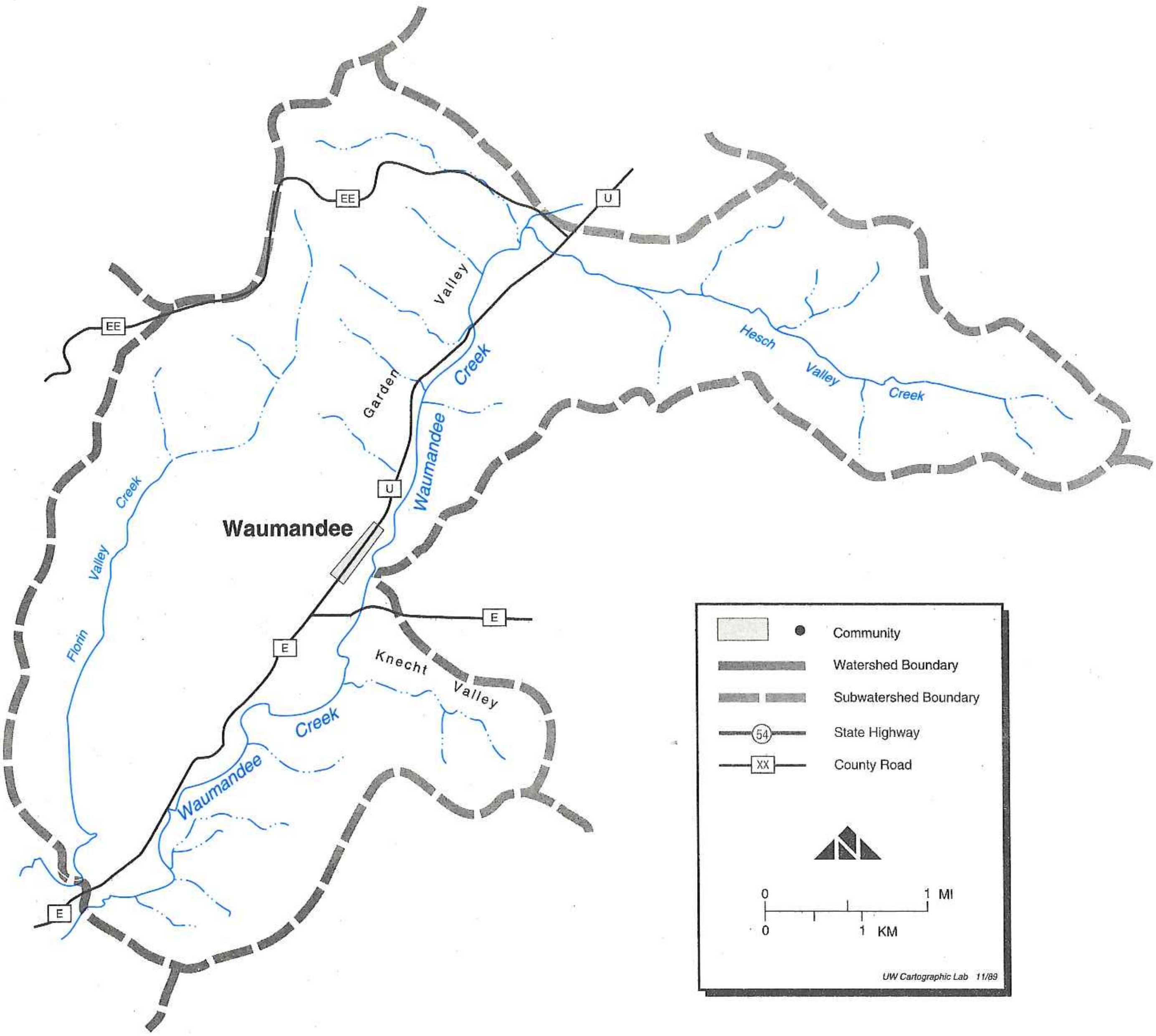
The section of Waumandee Creek that flows through the Garden Valley Subwatershed is classified as a warm water forage fishery. Macro-invertebrate samples collected along Waumandee Creek near the community of Waumandee indicate that water quality in the upper reaches of the mainstem is good, although fish habitat is poor. It is suspected that in-stream temperatures are elevated.

Channelization and erosion along upstream segments and tributaries above this subwatershed show their effects in the Garden Valley Subwatershed. The bottom substrate is composed mostly of sand, and sediment depths appear to increase as the Waumandee meanders to the confluence of Little Waumandee Creek at the bottom of the subwatershed. Pools and riffles have been filled-in in all but a few downstream segments. The raised streambed can no longer contain the creek during storm events; local flooding and an elevated water table adjacent to the stream result from this condition. Despite its degraded quality, there is strong local interest from angler groups in this stretch of the Waumandee.

Hesch Valley Creek is a tributary of the Waumandee which originates in springs and seeps in the northeast corner of the subwatershed. It is classified as a warm water forage fishery and suffers from sedimentation, elevated water temperatures and low dissolved oxygen levels.

Florin Valley Creek is classified as a warm water forage fishery, and due to low flow shows little potential for improvement. Habitat is poor, as the streambed is filled with sand and silt and there is little in-stream cover or shading.

Figure 6: Garden Valley Subwatershed



3. Pollutant Sources

The Garden Valley Subwatershed has the largest percentage of land area in cropland (48%) of any subwatershed, and exhibits the lowest average soil loss per acre for this type of agricultural use. This is likely due to the fact that this subwatershed has extensive areas of level cropland situated in the flat, broad Garden Valley. Its upland sediment contribution is only 591 tons, which is five percent of the entire Waumandee Creek Watershed load. Sixty-three percent (374 tons) of the sediment in Garden Valley originates from eroding cropland; 29% (170 tons) is from grazed woodlot and pastures; and an additional three percent is derived from commercial/residential areas in the community of Waumandee. The remainder is attributed to farmsteads and ungrazed woodlots.

Streambanks in the Garden Valley Subwatershed contribute 884 tons of sediment annually to the Waumandee Creek system, compounding the effects of sediments received from upstream subwatersheds. The majority of the Garden Valley streambank sediment load is derived from eroding sites located along the mainstem of Waumandee Creek. One particular site has eight-foot high eroding banks which extend for 280 feet, amounting to 151 tons of sediment per year.

More than 40% of the streambank along Hesch Valley Creek is suffering from erosion, trampling or slumping. Most of these sites are located in areas where the adjacent land use is pasture. Adjacent land use along Florin Valley Creek is mostly cropland with cultivation extending to the edge of the creek. Three barnyard operations are located right alongside the creek.

Garden Valley Subwatershed contains 60 animal lots. Runoff from these operations carries the third largest phosphorus load to surface waters in the Waumandee watershed: 663 pounds during a 10 year, 24 hour rainfall. This phosphorus delivery is an indication of the amount of organic and oxygen-demanding substances entering the creek. One of the worst contributors (35 pounds of phosphorus) is located directly alongside Florin Valley Creek.

4. Water Resource Objectives

The resource objectives for the Garden Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater by reducing sediment and nutrients delivered from sources further upstream in the Waumandee Creek Watershed.

b. Waumandee Creek (mainstem): Improve the physical and biotic condition of the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

c. Hesch Valley Creek: Improve the physical and biotic conditions of the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

d. Florin Valley Creek: Maintain the current warm water forage fishery. Improve the physical and biotic conditions of the creek to enhance the fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for Garden Valley Subwatershed are to:

a. Reduce upland sediment sources by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 495 acres in the Garden Valley Subwatershed.

b. Reduce streambank erosion in all creeks by 60%. Restrict livestock from creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 27,139 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in the subwatershed, or approximately 531 tons, need to be controlled.

c. Reduce the "top" 50% organic loads from barnyard runoff to creeks. Eleven barnyards produce one-half the organic load (330 pounds) in the Garden Valley Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to improve fish habitat.

f. Protect/restore wetlands and spring sources along Hesch Valley Creek by installing practices such as fencing.

H. IRISH-WATERS SUBWATERSHED

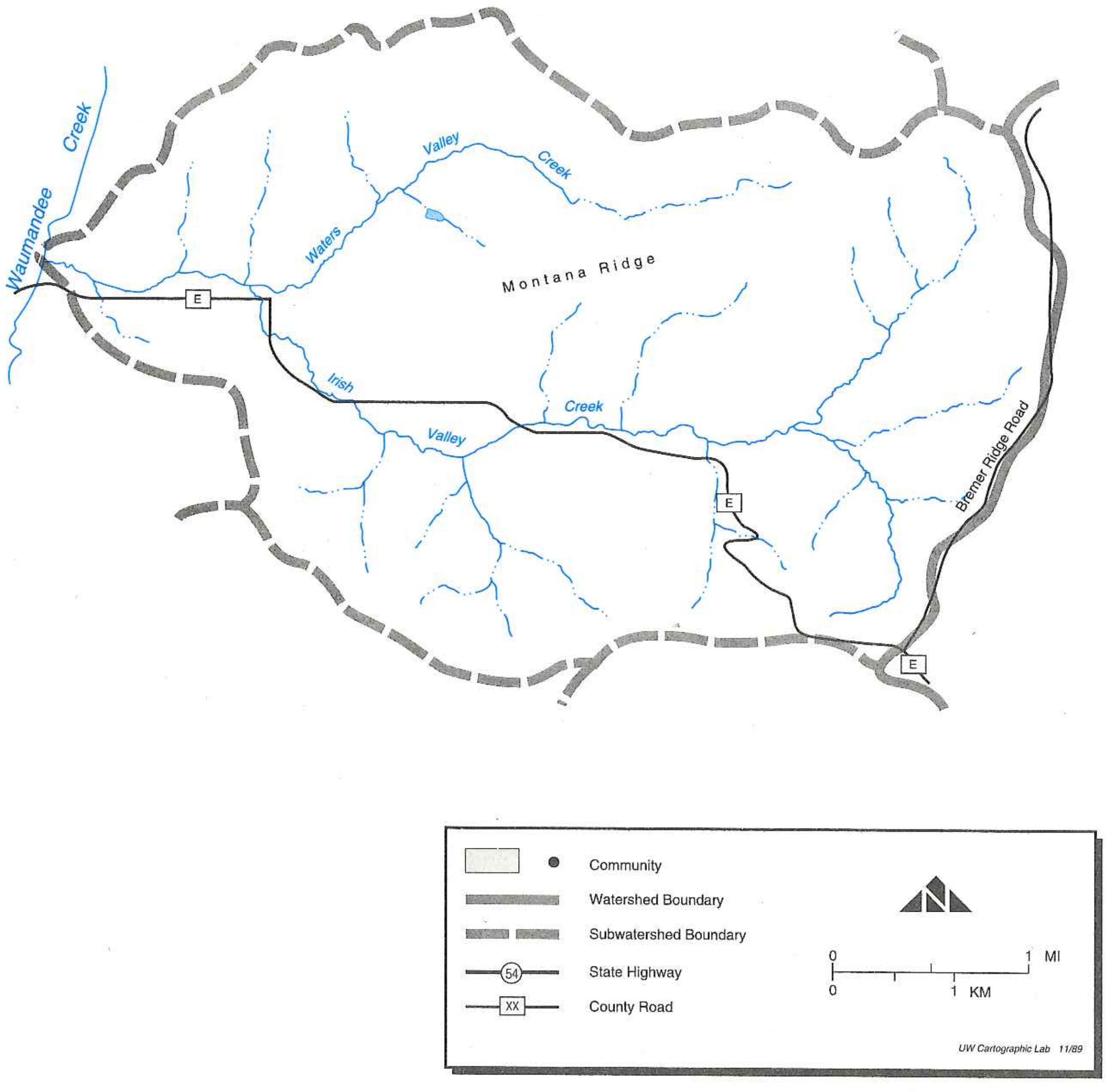
1. Description

The Irish-Waters Subwatershed drains 2,893 acres or about six percent of the entire Waumandee Creek Watershed. It is located in the eastern portion of the Waumandee Creek Watershed and contains a small headwaters area of Waumandee Creek (Figure 7). The Montana Ridge bisects the subwatershed in an east-west direction, separating Irish and Waters valleys. The Irish-Waters Subwatershed is bounded to the north and west by the Garden Valley Subwatershed, and to the south by Schoepp Valley and Eagle Valley subwatersheds.

2. Water Resource Conditions

Many small and intermittent tributaries drain the side valleys of the subwatershed, supplying flow to Irish Valley (stream #15-8) and Waters Valley (stream #14-8) creeks. These two creeks flow in a westerly direction and converge before emptying into Waumandee Creek at the base of the subwatershed.

Figure 7: Irish-Waters Subwatershed



Waters Valley Creek is approximately 1.9 miles long and is a tributary of Irish Valley Creek. It currently supports a warm water forage fishery. The gradient is low for a headwaters creek, and fishery improvements may be limited by the shallow and sandy bottom substrate.

Irish Valley Creek is 5.1 miles long and is a tributary of Waumandee Creek. It is classified as a Class III trout fishery. Recent macro-invertebrate and habitat survey information is lacking for this creek. Irish Valley Creek has good flow (about three cfs) in the headwaters area and has potential for fishery improvement.

3. Pollution Sources

Upland sources contribute 726 tons of sediment to the Waumandee Creek system each year. Sixty percent of this is derived from cropland and 12% is from pastures. Grazed woodlots utilize five percent of the land area but contribute 25% of the upland sediment load.

Streambanks in Irish-Waters Subwatershed generate 11% of the annual streambank sediment load (1285 tons/year) to the Waumandee Creek Watershed. Streambanks in this subwatershed are in poor condition; the subwatershed ranks second in terms of sediment load per mile of stream (129 tons per stream mile). Irish Valley Creek is the source of almost all of the sediment generated in the subwatershed -- nearly 20% of its streambanks are eroding, trampled, or slumping. Land adjacent to the lower portion of Irish Valley Creek is pastured with cattle permitted access to the creek. In the headwaters area the adjacent land uses include cropland, woodland, and grassland. Trampling by cattle is a problem along both creeks, and one site along Waters Creek has a stretch of trampled banks extending for one mile.

In the Irish-Waters Subwatershed, there are 28 animal lots which generate 280 pounds of phosphorus during a 10 year, 24-hour rainfall. (Phosphorus is used as an indication of the amount of organic and oxygen-demanding substances entering the creek.) Five animal yards contribute 50% of the phosphorus load. Most of the largest generators appear to be located in the western end of the watershed, near the lower end of Irish-Waters Creek.

4. Water Resource Objectives

The resource objectives for the Irish-Waters Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients derived from the Waumandee Creek Watershed.

b. Waters Valley Creek: Improve the physical and biotic conditions of the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

c. Irish Valley Creek: Maintain the Class III trout fishery. Improve the physical and biotic condition of the creek to enhance the fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Irish-Waters Subwatershed are to:

a. Reduce upland sediment sources by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 660 acres in the Irish-Waters Subwatershed.

b. Reduce streambank erosion along Irish and Waters Valley creeks by 60% (or 771 tons). Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock.

c. Reduce the "top" 50% of the organic loading from barnyard runoff along all creeks. Five barnyards produce one-half the organic load (138 pounds) in the Irish-Waters Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to stabilize streambanks.

f. Protect wetlands and spring source areas by installing practices such as fencing.

I. UPPER LITTLE WAUMANDEE SUBWATERSHED

1. Description

The Upper Little Waumandee subwatershed is located in the northwestern portion of the Waumandee Creek Watershed (Figure 8). It is the second largest subwatershed (15,452 acres), and drains a headwaters area of Little Waumandee Creek. Alma Ridge forms the subwatershed's northern drainage divide; Buell Valley and Jahns Valley subwatersheds are to the east, and the Middle Waumandee Subwatershed is to the south. Little Waumandee Creek runs the length of the subwatershed, flanked by numerous side valleys and tributaries. The unincorporated community of Praag is located within the subwatershed. Nearly half the land area is wooded, including expanses of swamp hardwood along Little Waumandee Creek.

2. Water Resource Conditions

Little Waumandee Creek originates in headwaters north of Praag, along the Montana and Alma ridges. It flows in a southwesterly direction through the subwatershed for approximately 10 miles before entering the Middle Waumandee Subwatershed. Perennial tributaries include Schmidt Valley Creek, 1.3 miles long (stream #36-3), and Wolf Valley Creek, 2.1 miles long (stream 18-16).

Figure 8: Upper Little Waumandee Subwatershed

The upper portion of Little Waumandee Creek currently supports a Class III trout fishery, with the potential to support a Class II fishery. The upper reaches in the northern portion of the subwatershed exhibit good water quality resulting from numerous springs and seeps. The creek is deep and bottom substrate is fairly good, with some sedimentation evident. Local trout club interest in this portion is strong. Habitat improvements were installed in the upper reaches years ago to slow water velocity, stabilize streambanks, and create in-stream cover. Further downstream (near Praag), the sand/silt substrate increases and habitat declines. Streambanks in this lower portion have been channelized and heavily pastured.

Schmidt Valley Creek currently supports a warm water forage fishery. High gradients (167 feet/mile) have saved the creek from extreme sedimentation, however the potential for fishery improvement is limited by low flow.

Wolf Valley Creek is classified as a warm water forage fishery. It has good gradient and bottom substrate but the potential for improvement may be limited by low flow.

3. Pollutant Sources

Upper Little Waumandee Subwatershed has the second highest soil loss rate in the Waumandee Creek Watershed and delivers the second largest sediment load to the Waumandee Creek system from upland sources. This amounts to 2,046 tons annually, or 17% of the entire watershed load. Cropland is the source of 62% of the sediment load from upland sources in the subwatershed, grazed woodlots contribute 30%, and pastures contribute seven percent.

Streambanks in the Upper Little Waumandee Subwatershed generate the second largest sediment loss of the entire watershed (1,945 tons per year). Almost all of this sediment originates from streambanks along Little Waumandee Creek. The lower reaches of the creek suffer from slumping and eroding banks adjacent to woodlots and grasslands; the middle portion is cultivated to the creek edge; and the upper stretches are heavily trampled by cattle. More than one-third of streambanks along Wolf Valley Creek are trampled.

