Nonpoint Source Control Plan for the Red River/Sturgeon Bay Priority Watershed Project

The Wisconsin Nonpoint Source Water Pollution Abatement Program

August, 1996

This Plan Was Cooperatively Prepared By:

The Door County Soil & Water Conservation Department
The Kewaunee County Land Conservation Department
The Brown County Land Conservation Department
The Wisconsin Department of Natural Resources
The Department of Agriculture, Trade, and Consumer Protection
and the City of Sturgeon Bay

Publication WT-466-96

For copies of this document please contact:

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Bureau of Watershed Management
Runoff Management Practices Section
P.O. Box 7921
Madison, WI 53707-7921

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

Watershed Plan Credits

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State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

101 South Webster Street
P.O. Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
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October 13, 1995

Mr. Guy Zima, Chair
Brown County Board of Supervisors
305 E. Walnut St. Rm 219
Green Bay, WI 54301

Dear ~~Mr. Zima~~ Guy:

I am pleased to approve Red River/Sturgeon Bay Priority Watershed Plan. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. The plan has been approved by the Land and Water Conservation Board. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program necessary to support the project. I am also approving the plan as an amendment to the Twin-Door-Kewaunee River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Brown County staff that participated in preparing the plan. I especially want to commend Jon Bechle for his work. We look forward to assisting Brown County and other units of government in the watershed in implementing the plan.

Sincerely,

George

George E. Meyer
Secretary

Congratulations on a great project.

cc: Bill Hafs - Brown Co. LCD
Rob McLennan - LMD
Becky Wallace - WR/2
Cindy Hoffland - CA/8

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September 20, 1995

TO THE HONORABLE CHAIRMAN & MEMBERS
OF THE BROWN COUNTY BOARD OF SUPERVISORS

Ladies & Gentlemen:

RESOLUTION RELATING TO THE APPROVAL OF THE
RED RIVER/STURGEON BAY PRIORITY WATERSHED PLAN

WHEREAS, the Red River/Sturgeon Bay project was designated by the state legislature as a "priority watershed" in 1992 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS, the Brown County Land Conservation Department, Door County Soil & Water Conservation Department, and Kewaunee County Land Conservation Department, in cooperation with the Wisconsin Department of Natural Resources and Wisconsin Department of Agriculture, Trade and Consumer Protection, conducted a detailed inventory of the land use within the watershed in 1993 and 1994, and

WHEREAS, a draft of the plan has been available for review and comments were accepted at a public informational hearing held July 12, 1995, and

WHEREAS, the priority watershed plan assesses the existing water quality and watershed conditions, identifies the management practices and actions necessary to improve or protect the water quality of the watershed, outlines the tasks required and the agency responsible for each, and establishes the time frame and cost estimates for the project, and

WHEREAS, the implementation of this plan will provide both technical assistance and cost-share monies to eligible landowners and local governments within the priority watershed for the installation of conservation practices designed to reduce the sources of nonpoint pollution and protect or improve the quality of Brown County's water resources.

NOW, THEREFORE, BE IT RESOLVED, that the Brown County Board of Supervisors does hereby approve the "Red River/Sturgeon Bay Priority Watershed Plan" and that the implementation of the plan begin as soon as possible.

Respectfully submitted,

Merlin Vanden Plas LCC Chairman

Pat Collins

Ken Simons

Terry Stauder

Gerald Peters ASCS

LAND CONSERVATION COMMITTEE

Approved By:

Nancy J. Nusbaum

COUNTY EXECUTIVE

Date Signed: 10/3/95

Final Draft Approved by Corporation Counsel

I, Randy Johnson, County Clerk of the county of Brown, Wisconsin, do hereby certify that the above is a true and correct copy of resolution number 9E adopted by the Brown County Board of Supervisors on September 20, 1995 and approved by the County Executive.

Randy Johnson, County Clerk, Brown County, WI

WISCONSIN
DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

101 South Webster Street
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October 13, 1995

Mr. Lyle Hill, Chair
Door County Board of Supervisors
P.O. Box 670
Sturgeon Bay, WI 54235

Dear ~~Mr. Hill~~: Lyle

I am pleased to approve Red River/Sturgeon Bay Priority Watershed Plan. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. The plan has been approved by the Land and Water Conservation Board. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program necessary to support the project. I am also approving the plan as an amendment to the Twin-Door-Kewaunee River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Door County staff that participated in preparing the plan. I especially want to commend Tom Sweeney for his work as project manager. We look forward to assisting Door County and other units of government in the watershed in implementing the plan.

Sincerely,

George

George E. Meyer
Secretary

Congratulations on a great project.

cc: Bill Schuster - Door Co. SWCD
Rob McLennan - LMD
Becky Wallace - WR/2
Cindy Hoffland - CA/8

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DOOR COUNTY
Soil & Water
Conservation Department

421 Nebraska Street • P.O. Box 670
Sturgeon Bay, Wisconsin 54235
(414) 746-2214
FAX (414) 746-2320

Secretary George Meyer
Department of Natural Resources
Box 7921
Madison, WI 53707-7921

Secretary Meyer:

I am pleased to inform you that the Door County Land Conservation Committee took action at their September 20, 1995, meeting approving the Red River/Sturgeon Bay Priority Watershed Implementation Plan. The LCC's action also forwarded the Implementation Plan to the Door County Board and the State Land and Water Conservation Board with a recommendation for approval.

On September 26, 1995, the Red River/Sturgeon Bay Priority Watershed Implementation Plan was presented to the Door County Board. The contents of the Implementation Plan were reported on and discussed. The Door County Board adopted a motion to accept the Plan as presented.

The Door County Land Conservation Committee and Soil & Water Conservation Department look forward to working with the DNR on this important water quality protection project.

Sincerely,

William E. Schuster
County Conservationist

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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George E. Meyer
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October 13, 1995

Mr. Harold Reckelberg, Chair
Kewaunee County Board of Supervisors
613 Dodge Street
Kewaunee, WI 54216

Dear ~~Mr.~~ Harold Reckelberg:

I am pleased to approve Red River/Sturgeon Bay Priority Watershed Plan. This plan meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. The plan has been approved by the Land and Water Conservation Board. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program necessary to support the project. I am also approving the plan as an amendment to the Twin-Door-Kewaunee River Basin Areawide Water Quality Management Plan.

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

Sincerely,

George

George E. Meyer
Secretary

Congratulations on a great project.

cc: Andy Wallander - Kewaunee Co. LCD
Rob McLennan - LWD
Becky Wallace - WRC
Cindy Hoffland - DAS

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RESOLUTION No. _____

Resolution to Approve and Support the Red River/Sturgeon Bay Nonpoint Source Priority Watershed Project Implementation Plan

WHEREAS, sources of nonpoint source pollution, such as excess soil erosion, stream sedimentation and mismanagement of animal manure, have degraded, or threaten to degrade, the water quality of surface and groundwater resources within the Red River/Sturgeon Bay Watershed Project area, and

WHEREAS, the Red River/Sturgeon Bay Nonpoint Source Priority Watershed Implementation Plan documents a detailed program to implement management actions that will address sources of nonpoint source pollution within the Watershed Project area, and

WHEREAS, the Kewaunee County Land Conservation Committee has reviewed the Plan, and has approved it through a motion at the Committee's August 14th, 1995 regular monthly meeting, and

WHEREAS, The Land Conservation Committee, within the same August 14th motion, recommends that the Kewaunee County Board of Supervisors adopt and approve of the Plan through County Board resolution.

NOW, THEREFORE, BE IT RESOLVED by the Kewaunee County Board of Supervisors, duly assembled this 26th day of September, 1995, that the Board goes on record as approving, adopting and supporting the Red River/Sturgeon Bay Nonpoint Source Priority Watershed Implementation Plan.

Land Conservation Committee

Gary Thayse

Gary Thayse, LCC Chairman

Harvey Mleziva

Harvey Mleziva

Gene Dalebroux

Gene Dalebroux

Gordon Prahl

Gordon Prahl

Gary Pinchart

Gary Pinchart, ASC Member

A NONPOINT SOURCE CONTROL PLAN FOR THE RED RIVER/STURGEON BAY PRIORITY WATERSHED PROJECT

SUMMARY

PREPARED BY

DOOR COUNTY SOIL AND WATER CONSERVATION DEPARTMENT

SUMMARY

INTRODUCTION

The Red River/Sturgeon Bay Watershed is a 139 square-mile drainage area located in Door, Kewaunee and Brown Counties and includes the city of Sturgeon Bay. About 15,000 people live in this watershed. Land uses are mostly rural. The project area is a subbasin of the Twin-Door-Kewaunee Basin.

The Red River/Sturgeon Bay Watershed was designated a "priority watershed" in 1992 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. It is one of 76 priority watersheds statewide, encompassing more than 4 million acres, in which the clean-up and protection of water resources through control of nonpoint source pollution is a priority for the Department of Natural Resources (DNR) and local governments.

Nonpoint source pollution is carried in runoff from farm fields, barnyards, improperly stored manure, streets, parking lots, construction sites and other sources that cannot be easily traced to a single point such as a municipal or industrial wastewater discharge. Nonpoint source pollution in the Red River/Sturgeon Bay Watershed has degraded groundwater and surface waters and reduced opportunities for safe drinking water, recreational uses and aquatic life.

Nonpoint sources in the Red River/ Sturgeon Bay Watershed include animal lots, eroding cropland, eroding streambanks, runoff from paved surfaces and rooftops, and erosion from developing and established urban areas. Pollutants from nonpoint sources are carried to groundwater or surface waters through the action of rainfall runoff, snow melt, and seepage. Principal pollutants of concern include sediment, bacteria, nutrients and toxic materials such as heavy metals and other contaminants from paved surfaces.