The Upper Little Waumandee Subwatershed ranks fourth in the amount of phosphorus generated by barnyard operations in the Waumandee Creek Watershed. This subwatershed has 25 animal lots which generate 569 pounds of phosphorus during a 10-year, 24-hour rainfall. (Phosphorus is used as an indication of the organic and oxygen-demanding substances entering the creeks.) Runoff from one barnyard operation located in the headwaters of Wolf Valley Creek generates 20% of the load (115 pounds).

4. Water Resource Objectives

The resource objectives for the Upper Little Waumandee Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients derived from the Waumandee Creek Watershed.

b. Little Waumandee Creek: Improve the physical and biotic conditions in the creek in order to change the classification from a Class III trout fishery to a Class II trout fishery.

c. Schmidt Valley Creek: Maintain the current warm water forage fishery. Improve the physical and biotic conditions in the creek to enhance the fishery.

d. Wolf Valley Creek: Improve the physical and biotic conditions in the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Upper Little Waumandee Valley Subwatershed are to:

a. Reduce the upland sediment delivered to creeks by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 1811 acres in the Upper Little Waumandee Subwatershed.

b. Reduce streambank erosion by 60%. Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 27,316 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in the subwatershed or approximately 1,167 tons need to be controlled.

c. Reduce the "top" 50% of organic loads from barnyard runoff. Four barnyards produce about one-half the organic load (268 pounds) in the Upper Little Waumandee Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

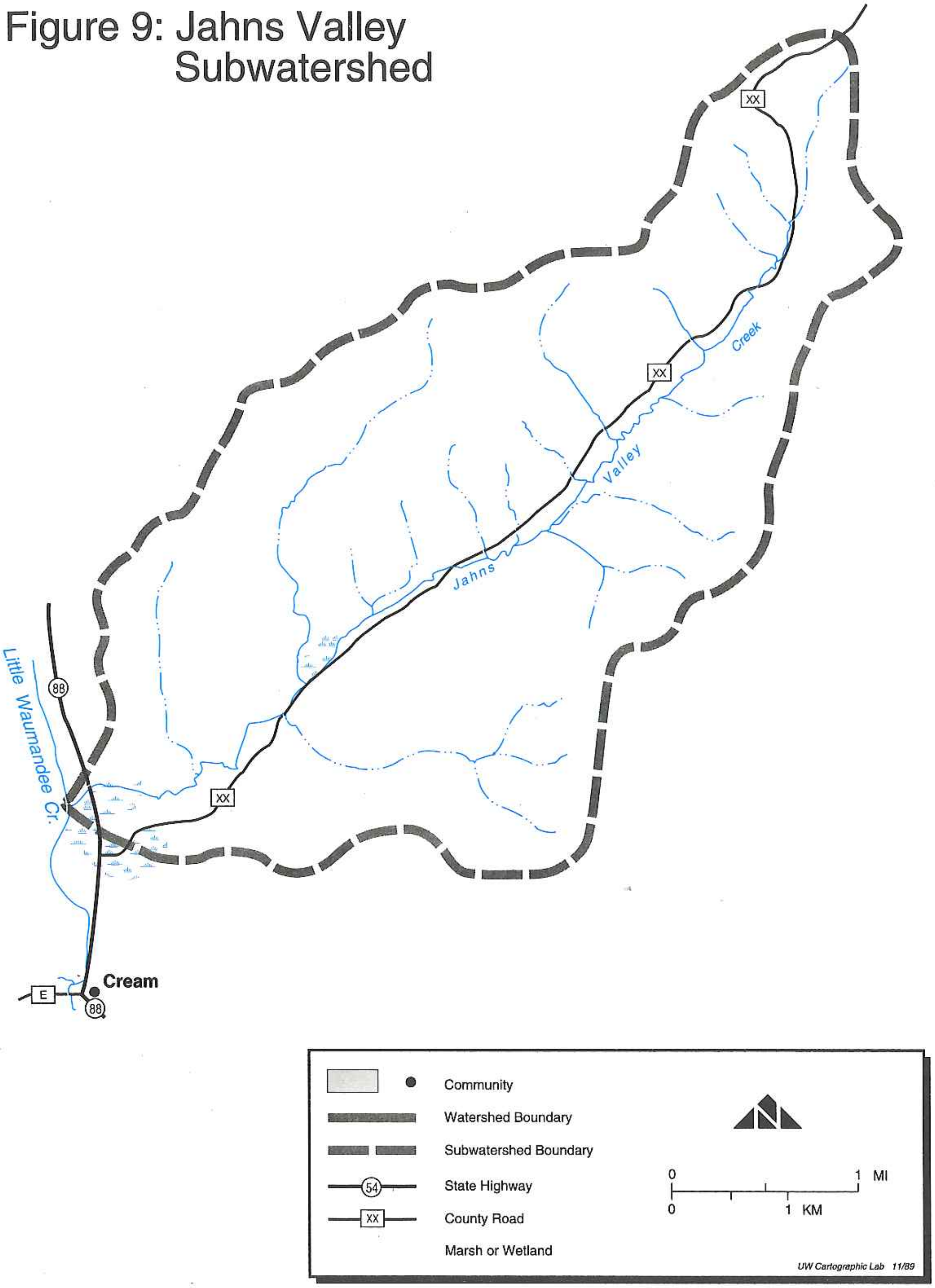
e. Manage the stream corridor to stabilize streambanks.

J. JAHNS VALLEY SUBWATERSHED

1. Description

Jahns Valley is one of the smaller subwatersheds in the Waumandee Creek Watershed and contains 6,050 acres (Figure 9). Jahns Valley creek flows the length of the subwatershed. Its headwaters originate in along the northern drainage divide; the creek exits the south end of the subwatershed at its confluence with the Little Waumandee Creek. Highway XX parallels its course through Jahns Valley.

Figure 9: Jahns Valley Subwatershed



2. Water Resource Conditions

Jahns Valley Creek (stream #6-7) is the only perennial creek in the subwatershed. It is 5.3 miles long and is supplemented by several intermittent side channels. Jahns Valley Creek is classified as a warm water forage fishery; macro-invertebrate studies indicate fairly good water quality, while habitat surveys reveal poor fish habitat. Most of the creek bottom, except for the portions of the upper headwaters, is covered with sand or silt. In-stream cover is scarce, and there is little or no shading. These conditions suggest elevated water temperatures and low dissolved oxygen levels. Downstream sections have been channelized and widened.

3. Pollutant Sources

The sediment contribution to surface water from upland erosion in the Jahns Valley Subwatershed is 436 tons per year, or about four percent of the entire Waumandee Creek Watershed load. (Jahns Valley subwatershed contains approximately seven percent of the land area in the entire watershed.) Almost one-half the land area in the subwatershed is covered by woodland which generates only three tons of sediment per year. The remainder is utilized by cropland (30%) which generates 175 tons of sediment per year, and pasture and grazed woodlot (22%) which generates 253 tons of sediment per year.

Streambank sources in Jahns Valley supply 401 tons of sediment annually to the creek. Approximately 30% of the streambank is eroding, trampled or slumping. Most of the stream is bordered by pasture, with cattle access permitted. Several sites along the downstream portion of Jahns Valley Creek are extensively trampled by livestock.

Jahns Valley Subwatershed contains 12 animals lots which generate 210 pounds of phosphorus during a 10 year, 24 hour rainfall. (Phosphorus is used as an indication of organic and oxygen demanding substances entering the creek.) Two of the barnyard operations in the subwatershed contribute nearly 50% of the organic load.

4. Water Resource Objectives

The resource objectives for the Jahns Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients derived from the Waumandee Creek Watershed.

b. Improve Jahns Valley Creek's physical and biotic condition in order to its change classification from a warm water forage fishery to a Class III coldwater trout fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Jahns Valley Subwatershed are to:

a. Reduce upland sediment contributions to the creek by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 424 acres in Jahns Valley Subwatershed.

b. Reduce streambank erosion by 60%. Restrict livestock from Jahns Valley Creek where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 22,300 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in this subwatershed, or approximately 241 tons, need to be controlled.

c. Reduce the "top" 50% of the organic loading from barnyard runoff. Two barnyards produce about 50% of the organic load (33 pounds) in the Jahns Valley Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to stabilize streambanks and improve stream cover and habitat.

K. MIDDLE WAUMANDEE SUBWATERSHED

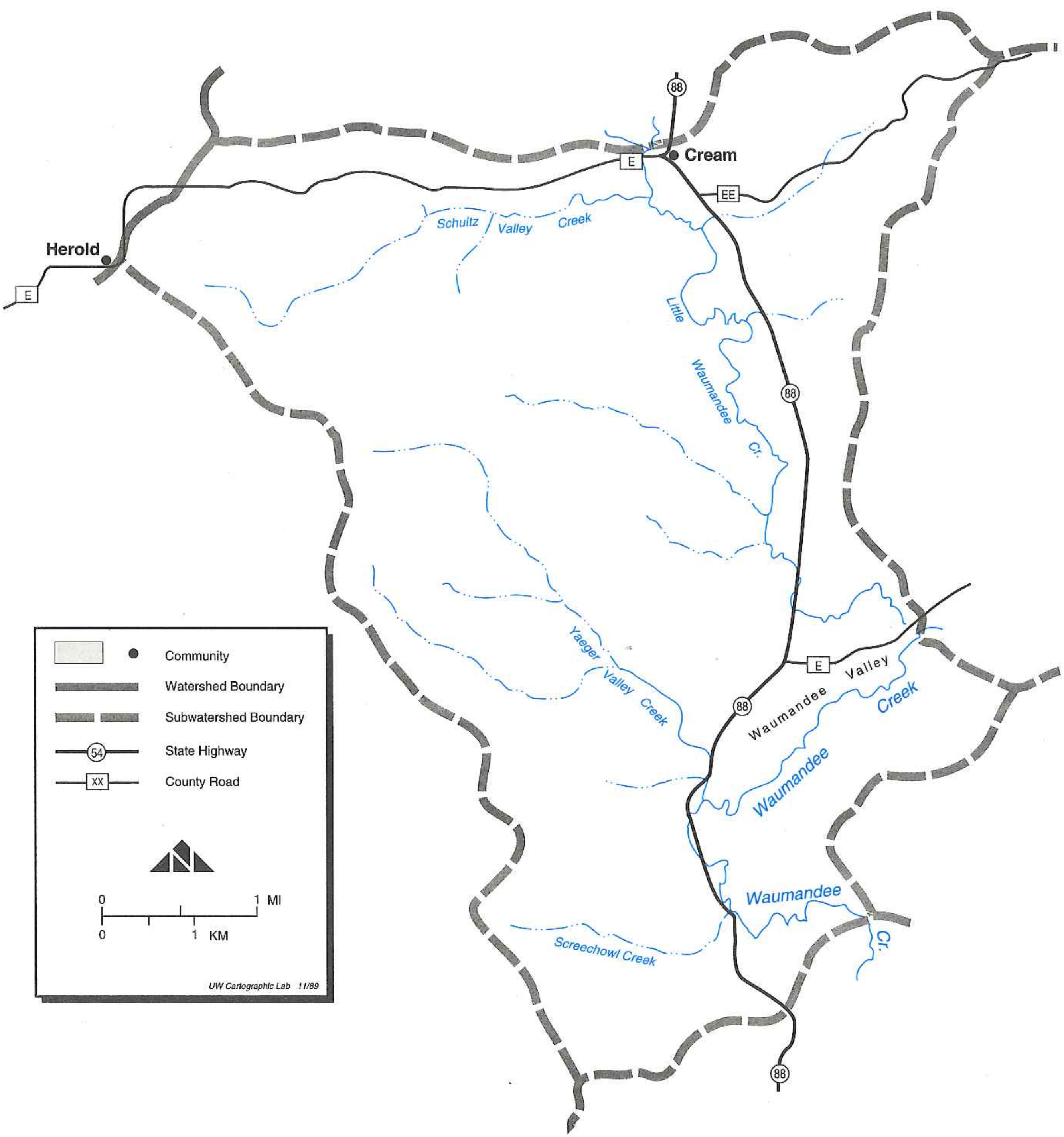
1. Description

The Middle Waumandee Subwatershed includes land that drains to the lower portion of Little Waumandee Creek and the middle reaches of Waumandee Creek. It also includes two smaller headwaters areas known as Schultz Valley and Yeager Valley (Figure 10). It is the fifth largest subwatershed in the Waumandee Creek Watershed and drains 12,183 acres. The subwatershed's western divide is the Belvidere Ridge; it shares common eastern borders with the Garden Valley and Schoepp Valley subwatersheds. To the north the is Upper Little Waumandee Subwatershed, and to the south is Lower Waumandee Subwatershed. The small community of Cream is located just inside its northern border.

2. Water Resource Conditions

Little Waumandee Creek flows south through the subwatershed for approximately six miles before it joins Florin Valley Creek and then empties into Waumandee Creek along the eastern subwatershed divide. (Florin Valley Creek, stream #29-2, is actually a tributary of Little Waumandee Creek which has been included in the Garden Valley Subwatershed delineation.) The Waumandee Creek flows south through the remainder of the subwatershed for approximately six miles. Small tributaries include Schultz Valley Creek (stream #12-13), Yeager Valley Creek (stream #31-7), and Screechowl Creek.

Figure 10: Middle Waumandee Subwatershed



Little Waumandee Creek is classified as warm water forage fishery in this subwatershed. The creek increases in sinuosity and sediment depth as it flows downstream. Sedimentation may be attributed to extensive channelization, and cultivation and pasturing practices upstream in the Upper Little Waumandee and Jahns Valley subwatersheds. The creek also suffers from a lack of in-stream and bank cover.

Schultz Valley Creek is a small tributary of Little Waumandee Creek. It flows approximately 1.1 miles in an easterly direction to its confluence with Little Waumandee Creek. It is classified as a warm water forage fishery. Its potential is limited due to low flow. A 1987 fish survey indicated that the bottom substrate is 90% sand.

This section of Waumandee Creek currently supports a warm water forage fishery. The creek widens and the bottom substrate becomes entirely sand below the confluence of Yeager Valley Creek. This section of the creek is surrounded by wooded wetlands and has fairly stable banks, according to a 1987 habitat survey. The depth of the channel (15 feet) indicates potential for a warm water sport fishery. There is strong local interest in the mainstem of the Waumandee Creek. Recent macro-invertebrate and habitat surveys are lacking for the middle and lower section of Waumandee Creek.

Yeager Valley Creek and Screeechowl Creek are named tributaries of the Waumandee in this subwatershed. Yeager Valley Creek flows approximately three miles in a southeasterly direction and currently supports a warm water forage fishery. Good gradient (94 feet/mile) and fairly good bottom substrate present potential for fishery improvement. Screechowl Creek is intermittent therefore water resource conditions were not appraised.

3. Pollutant Sources

Runoff from upland sources in the Middle Waumandee Subwatershed generates 587 tons of sediment annually to the Waumandee system. Most of the upland sediment load is derived from cropland (74%). Pastures contribute 12%, or 73 tons. Sediment from grazed woodlots is not as great a problem as in other subwatersheds, as only two percent of the subwatershed is in this type of agricultural use and it generates about 37 tons per year, or six percent of the subwatershed load from upland sources. Much of the land is wooded (46%), and this cover type generates only three percent of the sediment load.

Streambanks in the Middle Waumandee Subwatershed contribute the third largest amount of sediment (1,840 tons) annually to the Waumandee system. This amounts to 16% of the entire watershed streambank sediment load. About 22% of the streambanks in this subwatershed are eroding, slumping or trampled; most of the damage is occurring along the banks of Little Waumandee Creek. Much of the land adjacent to the creek is in pasture with cattle access permitted to the creek. Some sites are eroded to a height of 16 feet. Streambank erosion along the Waumandee Creek in this subwatershed is slight (135 tons/year).

Middle Waumandee Creek subwatershed has 37 animal lots which generate 421 pounds of phosphorus during a 12 year, 24-hour rainfall. (Phosphorus is used as an indication of the organic and oxygen-demanding substances entering the creek.) Barnyards are scattered throughout the subwatershed, with major phosphorus contributors located in the headwaters areas of Schultz Valley and Yeager Valley creeks.

4. Water Resource Objectives

The resource objectives for the Middle Waumandee Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients derived from the Waumandee Creek Watershed.

b. Waumandee Creek (mainstem): Improve the stream's physical and biotic condition in order to change the classification from a warm water forage fishery to a warm water sport fishery.

c. Yeager Valley Creek: Improve the stream's physical and biotic condition in order to change the classification from a warm water forage fishery to a Class III trout fishery.

d. Schultz Valley Creek: Maintain the current warm water forage fishery. Improve the physical and biotic conditions in the creek to enhance the fishery.

e. Reduce fecal coliform concentrations at Fountain City Bay.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Middle Waumandee Subwatershed are to:

a. Reduce upland sediment delivered to creeks by 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 475 acres in the Middle Waumandee Subwatershed.

b. Reduce streambank erosion by 60%. Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 39,141 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in the subwatershed, or approximately 1,104 tons, need to be controlled.

c. Reduce the "top" 50% of the organic loads from barnyard runoff. Nine barnyards produce about one-half the organic load (206 pounds) in the Middle Waumandee subwatershed.

d. Control 70% of the livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to allow natural sinuosity and stabilize streambanks.

f. Protect wetlands and spring areas along tributaries by installing practices such as fencing.

L. SCHOEPP VALLEY SUBWATERSHED

1. Description

The Schoepp Valley Subwatershed is a small headwaters area that drains to Schoepp Valley Creek (Figure 11). It contains 4,534 acres, or about four percent of the entire Waumandee Creek Watershed. Woodland occupies more than half of the land area in the Schoepp Valley Subwatershed.

2. Water Resource Conditions

Schoepp Valley Creek (stream #6-5) is the only perennial creek in the subwatershed and is a tributary of Waumandee Creek. It flows 5.2 miles in a southwesterly direction, supplemented by several intermittent side channels. Schoepp Valley Creek is classified as a warm water forage fishery. Macro-invertebrate studies undertaken in 1987 indicate good water quality in the headwaters, as well as gravel and rubble bottom substrate.

3. Pollutant Sources

The amount of sediment derived from uplands sources in the Schoepp Valley Subwatershed (342 tons per year) is low compared to other subwatersheds, probably due to its small drainage area. Sixty percent is supplied by runoff from cropland, 37% is from pastures and grazed woodlots. The remaining three percent is generated by farmsteads and ungrazed woodlots.

Nearly 30% of the streambank in Schoepp Valley Subwatershed is eroding, trampled or slumping; 426 tons of streambank are lost annually. Pasturing is common along the creek and about one-half of the degradation is due to trampling by cattle.

Schoepp Valley Subwatershed has relatively few animal lots (13), and these generate about four percent of the entire Waumandee Creek Watershed phosphorus load, or 202 tons during a 10 year, 24-hour rainfall. (Phosphorus is used as an indication of organic and oxygen-demanding substances entering the creek.) Three barnyards in the subwatershed generate more than one-half of this load.

4. Water Resource Objectives

The resource objectives for the Schoepp Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients derived from the Waumandee Creek Watershed.

b. Improve the physical and biotic conditions in the creek in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Schoepp Valley Subwatershed are to:

a. Reduce upland sediment 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 276 acres in the Schoepp Valley Subwatershed.

b. Reduce streambank erosion by 60%. Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 24,963 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in the subwatershed or approximately 256 tons need to be controlled.

c. Reduce the "top" 50% of the organic loads from barnyard runoff. Three barnyards produce about one-half the organic load (105 pounds) in the Schoepp Valley Subwatershed.

d. Control 70% of the livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to stabilize streambanks.

f. Protect wetlands and spring flow areas by installing practices such as fencing.

M. LOWER WAUMANDEE SUBWATERSHED

1. Description

This subwatershed drains the lowest part of the Waumandee Creek Watershed. Waumandee Creek meanders through it carrying a cumulative load of water, sediment, and organic matter collected during 28 miles of flow through the upper subwatersheds (Figure 12). The Lower Waumandee Subwatershed contains 14,881 acres, making it the third largest subwatershed in the Waumandee Creek Watershed. This subwatershed has the highest percentage of land in wetland: 21%, or 3,127 acres. The small community of Czechville is located within the subwatershed. Highway 35, a major north-south transportation route along the Mississippi River transects the south end of the subwatershed.

Waumandee Creek is supplemented by side tributaries with headwaters originating along the subwatershed's eastern divide, the Montana Ridge. The Waumandee divides into three branches as it exits the watershed and empties into the Mississippi River at Fountain City Bay and two points along the backwater complex. Merrick State Park, the Upper Mississippi River Fish and Wildlife Refuge, and most of the Fountain City Bay backwater complex are included in the Mississippi River backwater complex discussion.

Figure 11: Schoepp Valley
Subwatershed

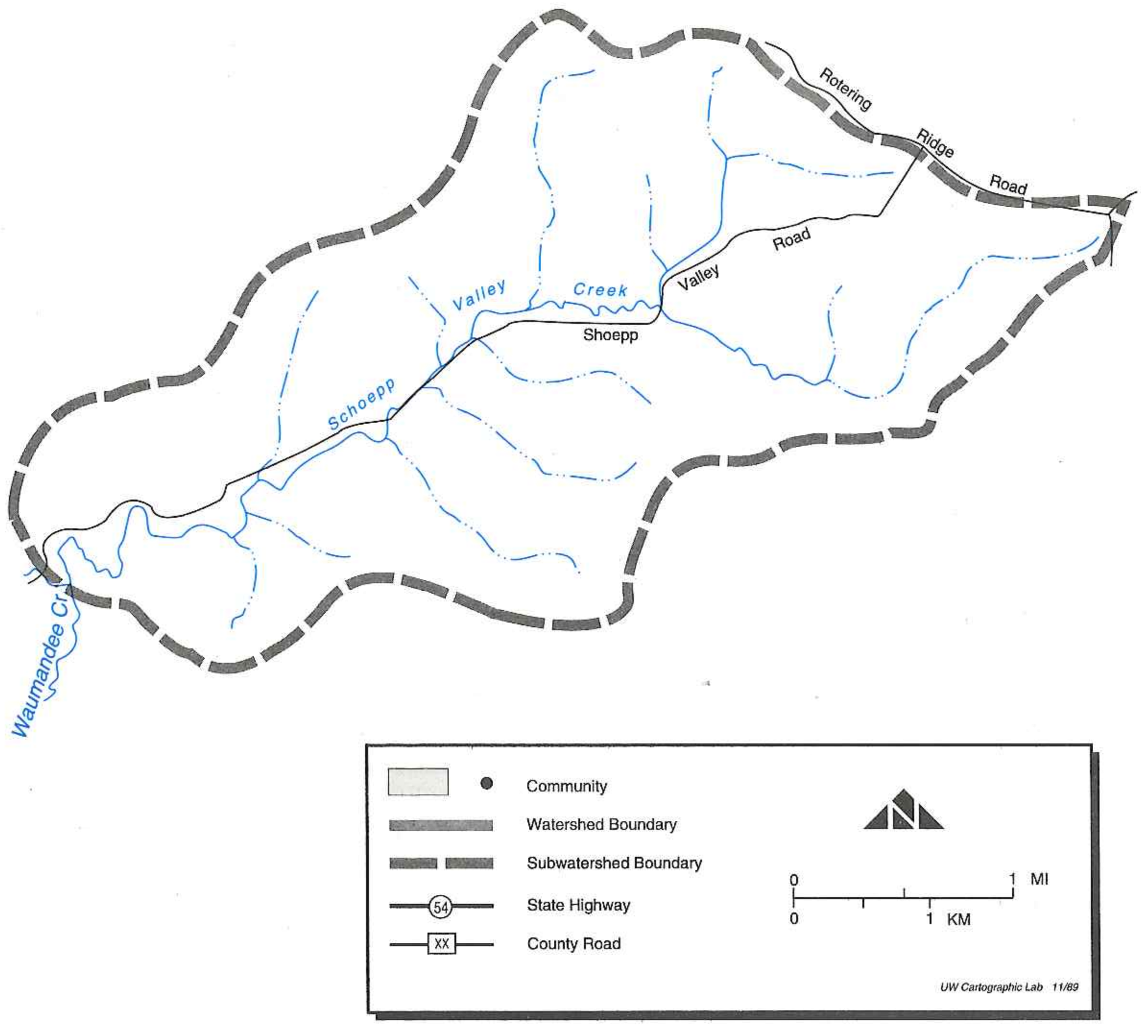
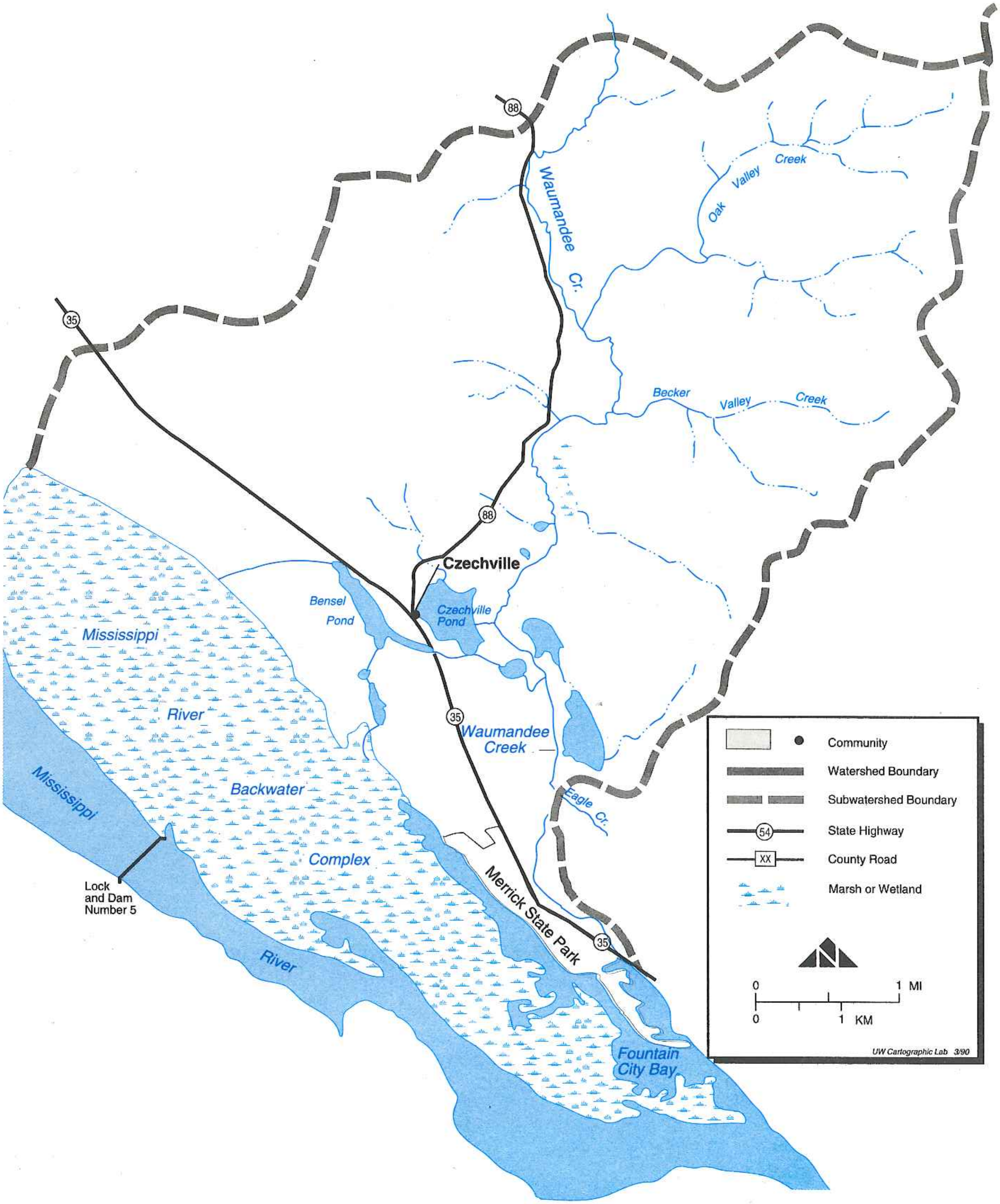


Figure 12: Lower Waumandee Subwatershed



2. Water Resource Conditions

Two perennial tributaries contribute to the Waumandee in this subwatershed. Oak Valley Creek (stream #7-11) and Becker Valley Creek (stream #18-9) run 1.5 and 0.8 miles, respectively. Other surface water resources include Bensel Pond (81 acres) and Czechville Pond (100 acres), situated west and east of Highway 35, respectively. The Lower Waumandee Subwatershed contains extensive lowland and wetland areas in addition to the 5,000 acres of backwater complex along the Mississippi River.

This subwatershed exhibits unique hydrology. In recent years, sedimentation has altered the morphology and flow patterns of the lower portion of Waumandee Creek. As shown in Figure 12, as the creek winds towards the Mississippi between Cochrane and Fountain City, it divides into three branches: an upper channel (flowing westward out of Bensel Pond); a middle channel (flowing southwest out of Bensel Pond); and a lower channel (flowing southward along the original Waumandee Channel). Prior to 1965, the Waumandee flowed directly southward into lower Waumandee Creek, the primary channel draining the watershed, where it was joined by Eagle Creek before discharging into Fountain City Bay.

A blockage developed at the confluence of Eagle Creek due to sedimentation and beaver activity. The result was a change of flow westward above this point, and increased discharge to the upper and middle channels from upstream portions of the Waumandee. Normal flow is now conveyed through the upper and middle stream channels into the marsh and wetland complex of upper Fountain City Bay via Czechville and Bensel Pond. During periods of high flows, water from Waumandee Creek may flow into the lower (original) channel and discharge into the bay below Merrick State Park. Currently, the primary source of inflow to the old lower channel of Waumandee Creek during normal flow is from the Eagle Creek Subwatershed.

The lower portion of Waumandee Creek is classified as a warm water forage fishery. Recent macro-invertebrate and habitat surveys are lacking for this section of the creek. As the Waumandee passes through this area, it carries the sediment and organic load generated by nearly the entire watershed. It appears that much of the creek's bottom substrate has been covered with sand and silt, filling in pools and riffles. These conditions generally result in elevated water temperatures and lowered dissolved oxygen levels. A raised streambed has resulted in flashy conditions where the creek continually overflows its banks during storm events. This situation is aggravated by lack of bank cover and stability.

Oak Valley and Becker Valley creeks are classified as warm water forage fisheries. These creeks also suffer from sedimentation and the problems associated with it, a characteristic of most tributaries of the Waumandee. Oak Valley Creek may be limited to some degree by poor flow, however Becker Valley Creek has good gradient (100 feet/mile) and adequate flow (about one cfs) to potentially support a Class III cold water trout fishery.

The Bensel and Czechville ponds are classified as recreational areas and migratory waterfowl habitat areas. They effectively filter and settle out a large portion of the sediment carried down through the altered Waumandee drainage system. This action is important to the protection of the sensitive backwater complex ecology. Czechville Pond receives inflow from two locations along Waumandee Creek, and a small headwaters area north of the pond. An outlet at its southern end discharges to Bensel Pond. Bensel Pond is fed primarily by inflow from Czechville Pond; outlets at its south and western end discharge to the Fountain City Bay backwater complex.

The ponds have been known to support northern pike, bluegill, pumpkinseed and carp; however the continuous sediment inflow and deposition has reduced their depths, resulting in low dissolved oxygen stores, high turbidity, loss of aquatic habitat, and winter kills. It is estimated that the surface area of the ponds has doubled in the years since the change in channel flow in the lower Waumandee Creek. There is no public access provided to either pond.

3. Pollution Sources

Upland sources in the Lower Waumandee Subwatershed contribute 1,006 tons of sediment annually to the Waumandee Creek. Cropland supplies 69% of this load, while pastures generate eight percent. Grazed woodlots make up only three percent of the land use in the subwatershed, but supply about 20% of the sediment load (204 tons per year).

Eroding, trampled or slumping sites are located along 19% of the streambank in this subwatershed, which is about average for the Waumandee Creek Watershed. The volume of sediment generated (196 tons/year) is low, however, in comparison to other subwatersheds. Adjacent land use is predominantly pasture, with cattle permitted access to the creek and its tributaries. Major portions of streambank along Oak Valley Creek have been trampled by cattle, some sites extend for one-half mile each.

Twenty-four barnyard operations in the Lower Waumandee Subwatershed generate 378 pounds of phosphorus during a 10-year, 24-hour rainfall, or about seven percent of the entire Waumandee Creek Watershed phosphorus load. The majority of the large generators are located in the western portion of the subwatershed. It is likely that livestock operations in this subwatershed are contributing to the high bacteria counts measured at Merrick State Park beach.

4. Water Resource Objectives

The resource objectives for the Lower Waumandee Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing sediment and nutrients delivered by creeks in the Lower Waumandee Subwatershed.

b. Waumandee Creek (mainstem): Improve the creek's physical and biotic condition in order to change the classification from a warm water forage fishery to a warm water sport fishery.

c. Oak Valley Creek and Becker Valley Creek: Improve the creeks' physical and biotic condition in order to change the classifications from warm water forage fisheries to Class III trout fisheries.

d. Reduce fecal coliform concentrations (and the resultant beach closings) at Merrick State Park.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Lower Waumandee Subwatershed are to:

a. Reduce upland sediment 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 931 acres in Lower Waumandee Subwatershed.

b. Reduce streambank erosion by 60%. Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 22,687 feet of streambank will require restricted cattle access. Overall, 60% of streambank sediments in the subwatershed, or approximately 117 tons, need to be controlled.

c. Reduce the "top" 50% of the organic loads from barnyard runoff. Six barnyards produce about one-half the organic load (187 pounds) in the Lower Waumandee Subwatershed.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to allow natural sinuosity and stabilize streambanks.

N. EAGLE VALLEY SUBWATERSHED

1. Description

Eagle Valley Subwatershed is the largest subwatershed; it drains 19,199 acres, which is 16% of the land area in the Waumandee Creek Watershed. Located in the southeastern portion of the Waumandee Creek Watershed, the Fountain City Ridge forms the eastern divide of this subwatershed, and the Canada Ridge and Highway 95 form its eastern barrier (Figure 13). A small portion of Fountain City lies within the subwatershed drainage area, however only four parcels of this land (32 acres) were associated with residential, commercial and developing land uses.

2. Water Resource Conditions

Eagle Creek flows southwesterly the length of the subwatershed, flanked by numerous side tributaries. Perennial feeder creeks include Joos Valley Creek (stream #15-1) and Baertch Valley Creek (stream #28-14).

Eagle Creek originates in northern part of the subwatershed, along the Glencoe Ridge, and runs approximately 14 miles before emptying into the lower portion of Waumandee Creek in a wetland area northeast of Merrick State Park. Eagle Creek currently supports a Class III trout fishery. It is one of only three creeks in the Waumandee Creek Watershed identified as having the potential to become a Class II fishery. The headwaters provide excellent habitat and good water quality resulting from numerous springs and seeps.

Further downstream near the confluence of Joos Valley Creek, the streambanks are straightened, in-stream deposition progressively increases, and habitat and water quality decline, according to fish and habitat surveys. However according to water resource appraisal investigations, the stream supports brown trout. Raised streambeds in the lower portion of the creek have resulted in flooding. It is suspected that these conditions have elevated groundwater levels, making cultivation in the vicinity of the creek difficult. The creek widens and deepens as it moves further downstream through the subwatershed.