SURFACE WATER QUALITY

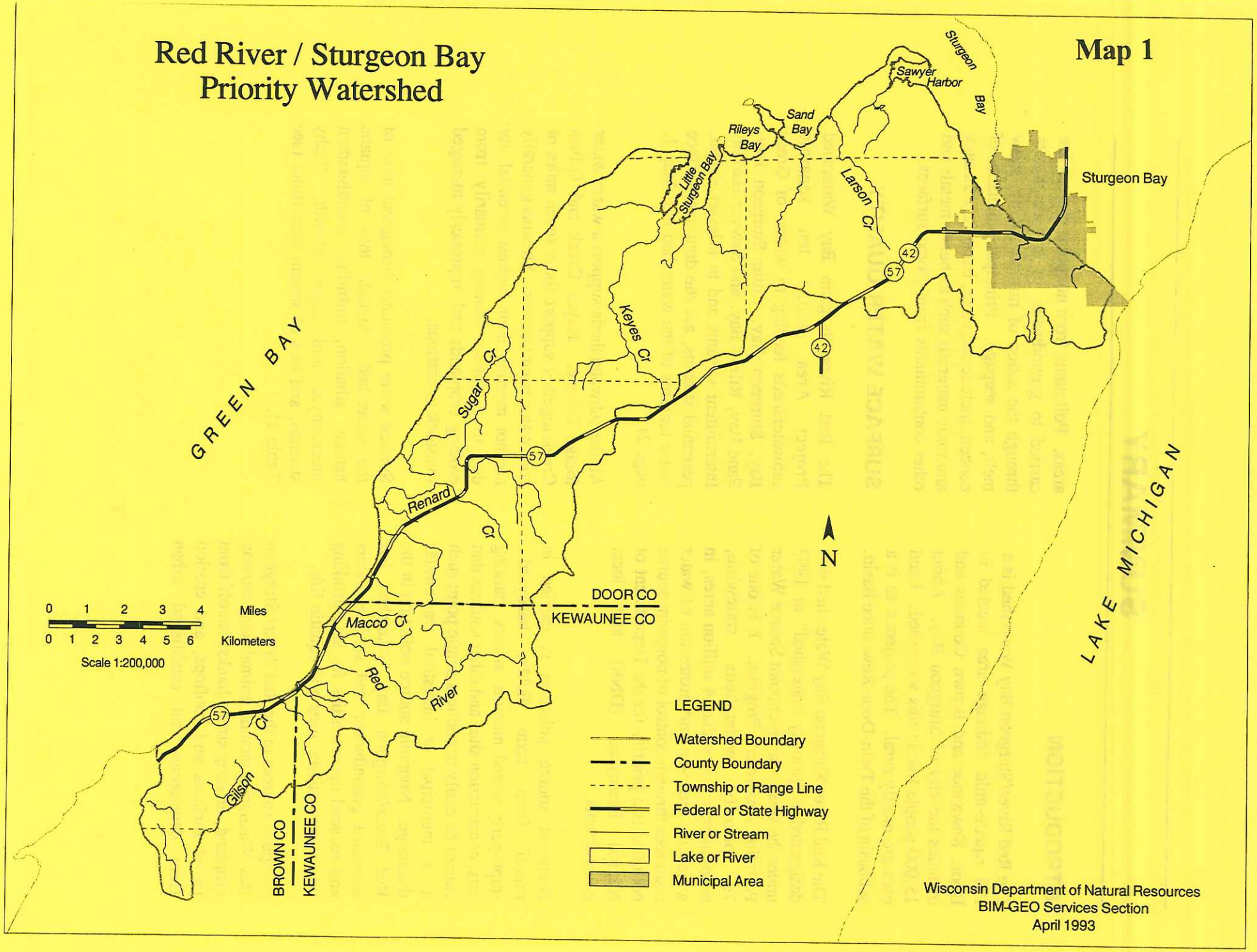
The Red River/Sturgeon Bay Watershed Project Area drains ten separate subwatersheds feeding to waters of Green Bay, Sturgeon Bay, Little Sturgeon Bay, Sand Bay, Rileys Bay, and Sawyer Harbor. Intermittent streams and to a lesser extent, perennial streams, are the dominant surface water features of the watershed (see Map 1, page 2).

All the subwatersheds support a warm water forage fishery. Keyes Creek and Gilson Creek together support about seven miles of cold water trout streams. Streams generally are not meeting their highest potential use due to pollution coming primarily from eroding croplands and improperly managed livestock operations.

Surface water problems throughout most of the watershed include loss of aquatic habitat, siltation, turbidity, overabundant macrophyte and algal growth, flashy streams, and loss of stream base flows (see Table 1).

Red River / Sturgeon Bay Priority Watershed

Map 1



Wisconsin Department of Natural Resources
BIM-GEO Services Section
April 1993

Table 1. Surface Water Quality Problems in the Red River/Sturgeon Bay Project Area.

Subwatershed Name	Water Quality Problem	Runoff Pollutants	Observed and Potential Sources
Strawberry Creek (SC)	Loss of aquatic habitat Threat to fall salmon run Siltation Overabundant macrophytes	Sediment Nutrients Low/high flow	Channelization Cropland erosion Barnyard runoff
Sturgeon Bay (SB)	Overabundant Algae Loss of aquatic habitat Siltation Waterweeds	Sediment Nutrients Metals Low/high flow	Urban runoff Construction Channelization Misuse of cleaning compound on recreational boats
Larson Creek (LC)	Loss of aquatic habitat Turbidity Siltation Overabundant macrophytes	Sediment Nutrients Low/high flow	Barnyard runoff Streambank pasturing Cropland erosion Landfill Golf course runoff
Keyes Creek (KC)	Loss of aquatic habitat Overabundant algae Siltation Low dissolved oxygen Overabundant macrophytes	Sediment Nutrients Bacteria BOD Low/high flow	Cropland erosion Channelization Streambank pasturing Barnyard runoff
Sugar Creek (SR)	Loss of aquatic habitat Turbidity Siltation Low dissolved oxygen	Sediment Nutrients Bacteria Low/high flow	Cropland erosion Streambank pasturing Channelization Barnyard runoff
Renard Creek (RC)	Loss of aquatic habitat Siltation Turbidity Overabundant macrophytes Overabundant algae	Sediment Nutrients Bacteria Low/high flow	Streambank pasturing Cropland erosion Barnyard runoff
Fabry Creek (EC)	Loss of aquatic habitat Turbidity	Sediment Nutrients Low flow	Cropland erosion Barnyard runoff
Red River (RR)	Loss of aquatic habitat Turbidity	Sediment Nutrients Low/high flow	Streambank erosion Cropland erosion Barnyard runoff Green Bay shoreline erosion
Gilson Creek (GC)	Loss of aquatic habitat Turbidity	Sediment Nutrients Bacteria Low/high flow	Streambank erosion Cropland erosion Barnyard runoff Sump pump discharges

Source: DNR

Many of the streams have been channelized or straightened, resulting in loss of aquatic habitat. Excessive amounts of sediments, nutrients, bacteria, and organic matter degrade or threaten the quality of surface waters.

GROUNDWATER QUALITY

Karst features such as sinkholes, caves, swallets, exposed bedrock and fracture traces are prevalent in many areas of the watershed. Shallow soils are also found throughout the watershed project area. The highest concentration of shallow soils are found in the northern third of the watershed project area. Closed depressional areas with a principal outlet (a sinkhole, swallet, or fracture trace) are also a commonly found feature within the watershed project area. These physical features provide a direct route for unfiltered surface waters to enter drinking water aquifers.

As part of a groundwater quality assessment and information/education campaign, 457 private wells in the watershed were sampled for one or more of the following constituents: bacteria, nitrates, lead, turbidity, chloride, and atrazine. About 38 percent of the samples tested positive for bacteria. Two percent of the wells sampled were found to contain nitrate levels above the drinking water enforcement standard. Detectable levels of atrazine were found in 15 percent of the samples. Historically, the project area has had numerous cases of well contamination documented.

NONPOINT POLLUTION SOURCES

Nonpoint sources of pollution are derived from animal lot runoff, winter spread manure, cropland erosion, improperly sited manure storage, streambank erosion, developing and redeveloping areas, and runoff from established urban areas such as commercial, residential, and industrial lands.

Pollutants found in runoff from agricultural and urban lands include sediment, phosphorus, nitrogen, bacteria, pesticides, and oxygen demanding materials. In addition, urban runoff may contain heavy metals (copper, zinc, cadmium, chromium, lead, etc.) and a large number of toxic organic chemicals (PCBs, aromatic hydrocarbons, esters and others).

Animal Lot Runoff and Infiltration: Concentrated flows of runoff from animal lots and other livestock feeding, loafing and pasturing areas are a large source of pollutants in streams and groundwater. More than 4,600 pounds of phosphorus are delivered to streams in the watershed from these sources each year. Areas with shallow soils, soils with low pollutant attenuation potential, internally drained areas, and sites draining to exposed bedrock have the greatest potential to convey animal lot runoff to drinking water aquifers.

Improperly Stored Manure: Unconfined manure stored on shallow soils is a source of pollutants infiltrating groundwater. Impacts of these sources are the same as those described above for animal lot runoff and infiltration.

Winter Spread Manure: Manure spread on areas where runoff has concentrated flow, in floodplains, or where slopes exceed 9 percent is a hazard to surface water. About 4,500 acres are considered "high" hazard for surface water quality. Manure spread on

areas with: (1) low soil attenuation values, (2) a high concentration of bedrock features (such as sinkholes), (3) closed depressions, (4) a high density of fracture traces are a groundwater quality concern.

Upland Erosion: Eroded soil from croplands and gullies affects streams and wetlands. An estimated 12,000 tons of soil per year are delivered to surface waters from croplands. Gullies need to be repaired in order to reduce further erosion and sedimentation.

Eroded soil from cropland and to a lesser extent gullies, impacts groundwater quality. An estimated 1557 tons of soil are delivered to the groundwater from cropland annually.