Joos Valley Creek is a major tributary of Eagle Creek and flows west 3.8 miles before emptying into Eagle Creek. Upstream reaches of Joos Valley Creek have steep gradients and constant supplies of cold spring water. The creek has fairly good bottom substrate and in-stream cover despite heavy bank erosion in some locations. It currently supports a warm water forage fishery. A Biotic Index survey conducted in 1987 indicates poor water quality due to organic loads, such as manure, along the lower stretch of Joos Valley Creek. It is suspected that Joos Valley Creek is not reaching its potential due to the high organic loads it receives, including ammonia and bacteria, and low dissolved oxygen levels.

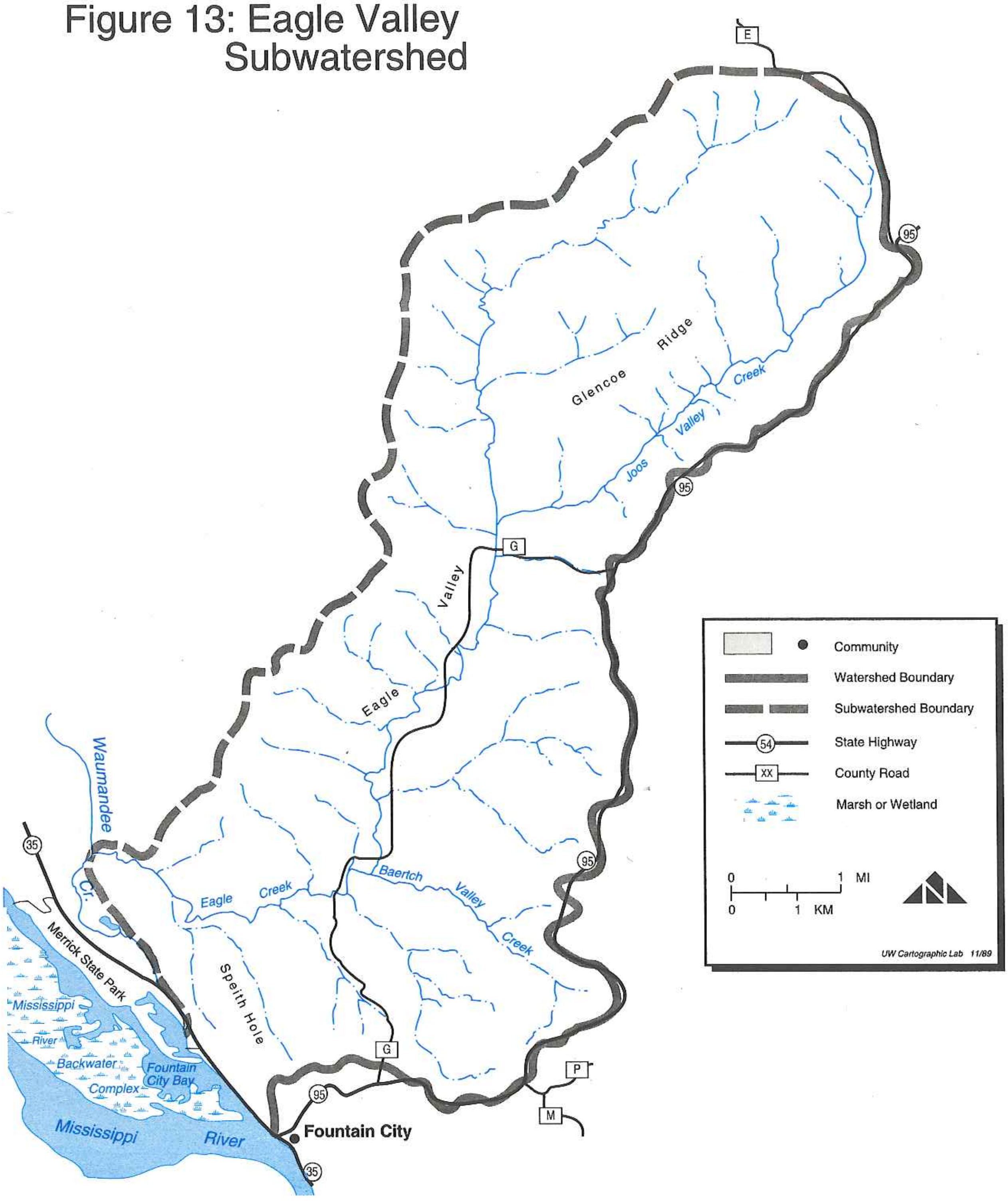
Baertch Valley Creek is a small perennial tributary that flows west toward Eagle Creek approximately two miles. It is limited by low flow and is classified as a warm water fishery.

3. Pollutant Sources

As might be expected, the large pollutant loads reflect the large surface area of this drainage basin. The Eagle Creek Subwatershed has the highest soil loss (or erosion rate) on cropland, and generates the largest upland sediment load (2,690 tons/year) of all the subwatersheds. Most of it is derived from cropland (55%) and pastures and grazed woodlot (44%). These sources combined make up only 52% of the land area. A large percentage of the drainage area (45%) is in woodland and supplies little sediment to surface waters.

Each year, eight miles of eroding and/or slumping streambanks in Eagle Valley Subwatershed lose 1,342 tons of sediment to the stream system. Streambank erosion is not as severe along the mainstem of Eagle Creek (55 tons/steam mile) as it is along Joos Valley Creek (90 tons/stream mile). Significant portions of both creeks have been channelized and straightened. Much of the adjacent land use in the lower section of

Figure 13: Eagle Valley Subwatershed



Eagle Creek is woodland. The upper reaches are pastured with cattle permitted access to the creek. Adjacent land use in Joos Valley Creek is mainly pasture with extensive trampling of banks by cattle. Baertch Valley Creek has moderate streambank erosion (seven tons/mile) along its short run.

The 42 animal lots in the Eagle Valley Subwatershed produce the largest load of phosphorus of all the subwatersheds. (Phosphorus runoff during a 10-year, 24-hour rainfall is an indication of the organic, oxygen-demanding substances and bacteria entering the creek.) This amounts to 16% of the entire Waumandee Creek Watershed organic load, or 846 pounds of phosphorus. Two barnyard operations alone contribute over 30% of the load. Barnyard inventories indicate that the generators of large phosphorus loads are scattered throughout the watershed.

4. Water Resource Objectives

The resource objectives for the Eagle Valley Subwatershed are to:

a. Maintain and protect the water quality of the Mississippi River backwater complex by reducing the sediment and nutrients delivered by creeks in the Eagle Creek Subwatershed.

b. Eagle Creek: Improve the physical and biotic conditions in the creek in order to change the classification from a Class III coldwater trout fishery to a Class II trout fishery.

c. Joos Valley Creek: Improve the creek's physical and biotic condition in order to change the classification from a warm water forage fishery to a Class III coldwater trout fishery.

d. Baertch Valley Creek: Maintain the current warm water forage fishery. Improve the physical and biotic conditions in the creek to enhance the fishery.

5. Reduction Goals and Management Actions

The pollutant reduction goals for the Eagle Valley Subwatershed are to:

a. Reduce upland sediment 50%. Agricultural lands contributing sediment at a rate greater than 0.3 tons/acre/year must be brought down to 0.3 tons/acre/year. This amounts to 2,246 acres in the Eagle Valley Subwatershed.

b. Reduce streambank erosion along Eagle Creek by 80% (or 712 tons). Reduce streambank erosion along all other creeks by 60% (or a total of 271 tons). Restrict livestock from all creeks where there is evidence of trampling along the bank, streambed damage, or streambank erosion by livestock. An estimated 27,139 feet of streambank in the subwatershed will require restricted cattle access.

c. Reduce the "top" 70% of organic loads from barnyards draining to Eagle Creek. Reduce the "top" 50% of organic loads from barnyards draining to Joos Valley Creek and Baertch Valley Creek.

d. Control 70% of livestock wastes spread on "unsuitable" lands. Landowners who winter-spread manure on more than 15 acres of "unsuitable" land must reduce "unsuitable" spreading down to 15 acres.

e. Manage the stream corridor to stabilize streambanks and improve streambank habitat.

SECTION THREE:

A DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VII. RURAL IMPLEMENTATION STRATEGY

CHAPTER VIII. INFORMATION AND EDUCATION PROGRAM

SECTION THREE:

A DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VII. RURAL IMPLEMENTATION STRATEGY

A. INTRODUCTION

This chapter of the watershed plan serves as the strategy for meeting the watershed objectives identified in Chapter IV.

This chapter identifies:

(1) the agencies and units of government responsible for carrying out the identified tasks;

(2) the best management practices (BMPs) necessary to control pollutants on the critical sites identified earlier;

(3) the funding sources and the administrative procedures for carrying out the project;

(4) the information and education activities;

(5) the schedule for completion of the implementation tasks;

(6) the type and amount of staff needed by Buffalo County to carry out the project; and

(7) the cost of installing BMPs, including cost sharing, technical assistance, and administration.

B. PROJECT PARTICIPANTS: ROLES AND RESPONSIBILITIES

1. Landowners and Land Operators

Owners and operators of public and private lands are important to the success of the priority watershed project. As participants in the program they will adopt BMPs which control nonpoint sources of water pollutants, which ultimately result in the protection and enhancement of fish, wildlife and other resources. Eligible land owners and land operators in the Waumandee Creek Watershed include individuals, Buffalo County, corporations, and the State of Wisconsin.

2. Buffalo County

As required by statutes and administrative rules, Buffalo County is responsible for implementing this plan in the unincorporated areas of the watershed. The Buffalo County Land Conservation Committee (LCC) will act for the Buffalo County Board and will be responsible contractually and financially to the State of Wisconsin for the management of the project. The LCC will coordinate the activities of all other local agencies involved with the project.

Since no significant nonpoint sources of pollutants were identified in the incorporated areas of the watershed, Buffalo County will be the only local government unit discussed in this chapter. If critical nonpoint sources of pollutants are found in incorporated areas during the implementation of the project, this plan will be amended to allow for the control of these sources.

The specific responsibilities for Buffalo County are defined in the Wisconsin Administrative Code, NR 120.04, and are summarized below:

a. Identify in writing a person to represent the county during implementation of the project.

b. Contact all owners or operators of lands identified as significant nonpoint sources within one year of signing the nonpoint source grant agreement. Buffalo County's strategy for contacting landowners is included in this chapter.

c. Develop farm conservation plans consistent with the needs of the project.

d. Enter into nonpoint source cost share agreements with eligible landowners and enforce the terms and conditions of cost share agreements as defined in NR 120.13, Wisconsin Administrative Code.

e. Design Best Management Practices and verify proper practice installation.

f. Reimburse cost share recipients for the eligible costs of installing BMPs at the rates consistent with administrative rules and this plan.

g. Prepare and submit annual work plans for the activities necessary to implement the project. The Buffalo County Land Conservation Department (LCD) shall submit a workload analysis and grant application to the Department of Agriculture, Trade and Consumer Protection (DATCP) as required in Ag. 166.50.

h. Prepare and submit to the Department of Natural Resources (DNR) and the Department of Agriculture, Trade and Consumer Protection (DATCP) the annual resource management report required under NR 120.21(7). This report monitors project implementation by tracking changes in the nonpoint source inventory, and quantifying pollutant load reductions which result from installing BMPs.

i. Participate in the annual watershed project review meeting.

j. Conduct the information and education activities identified this plan.

3. Department of Natural Resources

The role of the Department of Natural Resources (DNR) is identified in s. 144.24, Statutes, and NR 120, Wisconsin Administrative Code. The Department has been statutorily assigned the overall administrative responsibility for the Wisconsin Nonpoint Source Water Pollution Abatement Program. The Department's roles are summarized below:

a. Project Administration: Project administration includes working with Buffalo County to ensure that the work commitments required during the eight-year project implementation phase can be met. The DNR participates in the annual work planning process with the county.

The Department reviews the cost share agreements signed by the county and the participating landowners for installing BMPs. These cost share agreements are described later in this chapter. The DNR provides guidance when questions arise concerning the conformance of proposed activities with the statutes, administrative codes, and the watershed plan.

b. Financial: Financial support for the implementation of the Waumandee Creek Priority Watershed Project will be provided in two ways: a local assistance grant agreement and a nonpoint source grant agreement. These agreements are described later in this chapter.

The DNR may also enter into cost share agreements directly with local or state units of government for the control of pollution sources on land these governmental units own or operate.

c. Project Evaluation: The DNR has the responsibility for priority watershed project monitoring and evaluation activities. These efforts determine if changes in water quality occurred as Best Management Practices and other pollutant controls were installed or implemented. The water quality evaluation and monitoring strategy for the Waumandee Creek Watershed are included in Chapter IX. The DNR documents the results of monitoring and evaluation activities in interim and final priority watershed project reports.

d. Technical Assistance: The DNR provides technical assistance to the county on the design and application of Best Management Practices.

e. Other Responsibilities:

1) Assisting LCD staff with site reviews to determine the impacts of nonpoint sources on wetlands and/or groundwater quality.

2) Assisting county LCD staff to integrate wildlife and fish management concerns into the selection and design of BMPs.

4. Department of Agriculture, Trade and Consumer Protection

The role of the Department of Agriculture, Trade and Consumer Protection (DATCP) is identified in Section 144.25, Statutes; Chapter 92, Statutes; and NR 120. In summary, the DATCP will:

a. Manage a training program for the county land conservation department(LCD) staff involved with project implementation.

b. Cooperate with the University of Wisconsin - Extension to act as a clearinghouse for information related to agricultural Best Management Practices, sustainable agriculture, and nutrient and pest management.

c. Assist Buffalo County in carrying out the information and education activities or tasks described in this plan.

d. Assist LCD staff in identifying watershed participants subject to federal or state conservation compliance programs.

e. Assist LCD staff, if requested, in developing a manure storage ordinance.

f. Assist LCD staff in completing annual workload analyses and grant applications for work conducted under the priority watershed project.

g. Participate in the annual project review meetings.

h. If the need arises, assist in developing technical standards for agricultural BMPs, and provide technical assistance to county LCD staff concerning the application of these practices.

i. Assist LCD staff in evaluating the site-specific practicality of implementing rural Best Management Practices.

5. Other Agencies

The Waumandee Creek Watershed project will receive assistance from the agencies listed below.

a. Soil Conservation Service (SCS): This federal agency works through the local LCC to provide technical assistance for planning and installing conservation practices. The local SCS personnel will work with the local Land Conservation Department staff to provide assistance with technical work. Personnel from the area SCS office will provide staff training and engineering assistance for Best Management Practices, especially where there is a lack of engineering job approval for particular practices. Efforts will be made by DATCP to assist SCS to coordinate the Waumandee Creek Priority Watershed Project with the conservation compliance and other conservation provisions of the 1985 and subsequent federal farm bills.

b. University of Wisconsin-Extension (UWEX): County and area extension agents will provide expertise in the development of and assist the LCC in conducting a public information and education program aimed at increasing voluntary participation in the project. This will include assistance to carry out the activities described in this plan.

c. Agricultural Stabilization and Conservation Service (ASCS): ASCS administers most of the federal programs aimed at the stabilization of the prices paid to producers for agricultural products, and administers federal funds for rural soil and water programs and other resource conservation activities. The Agricultural Conservation

Program (ACP), which is administered by ASCS, will, to the extent possible, be coordinated with the Waumandee Creek Priority Watershed Project. In addition, other conservation incentives such as the Conservation Reserve Program (CRP) will be used whenever possible to control critical nonpoint sources of pollution.

C. BEST MANAGEMENT PRACTICES

1. Eligible Practices and Cost Share Rates

Best Management Practices are those practices identified in both NR 120 and this watershed plan to be the most effective controls of the nonpoint sources of pollutants. The practices eligible for cost sharing under the Waumandee Creek Priority Watershed Project, and examples of eligible practices that are not cost shared in this project, are listed in Table 12. The cost share rates for each BMP, consistent with NR 120, are also in Table 12. Other practices listed in NR 120 may be used, subject to an approval by DNR of the cost share rate to be used. Those BMPs which will not be cost shared, but will be included on the cost share agreement, are listed in NR 120.17. Several examples are included in Table 12, and are identifiable as showing zero percent as the cost share rate.

The design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use the specific standard specifications included in the SCS Field Office Technical Guide are cited in NR 120. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14.

2. Description of Best Management Practices

Brief descriptions of some of the most commonly used Best Management Practices which are included in Table 12 are included in this section. More detailed descriptions of these practices and others that are appropriate for use can be found in NR 120.14.

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

b. Contour and Field Strip Cropping - Growing crops in a systematic arrangement, usually on the contour, in alternate strips of close grown crops, such as grasses or legumes, and tilled row crops.

c. Reduced Tillage - A system which leaves a roughened surface or substantial amounts of crop residue in or on the soil surface after crops are planted. The system consists of no more then one primary tillage pass in the fall or spring and no more than two passes with light or secondary tillage equipment prior to planting. It is utilized in two situations: one for continuous row crops or long corn rotations; and the other for short crop rotations or for the establishment of forages and small grains.

d. Critical Area Stabilization - The planting of suitable vegetation on critical nonpoint source sites.

TABLE 12. State Cost Share Rates for Best Management Practices

BEST MANAGEMENT PRACTICE	STATE COST SHARE RATE
Change In Crop Rotations	0%
Change From Cropland To Grassland	0%
Contour Farming	50% *
Contour Strip Cropping	50% *
Field Strip Cropping	50% *
Field Diversions and Terraces	70%
Grassed Waterways	70%
Reduced Tillage (No Till)	50%
Critical Area Stabilization	70% (1.)
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70%
Streambank Fencing	70%
Shoreline Buffers	70% (1.)
Barnyard Runoff Management	70%
Animal Lot Relocation	70%
Manure Storage Facilities	70% **
Manure Spreading Management	0%
Livestock Exclusion from Woodlots	50%

1. Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter VI for details concerning where easements may apply.

* If the reestablishment of wildlife habitat is needed, the cost share rate is 70%.