Flashy Streams: Accelerated runoff from paved and roofed surfaces causes increases in peak stream flows. When compared to undeveloped stream basins, flows are much higher during rain storms and decrease below normal levels between rain storms. This produces flashy streams with temperatures and chemical characteristics which limit aquatic life and recreational uses.

Streambank Erosion: Streambanks along most of the streams in the watershed project area were surveyed. About 540 tons of sediment per year are eroding at sites along 18,000 feet of streambanks in the watershed. The most extensive areas of erosion caused by runoff and cattle trampling exist in the Renard Creek and Sugar Creek subwatersheds.

Urban Runoff: Storm water runoff discharges about 600 tons of sediment and 2,200 pounds of phosphorus from urban areas of the city of Sturgeon Bay annually. Construction of new buildings, roads, and utilities disturbs otherwise stable areas, exposing large amounts of soil to erosion. Without adequate controls, construction site erosion can wash soil and debris onto road surfaces and sidewalks, clog storm sewers, and have significant impacts on streams and groundwater.

WATER RESOURCES OBJECTIVES

To improve water quality and safeguard wells by reducing nutrients, sediment and bacteria loading from animal lots, improperly stored manure, milkhouse waste, eroding farm fields and urban areas; develop a well head zone of contribution for the city of Sturgeon Bay and incorporate any areas delineated into the project area; stabilizing flow rates of creeks in the watershed; and maintaining woodland corridors and buffers.

POLLUTION REDUCTION GOALS

Water quality and aquatic habitat investigations were conducted as part of the planning effort for the Red River/Sturgeon Bay Watershed Project. The results indicate that significant reductions are needed for several key pollutants to achieve the watershed project's water quality objectives.

Overall, a 33 percent reduction in total sediment loading and a 70 percent reduction in phosphorus from barnyards and high hazard cropland acres are needed to improve water quality and aquatic habitat in the watershed project area. An estimated 10 percent of degraded wetland acres need restoring to meet project goals.

MANAGEMENT ACTIONS

This plan prescribes best management practices (BMPs). BMPs are actions or structures that are needed to control nonpoint pollution sources to the levels described above. State funding is available to help offset the expense of installing these practices and managing the local runoff pollution control program recommended in this plan.

Financial and technical assistance is available from the nonpoint source program for a variety of activities. Landowners, land renters, counties, cities, towns, sewerage districts and other units of government are eligible for the financial assistance available to the project. State funds help support:

- Construction of BMPs such as those described in Chapters Four and Five of the watershed plan.
- Staff to contact landowners and develop site specific plans and detailed designs for needed BMPs.
- Staff and supplies for developing informational and educational materials such as newsletters and signs, conducting landowner surveys, and carrying out other activities which encourage participation in the project.
- Easements which establish permanent vegetative cover for shoreline buffers, wetland restorations, and stabilization of severely eroding areas.

The watershed project is implemented by local units of government, the counties and the city of Sturgeon Bay. The DNR reviews the progress of local units of government and provides them with assistance throughout the life of the project. The DNR also monitors changes in water quality resulting from the control of nonpoint sources.

The following is an overview of the management actions needed to meet water quality goals in the Red River/Sturgeon Bay Watershed Project Area.

Critical Sites

Participation in watershed projects is mostly voluntary, but state statutes require that critical sites be identified in the plan to ensure that water resource goals will be achieved.

Landowners with sites meeting the criteria for critical sites are required through s. 144.25 Stats, to achieve the pollution reduction goal for their site through the installation of BMPs or by eliminating the pollution source by other methods. All critical sites will be verified prior to signing a cost-share agreement. Findings shall be reported to the DNR. Verification begins within the first six months after plan approval.

Notification of landowners with critical sites will begin within six months following plan approval and within 60 days of critical site verification. All landowners or land operators with critical sites will be notified. The notification will include the following information:

- The 36 month period in which the landowner is eligible for the full level of state cost-sharing (in most cases, 70 percent) and the 50 percent reduction in

state cost-sharing after the 36 month period.

- The potential consequences of either ch. NR 243, for animal waste, or s. 144.025(2)(u), (v), or (w), Stats, for sediment delivery and streambank erosion, that the landowner may face if no action is taken. Some of these include receiving a notice of discharge, requiring of a WPDES permit, or the issuing of a notice of intent.
- The right to appeal the designation of a critical site through a written request to the Land Conservation Committee within 60 days of receipt of the notification letter.

Of the 616 landowners inventoried during the project planning phase, 168 have critical sites on their property (27 percent). About a third of the critical sites are the result of cropland erosion and the other two thirds the result of improper manure handling and storage.

Animal Lot Runoff Control: Of the 125 livestock operations that affect surface water in the watershed, 32 are identified as critical; each delivering more than 50 pounds of phosphorus to streams annually. Of the 192 animal operations that are ranked for groundwater impacts, 19 are listed as critical sites.

Manure Management: A field rating system was used to determine if a farm operation has adequate acres to safely spread manure during the winter months. If a farming operation was determined to have an acreage deficiency, as shown through the field rating system, that farm was identified as eligible for cost-sharing for a nutrient management plan (NRCS spec. 590).

If the nutrient management plan shows that all manure produced can not be spread in winter without causing a surface water impact, the farm is then eligible for a manure storage facility to address the deficient acres. Under this scenario, 120 landowners in the watershed are eligible for nutrient management planning.

Of the 192 livestock operations which were rated for groundwater pollution potential for manure storage sites, 21 sites were listed as critical. These sites had shallow soils, drain to a rock hole opening, or are close to a flow path which drains to a closed depression with an outlet to groundwater.

Cropland Erosion Control: Croplands that are delivering greater than 0.35 tons per acre per year will need BMPs to meet water resources objectives of the plan. Those contributing over 0.6 tons per acre per year and a USLE soil loss "A" greater than the soil loss tolerance "T" together make up 13 percent of the cropland sediment load and are considered critical. There are an estimated 68 critical sites for this category.

Well Abandonment: To achieve groundwater quality objectives of the watershed plan, improperly constructed wells and abandoned wells must be sealed to prevent runoff infiltration.

Milking Center Waste Control: Sites with less than or equal to 36 inches of soil to bedrock or those within a channelized drainage to surface waters will be eligible for BMPs installed for the purpose of treating and reducing the quantity of milkhouse wastewater.

Streambank Erosion Control: Approximately 6,000 feet of streambank erosion at 26 sites are eligible for cost-sharing.

Construction Site Erosion Control: About 100 acres of urban development and construction is expected in the watershed project area over the next two decades. Effective construction erosion control measures are needed in the city of Sturgeon Bay to meet project goals.

Storm Water Pollution Control: The control program for urban storm water is based on a pollutant reduction goal of 25 percent of suspended solids.

Approximately 960 acres of urban lands are designated source areas targeted for nonpoint source control. Urban nonpoint source controls include wet detention ponds, supplementary street cleaning, and urban pollution prevention practices. If wet detention alone is used, nearly 5 acres of ponds need to be constructed to meet project goals.

Urban Core Program: The core elements of the urban nonpoint source control program applicable to the city of Sturgeon Bay include basic measures that can be implemented without further study. Adopting an urban core program is the first step in the implementation process. The city of Sturgeon Bay will need to commit within the first three years of the project to implement the core program. This is a requirement to receive technical and financial assistance through the priority watershed project. The basic elements of the core program are:

- Effectively enforce existing construction erosion control ordinances based on the state model ordinance and state building codes. Construction site erosion control practices should be consistent with the standards and specifications in the "Wisconsin Construction Site Best Management Practice Handbook."

- Develop and implement a community specific program of urban pollution prevention practices which reduce urban nonpoint source pollution. This may include a combination of activities such as adoption of ordinances regulating pet wastes or changes in the timing and scheduling of leaf collection.

- Following the completion and adoption of the DNR Storm Water Management Guidebook (in preparation), it is recommended that a storm water management ordinance be incorporated into the core program.

Urban Segmented Program: The segmented components of the urban nonpoint source program include those requiring site specific investigations prior to implementation. Best management practices implemented under this portion of the program likely will include wet detention ponds, streambank erosion controls and other structural means for reducing urban nonpoint source pollution.

Detailed studies will include engineering feasibility and other site specific investigations. The results will determine the best means for reducing urban nonpoint sources by more site specific application of the plan's recommendations.

The basic elements of the segmented program are:

- Adopt and enforce a comprehensive storm water management ordinance consistent with the state's model storm water ordinance (under preparation).

- Develop, as needed, storm water management plans for urban development and redevelopment. These plans will identify the type and locations of structural urban best management practices.

- Conduct engineering studies to determine the best means to implement community specific nonpoint source control measures for existing urban areas. This component will consider structural urban practices such as detention as well as supplementary street cleaning.

- Design and install structural urban best management practices as described in the state's storm water manual (in preparation) for existing urban areas.

COSTS

The total estimated cost of carrying out the recommendations presented in this plan is about $19 million over ten years. This cost will be shared by the State of Wisconsin through its Nonpoint Source Water Pollution Abatement Program, local units of government and individual landowners. The state share is estimated to be about $15 million.

Of the estimated $15 million state share, 75 percent will be spent on BMPs in the watershed, 21 percent on local staff costs, and 4 percent on other costs such as easements, supplies, and educational materials. The Sturgeon Bay Utilities will be offering additional cost-sharing for landowners who's operations are within the city of Sturgeon Bay's well head zone of contribution. The Utilities has committed to a $10,000.00 budget/year for ten years, if the funding is made available.

PROJECT IMPLEMENTATION

Project implementation is scheduled to begin in fall, 1995 and continue for ten years. Cost-share agreements may be signed throughout the ten year project period.

INFORMATION AND EDUCATION

An information and education program will be conducted throughout the project period. Local units of government and UW-Extension staff have overall responsibility for the program. The program includes:

- An informational campaign with press releases and newsletters to inform the public about runoff pollution and what can be done to reduce it.

- Interactive educational activities, such as landowner surveys, workshops, and demonstration projects for landowners and local government officials to share ideas in preparation for adopting new pollution control techniques.

- Water quality informational materials, signs, and displays for homeowners, local government officials, community groups, and concerned citizens to inform them about watershed project activities,

water resources, project boundaries, and pollution control methods.

- Activities such as Adopt-A-Stream programs and service projects for youth such as storm drain stenciling to inform them about water resource issues and help them develop an understanding of the goals of the project.

PROJECT EVALUATION

The project will be evaluated annually to determine project staff accomplishments and pollutant load reductions resulting from BMPs installed. Local units of government participating in the project will be responsible for reporting activities to the DNR.

Evaluation monitoring activities in priority watersheds are planned and conducted according to monitoring program guidance in the Bureau of Water Resources, Surface Water Monitoring Strategy. However, evaluation monitoring is not conducted in every priority watershed. Extensive water quality monitoring will be conducted on the Bower Creek Master Monitoring Site where similar priority watershed management practices are being planned and installed. Depending on the availability of state and local funding, additional monitoring activities may be prescribed for the project at a later time.

FURTHER INFORMATION

If you want more information about the Red River/Sturgeon Bay Priority Watershed Project or a copy of the watershed plan contact:

Door County Soil and Water
Conservation Department
P.O. Box 670
421 Nebraska Street
Sturgeon Bay, WI 54235
(414) 746-2214

Kewaunee County Land
Conservation Department
925 Marquette Drive
Kewaunee, WI 54216
(414) 388-0787

Brown County Land
Conservation Department
Ag & Ext. Service Center,
1150 Bellevue St.
Green Bay WI 54302
(414) 391-4620

Nonpoint Source Program Coordinator
Department of Natural Resources
P.O. Box 7921
101 S. Webster Street
Madison, WI 53707-7921
(608) 264-6294

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CHAPTER ONE
Plan, Purpose and Legal Status

Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The program goal is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources. The program is implemented through the Priority Watershed projects. The 139-square-mile Red River/Sturgeon Bay Priority Watershed is located in Door, Kewaunee and Brown Counties, and was designated a "priority watershed" in October 1992. The primary objective of this project is to reduce nonpoint source pollution loads to the groundwater and to enhance and protect the water quality of the streams and near shore waters of Green Bay.

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

The following is an overview of the Nonpoint Source (NPS) program:

- The Department of Natural Resources (DNR) administers the program. It focuses on critical hydrologic units called priority watersheds. Priority Watershed projects implement the NPS program.

- A priority watershed project is guided by a plan prepared cooperatively by the DNR, Department of Agriculture, Trade, and Consumer Protection (DATCP) and local units of government, with input from a local citizen's advisory committee. Project staff evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to meet specific water resource objectives. The plan guides implementation of these practices in an effort to improve water quality.

- Upon approval by state and local authorities, local units of government implement the plan. Water quality improvement is achieved through implementation of nonpoint source controls BMPs and the adoption of ordinances. Landowners, land renters,

counties, cities, villages, towns, sanitary districts, lake districts, and regional planning commissions are eligible to implement the program.

- Technical assistance is provided by the local unit of government to aid in the design of BMPs. State level cost-share assistance is available to help offset the cost of installing these practices. Eligible landowners and local units of government are contacted by the County Soil and Water Conservation Department (SWCD) or Land Conservation Department (LCD) to determine their interest in installing the BMPs identified in the plan. Signed cost-share agreements list the practices, costs, cost-share amounts and a schedule to install management practices.

- Informational and educational activities are developed to encourage participation.

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

Legal Status of the Nonpoint Source Control Plan

The Red River/Sturgeon Bay Priority Watershed Implementation Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared through the cooperative efforts of the Door County Soil and Water Conservation Department, Kewaunee and Brown County Land Conservation Departments, the city of Sturgeon Bay, DNR, DATCP, and the Red River/Sturgeon Bay Watershed Citizens Advisory Committee.

This watershed plan is the basis for the DNR to enter into cost-share and local assistance grants with agencies responsible for project implementation. The plan will be used as a guide to implement measures to achieve desired water quality conditions. If a discrepancy occurs between this plan and the statutes or the administrative rules, or if statutes or rules change during implementation, the statutes and rules will supersede the plan. Similarly, this plan is subject to the amendment process under NR 120.08(e) for substantive changes. This watershed plan does not in any way preclude the local, state or federal government use of normal regulatory procedures developed to protect the environment. All local, state and federal permit procedures must be followed. In addition, this plan does not preclude the DNR from using its authority under Chapters 147 and 144 of the state statutes to regulate significant nonpoint pollution sources in the project area.

Plan Organization

The remainder of this plan covers three areas: the watershed assessment (Chapters Two, Three

and Four), a detailed program for implementation (Chapters Five, Six and Seven), and project evaluation (Chapter Eight). The contents of each chapter are described below.

The Watershed Assessment

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

Chapter Three. "Water Quality Conditions, Objectives and Nonpoint Pollution Sources" presents field inventory results, identifies the water quality or water resource problems and lists improvements that can be obtained through implementing a nonpoint source control project. This chapter discusses the level of pollutant control needed to achieve the water resource objectives, and describes the nonpoint sources and other sources of pollution.

Chapter Four. "Management Actions" identifies the level of urban and rural nonpoint source control needed to meet the water quality objectives. Eligibility criteria for funding to control nonpoint sources under the priority watershed project are also presented.

A Detailed Program for Implementation

Chapter Five. "Local Government's Implementation Program" describes how local units of government administer the project, and estimates a local assistance and management practice cost-share budget.

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

Chapter Seven. "Integrated Resource Management Program" presents the strategy for involving DNR resource management programs (fisheries management, wildlife, etc.) in the nonpoint source pollution abatement efforts in the Red River/Sturgeon Bay Priority Watershed.

Project Evaluation

Chapter Eight. "Progress Assessments" discusses how to access the amount of nonpoint source control gained through installation of best management practices in the watershed.

CHAPTER TWO
General Watershed Characteristics

Location

The Red River/Sturgeon Bay Priority Watershed is a 139 square-mile or 89,215 acre drainage basin. This watershed is a subbasin of the Twin-Door-Kewaunee Basin which is located in northeastern Wisconsin. The watershed is bound to the north by the Upper Door County Watershed, to the east by the Ahnapee River Watershed, the Stoney Creek Watershed, and the Kewaunee River Watershed, and to the south by the East River Watershed. Figure 2-2 illustrates the Twin-Door-Kewaunee Basin. Figures 2-3 and 2-4 outline the Red River/Sturgeon Bay Priority Watershed.

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

Cultural Features

Civil Divisions

The Red River/Sturgeon Bay Priority Watershed lies within Door, Kewaunee, and Brown Counties. The only incorporated area in the watershed is the city of Sturgeon Bay. Unincorporated areas include the villages of Brussels and Dyckesville. Publicly owned lands within the Watershed are Gardner Wildlife Area and Potawatomi State Park. Many county and town owned parks are located throughout the Watershed. Land distribution by county is approximately:

- Door 78%
- Kewaunee 13%
- Brown 9%

Population Size and Distribution

The Red River/Sturgeon Bay Watershed population is estimated to be approximately 15,000 year round residents. A majority of the watershed population (approximately 67%) lives in the city of Sturgeon Bay. The remainder of the population resides in the unincorporated villages and the rural areas. Population rates in the watershed are stable and will likely remain so. The watershed has a large number of summer/part time residents which tend to locate on the shoreline of Green Bay.