** The maximum cost share amount is $10,000 including no more than $5,000 for manure transfer equipment.

e. Grassed Waterways - Natural or constructed channels shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

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

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

h. Shoreline and Streambank Stabilization - The stabilization and protection of stream and lake banks against erosion, and the protection of fish habitat and water quality from livestock access. This practice includes streambank fencing.

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

j. Field Diversions - This practice diverts water from areas where quantities are excessive or the water is doing damage, to areas where it can be transported safely.

k. Barnyard Runoff Management - Structural measures such as gutters, downspouts, or diversions to direct surface runoff around the barnyard, or to collect, convey and temporarily store runoff from the barnyard.

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

m. Nutrient and pesticide management practices are not eligible for cost sharing at this time, however new practices are being developed and may be added to the plan in the future.

n. Easements - Although not considered to be Best Management Practices, easements are useful legal tools and their applicability is defined in Chapter V, Management Actions. Details for such arrangements will be worked out between DNR and Buffalo County during the implementation phase.

3. Nonpoint Sources And Control Practices Not Eligible For Cost Share Assistance

Priority watershed cost share funds cannot be used to control certain nonpoint sources and land management activities specifically listed in NR 120.10(2). The following is a partial list of these activities:

a. Activities which are normally and routinely used in growing crops;

b. Actions which have the drainage of land or the clearing of land as the primary objective;

c. Activities which have installation costs that can reasonably be passed on to potential consumers;

d. Practices already installed, or placed on lands already controlled prior to this project;

e. Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of the Wisconsin Statutes, including livestock operations with more than 1,000 animal units, or livestock operations issued a notice of discharge under Chapter NR 243;

f. Septic system controls or maintenance;

g. Dredging activities;

h. Silvicultural activities;

i. Bulk storage of fertilizers and pesticides; or

j. Coal storage.

D. NONPOINT SOURCE GRANT AGREEMENT AND ADMINISTRATION

1. General Information

The Nonpoint Source Grant Agreement is the means for transmitting funds from the DNR (through the Nonpoint Source Water Pollution Abatement Program) to Buffalo County to use in funding the state's share of cost share agreements. Cost share agreements are the means to transmit funds from Buffalo County to the landowners.

A portion of the Nonpoint Source Grant is forwarded to Buffalo County to allow the county to establish an "up front" account. Funds from this account are used by the county to pay landowners after practices are installed under the project. As this account is drawn down, the county will request reimbursements from DNR to replenish the account. Buffalo County will submit reimbursement requests on a quarterly basis. This reimbursement schedule will insure that the "up front" account balance is maintained at an adequate level. As specified in the administrative rules, the proper documentation for a reimbursement request includes: 1) the "Cost Share Calculation and Practice Verification Form" (Form #3200-53) for each landowner reimbursed for cost shared BMPs; 2) a "Request for Advance or Reimbursement Form" (Form #3200-54, revised 1/90) documenting total prior pay requests and the current amount of reimbursement requested; and 3) a "Reimbursement Claims Worksheet" (Form #3200-80) listing the landowners paid from the reimbursement request.

The NPS Grant Agreement will be amended annually to provide funding needed for cost sharing for the year. The funds obligated under cost share agreements must never exceed the total funds in the NPS Grant Agreement.

2. Fiscal Management Procedures and Reporting Requirements

The County LCC is required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Waumandee Creek Priority Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

E. COST SHARE AGREEMENT AND ADMINISTRATION

1. Purpose and Responsibilities

Consistent with Section 144.25, Wisconsin Statutes and NR 120, Wisconsin Administrative Code, cost share funding is available to landowners for a percent of the costs of installing BMPs to meet the project objectives. Landowners have three years after formal approval of the watershed plan to enter into cost share agreements. Practices included in cost share agreements must be installed within the schedule agreed to in the cost share agreement.

The cost share agreement is a legal contract between the landowner and Buffalo County. The agreement includes the name and other information about the landowner and grant recipient; conditions of the agreement; the practices involved and their location; the quantities and units of measurement involved; the estimated total cost; the cost share rate and amount, the timetable for installation; and number of years the practice must be maintained. The agreements also identify and provide information on practices not cost shared through the nonpoint source control program but which are essential to controlling pollutant sources, such as crop rotations. Once the agreement is signed by both parties, they are legally bound to carry out the provisions in it.

If land ownership changes, the cost share agreement remains with the deed and the new owner is legally bound to carry out the provisions. Additional information on changes of land ownership and the recording of cost share agreements can be found in NR 120.13(9) and (10).

Local, state, or federal permits may be needed prior to installation of some BMPs. The areas most likely to need permits are zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. Landowners should consult with the County Planning and Zoning Department or the Land Conservation Department offices to determine if any permits are required. The landowner is responsible for acquiring the needed permits prior to the installation of practices.

The cost share agreement binds the county to provide the technical assistance needed for the planning, design, and verification of the practices on the agreement, and to provide the cost share portion of the practice costs.

Buffalo County is responsible for enforcing the compliance of cost share agreements to which they are a party. Where DNR serves as a party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance.

2. Landowner Contact Strategy

   a. During the first two months of the implementation period, all landowners or operators with eligible nonpoint sources will receive a mailing explaining the project and how they can become involved.

   b. After the initial landowner mailings, LCD staff will make personal farm visits to those landowners whose barnyards have the greatest pollution potentials. These were defined as those yards in the top 50% of the calculated pollutant loads for each subwatershed. These visits will take place within the first year.

      Barnyards were used to prioritize landowners contacts because barnyard runoff management tends to be of the most interest to landowners who are undecided about participating in the project. Also, landowners with livestock generally also have streambank protection needs. As discussed earlier, streambank erosion control is imperative for improving the water resources.

   c. Several eligible landowners have already shown a keen interest in participating in the project. Cost Share Agreements will be prepared for them following plan approval, and the necessary practices will be designed and installed during the first six to nine months of the project. This early installation of practices allows other landowners to learn about the types of practices the project supports.

   d. The strategy for contacting landowners in the second and third years of the project will be determined during the annual work planning process.

3. Procedure for Developing a Cost Share Agreement

Eligibility for cost sharing is verified following a site visit, using the criteria described in Chapter VI. Barnyards draining to wetlands or areas covered with shallow soils are reviewed jointly by DNR, DATCP, and the land conservation staff to determine the nonpoint management categories.

Farm conservation plans will serve as guidelines in the development of cost share agreements. These plans are specific to a particular landowner and are a comprehensive approach to the abatement of the nonpoint sources of pollution, as well as the conservation of soil and other resources. The farm plan takes into consideration the sustainability of the agricultural resources and the management decisions of the owner or operator. Cost share agreements must include all BMPs needed to control the eligible sources.

When a landowner has livestock, a manure spreading plan will be developed. Participants in the watershed project will not be permitted to winter-spread livestock manure on lands with slopes greater than six percent.

Using the farm conservation plan as a reference, the cost share agreement will specify the existing types of management and the level of management that must be maintained to protect water quality.

The following procedure will be used by the Buffalo County LCD for the development of cost share agreements and the administration of funds. Outlined below are the steps from the initial landowner contact through the completion of the BMP maintenance:

a. The landowner and LCD staff meet to discuss the watershed project, nonpoint control practice needs, and coordination with conservation compliance provisions, if applicable.

b. The landowner agrees to participate in the watershed project.

c. A farm conservation plan is prepared by the LCD.

d. The landowner agrees with the plan, a Cost Share Agreement is prepared, and both documents are signed by the landowner and the County Conservationist. Two copies of the Cost Share Agreement (CSA) are sent to the DNR Western District Nonpoint Source Coordinator and a copy is given to the landowner. The CSA will be recorded with the County's Registrar of Deeds.

e. The funds encumbered on the CSA are recorded on the county's ledger for tracking the Nonpoint Source Grant funds.

f. Control practices are designed by the LCD or SCS, and a copies of the design are provided to the landowner.

g. The landowner obtains the necessary bids or other information required in the cost containment policy.

h. Amendments to the CSA are made if necessary.

i. The LCD or SCS lay out the practices included in the cost share agreement or conservation plan.

j. The contractor installs the practice, with necessary inspection during construction by the LCD or SCS.

k. The LCD verifies the installation.

l. The landowner submits paid bills and proof of payment (cancelled checks or receipts marked paid) to the LCD office.

m. Buffalo County prepares a voucher for reimbursement, which is signed by the LCD County Conservationist.

n. The County Clerk issues the check based on the approved voucher, updates the cost share ledger, and mails the check to the landowner. Before mailing the check the Clerk will provide information to the LCD and will include a cover letter provided by the LCD.

o. The LCD records the check amount, number, and date, and retains this information in their files.

4. Identifying Wildlife and Fishery Needs

The Buffalo County Land Conservation Department staff will consult with DNR's Western District wildlife management and fisheries management staff to optimize the wildlife and fish management benefits of nonpoint source control BMPs. Specifically, the county staff will contact DNR staff if:

a. Streambank protection practices, agricultural sediment basins, or critical area stabilization practices are being considered.

b. Fence rows, rock piles, wetlands, or other wildlife habitat components will be adversely affected by the installation of agricultural BMPs.

The DNR staff will assist county LCD staff by:

a. Identifying streambank protection practices (including the use of "lunker structures") that benefit fish and wildlife.

b. Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.

c. Reviewing placement of agricultural sediment basins to assure that negative impacts on stream fish and aquatic life do not occur, and recommending wildlife habitat components.

d. Providing technical assistance on the removal of obstructions and proposing measures to minimize the wildlife habitat impacts.

e. Assisting to resolve questions concerning effects of agricultural nonpoint source BMPs on wetlands.

5. Submittal to the Department of Natural Resources

NR 120 requires that cost share agreements need prior approval from DNR in the following instances:

a. Where cost share funds are to be used for practices on land owned or controlled by the county.

b. For agreements or amendments where the cost share amount for all practices for a landowner exceeds $50,000 in state funds.

c. For grade stabilization structures and agricultural sediment basins with embankment heights between 15 and 25 feet and impoundment capacities of 15 to 50 acre-feet.

d. Where streambanks to be controlled using riprap or other materials have eroding banks over six feet high.

e. For animal lot relocation.

In addition, the Nonpoint Source Control Plan for the Waumandee Creek project requires DNR approval for the cost sharing of a practice for the control of gully erosion in instances where a permanent pool will be formed by control measures, or where the gully is greater than five vertical feet.

F. COST CONTAINMENT PROCEDURES

Chapter NR 120 requires that cost containment procedures be identified in this plan. The cost containment procedures to be used by Buffalo County are described below.

1. Bids

Competitive bids will be required for all structural BMPs which have estimated total costs, as determined by the project technicians, exceeding $5,000. The bidding process requires the cost share recipient to receive a minimum of two bids from qualified contractors in lump sum bids. The cost share recipient must provide copies of the bids to the Land Conservation Department prior to initiating construction. In cases where the cost share recipient provides proof that bids were requested from a minimum of three qualified contractors but only one bid was received, the LCD will determine if the bid constitutes an appropriate cost for the project. If no bids are received or if the lone bid is not deemed appropriate, the County Conservationist will use an average cost for the practice.

2. Average Costs

Average costs will be used for all structural BMPs with an estimated cost equal to or less than $5,000, unless the cost share recipient decides to bid the installation of the BMPs. The average costs used will be sent to DNR and DATCP for approval prior to Buffalo County signing cost share agreements. The average cost list will be reviewed annually and appropriate changes will be made. If changes are made, the list will be forwarded to DNR and DATCP for final approval before the changes are used for calculating cost share agreements and payments.

3. Flat Rates

Several of the BMPs listed in Table 13 utilize flat rates for determining the state's cost share funding amount. The rates shown in Table 13 are the state's share of the practice installation costs.

Table 13. Flat Rates for State Cost Share Funding of Best Management Practices

BEST MANAGEMENT PRACTICE	FLAT RATE
Contour Farming	$6.00/acre
Strip Cropping	$12.00/acre
Field Strip Cropping	$10.00/acre
Reduced Tillage (No Till)	$15.00/acre
Livestock Exclusion from Woodlots	
single strand electric	$5.50/rod
3 strand barb wire	$8.50/rod
Streambank Fencing	
single strand electric	$8.00/rod
3 strand barb wire	$12.00/rod

G. LOCAL ASSISTANCE GRANT AGREEMENT ADMINISTRATION

1. General Information

The Local Assistance Grant Agreement (LAGA) is a grant from the DNR to Buffalo County for supporting the county's costs of carrying out this watershed plan. Following NR 120, Buffalo County will use funds from the LAGA for additional staff to implement the project and to conduct information and education activities. Other items such as travel, training, and certain office supplies are also supported by the LAGA. Further clarification of the eligible costs supported by this grant is given in NR 120.14(4) and (6).

2. Grant Agreement Application Procedures

An annual review of the Local Assistance Grant Agreement is conducted through the development of an annual workload by the county. This workload estimates the work needed to be accomplished each year. The workload is provided to DATCP and DNR for review and clarification. Along with the workload analysis, a grant application form is sent. Funds needed to complete the agreed upon annual workload are amended to the local assistance grant agreement.

3. Fiscal Management Procedures and Reporting Requirements

The county LCC is required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Waumandee Creek Priority Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

NR 120 requires quarterly reports to DATCP from the Buffalo County LCC in accordance with s. Ag. 166.40(4), accounting for staff time, expenditures, and accomplishments regarding activities funded through the watershed project. Reimbursement requests may be included with the submittal of the quarterly project reports.

Table 14. Cost Share and Easement Budget Needs for Rural Management Practices

Best Management Practice	Number Needed	Cost/Unit	Total Cost (1)	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Upland Sediment Control							
Change in Crop Rotation	4,650 ac	NA(3)	0	0	0	0	0
Contour Cropping	1,789 ac	$6	10,734	10,700	(2)	8,051	(2)
Contour Strip Cropping	1,310 ac	$12	15,720	15,720	(2)	11,790	(2)
Reduced Tillage (4)	1,250 ac	NA	0	0	0	0	0
Reduced Till.(5)	600 ac	$15	9,000	9,000	(2)	6,750	(2)
(no till)			0			0	
Critical Area Stabilization	450 ac	$200	90,000	63,000	27,000	47,250	20,250
Grass Waterways	400 ac	$3,500	1,400,000	980,000	420,000	735,000	315,000
Field Diversions & Terraces	30,000 ft	$3	90,000	63,000	27,000	47,250	20,250
Grade Stabilization	300 ea	$6,500	1,950,000	1,365,000	585,000	1,023,750	438,750
Agricultural Sediment Basin	2 ea	$15,000	30,000	21,000	9,000	15,750	6,750
Livestock Fencing from Woodlots	25,000 rd	$9	225,000	112,500	112,500	84,375	84,375
Pasture Management	1,636 ac	NA	0	0	0	0	0
Animal Waste Management							
Barnyard Runoff Control							
Complete System	154 ea	$14,000	2,156,000	1,509,200	646,800	1,131,900	485,100
Clean Water Diversion	35 ea	$4,000	140,000	98,000	42,000	73,500	31,500
Manure Storage Facility	22 ea	$14,300	314,600	220,000	94,380	165,000	70,785
Manure Spreading Management	3,264 ac	NA	0	0	0	0	0
Streambank Erosion Control							
Shape and Seed	5,240 rd (6)	$132	691,680	484,176	207,504	363,132	155,628
Fencing	15,950 rd	$6	95,700	66,990	28,710	50,243	21,533
Rip-Rap	4,930 rd	$363	1,789,590	1,252,713	536,877	939,535	402,658
Stream Crossing	192 ea	$4,000	768,000	537,600	230,400	403,200	172,800
Totals:			$9,776,024	$6,808,599	$2,967,171	$5,106,475	$2,225,378

(1) Total cost to control identified critical pollution sources
(2) Local share consists of labor and any additional equipment costs.
(3) NA means that cost share funds are not available for this practice
(4) This practice is minimum tillage on continuous row, or long rotation croplands
(5) This practice is no till on short rotation croplands or for establishing forage crops
(6) A rod = 16.5 feet

Estimated Easements Needs & Costs: (1)

Weiland Creek:	4.7 acres	$1,880
Little Waumandee Cr.	22.7 acres	$9,800
Eagle Creek	22.7 acres	$9,800
Totals:	50.1 acres	$20,040

(1) Need based on (eroding length) x (2 rod width)
Costs based on easement value of $400/acre

H. BUDGET AND STAFFING NEEDS

1. Costs of Installing BMPs

The quantity and type of Best Management Practices that are needed to meet this project's water quality objectives are listed in Table 14. The cost of installing the BMPs which are listed in this table assume landowner participation rates of 100% and 75%. Also included are the units of measurement and cost share amount per unit for the various BMPs.

The total cost of installing the Best Management Practices in the watershed in order to achieve water quality objectives is approximately $11.7 million dollars. The state funds necessary to cost share this level of control would be about $ 8.1 million dollars, or about 69% of the total. The local share provided by landowners and other cost share recipients would be about $ 3.6 million dollars, or about 31% of the total.

2. Staff Needs

Table 15 lists the total estimated staff needed to implement the management objectives assuming that 75% or 50% of eligible Best Management Practices are adopted. A total of approximately 41 staff years (calculated at 1820 hours per staff year) will be needed to implement this plan at a 75% landowner participation rate. Included are the 1.4 staff years required to carry out the information and education program. The estimated total cost for staff for the entire project would be $ 1.3 million if 75% of the significant nonpoint sources are controlled.