Fig. 2-3: Red River / Sturgeon Bay Priority Watershed

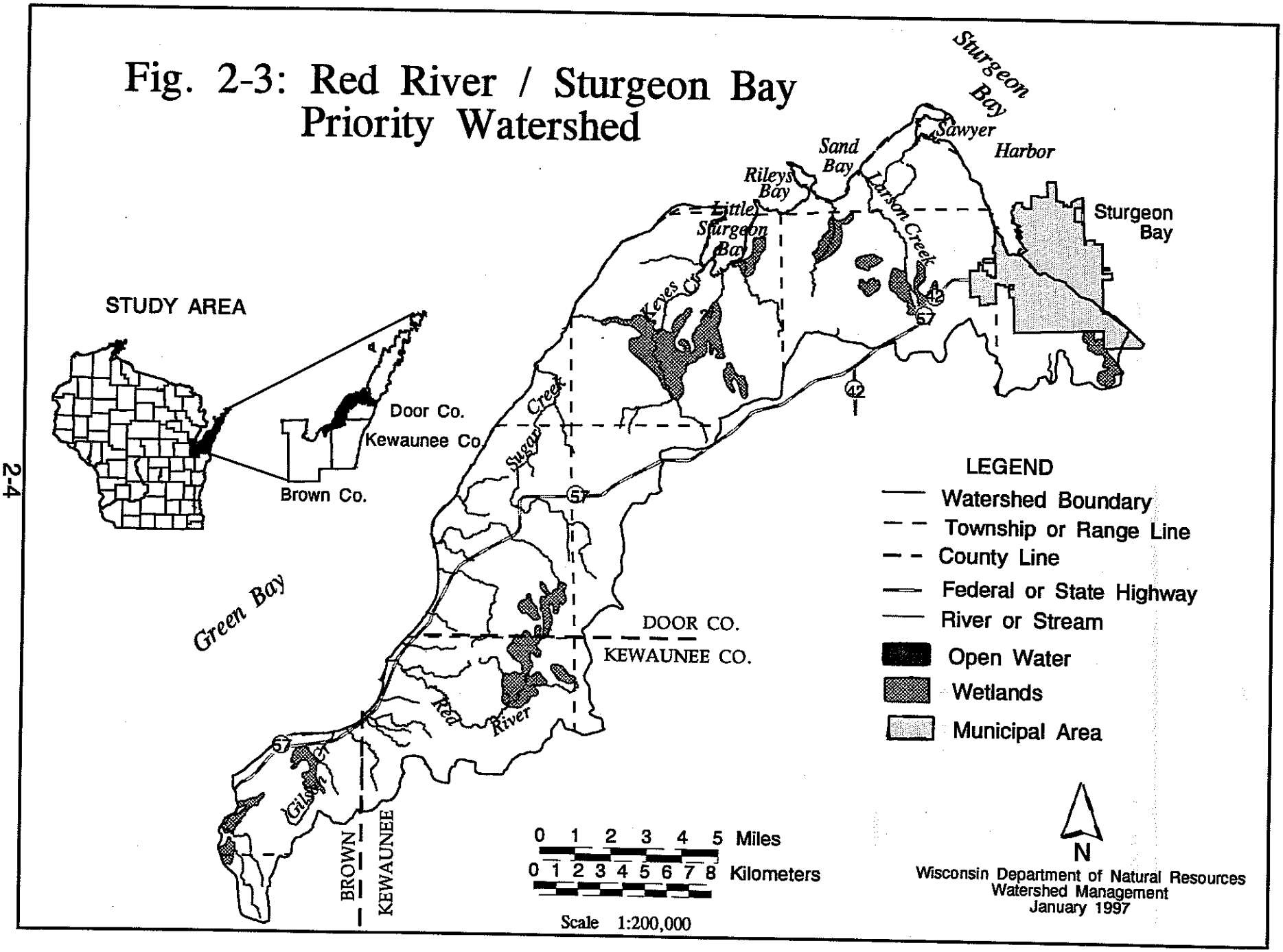
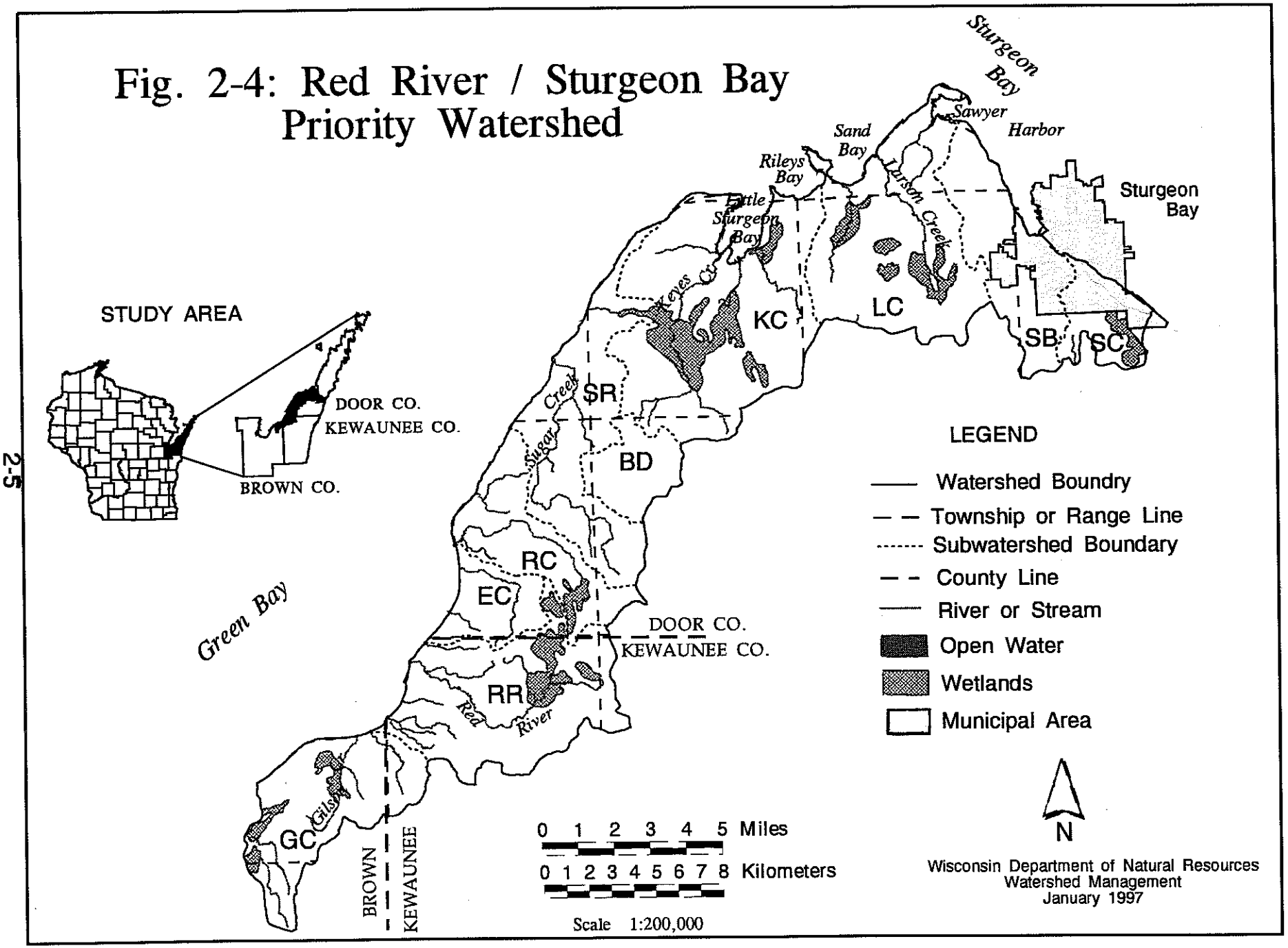


Fig. 2-4: Red River / Sturgeon Bay Priority Watershed



Municipal and Industrial Point Sources of Water Pollution

Discharges of wastewater from permitted municipal and industrial sources are known as point sources of pollution. These sources of pollution are important considerations for improving and protecting surface water resources. An inventory of point sources is presented in the Twin Door Kewaunee Basin Plan. Most of these point sources are controlled through permits that the DNR issues under the Wisconsin Pollution Discharge Elimination System (WPDES).

Sanitary Sewer Service

Sanitary sewer service availability is extensive throughout the city of Sturgeon Bay and the village of Dyckesville. The Sturgeon Bay Utilities (SBU) provides sanitary service for all of the Sturgeon Bay incorporated area. The Dyckesville Sanitary District provides service to all village residents and many non-residents residing along the waterfront. Dyckesville raw sewage is pumped to the Green Bay Municipal Sewage District Facility. Conventional septic systems, mound septic systems, and holding tanks provide the remainder of the watersheds residents with sanitary service. Treated wastewater from the SBU wastewater treatment plant is discharged into the waters of Sturgeon Bay. Wastewater generated by the remainder of the watershed residents is disposed of through private on-site systems.

Water Supply Service

Drinking water supplies used in the Red River/Sturgeon Bay Watershed are obtained from groundwater sources. There are three principal aquifers lying beneath the watershed from which groundwater is obtained. Refer to the Groundwater section in this chapter for discussions of the aquifers, (page 2-12). Water obtained from these aquifers is either pumped from individual private wells or through municipal pumping facilities.

Sturgeon Bay Utilities water supply system provides water to a majority of the city residents; approximately 67 percent of the watershed population. Most cities along Lake Michigan and Green Bay meet their water needs from obtaining water from the lake or bay. However, the city of Sturgeon Bay is unique in that their water is obtained from drilled wells which extract water from the Silurian age dolomite aquifer. The Sturgeon Bay Utilities treats well water from two of their five wells with an ozone treatment process to ensure a safe water supply. Ozone treatment is required to kill bacteria present in the municipal wells.

Natural Resource Features

Climate and Precipitation

The frequency, duration and amount of precipitation influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics, and the physical condition of waterways. The Red River/Sturgeon Bay Watershed lies in the continental zone which is characterized by winters which are long and relatively cold and snowy and summers which are

mostly warm with periods of hot humid conditions. Mean annual precipitation for the region is approximately 31.49 inches of rain and melted snow; the majority of the precipitation is a result of thunderstorms during the growing season (May-September). Most runoff occurs in February, March, and April when the land surface is frozen and soil moisture is highest.

Topography

The Red River/Sturgeon Bay Watershed lies within the Eastern Ridges and Lowlands geographic province, which is part of the continental zone. The topography reflects periods of glaciation which left shallow soil deposits in much of the watershed. Glacial features such as drumlins, eskers, and moraines are prevalent in portions of the watershed. Karstic features such as sinkholes, caves, and highly fractured bedrock are also prevalent in areas of the watershed. Karst Topography will be explained in greater detail in the bedrock geology section and Appendix A. Karst areas exhibit very limited surface water drainage patterns. The Niagara Escarpment forms a prominent ridge throughout the watershed and has a steep west-facing slope and a gentle backslope.

Soils

Soils are the weathered, uppermost layers of organic and inorganic earth materials. The soils of the watershed originate from three main sources: glaciation, bedrock weathering, and fluvial activity. The soils of the watershed consist mainly of three soil associations: the Summerville-Longrie-Omena, the Emmet-Solona-Angelica and the Kewaunee-Kolberg-Manawa. The Summerville-Longrie-Omena association comprises approximately 40% of the land area in the northern half of the watershed. These soils are very shallow (less than 20 inches to bedrock) to moderately deep (greater than 50 inches to bedrock), well drained, and level to moderately steep soils that have a sandy loam or loam subsoil over sandy loam, fine sandy loam, or dolomite bedrock. This association is also found in various concentrations throughout the southern half of the watershed. The Kewaunee-Kolberg-Manawa association is found mainly in the southern half of the watershed. This association is also found in various concentrations throughout the watershed. The soils in this association tend to be deep to moderately deep, well drained to somewhat poorly drained, nearly level to moderately steep soils that have a dominantly silty clay subsoil over silty clay till or dolomite bedrock. The Emmet-Solona-Longrie association is found throughout the watershed in various concentrations. The soils in this association tend to be deep, well drained to poorly drained, nearly level to sloping soils that have a loamy sand to silt loam subsoil over sandy loam or loam till.

Bedrock Geology

The youngest rock which comprises a majority of the surface bedrock is the Silurian age dolomite. The unit forms an escarpment throughout the watershed. This stratigraphic unit ranges in thickness from zero feet, west of the escarpment, to over 500 feet in the eastern portion of the watershed. The Silurian age dolomite is a calcareous rock formation with a high concentration of magnesium and a small concentration of iron. This formation has well developed horizontal bedding planes and vertical crevices. The development of the vertical crevices and horizontal bedding planes is attributed to solution processes. The solution process

results from carbonic acids (atmospheric carbon dioxide mixed with precipitation) physically contacting the dolomite causing a chemical reaction which dissolves the dolomite by neutralizing the carbonic acid. The features resulting from the solution process are referred to as "karst". The Silurian age dolomite supports many karst features such as sinkholes, collapse features, and swallets. Sinkholes are cone-shaped depressions attributed to the solution process. A collapse feature is an area surrounding a sinkhole which has caved in because enlargement of the crevices and bedding planes weakens the dolomite structure. Swallets are sinkholes or enlarged bedding planes which intercept a stream, diverting it to subterranean routes or the groundwater. The karst features described above are present throughout the watershed and provide a direct route for unfiltered surface waters to enter the Silurian age dolomite aquifer.

The Maquoketa Shale underlies the Silurian age dolomite and functions as an aquitard which inhibits water movement from the overlying aquifer to the underlying aquifer. The Maquoketa Shale is the uppermost rock unit in a small area of the watershed west of the escarpment along the shores of Green Bay.

The Ordovician aged rock units underlying the Maquoketa Shale include Galena Dolomite, Decorah, and Plattville Formations, the St. Peter Sandstone, and the Prairie Du Chien Group. In areas of the watershed where the Silurian age dolomite aquifer does not exist, this rock unit complex supplies the groundwater water needs.

The Cambrian sandstones underlie the Ordovician rock units which are underlain by the Pre-Cambrian basement complex.

Surface Water Resources

Land drainage patterns in the Red River/Sturgeon Bay Watershed are delineated into 10 separate subwatersheds. All convey surface water directly or via tributaries to the waters of Green Bay, Sturgeon Bay, Little Sturgeon Bay, Sand Bay, Rileys Bay, and Sawyer Harbor. Major tributaries, associated streams, wetlands, and subwatershed divides are shown in map 2-4. See table 3-1 for the general conditions of major stream resources in the Red River/Sturgeon Bay Watershed.

Subwatersheds in the Red River/Sturgeon Bay Watershed

Strawberry Creek	(SC)
Sturgeon Bay	(SB)
Larson Creek	(LC)
Keyes Creek	(KC)
Sugar Creek	(SR)
Brussels Closed Depression	(BD)
Renard Creek	(RC)
Fabry Creek	(EC)
Red River	(RR)
Gilson Creek	(GC)

Streams

Intermittent streams are the predominant surface water drainage network in the watershed. Intermittent streams flow only when there is a runoff event or when groundwater discharge is highest. Intermittent streams and waterways are also the headwaters of the watersheds perennial streams. Their small size makes them very susceptible to nonpoint source pollution because they are usually considered drainage ditches. Many of the watersheds intermittent streams or waterways have been straightened or ditched to provide quicker runoff which reduces the possibility of flooded fields and crop failure. If the level of non-point source pollution and drainage activities are reduced, their dynamic nature does allow for rapid improvement.

Perennial streams maintain at least a small continuous flow throughout most of the year. Sugar Creek is the longest perennial stream in the watershed; it is approximately 9 miles in length. Other perennial streams in the watershed are: Strawberry, Keyes, Renards, and Gilson. Many of the watershed's streams support fish runs in the spring, summer, and fall months. All subwatersheds support a warm water forage fishery. The Keyes Creek Subwatershed contains approximately 3.3 miles of cold water streams which are classified trout waters. The Gilson Creek Subwatershed contains approximately 3.75 miles of cold water streams. The streams are not reaching their highest potential use due to pollution from nonpoint sources. Eroding croplands and improperly managed livestock operations are the major sources of nonpoint pollution in the watershed.

Receiving Waters

The receiving waters of the Red River/Sturgeon Bay Watershed are very important natural resources. These waters support one of the best fresh water fisheries nationally and possibly worldwide. The waters of Sturgeon Bay, Sawyer Harbor, Little Sturgeon Bay, and Green Bay have all experienced an increase in nuisance aquatic plant growth and high levels of turbidity in recent years. These water resources need to be protected from nonpoint source pollution to revive them to their best overall condition.

Wetlands

Wetlands are valuable natural resources. They provide wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff and flood flows and removal of pollutants. Floodplain wetlands support furbearers and waterfowl populations and may provide seasonal habitat for sport fish. There are also extensive wetland areas along the riparian corridors of Keyes Creek and Red River.

A wetland inventory was done to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration. The focus of the inventory was on wetlands that are presently in, or have been in the past, degraded through drainage, grazing, cropping, or other activities causing water storage loss, build up of sediments, and damage to vegetation. Data was collected on 111 wetlands (938 acres), with an average of 8.5 acres per site. Data was gathered from Natural Resource Conservation Service maps, air photos, and the DNR wetland inventory maps; as a result this is a more comprehensive estimate than indicated

in table 2-1: Summary of Land Uses. Guidelines for wetland restoration, which will be a component of this project, are outlined in Chapter Four. See table 2-5 for Wetland Inventory Summary.

Table 2-5. Wetland Inventory For The Red River/Sturgeon Bay Priority Watershed

Subwatershed	Wetland Inventory Results															
	Prior Converted		Grazed Wetland		Excavated Wetland		Farmed In Dry Years		Converted Wetlands		Vegetation Removed		Abandoned Farmland		Subwatershed Totals	
	# of		# of		# of		# of		# of		# of		# of		# of	
	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres	Sites	Acres
Strawberry Creek	0	0	0	0	0	0	0	0	0	0	0	0	1	10	1	10
Sturgeon Bay	0	0	3	17	0	0	0	0	0	0	0	0	3	21	6	38
Larson Creek	0	0	9	73	0	0	0	0	1	3	0	0	0	0	10	76
Keyes Creek	0	0	21	202	0	0	1	10	1	22	0	0	20	156	43	390
Sugar Creek	0	0	18	172	0	0	1	4	0	0	0	0	6	41	25	217
Renard Creek	2	4	3	47	0	0	0	0	0	0	0	0	0	0	5	51
Fabry Creek	0	0	0	0	0	0	0	0	0	0	0	0	1	6	1	6
Brussels Depression	0	0	3	18	0	0	0	0	0	0	0	0	1	2	4	20
Red River	0	0	0	0	0	0	4	15	0	0	2	20	2	18	8	53
Gilson Creek	0	0	4	55	0	0	4	22	0	0	0	0	0	0	8	77
Totals	2	4	61	584	0	0	10	51	2	25	2	20	34	254	111	938

0 - means a potential for this type of wetland to exist remains. The NRCS and DNR wetland maps used for this inventory were not complete. Many sites had a NI symbol, which means the site was not field checked.

Groundwater Resources

The Red River/Sturgeon Bay Watershed was selected as a "Priority Watershed" as a result of a need to protect the groundwater resources from nonpoint and point source pollution. Landuses, thin soils over fractured bedrock, soils with high permeability rates, karst features, and closed depressions all contribute to the high potential for groundwater contamination.
All of the potential attributes of the groundwaters pollution potential will be discussed throughout this document.

Regional Aquifers

There are three principal aquifers providing water supply for the residents of the Red River/Sturgeon Bay Watershed project area. They are from youngest to oldest (shallowest to deepest), the sand and gravel aquifer, Silurian age dolomite aquifer, and the St. Peter sandstone aquifer.

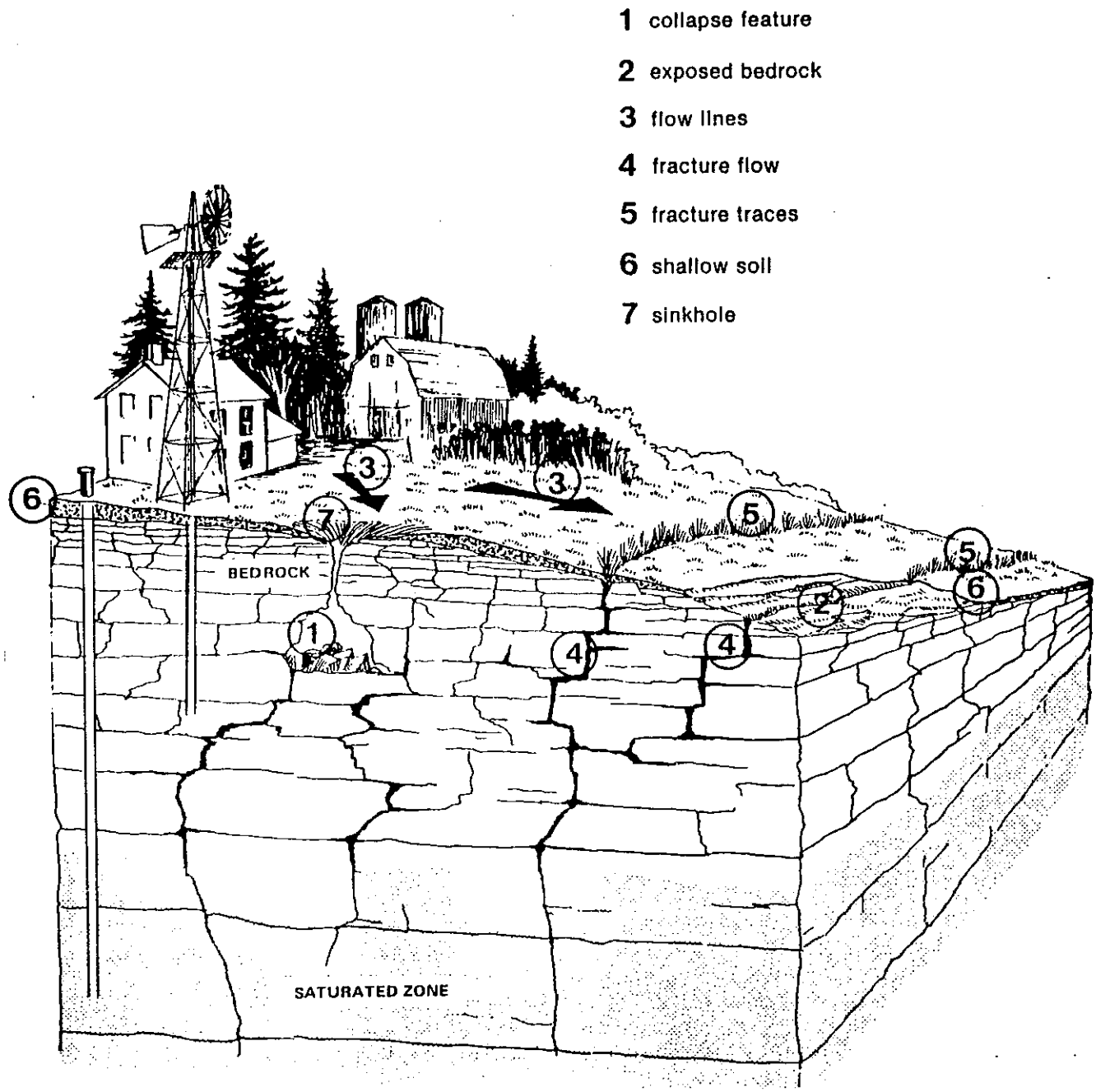
The sand and gravel aquifer is a source of water for localized areas in the basin. It is a relatively shallow aquifer consisting of permeable sediments of unconsolidated glacial deposits. Use of this aquifer is limited in most parts of the basin due to high contamination potential, current well codes, and the shallow depth.