Table 15. Estimated County LCD Staff Needs for Project Implementation

Activity	Project Years When Work Will Be Done	75% Landowner Participation (Staff Years)	50% Landowner Participation (Staff Years)
Project & Financial Mgmt.	1-8	2.4	2.4
Information & Education Program	1-8	1.5	1.5
Pre-Contact Office Inventory; Landowner Contacts, & Progress Tracking	1-3	1.5	1.0
Conservation Planning; Cost Share Agrmt. Development	1-3	2.5	1.6
Practice Design & Installation	1-8		
Upland Sediment Control		11.5	7.7
Barnyard Runoff Control		10.5	7.0
Manure Spreading Mgmt. & Storage		1.4	1.0
Streambank Erosion Control		9.7	6.4
Training	1-8	1.0	0.9
Total LCD Workload:		42.0	29.5
Estimated Staff Required for Years 1-3:		3.0 per year	2.1 per year
Estimated Staff Required for Years 4-8:		6.6 per year	4.6 per year

Table 16. Total Project Costs at 75% Landowner Participation Rate

Item	Costs (State Share)
Cost Share Funds	$5,106,475
Local Assistance Staff Support	$1,344,000 *
Information/Education Direct	$47,682
Other Direct (travel, supplies, etc.)	$188,312

	$6,686,469

* Salary + Indirect = $32,000/year/staff

I. GRANT DISBURSEMENT AND PROJECT MANAGEMENT SCHEDULE

Implementation may begin upon the approval of this watershed plan by the Buffalo County Board; the Wisconsin Department of Agriculture, Trade and Consumer Protection; and the Department of Natural Resources. The priority watershed project implementation period lasts eight years. It includes an initial three-year period for contacting eligible landowners and signing cost share agreements. Practices on any cost share agreement must be installed within a five-year period.

Under extenuating circumstances, the initial period for entering into cost agreements can be extended for a limited period of time by DNR if it will result in a significant increase in nonpoint source control. Limited extensions for the installation period for practices on individual cost share agreements must also be approved by DNR and DATCP.

The disbursement of the grants (Local Assistance and Nonpoint Source) will be based on an annual workload analysis and the grant application process.

Table 17. Schedule of Grant Disbursement

Grant	Project Year 1	2	3	4-8
Nonpoint Source Grant	$2,042,600	$1,021,300	$2,042,600	
Local Assistance Grant				
Salary	96,000	96,000	96,000	96,000/yr
Direct Cost	24,800	18,200	18,200	18,200/yr

J. COORDINATION WITH STATE AND FEDERAL CONSERVATION COMPLIANCE PROGRAMS

The Waumandee Creek Priority Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by DATCP, and the Federal Food Security Act (FSA) administered by the Soil Conservation Service. DATCP will assist the Buffalo County LCD and SCS to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FPP and FSA by December 1989.

There will be a need to implement the conservation plans, and in the future, amend these plans, during the implementation phase of the watershed project. Watershed project-supported staff will revise the conservation plans developed for FPP and FSA to include management decisions and the installation of needed BMPs for nonpoint source pollution abatement while addressing other resource conservation problems. This comprehensive approach to farm planning will facilitate the consideration of the various goals and objectives for all the programs in which the landowner participates.

The Waumandee Creek Priority Watershed Project will support the costs of designing and constructing practices to reach the soil loss "T" value on critical lands which are eroding above the "T" level after meeting the sediment delivery target. The tolerable soil loss rate, commonly referred to as "T", is the "acceptable" amount of soil erosion which can occur on lands of specific soil types and in specific climates, while maintaining long-range soil productivity. This support will apply only to landowners under cost share agreement with the Waumandee Creek Priority Watershed Project.

CHAPTER VIII. INFORMATION AND EDUCATION PROGRAM

A. OBJECTIVE

The objective of the Information and Education (I&E) Program is to improve water quality in the Waumandee Creek Priority Watershed Project by maximizing landowner participation in the project.

B. INFORMATIONAL AND EDUCATIONAL GOALS OF THE PROGRAM

To achieve its objective of cleaner water, the I&E program has been structured around the following goals especially for watershed landowners as well as the general public.

1. Increased awareness, understanding and appreciation of the water resources in the Waumandee Creek Priority Watershed Project.

2. Increased understanding of the principles of water pollution, especially nonpoint source water pollution as experienced in the Waumandee Creek Priority Watershed Project.

3. Increased awareness and understanding of Best Management Practices (BMPs) being promoted through the Waumandee Creek Priority Watershed Project, including how these practices can lead to cleaner water and improved farm management.

4. Increased awareness and understanding of the purpose, operation and benefits of the Waumandee Creek Priority Watershed Project.

The program activities described later in this chapter identify which of these four goals are the targeted goals for each individual activity.

C. AUDIENCE

The primary audience of the Information and Education Program are priority watershed landowners who have been classified as being eligible for project participation. Secondary audiences are priority watershed landowners and residents that are classified as not being eligible for project participation; suppliers of services to the priority watershed; interest groups; and the public in general.

D. DELIVERY TEAM

The Buffalo County Land Conservation Department will take lead responsibility for I&E program delivery, with the University of Wisconsin Cooperative Extension, the Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection providing supporting assistance.

Table 18 shows the agencies to be involved in each activity along with the funding and staff needs.

Table 18. Information & Education Program Budget and Staff Requirements

Activity	Total Number	Total Direct Costs	ANNUAL REQUIRED STAFF HOURS: Years 1-3				Years 4-8			
			LCD	UWExt	DNR	DATCP	LCD	UWExt	DNR	DATCP
Newsletters	19	$9,500	60	60	4	4	40	40	4	4
News Releases	16	$160	20	16	0	0	20	16	0	0
Radio	6	$0	10	8	0	0	0	0	0	0
& Television	4	$0	8	8	0	0	8	8	0	0
Public Meetings	3	$740	50	64	16	16	0	0	0	0
Field Days	5	$2,755	48	48	8	8	12	12	4	4
Nutrient/Pesticide Demo Plot	1	$9,422	176	40	0	0	176	40	0	0
Streambank Protection Demonstration	1	$15,000	40	40	8	8	0	0	0	0
Signs: Watershed	6	$1,050	48 (1st year only)				0	0	0	0
Landowner	150	$3,750	0	0	0	0	0	0	0	0
Posters	3	$330	6	36	0	0	0	0	0	0
Promotional Items										
Caps	200	$800	20 (1st year only)				0	0	0	0
Mugs	200	$800								
Private Well Sampling	450	$3,375	20							

	Costs	LCD	UWExt	DNR	DATCP
1st Year Costs & Staff Needs:	$29,524	506	320	36	36
2nd Year Costs & Staff Needs:	$3,489	418	320	36	36
3rd Year Costs & Staff Needs:	$3,229	418	320	36	36
4th - 8th Year Estimated Annual Cost and Staff Needs:	$1,613	256	116	8	8
Total Project Costs and Staff Needs:	$44,307	2,622	1,540	148	148

E. ACTIVITIES

Brief program information is presented for each of the I&E program activities listed below.

1. Newsletters

   a. Targeted I&E Goals: 1, 2, 3 and 4 (see above)

   b. Audience:
      1) Owners and operators of agricultural lands in the priority watershed.
      2) Non-farm residents in the priority watershed.
      3) Agri-businesses active in the priority watershed.
      4) Recreational, environmental or other public interest groups involved in the project.
      5) Local state government and governmental agencies.

   c. Description:

      Newsletters have proven to be an effective I&E activity in previous priority watershed projects, and will be a major component of the I&E program in this watershed. During the initial three-year sign-up period, newsletters will focus on eligibility requirements, cost shareable BMPs, and benefits derived from BMP application. During the five-year implementation period following contract sign-up, newsletters will focus on the operation and maintenance of BMPs and the water quality improvements realized through BMP application.

   d. Materials required:
      1. Logo/format
      2. Articles
      3. Photographs/illustrations
      4. Mailing list
      5. Postage

   e. Schedule:
      1990 - 92: Three newsletters per year
      1993 - 97: Two newsletters per year

   f. Primary Responsible Agency: Buffalo County UW-Extension.

2. News Releases

   a. Targeted I&E Program Goals: 1, 2, 3 and 4

   b. Audience
      1) Owners and operators of agricultural land in the priority watershed
      2) General public

To gain access to these audiences, news releases will be prepared for the following media outlets:
1) Country Today
2) Winona Daily News
3) Cochrane/Fountain City Reporter
4) Arcadia News Leader
5) Buffalo County Journal

c. Description:

News releases will be published frequently so that the purpose and progress of the watershed project remain clear in the mind of watershed residents. Topics for news releases include:
1) Current status of watershed project progress.
2) Explanation of BMPs being assisted by project.
3) Success stories of landowners improving water quality through applying BMPs.
4) Description of the water resources in the watershed and impacts of nonpoint source pollutants.

d. Materials required:
1. Story ideas
2. Photographs/illustrations
3. Media contacts

e. Schedule: Minimum of two releases per year.

f. Primary Responsible Agency: Buffalo County LCD

3. Radio and Television Publicity

a. Targeted I&E Program Goals: 1, 2, 3 and 4

b. Audience
1) Owners and operators of agricultural land in the priority watershed project
2) General public

To reach these audience the following radio and television stations will be used.
1) WAAX - Eau Claire
2) WHDL - Whitehall
3) Channel 8 - LaCrosse
4) Channel 13 - Eau Claire
5) Channel 18 - Eau Claire

c. Description:

Radio and television coverage of the project is limited. Unlike some agricultural communities, there is not one morning or noon show that "everyone" listens to. However, a moderate level of effort in using the media would help raise the general public's awareness of the project.

d. Materials required:
   1. Story ideas
   2. Scripts
   3. Media contacts

e. Schedule: two radio releases per year.
   four television spots over the project period

f. Primary Responsible Agency: Buffalo County LCD

4. Public Information Meetings

   a. Targeted I&E Goals: 1, 2, 3, and 4

   b. Audience: Residents of the priority watershed project

   c. Description:

   During the first year of project implementation, a series of township-based public information meetings will be held to cover the following topics:

   1) Goals and objectives of the watershed plan
   2) Administrative rules of the watershed project, including eligibility and cost sharing
   3) The nature of nonpoint source water pollution and the effectiveness of BMPs.

   d. Materials required:
      1. Slide set / visual materials
      2. Project map
      3. Handout materials
      4. Meeting locations
      5. Announcements/agenda
      6. Refreshments

   e. Schedule: A total of three township meetings, to be held between April and May 1990.

   f. Primary Responsible Agency: Buffalo County LCD

5. Field Days

   a. Targeted I&E Goals: 3 and 4

   b. Audience:
      1. Owners and operators of agricultural land
      2. Interest groups
      3. General public

c. Description:

Field days will be conducted on watershed demonstration sites in order to demonstrate the operation and effectiveness of BMPs. Observing BMPs first hand and meeting with farmers who have installed BMPs hopefully will encourage landowners attending the tours to participate in the project themselves. Tours conducted after the sign up period ends will concentrate on the proper maintenance of BMPs. The field day of the second year will be an expanded event to attract the most attention during the most active period of landowner sign-ups.

d. Material required:
1. Demonstration sites
2. Transportation
3. Audio equipment
4. Handouts/displays
5. Refreshments/meal
6. Invitation/program

e. Schedule: 1990 - 92: One per year
1993 - 99: Every other year

f. Primary Responsible Agency: Buffalo County UW-Extension

6. Nutrient/Pesticide Management Demonstration Plot

a. Targeted I&E Goals: 3 and 4

b. Audience:
1. Owners and operators of agricultural land.
2. Interest groups
3. General public

c. Description:

A demonstration plot will be established on a two-acre parcel in the watershed. The demonstration plot will begin the first year of implementation and will end at the completion of the watershed project. The plot will be used to demonstrate the benefits of nutrient and pesticide management in farming operations. The plot will include the use of nutrient and pesticide BMPs as recommended in the DATCP Technical Bulletin ARM-1. This demonstration will be carried out in cooperation with the UW-Extension Nutrient and Pesticide Program.

Demonstration will include:
1) comparisons of the effects of crop rotation versus continuous corn;
2) the use of manure and legume credits versus nitrogen fertilizer application;
3) the calibration of manure spreaders and how to use manure analysis in determining fertilizer application rates;
4) the benefits and types of soil testing for determining fertilizer needs; and
5) the use of the rotary hoe and proper cultivation techniques.

d. Materials required:
   1. Seed, fertilizer, Pesticides
   2. Soil and manure nutrient testing
   3. Land rent
   4. Implement rental
   5. Educational signs & fact sheets

e. Schedule: The establishment of the plot must be completed by the end of the planting season, 1990.

f. Primary Responsible Agency: Buffalo County LCD

7. Streambank Management Demonstration

a. Targeted I&E Goals: 3 and 4

b. Audience:
   1. Owners and operators of agricultural land.
   2. Interest groups
   3. General public

c. Description:

Streambank management has been identified as a primary source to be controlled in order to achieve the project water resource objectives. A streambank protection demonstration site will be established which incorporates the various measures which are used for erosion control and fishery habitat enhancement. These measures include: fencing, stream crossing, rip-rap, and lunker structures. The site will include a self-guided walking tour with signs and "before" and "after" photographs. This site will also be used during the planned field days. The implementation of this demonstration will be contingent upon locating a site which has good visibility, easy access, and a cooperative landowner.

d. Materials required:
   1. Material for appropriate BMPs
   2. Signs and photographs
   3. Fact sheets

e. Schedule: Construction phase of the demonstration must be substantially completed by October of 1990.

f. Primary Responsible Agency: Buffalo County LCD

8. Signs

a. Targeted I&E Goals: 4

b. Audience: General public

c. Description:

Two sets of signs will be utilized to increase awareness of project activity:
1) "Entering Waumandee Creek Priority Watershed Project" signs to mark project boundaries on major roads.
2) "Waumandee Creek Priority Watershed Project Participant" signs for display at each contract farm.

d. Materials required:
1. Logo
2. Signs
3. Posts/mounting material

e. Schedule: Boundary signs installed in May 1990, providing that the frost is gone or the ground is not frozen.
Participant signs installed as contracts are signed.

f. Primary Responsible Agency: UW-Extension Area Office - Eau Claire

9. Posters

a. Targeted I&E Goals: 3 and 4

b. Audience: General public

c. Description:

Posters will be developed to increase awareness of the BMPs supported by the project as well as the watershed project in general. Posters will be displayed in locations frequented by priority watershed landowners, such as agri-businesses, shops, and cafes.

d. Materials required:
1. Topics/concepts
2. Art work
3. Finished products

e. Schedule: One poster/year 1990 - 92 (total of three)

f. Primary Responsible Agency: UW-Extension Area Office - Eau Claire

10. Promotional Items

a. Targeted I&E Goals: 1, 3, and 4

b. Audience: Priority watershed landowners.

c. Description:

The following items will be produced for distribution within the watershed:

1) 200 baseball-style caps with project logo, for use by project staff and contract landowners.
2) 200 coffee cups with logo for use by project staff and contract landowners.

The purpose of the promotional items is to increase the project's recognition in the watershed and to stimulate conversion about the project among landowners about the project.

d. Materials required: 1. Logo

e. Schedule: Caps and cups produced during May 1990

f. Primary Responsible Agency: UW-Extension Area Office - Eau Claire

11. Private Well Sampling

a. Targeted I&E Goals: 1,2,3,and 4

b. Audience: Landowners within the project

c. Description:

In conjunction with landowner contacts, private well sampling for nitrates will be offered on a voluntary basis. The purpose of the sampling will be to: 1) provide the LCD with another tool to facilitate landowner contacts and promotion of the project, and 2) to provide a method to heighten the landowner's awareness of the relationship between land activities and groundwater quality.

Well sampling procedures will be provided by DNR.

d. Materials required: sample bottles and mailing packs instructions provided by DNR.

e. Schedule: throughout the project's first three years.

SECTION FOUR:

THE PROJECT EVALUATION

CHAPTER IX. THE PROJECT EVALUATION AND MONITORING

CHAPTER IX. PROJECT EVALUATION AND MONITORING

A. INTRODUCTION

This chapter briefly summarizes the plan for monitoring the progress and evaluating the effectiveness of the Waumandee Creek Priority Watershed Project. The evaluation strategy includes three components:

(1) administrative review,
(2) pollution reduction evaluation, and
(3) water resource monitoring.

Information on the first two components will be collected by the Buffalo County Land Conservation Department (LCD) and reported on a regular basis to DNR and DATCP. The third component is performed by the DNR. Additional information on the numbers and types of practices on cost share agreements; funds encumbered on cost share agreements, and funds expended will be provided by DNR's Bureau of Community Assistance.

Upon completion of the landowner sign-up period, an interim report will be prepared cooperatively by the LCD, DATCP, and DNR. This report will summarize the administrative, pollutant load reduction, and water quality information that is available at that time. The report will make preliminary conclusions on the success of the project to date and will recommend actions to be taken during the rest of the implementation phase.

B. ADMINISTRATIVE REVIEW

The first component, the administrative review, will focus on the progress of Buffalo County in implementing the project. The project will be evaluated with respect to 1) accomplishments, 2) financial expenditures, and 3) staff time spent on project activities.

1. Accomplishment Reporting

The Computer Assisted Management and Planning System, called CAMPS, is a computer data management system that has been developed by the US Soil Conservation Service (SCS). It is used by SCS, DNR and DATCP to meet the accomplishment reporting requirements of all three agencies. Data on administrative accomplishments will be collected by Buffalo County LCD using CAMPS, and will be provided to DNR and DATCP for program evaluation.

The Buffalo County LCD will provide the following data to DNR and DATCP on a quarterly basis:

a. number of personal contacts made with landowners,
b. completed I&E activities,
c. number of farm conservation plans prepared for the project,
d. number of cost share agreements signed,
e. number of farm conservation plan and cost share agreement status reviews completed, and

f. number of farms and acres of cropland checked for proper maintenance of Best Management Practices,

In addition to quarterly reports, Buffalo County representatives will meet with DNR and DATCP staff annually to review progress and plan for the subsequent year.

2. Financial Expenditures

Buffalo County will provide the following financial data to DNR and DATCP on a quarterly basis:

a. number of landowner cost share agreements signed,
b. amount of money encumbered in cost share agreements,
c. number of landowner reimbursement payments made for the installation of BMPs, and the amount of money paid,
d. staff travel expenditures,
e. information and education expenditures,
f. expenditures for equipment, materials, and supplies,
g. expenditures for professional services and staff support costs,
h. total project expenditures for LCD staff, and
i. amount of money paid for installation of BMPs, and money encumbered in cost share agreements.