The Silurian age dolomite aquifer underlies most of the watershed. It is the most important aquifer to the watershed since it supplies most of the water needs of the residents. The nature of the host bedrock for the aquifer makes it very susceptible to groundwater pollution. Thin soils, karst features, well developed vertical crevices and horizontal bedding plains, and landuses on the surface contribute to the pollution potential of this aquifer. Recharge to this aquifer is generally local. In general, the thickness and permeability rate of the soils overlying the dolomite controls the amount of recharge. In some areas of the watershed, deep soils with very low permeability rates with sink holes recharge the aquifer quite rapidly.

The Sandstone aquifer underlies all of the watershed. It is probably the least significant of the three aquifers for the watershed, but it is significant to localized areas which have neither the sand and gravel or the Silurian dolomite aquifers present. Generally, the water quality of this aquifer is good due in part to the upper confining Maquoketa shale layer.

See figure 2-6, Common Karst Features in the Red River Sturgeon Bay Watershed Which Affect Groundwater.

Figure 2-6. Common Karst Features Found in the Red River Sturgeon Watershed Which Affect Groundwater



Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites, and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.40, Wis. Stats., have been blended to produce a cultural resource management program which is both compatible to preserving cultural sites and implementing the watershed project. The archaeological sites within the watershed will need special consideration when structural best management practices are being considered. Settling basins, manure storage structures, and streambank or shoreline shaping and riprapping are practices that may impact archaeological sites. As discussed above, state and federal laws require preservation of archaeological resources within the framework of the NPS Program.

The watershed project will address these concerns with the following procedures:

1. Door, Kewaunee, and Brown Counties and the city of Sturgeon Bay will obtain inventory maps from the regional Wisconsin State Historical Society office if they are made available.

2. Landowners will then have their lands evaluated by county or city staff for the need to conduct an extensive archaeological survey. Site evaluation forms will be filled out for each site. If any archaeological conditions are noted, the evaluation forms will be sent to the State Historical Society to determine the need for an additional extensive survey. The counties and the DNR District NPS Program coordinator will also be involved in this determination.

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

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

5. All costs for the archeological site study will be paid for through a local assistance grant. See Chapter 5.

Endangered and Threatened Resources

Information on threatened and endangered resources was obtained from the Bureau of Endangered Resources of the DNR. Endangered resources include rare species and natural communities.

It should be noted that comprehensive endangered resource surveys have not been completed for the entire watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and are not in the lists below.

Rare Species

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

Wisconsin Endangered Species

Any species whose continued existence as a viable component of this state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. Wisconsin endangered species within the watershed are:

Astragalus neglectus, Cooper's milk vetch

Luxilus chrysoccephalus, Striped shiner

Somatochlora hineana, Hines emerald dragonfly

Wisconsin Threatened Species

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

Amerorchis rotundifolia, Small round-leaved orchid;

Carix formosa, Handsome sedge;

Cirsium pitcherii, Dune thistle;

Erynnis martialis, Mottled dusky wing;

Iris lacustris, Dwarf lake iris;

Solidago simplex var. *gillmanii,* Dune goldenrod.

Wisconsin Special Concern Species

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

Acipenser fulvescens, Lake sturgeon;

Adlumia fungosa, Allegheny vine;

Anguilla rostrata, American eel;

Deschampsia flexuosa, Common hairgrass;

Euphorbia polygonifolia, Seaside spurge;

Gymnocarpium robertianum, Limestone oak fern;

Platanthera hookeri, Hooker's orchid;

Viola rostata, Long-spurred violet.

Natural Areas

Natural areas are sites that contain high quality examples of natural communities. State Natural Areas (SNA's) have been officially designated by the DNR Natural Areas Program as deserving protection. They are owned by the DNR, other state and local agencies, or conservation organizations, and are managed to protect the natural resources.

The following natural areas have been identified in the watershed. The natural communities found at each area are also listed.

Duvall Swamp natural area (northern wet mesic forest; northern sedge meadow; scrub-carr)
Gardner Swamp natural area (northern wet-mesic forest; alder thicket)
Ruloss Woods natural area (northern dry-mesic forest)

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

CHAPTER THREE
Water Quality Conditions, Nonpoint Sources and Resource Objectives

Introduction

Nonpoint sources of pollution are primarily responsible for the degraded conditions of the streams and the waters of Sturgeon Bay, Sawyer Harbor, and Little Sturgeon Bay. They also contribute to the decline in water quality in Green Bay, Riley's Bay, and Sand Bay. Excessive amounts of sediment, nutrients, and bacteria degrade the surface water quality, causing a decline in the overall balance of the aquatic ecosystems. Nonpoint source pollution is primarily responsible for the decline in water quality in the watershed aquifers. Under certain conditions, where little or no attenuation of pollutants occurs, nutrients, bacteria, and/or soil particles will degrade the quality of groundwater to a point where it becomes non-potable. The nonpoint sources of pollution inventoried for the watershed and the methods for evaluating their impacts on surface and groundwater are described in Appendix A "Watershed Planning Methods".

Land uses and activities in the watershed which produce pollutants, other than nonpoint sources, also have the potential to impact surface water and/or groundwater quality. These sources may include, but are not limited to, municipal waste water treatment facilities, landfills, abandoned town dumps, private septic systems, and hazardous waste spills. Many of the activities and the land uses are regulated by the State of Wisconsin or other governmental agencies. These and other activities are defined in detail in the Twin-Door-Kewaunee Basin Water Quality Management Plan. A brief review of these sources are in this chapter.

This chapter presents a general overview of the nonpoint sources of pollution in the watershed, current surface water quality and groundwater pollution potentials. Also, the chapter presents an overview of the findings (actual quantities of pollution generated from each source) of the urban and rural nonpoint inventories. Finally, this chapter also presents watershed specific objectives for groundwater and surface water quality and subwatershed specific objectives.

Major Nonpoint Source Pollutants

Manure

Manure contains several components which adversely affects surface water quality and aquatic life. Manure entering a stream breaks down, resulting in depletion of the oxygen in the water that fish and other aquatic life require to survive. In addition, manure contains nitrogen which

can form ammonia in the streams and the receiving waters. In high concentrations, the ammonia is toxic to fish and other aquatic life. The nutrients in manure (including nitrogen and phosphorus) promote nuisance algae and weed growth in the streams and receiving waters. Manure can also adversely affect groundwater quality. Surface water runoff containing manure components can enter the groundwater through shallow soils, sinkholes, swallets, or other karst features and has been known to make wells non-potable within minutes. The bacteria and nitrates found in livestock manure are harmful to humans using the water for drinking, cooking, bathing, or for recreation. The major sources of manure in the watershed are runoff from barnyards; unconfined manure stacks; improperly located or constructed manure storage facilities; and runoff from improperly field-spread manure.

Sediment

Sediment (soil particles) adversely impacts the water resources in many ways. It degrades or eliminates habitat for fish and other forms of aquatic life. High sediment concentrations abrades fish gills, making the fish more susceptible to disease, fills in pools and degrades fish spawning habitat. Suspended sediment also warms the water in the summer, causing an oxygen depletion. The sources of sediment in this watershed are upland erosion from croplands, stream bank erosion, shoreline erosion, construction site erosion and activities which displace permanent vegetation. When sediment laden runoff water enters the groundwater system, it carries with it many components which negatively impacts the aquifers quality. Pollutants which attach to soil particles include nitrogen, bacteria, and pesticides. All of the mentioned components can render a well non-potable.

Nitrates

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

Coliform Bacteria

Groundwater should be free of all forms of bacteria. As it moves through the soil profile, bacteria and other pathogens are filtered out by the soil's physical and chemical properties. Groundwater with coliform bacteria, which is considered harmless, may indicate the presence of other forms of harmful bacteria which have the potential of transmitting diseases. Coliform bacteria are found in the feces of animals and humans as well as in surface water. Their presence indicates that unfiltered or poorly filtered surface water or runoff is entering the groundwater system. If coliform bacteria is present in a sample, water should not be used unless it is boiled.