Buffalo County will also provide both agencies with the following financial data on an annual basis:

a. staff training expenditures,
b. interest money earned and expended, and
c. total county LCD budget and expenditures on the project.

3. Time Spent On Project Activities

Buffalo County will provide time summaries to both departments for the following activities on a quarterly basis:

a. project and fiscal management,
b. clerical assistance,
c. pre-design and conservation planning activities,
d. technical assistance: practice design, installation, cost share agreement status review and monitoring,
e. educational activities,
f. training activities, and
g. leave time.

C. POLLUTANT LOAD REDUCTION

1. Key Nonpoint Sources for Evaluating Pollutant Load Reductions

The purpose of the second evaluation component, pollutant load reduction, is to calculate reductions in the amount of key pollutants as a result of installing Best Management Practices. Three key sources have been identified for estimating changes in pollutant loads that reach creeks in the Waumandee Creek Watershed: a) streambank erosion, b) upland sediment, and c) runoff from barnyards and fields spread with manure.

As described in Chapter IV, this plan calls for the following pollutant reductions:

a. an 80% reduction in streambank erosion for "high priority" creeks (Weiland Valley, upper Little Waumandee, and Eagle creeks) and 60% reduction in streambank erosion for all other creeks.

b. a 50% reduction watershed-wide in sediment entering creeks from agricultural lands.

c. a reduction of the "top" 70% of manure and organic matter entering creeks from barnyards in subwatersheds with "high priority" creeks (Buell Valley, Upper Little Waumandee, and Eagle Valley subwatersheds) and 50% reduction in all other subwatersheds.

d. a reduction of the "top" 70% of organic matter reaching creeks from fields winter-spread with manure.

2. Streambanks

Buffalo County LCD staff will calculate changes in streambank sediment in terms of tons of sediment and length of eroding sites. A tally will be kept of landowners contacted, the amount of streambank sediment being generated at the time of contact, and changes in erosion levels estimated after installing Best Management Practices.

3. Upland Sediment Sources

The DNR will use the WIN (Wisconsin Nonpoint Source) model to estimate sediment reductions due to changes in cropping practices. Data for the WIN model will be provided quarterly by Buffalo County LCD through CAMPS, as described above.

4. Barnyard Runoff

Buffalo County will use the BARNY (Modified ARS) model to estimate phosphorus reductions due to the installation of barnyard control practices. The county will report the information to DNR through CAMPS.

D. WATER RESOURCES MONITORING PLAN

1. Introduction

The primary purpose of the monitoring plan is to evaluate how well the Waumandee Creek Priority Watershed Project achieves the identified water quality objectives in selected water resources. The plan identifies the monitoring locations, the methods, and the analysis techniques that the DNR will use. The principal methods include 1) fishery surveys; 2) habitat evaluation; 3) macroinvertebrate sampling; 4) temperature and dissolved oxygen monitoring; 5) flow and water chemistry monitoring; and 6) sedimentation measurements.

This chapter is a summary of the actual watershed monitoring plan, which is available at the DNR Western District Headquarters in Eau Claire.

2. Water Resources to be Monitored

Water resources proposed for monitoring in the Waumandee Creek Watershed are as follows:

Eagle Creek (above County Highway G). Based on a 1989 fishery survey, Eagle Creek is a strong Class III brook and brown trout stream. This stream has the potential to become a Class II trout stream with the implementation of BMPs, especially barnyard management and streambank fencing.

Joos Valley Creek. Joos Valley Creek flows southwesterly 3.8 miles before entering Eagle Creek. The stream is currently a warm water forage fishery and has the potential to become a Class III trout stream with the implementation of BMPs.

Little Waumandee Creek (above County Highway E). Based on a 1989 fishery survey, the segment of Little Waumandee Creek above County Highway E is a Class III brook and brown trout fishery. This reach has the potential to become a Class II fishery with project implementation.

Irish Valley Creek. Irish Valley Creek is a Class III trout fishery with the potential to become an improved Class III trout stream. The headwaters area of this stream is primarily wooded and streambanks are well protected. Moving downstream, the creek is seriously affected by barnyard and cropland runoff and streambank erosion due to cattle pasturing.

Danuser Creek (above Flurry Road). Danuser Creek is currently a Class III trout fishery stream with the potential to become an improved Class III stream following the reduction of nonpoint source impacts. Streambank erosion is slight to moderate in the headwaters area and heavy in the lower portion due to cattle pasturing and channelization. The lack of instream cover, sedimentation and possibly temperature limit the fishery potential in this stream.

Bensel Pond and Fountain City Bay. Sedimentation is occurring in Bensel and Czechville Ponds due to considerable sediment loading from the Waumandee Creek Watershed. In addition, coliform bacteria loading from the watershed to the Fountain City Bay backwaters has forced occasional closing of the Merrick State Park swimming beach.

3. Monitoring Techniques

A variety of monitoring methods will be used for this evaluation, including a) habitat evaluations; b) fishery surveys; c) macroinvertebrate sampling; d) physical, chemical and bacteriological monitoring; and e) sedimentation measurements. Unless otherwise stated, all of the monitoring described below will be conducted by the staff of the DNR Western District Office.

a. Habitat Evaluation. Habitat availability is a major factor limiting trout fisheries in the Waumandee Creek Watershed. Since a primary objective of this watershed project is to improve trout streams, much of the assessment effort will focus on factors directly or indirectly affecting the trout fishery. Several key habitat-related factors that limit coldwater fisheries in the Waumandee Creek Watershed include 1) lack of spawning substrate; 2) lack of instream cover; 3) warm water temperatures; and 4) possibly occasional low dissolved oxygen (D.O.) conditions.

The U.S. Fish and Wildlife Service has developed a habitat evaluation procedure (HEP) that focuses on habitat requirements of selected species. The end product of the HEP method is a numerical habitat suitability index (HSI) on a 0.0 to 1.0 scale (Terrell et al., 1982).

The HSI will be used to compare habitat conditions prior to and after project implementation at one or two sites in each of the study streams. The habitat evaluation sites will be located where BMP implementation is expected to measurably improve stream conditions. In most cases, significant improvements in the HSI can only be expected where BMPs directly affecting stream habitat, such as streambank fencing, are implemented.

Exact sites for the HEP analysis will be identified after cost share agreements have been signed for practices that will immediately benefit fish habitat. An HSI will be determined for each site before and several years after practices have been installed.

b. Fisheries. Electrofishing surveys were conducted in 1989 by the University of Wisconsin - Stevens Point at 48 sites in seven streams to assess pre-implementation fishery conditions in the watershed. Single-run electrofishing surveys were run on 1000 foot reaches of each stream mile in the streams studied. The fish survey results were used with other information to develop project objectives and an evaluation monitoring strategy. Additional fishery data will be collected to supplement HSI determinations and to help assess the overall success of the watershed project.

Due to low trout population densities in the Waumandee Creek Watershed, fishery surveys have been limited to single-run electrofishing surveys. These surveys were primarily used to supplement habitat evaluation information. Follow-up fish surveys will be conducted at the 1989 survey sites and habitat evaluation sites the year after project completion. Beginning in 1990, the DNR's Bureau of Research will conduct intensive fish surveys and habitat evaluations at three sites each in the Little Waumandee and Joos Valley creeks. Fish surveys will also be conducted at the 1989 survey sites and habitat evaluation sites the year after the project completion.

c. Macroinvertebrate Sampling. Stream macroinvertebrates were sampled at 10 sites in the watershed in 1987 as part of the appraisal process. A Hilsenhoff Biotic Index (HBI) was determined for each site to assess water quality conditions.

The HBI primarily reflects long-term oxygen conditions in streams, but does not necessarily measure other habitat-related variables such as turbidity or sedimentation. Use of the HBI will generally be limited to sites where organic loading and low D.O. levels are likely to be of concern, such as below barnyards located in close proximity to streams. Other macroinvertebrate biometrics, such as diversity indices and functional feeding group analysis will also be used, where appropriate, to assess changes in water quality or habitat.

Macroinvertebrates will be collected at two sites in each of the study streams in spring and fall, 1990. The macroinvertebrate sampling protocol will be repeated at the same sites following completion of the watershed project.

d. Dissolved Oxygen and Temperature. Dissolved oxygen and temperature data will be collected to determine whether these parameters are limiting to trout carryover or reproduction. Continuous D.O. and temperature monitoring will be conducted during summer low flow at one to two sites in each of the study streams using LICOR dataloggers connected to YSI D.O. meters. Water temperature extremes will be recorded with maximum/minimum thermometers placed in streams at sites without dataloggers and recorded on a monthly basis.

e. Sedimentation. Sediment traps will be placed at select sites to provide a relative measure of sedimentation in the watershed. The sediment traps to be used are plastic cylinders of appropriate dimensions that are attached to a metal stake driven into the substrate of a quiescent reach of stream. The amount of accumulated sediment in the trap will be measured with a ruler on a monthly basis, and a sediment accumulation rate per unit time will then be estimated. The traps will be used during the first two years of project implementation and the year following implementation to measure changes in stream sedimentation rates.

A mapping survey was conducted on Bensel Pond in 1988 to obtain sediment and water depth information. A follow-up mapping survey will be conducted during winter 1990-91 to provide an estimate of pre-implementation sedimentation rates. A final mapping survey will be conducted following completion of the watershed project to provide a comparison of pre- and post-project sedimentation rates.

f. Continuous Stream Flow And Water Quality Monitoring. Two stream sites will be selected for continuous water quality monitoring and stream flow measurement. This effort will be conducted through a contract between DNR and the U.S. Geological Survey (USGS). One site will be located in the Little Waumandee Creek Subwatershed and the other in the Joos Valley Creek Subwatershed. The exact locations will depend upon the site's suitability for establishing the stations. The stations will be installed in 1990 to measure stream flow, total suspended sediment, total phosphorus, ammonia-nitrogen, and dissolved oxygen. The stations will be operated throughout the BMP implementation period in the selected subwatersheds.

g. Bacteriological Monitoring. Bacteriological sampling is conducted weekly from Memorial Day to Labor Day at the Merrick State Park swimming beach by park staff. This assessment proposes to use the bacteriological data collected at the park to measure changes in fecal coliform levels that result from project implementation.

4. Workload Analysis

The workload analysis focuses on the initial three years of project implementation, when most of the pre-implementation monitoring efforts will occur. A similar work effort is anticipated after project implementation is complete (approximately the year 2000). Because of the uncertainty of when and where some of the monitoring will be conducted which depends on where BMPs are installed, the workload estimates may need future revisions.

Table 19 is a summary of the anticipated time needed for each monitoring activity. The hours are divided into Department permanent staff (FTE) and limited term staff (LTE) time requirement.

Table 19. Workload Estimates (in hours) for Monitoring Activities

Monitoring Activity	FY90 FTE	FY90 LTE	FY91 FTE	FY91 LTE	FY92 FTE	FY92 LTE	FY99 FTE	FY99 LTE
Habitat Evaluation	80	64	40	32	20	20	40	32
Fish	64	128	32	64	--	--	40	160
Macroinvertebrates	64	64	32	32	10	10	96	96
Sedimentation								
Streams	24	24	24	24	--	--	24	24
Bensel Pond	--	--	20	10	--	--	20	10
D.O. & Temp. Monitoring	80	40	40	20	--	--	40	20
Data Analysis	40	40	20	20	10	10	160	40
Totals:	352	360	20	202	40	40	420	382

Table 20 is a summary of the estimated cost of monitoring activities in the Waumandee Creek Watershed. Fish surveys and habitat evaluations will be conducted on two streams by the DNR Bureau of Research over the life of the project. The estimated total cost of the Bureau of Research contract is $210,000 over the life of the project. Fish and habitat surveys on other study streams will be conducted by district fish management and water resources management staff, or will be contracted to outside agencies.

The proposed USGS stations will be installed in spring 1990 and operated continuously until 1999. The total cost of the USGS monitoring over the project life is estimated at $110,000.

Table 20. Monitoring Cost Estimates

Activity	FY90	FY91	FY92	FY93	FY99
Bur. of Research		$30,000	$30,000	$30,000	$30,000
HBI Analysis	500	1,000	500		1,000
USGS	40,000	10,000	10,000	10,000	10,000
	------	------	------	------	------
	$40,500	41,000	40,500	40,000	41,000

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APPENDICES

APPENDIX A:

METHODS USED TO ASSESS THE WATER QUALITY AND NONPOINT SOURCE CONDITIONS IN THE WAUMANDEE CREEK PRIORITY WATERSHED PROJECT

I. WATER RESOURCE ASSESSMENT METHODS

A. Introduction

As part of the Waumandee Creek Priority Watershed Project planning process, considerable time and effort was given to the determination of the current water quality and water use conditions of the streams and ponds in the project area. Then an assessment was made of the potential changes in water quality and use that might be expected as a result of the control of nonpoint source pollutants.

This assessment was made based on many sources of information including: chemical and biological water quality data from DNR files, the Surface Water Resources of Buffalo County publication (DNR, 1976); and input from county LCD staff, DNR fish managers, and DNR water quality specialists. Two of the tools used in this assessment are discussed in more detail below.

B. Biotic Index

The type of insects found living on rocks and in other habitats in a stream reflects the water conditions of that stream. Certain species of insects will tolerate only unpolluted waters while others are able to survive various degrees of water pollution. The term pollution in this discussion refers to organic material in the water. Two ways organic pollutants affect water quality are: 1) the organic material adds nutrients to the water which may result in nuisance growth of algae or weeds, and 2) the breakdown of the organic material by bacteria can deplete the water of its dissolved oxygen, which is required for fish survival.

A system developed in Wisconsin indicates the degree of organic pollution in a stream by the types of insects living in the stream. The procedure used in Wisconsin is called the Hilsenhoff Biotic Index, or HBI (Hilsenhoff, 1982). Organic pollution tolerance values are assigned to various species of insects. The scale of the values is zero to 10, with zero being the least tolerant (that is, insects least tolerant to organic pollution in the stream). The number and types of insects found at a stream site are used to calculate a HBI value between zero and five for the stream. Qualitative descriptions of water quality for the index values are given in Table 21.

Table 21. Qualitative Descriptions for the Biotic Index

HBI Range	Water Quality	Degree of Organic Pollution
0.00 - 3.50	Excellent	No organic pollution
3.51 - 4.50	Very Good	Possible slight organic pollution
4.51 - 5.50	Good	Some organic pollution
5.51 - 6.50	Fair	Significant organic pollution
6.51 - 8.50	Poor	Very significant organic pollution
8.51 -10.00	Very Poor	Severe organic pollution

Source: Hilsenhoff 1987

This procedure was conducted on eight streams at 10 sites in the watershed in 1987. In order for a biotic index to be calculated, at least 80 individual insects must be found in the sample.

C. Stream Fishery Habitat Assessment

In order to determine the present and potential future fishery uses of the streams, a procedure developed by Joe Ball of the DNR was used. This procedure is described in Stream Classification Guidelines for Wisconsin (Ball, 1982). The system uses an inventory of the stream's physical fish habitat conditions (such as stream flow, bed type, amount of riffles and pools, and streambank conditions) along with other parameters (water quality, water temperature, pH [degree of acidity or alkalinity], and current stream biotic conditions) to classify the present fishery use of the stream.

Then this information is modified to simulate the conditions that may be present as a result of a successful nonpoint source control project in the watershed. This second step results in an indication of the fishery which may be expected after a successful nonpoint source control project.

Table 22 indicates the general conditions that need to be present in order for a stream to support various fishery types.

Department of Natural Resources staff from the Bureau of Water Resources Management conducted the habitat classification at 20 sites in 11 streams in 1987.

D. Summary

The biotic index and the stream habitat assessment are both important tools for helping to establish water quality and water use objectives in the watershed project. Although no water quality assessment tool can predict with 100% accuracy the changes in water quality and water use, these tools can be useful in appraising the current and potential future conditions of the water resources in the watershed project area.

Table 22. Physical and Chemical Guidelines for Aquatic Life Use

	Use Class and Criteria				
Parameter	A	B	C	D	E
Flow (cfs) (1)	>.5	>3	>.2	>.1	>0
Water Quality Dissolved Oxygen (mg/l) (2)(3)	>4	>3	>3	>1	<1
Temperature (Deg.F)(3)	<75	<86	<86	<90	>90
pH (3)	5-9.5	5-10.5	5-10.5	4-11	4-11
Toxics (4)	<acute	<acute	<acute	acute	>acute
Habitat Rating (1)	<144	<144	<144	>144	>200

(1) Wis DNR
(2) U.S. EPA (1977)
(3) Alabaster and Lloyd (1980)
(4) U.S. EPA (1980)

"<" means "less than"
">" means "greater than"

Use Classes
A: Cold Water Sport Fishery
B: Warm Water Sport Fishery
C: Valuable Tolerant Forage Fishery
D: Rough Fish
E: No Fishery

Source: DNR Technical Bulletin (Unpublished) (Ball, 1982).

II. POLLUTANT SOURCE ASSESSMENT METHODS

A. Introduction

Another part of the watershed planning process was the collection of information on the various nonpoint sources of pollutants in the watershed. The collection of data was conducted under the supervision of the Buffalo County Land Conservation Department (LCD), with funding support from the DNR. People were hired by the LCD to gather the actual field data. The quality of these data were reviewed and approved by the LCD. Then these data were sent to the DNR for analysis. The inventory methods used for each nonpoint pollutant source are described below.

Before the inventories were conducted, the watershed was divided into 12 subwatersheds. The divisions were based upon individual water resources which could be protected or improved as a result of the control of nonpoint sources of pollutants. The data from each of the inventories were organized by the subwatersheds. With this information, objectives could be set for each water body and the corresponding reduction in pollutants needed to meet the objectives could be determined.

B. Upland Sediment Sources

Upland erosion is of concern because it can be a major contributor of sediment in the streams and lakes of a watershed. Sediment in streams and lakes adversely affects the water resources in many ways. The suspended sediment makes it difficult for fish to feed, and it abrades fish gills, making the fish more susceptible to disease. The suspended sediment also causes the water to be warmer in the summer, and warm water cannot hold as much oxygen as cold water. Sediment that settles out to the stream or lake bottoms fill up pools in streams (destroying the fish habitat) and fill up the bays in lakes (promoting excess aquatic weed growth.). Soil from cropland entering the water also contains nutrients and pesticides, which increases the algae and weed growth in lakes and harms the aquatic life of a water body.

An upland sediment source for this project is defined as the sheet and rill erosion from land areas. This erosion is commonly measured by sediment delivery in tons per acre per year. This sediment results from the overland flow of water on fields. It does not include the gully and streambank types of erosion both of which also contribute sediment to the surface waters.

The evaluation for this project quantified upland erosion and estimated the amount of eroded sediment that reaches surface waters. Cropland, pastures, grasslands, woodlands and other open non-urban land uses were investigated. Individual parcels were identified on aerial photographs. Parcel boundaries were based on the slope, cropping pattern or predominant vegetation type, property boundaries, and drainage characteristics.

The inventory was conducted on 192 square miles, using existing data and field investigations. Existing data sources included site specific farm conservation plans, aerial photographs, U.S. Geological Survey 1"=2,000' scale quadrangle maps, and the county's soil survey. The information obtained for each parcel included size, soil type and erodibility, slope percent and length, land cover, crop rotation, present management, overland flow distance and destination, channel type, and receiving water.

Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source Model, also called WIN (Baun, 1988). This analytical tool was developed by the Wisconsin Nonpoint Source Control Program to assess the pollution potential from eroding uplands. The WIN model calculates the average annual quantity of eroded soil that reaches surface waters by determining the soil loss and routing the runoff originating on each parcel under a "typical" year of precipitation. The parcels are ranked according to their potential to contribute sediment to streams, lakes, and wetlands.

C. Streambank Erosion Survey

Streambank erosion is the bank failure along channels caused by the cutting action of water on the banks. This erosion is important because of its direct impact on fish habitat in terms of bank shade and cover, in addition to the impact of the sediment filling up the stream's pools. Streambank erosion is caused by cultural activities such as grazing cattle as well as natural conditions.

The inventory method used to evaluate streambank erosion was a modification of the Phase II of the Land Inventory Monitoring process (SCS). The main channels of 25 streams, totalling 140 stream miles, were assessed with this method. For each erosion site, the method estimates the volume and the tons of sediment lost on a yearly average. This was done through measuring the length, height, and recessional rate of each erosion site. Recession rates were determined based upon the physical characteristics of the eroded site. The volume of sediment was then multiplied by the density of the sediment to obtain the tons of soil loss from the site. Along with this data, information on the location, landowner identification, and cattle access was collected for each site. This information was collected by field personnel walking the streams. Each erosion site was located on the ASCS eight inch to the mile air photos.

D. Barnyard Runoff

Dairy operations are the major type of agriculture in the Waumandee Creek Watershed. All of the barnyards were inventoried for their potential to degrade water quality from their runoff. The runoff from these yards carries manure to the streams and ponds of the watershed.

The manure contains several components that adversely affect the water quality and aquatic life. Manure contains nitrogen in the form of ammonia. In high concentrations the ammonia can be toxic to fish and other aquatic life. When the manure enters a water system the breakdown of the organic matter results in a depletion of the oxygen which fish and other organisms require to survive. Also, the nutrients in manure (including nitrogen and phosphorus) will promote nuisance algae and weed growth in the streams and ponds. Finally, the bacteria found in livestock manure is harmful to other livestock drinking the water, and humans using the water for recreation.

The United States Department of Agriculture - Agriculture Research Service developed a computer model to estimate the amount of pollutants coming from a barnyard as a result of a rainstorm (Young, et al. 1982). This model was modified by the Wisconsin DNR's Nonpoint Source and Land Management Section. The model has been used to indicate which barnyards within a watershed have the greatest potential to affect water quality from a rainfall washing through a barnyard. The model does not assess any needs for manure storage or the impact from manure runoff from spread fields -it only assesses the barnyard runoff pollutant quantities.

The information needed to run this model was collected on all of the barnyards in the Waumandee Creek Watershed. The data required by this model includes: the types and numbers of livestock; the size of the yard; the physical characteristics of the area which contributes surface runoff waters to the yard; and the physical characteristics of the area through which the runoff waters leaving the barnyard flow before becoming channelized. A rainfall amount is assigned to the model. The 10 year, 24 hour rain event (4.0 inches) was selected.

With all of this information, the model calculates the pounds of phosphorus and pounds of Chemical Oxygen Demand (COD) for each barnyard as a result of the selected rainfall event. Chemical Oxygen Demand is a measure of the amount of organic material in the barnyard runoff.

E. Manure Spreading Runoff

The disposal of livestock wastes on land is a concern for water quality when manure is spread on frozen land with steep slopes or on land in a floodplain. Under these conditions, the spread manure runs off with melting snow or winter rain and enters the streams and lakes of the watershed. The impacts from this runoff are the same as those mentioned in the barnyard runoff discussion.

The information collected for the upland sediment inventory and the barnyard runoff inventory was combined and used to estimate the amount of unsuitable land in this watershed that is used for manure spreading during the winter. Lands unsuitable for winter spreading of manure were defined as parcels with slopes greater than six percent or having soil types indicative of being prone to flooding.

The first step in this evaluation was to estimate how much land was required by each livestock operation to dispose of the manure generated over a 180-day period (the frozen ground period). The amount of manure generated by each operation was determined based on the animal type and number of animals. Using a rate of 25 tons per acre per year, the number of acres required for manure disposal was calculated for each operation. This number was compared to the acres of land suitable for winter spreading for each landowner according to the upland sediment inventory information. Lands unsuitable for winter spreading were those field with greater than six percent slope or those fields in the floodway. In this manner it was estimated, on an average basis, how many acres of unsuitable land were used for manure disposal during the winter. This procedure assumed every field had an equal chance for manure disposal from the landowner. The procedure does not account for the fact that livestock operators do not evenly spread their manure across all of their property. In general, the most accessible land is used for disposal of the manure.

F. Point Sources of Pollution

Unlike the activities mentioned above, the point sources of pollution in Wisconsin are regulated by law. For each municipal or industrial wastewater discharge or landfill, a permit is issued by the DNR which controls the activities and the effluent from each site. The point sources have been the most significant, and the most obvious, sources of water quality impairment in the past. With the large scale effort and funding directed at cleaning up point source pollution in the past 20 years, the water quality impacts from these sources in the watershed have been minimized.

As mentioned above, each municipal or industrial discharger or landfill has a permit from the DNR. These permits are reviewed to determine how well the facility is meeting its requirements. If a facility is not in compliance, there are regulatory measures which are employed to insure that the control of the nonpoint sources of pollutants will not be compromised by these point sources.

APPENDIX B: SURFACE WATER BIOLOGICAL AND RECREATIONAL USE CLASSIFICATIONS

I. BIOLOGICAL STREAM USE CLASSIFICATION AND WATER QUALITY STANDARDS

A. Introduction

Biological stream use classes describe the fish species or other aquatic organisms supported by a stream system. Designation is based on the ability of a stream to provide suitable habitat and water quality conditions for those fish and other forms of life. The following biological stream use classification system shown in Table 23 is used statewide and was applied to surface waters in the Waumandee Creek Priority Watershed Project.

Table 23. Biological Stream Use Classification System

USE CLASSIFICATION	DESCRIPTION
FULL FISH & AQUATIC LIFE CATEGORY (FAL)	
FAL A	Capable of supporting cold water sport fish (trout and other salmonid species) to the following extent:
(Class I)	Trout fishery sustained by natural reproduction
(Class II)	Trout fishery sustained by natural reproduction and periodic stocking
(Class III)	Trout fishery sustained entirely by stocking
FAL B	Capable of supporting or serving as a spawning area for warmwater sport fish (walleye, bluegill, smallmouth bass)
FAL C	Capable of supporting forage fish (shiners, minnows) and aquatic invertebrates (insects, clams, crayfish) intolerant of pollution, or forage fish tolerant of pollution
VARIANCE CATEGORIES	
INTERMEDIATE D	Capable of supporting forage fish or rough fish (carp) tolerant or very tolerant of pollution and aquatic invertebrates tolerant of pollution
MARGINAL E	Capable of supporting aquatic invertebrates which are very tolerant of pollution or no aquatic life. They may support amphibians, reptiles, waterfowl, and other wildlife.

B. Stream Use Class Descriptions

Some of the various stream use categories shown in Table 23 are discussed in more detail in the following paragraphs:

1. FAL A Cold Water Sport Fish: These streams are capable of supporting a cold water sport fishery, or serving as a spawning area for salmonid (trout, salmon) species. The presence of an occasional trout or salmon in a stream does not justify classifying it as supporting a cold water sport fishery.

2. FAL B Warmwater Sport Fish: These streams are capable of supporting a warmwater sport fishery or serving as a spawning area for warmwater sport fish (walleye, bluegill, smallmouth bass). Although warm water fish are occasionally found in many small streams, fish must be commonly found in a water body for it to be classified under this category.

3. FAL C Cold/Warmwater Forage Fish: These streams are capable of supporting an abundant, usually diverse, population of forage fish (shiners, minnows) and/or aquatic invertebrates (insects, clams, crayfish) which are intolerant of pollution. These streams are generally too small to support cold or warmwater sport fish and/or aquatic invertebrates. Streams capable of supporting valuable populations of tolerant forage fish are also included in this category.

4. Intermediate D: These streams are capable of supporting small populations of forage fish tolerant of pollution, or fish and aquatic invertebrates tolerant of pollution. The aquatic community is usually limited by small physical stream size and reduced stream flow.

5. Marginal E: These streams are capable, at best, of supporting aquatic invertebrates or occasionally very tolerant fish species. These streams are usually small, such as intermittent streams and ditches, and the capacity to support aquatic life is extremely limited.

C. Water Quality Standards

The water quality necessary to support stream biological uses has been quantified by certain measurable standards. These standards are statements of the characteristics of surface waters which must be maintained to enable the stream to continually meet its designated use. Generally, the best water quality supports the highest level of aquatic life. The standards are set forth in Chapters NR 102 and NR 104 of the Wisconsin Administrative Code.

D. Recreational Stream Use Classification and Water Quality Standards

Recreational stream use classifications are described by a level of human body contact determined to be safe and reasonable. The system applies to all surface waters including those categorized as intermediate or marginal under the above-referenced biological use classification system. Three designations are used under the recreational stream classification system: full body contact, partial body contact, and noncontact. Each designation is discussed below:

1. Full Body Contact: These waters are used for human recreation where immersion of the head is expected and occurs often. Recreation activities classified as full body contact include swimming, waterskiing, sailboarding and other similar activities where frequent and significant contact with the water occurs. Water quality standards for full body contact use are applicable from May through September.

2. Partial Body Contact: These waters are used for human recreation where immersion of the head is not frequent and contact is most often incidental or accidental. Recreational activities classified as partial body contact include boating, canoeing, fishing, and wading. Water quality standards for partial body contact use are applicable year-around.

3. Noncontact: These waters should not be used for human recreation. This category is used infrequently when extenuating circumstances such as high concentrations or in-place pollutants, an uncontrollable pollution source, or other conditions dictate that contact with the water would be an unnecessary health risk. Typically, surface waters included in this classification would ordinarily be considered to be capable of supporting partial body contact uses.

PRIORITY WATERSHED PROJECTS IN WISCONSIN
1989

Map Number	Large-scale Priority Watershed Project	County(ies)	Year Project Selected
79-1	Galena River	Grant, Lafayette	1979
79-5	Root River	Racine, Milwaukee, Waukesha	1979
80-1	Onion River	Sheboygan, Ozaukee	1980
80-2	Sixmile-Pheasant Branch Creek	Dane	1980
80-3	Big Green Lake	Green Lake, Fond du Lac	1980
80-4	Upper Willow River	Polk, St. Croix	1980
81-1	Upper West Branch Pecatonica River	Iowa, Lafayette	1981
81-2	Lower Black River	La Crosse, Trempealeau	1981
82-1	Kewaunee River	Kewaunee, Brown	1982
82-2	Turtle Creek	Walworth, Rock	1982
83-1	Oconomowoc River	Waukesha, Washington, Jefferson	1983
83-2	Little River	Oconto, Marinette	1983
83-3	Crossman Creek/Little Baraboo River	Sauk, Juneau, Richland	1983
83-4	Lower Eau Claire River	Eau Claire	1983
84-1	Beaver Creek	Trempealeau, Jackson	1984
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark	1984
84-3	Sevenmile-Silver Creeks	Manitowoc, Sheboygan	1984
84-4	Upper Door Peninsula	Door	1984
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee	1984
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac	1984
84-7	Milwaukee River South	Ozaukee, Milwaukee	1984
84-8	Cedar Creek	Washington, Ozaukee	1984
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington	1984
85-1	Black Earth Creek	Dane	1985
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet	1985
85-3	Waumandee Creek	Buffalo	1985
86-1	East River	Brown, Calumet	1986
86-2	Yahara River — Lake Monona	Dane	1986
86-3	Lower Grant River	Grant	1986
89-1	Yellow River	Barron	1989
89-2	Lake Winnebago/East	Calumet, Fond du Lac	1989
89-3	Upper Fox River (Ill.)	Waukesha	1989
89-4	Narrows Creek — Baraboo R.	Sauk	1989
89-5	Middle Trempealeau River	Trempealeau, Buffalo	1989
89-6	Middle Kickapoo River	Vernon, Monroe, Richland	1989
89-7	Lower East Branch Pecatonica River	Green, Lafayette	1989

Map Number	Small-scale Priority Watershed Project	County(ies)	Year Project Selected
SS-1	Bass Lake	Marinettte	1985

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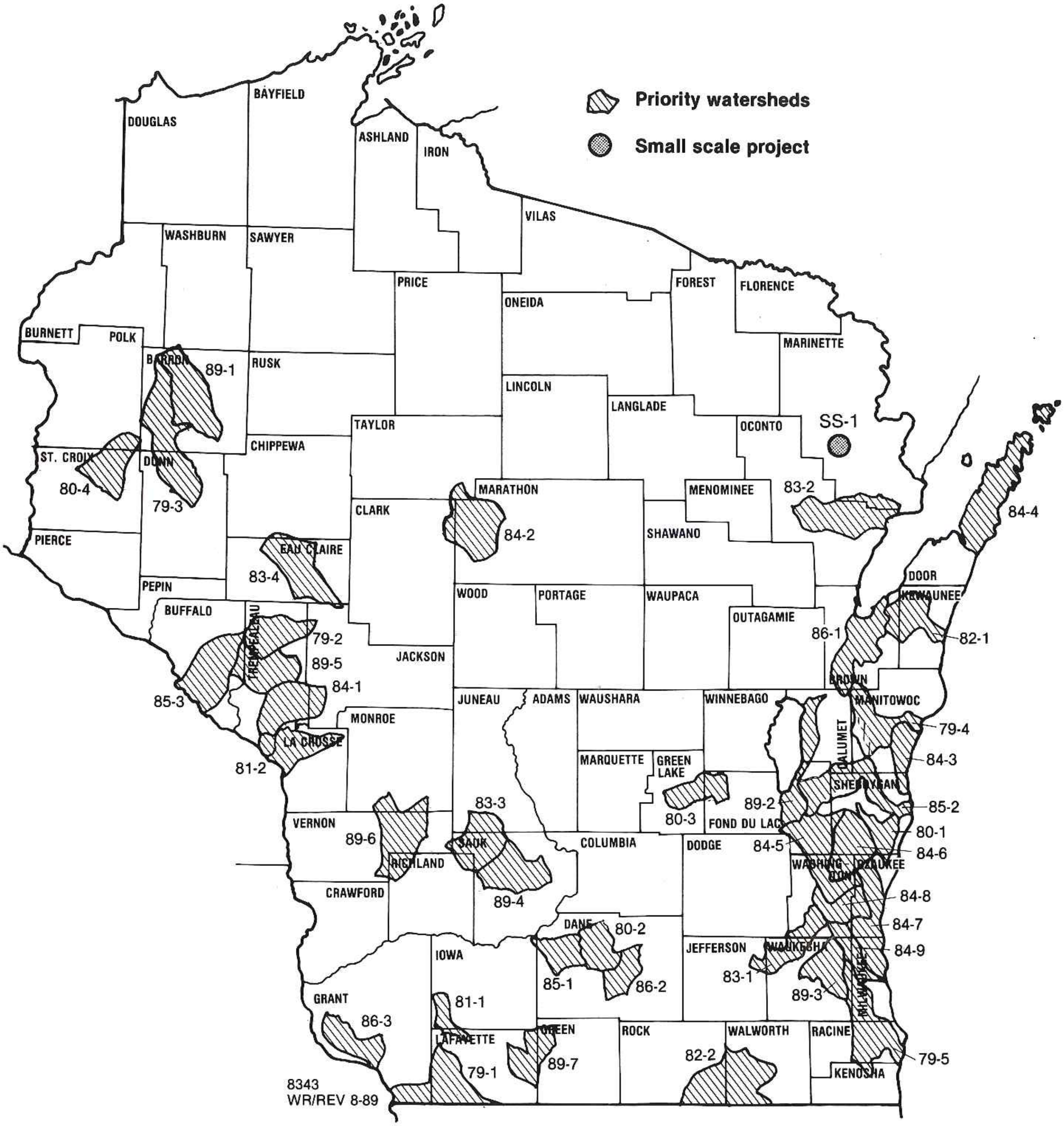
Priority Watershed Projects in Wisconsin
1989



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OUR MISSION:

To protect and enhance our Natural Resources —
our air, land and water;
our wildlife, fish and forests.

To provide a clean environment
and a full range of outdoor opportunities.

To insure the right of all Wisconsin citizens
to use and enjoy these resources in
their work and leisure.

And in cooperation with all our citizens
to consider the future
and those who will follow us.

Wisconsin
Dept. of Natural Resources

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