Surface Water Quality Conditions

Streams

Streams in this watershed include, but are not limited to: Strawberry Creek, Larson Creek, Keyes Creek, Sugar Creek, Renards Creek, Fabry Creek, Red River, and Gilson Creek. Each of the aforementioned streams is a main tributary to the receiving waters within a subwatershed. An example of this would be Keyes Creek subwatershed. The receiving waters of this subwatershed is Little Sturgeon Bay. The main tributary to which the receiving waters is Keyes Creek, but other streams exist within this subwatershed which include Twin Harbor Creek, Malvitz Creek, and Krueger Creek. This will be described in more detail in the subwatershed descriptions later in this chapter. Also, the actual water quality condition of every stream in the watershed will be reviewed in the subwatershed description section of this chapter. The need for reduction in the overall pollutant loading from sedimentation and/or nutrient enrichment will also be examined.

Excessive amounts of sediment, nutrients, bacteria, and/or organic matter degrade or threaten the quality of surface waters. Most of the watershed's streams are not reaching their full potential or the water quality is being threatened by nonpoint source pollutants. The stream beds are often covered with silt and sediment. Streambank erosion and upland soil erosion results in sedimentation of pools, filling in of spawning substrate, reducing suitable habitat for macroinvertebrates in riffle areas, and elimination of stream bank cover. Nutrients, pesticides, and pathogens often attach to sediment and are delivered to the surface water. The high productivity of the streams, indicated by the excessive macrophyte (large aquatic plants) and algae populations, are a symptom of excessive nutrient inputs. Phosphorus is the most significant nutrient which promotes macrophyte and algae growth. Water chemistry samples, taken during periods of runoff, showed high levels of contaminants entering the watershed streams. The sources of the pollutants are barnyard runoff, runoff from improperly sited manure stacks, erosion from cropped fields, streambank erosion, winter spread manure, and urban runoff. Table 3-1 provides water resource conditions for creeks in the Red River/Sturgeon Bay Priority Watershed.

Table 3-1. Water Resource Conditions for the Red River/Sturgeon Bay Priority Watershed

Subwatershed	Stream Name	Length (Miles)	Current Biological Use[1]	Habitat Rating[2]	Limiting Factors[3]	Observed or Potential Sources[4]
Strawberry Creek (SC)	Strawberry Creek	1.6	Cold	Good	CH,VF	CR
	Unnamed Trib	0.5	LFF	Fair	FLO, PL, SED	
Sturgeon Bay (SB)	Samuelson Creek	1.25	LFF	Fair	FLO, AL	
Larson Creek (LC)	Larson Creek	4	WWFF	Fair	FLO, SED, PSB	PSB, BY, CR
	May Creek	3	LFF	Fair	FLO, AL, SED	
	Lost Creek	2.5	LFF	Fair	FLO	CR
Keyes Creek (KC)	Keyes Creek	7	WWSF,WWFF, Cold	Good to Fair	CH, AL, DO, PSB	PSB, CR, BY
	Krueger Creek	1	LFF	Fair	FLO, AL	CR
	Twin Harbor Creek	1	LFF	-	FLO, DO	
	Malvitz Creek	1	LFF	Fair	FLO	CR
Sugar Creek (SR)	Sugar Creek	9	WWFF	Good to Fair	CH, PSB, BY, VF	PSB, BY, CR
Renard Creek (RC)	Renard Creek	6	WWFF	Fair to Poor	PSB, PL, SED	PSB, CR, SED
	Silver Creek	0.5	LFF	Poor	FLO, AL	PSB, CR
Fabry Creek (EC)	Fabry Creek	1	LFF	Fair	FLO, SED	CR
Red River (RR)	Red River	9	LFF	Fair	FLO	CR, PSB
	Macco Creek	1	LFF	Fair	FLO, SB	SB, CR
Gilson Creek (GC)	Gilson Creek	4	WWFF	Fair	FLO	CR, PSB, SB
	Bader Creek	2.5	WWFF	Fair to Poor	FLO, SB	SB

LEGEND:

[1] **Current Biological Use** - this column indicates the current biological use supported by the stream.

COLD: Cold Water Communities; Includes surface waters capable of supporting a community of cold water fish and other aquatic life, or serving as a spawning area for cold water fish.

WWSF: Warm Water Sport Fish Communities; includes surface waters capable of supporting a community of warm water sport fish, or serving as a spawning area for warm water sport fish.

WWFF: Warm Water Forage Fish Communities; indicates surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.

LFF : Limited Forage Fishery (intermediate surface waters); includes surface waters of limited capacity because of low flow, naturally poor water quality, or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

LAL : Limited Aquatic Life (marginal surface waters); includes surface water severely limited because of very low or intermittent flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

[2] **Habitat Rating** - This column indicates the quality of aquatic life habitat in the stream (excellent, good, fair, poor)

[3] **Limiting Factors**

CH	- Channelization
SED	- Sedimentation (filling in of pools)
PL	- Plants(excessive growth)
DO	- Dissolved Oxygen (too low)
FLO	- Low stream flow
AL	- Algae (abundant)
VF	- Varying stream flow
PSB	- Pasturing of streambanks
BY	- Barnyards/feedlots runoff
SB	- Streambank erosion

[4] **Observed or Potential Sources**

CR	- Cropland erosion
SB	- Streambank erosion
PSB	- Streambank pasturing
BY	- Barnyard or exercise lot runoff

Receiving Waters

The waters of Green Bay, Sturgeon Bay, Sawyer Harbor, and Little Sturgeon Bay support one of the best fresh water fisheries in the United States. Sport fish, such as smallmouth and largemouth bass, northern pike, walleye, muskellunge, sturgeon, varieties of salmon and trout, and other fish such as yellow perch, crappie, sunfish, and bluegill are all present in the receiving waters. Other forms of aquatic life and wildlife dependent on the surface water abound in and around these waters (Rasman, 1993).

The watershed's waters have experienced a decline in overall water quality. Seasonal heavy nuisance aquatic plant growth in many of the bays has increased in the recent past (Rasman, 1993). As a result of the aquatic plant growth, the city of Sturgeon Bay has implemented an aquatic plant harvesting program. The city purchased a harvester and conveyor system at a cost of approximately $32,000.00. The city harvested approximately 1,156 tons of aquatic plant material in 1994 with a cost of approximately $17,900.00. The city budgeted approximately $43,500.00 for the 1995 program. The Little Sturgeon Bay Property Owners Association has

used chemical treatment to control the aquatic plant community in Little Sturgeon Bay waters. The Door County Board of Supervisors went on official record, through a resolution, requesting the DNR deny all aquatic plant herbicide applications. The programs just mentioned are only temporary remedies to the listed problems. Reduction in sediment and nutrients delivered to these waters should decrease aquatic plant and algae growth rates.

Excessive algae growth has occurred on Sawyer Harbor during 1993 resulting in a reduction in desirable aquatic vegetation (Rasman, 1993). The lack of desirable aquatic vegetation negatively affects aquatic life. This includes but is not limited, to aquatic insects, fish, waterfowl, and other wildlife. Excessive algae growths also have been observed in Little Sturgeon Bay. Algae blooms are attributed to excessive phosphorus delivered to the waters. Algae blooms reduce the amount of sunlight which penetrates the water resulting in a decrease in desirable aquatic plant populations. Aquatic plants produce dissolved oxygen during the day. Fish and other aquatic life become stressed, due to a lack of dissolved oxygen in the water when algae blooms occur.

"Land use along the shore of the Sturgeon Bay has undergone major changes over the years. Increased development along the channel, including the use impermeable surfaces, has changed the quantity and quality of runoff entering these waters. This has resulted in an increase in nutrient and sediment delivery to the surrounding waters." (Rasman, 1993)

Ground Water Quality Conditions

As part of a groundwater quality appraisal and an information/education campaign, 457 private well samples were collected and analyzed in 1993. Door County collected 370 samples, Kewaunee County collected 47 samples and Brown County collected 40 samples. The samples were tested for one or more of the following parameters: nitrates, bacteria, lead, turbidity, chloride and atrazine. Sample analytical results are summarized below. The results of the sampling program must be reviewed with caution, since the groundwater in this type of aquifer moves very rapidly when compared to a sand and gravel aquifer. Groundwater in sand and gravel type aquifers moves only a few inches in a day. Therefore, the results of any given well in the silurian dolomite aquifer is only a snapshot of the moment the sample was drawn. Groundwater quality in this aquifer can change dramatically within minutes. Note that this was an uncontrolled study; participants volunteered their wells for sampling and were not chosen at random. It should not be assumed that the samples are representative of the watershed as a whole.

Coliform Bacteria

Analysis for the presence of coliform bacteria was conducted on 138 water samples. Results of sampling indicated that 42 wells (38%) were bacteriologically unsafe. Coliform bacteria are usually harmless but indicate that more dangerous pathogens might be present in the groundwater. Coliform bacteria occur in the soil and the feces of animals and humans. Sampling did not indicate a pattern of groundwater contamination that can be linked to a specific source(s). Coliform bacteria can be a drinking water problem where septic systems or barnyards

are located in a public or private well's zone of contribution. Bacteria can enter the drinking water supply through many pathways, along the well casing of improperly constructed or poorly constructed wells, through improperly abandoned wells, sinkholes, areas with thin soils, etc.

Lead

Analysis for the presence of lead was conducted on 50 water samples. Results indicate that 27 wells (54%) had detectable levels of lead which were below the Preventative Action Limit (PAL) of 15 ppb. One well had a lead level over the 15 ppb PAL. All samples taken were from wells which are located in close proximity to known orchard sites either active or abandoned. The concern of lead contamination in proximity of orchards stems from the discovery of abandoned lead arsenate pesticide mixing sites in Door County. Lead arsenate was the principal pesticide in this area's fruit growing industry prior to 1960.

Nitrates

All samples collected (457) were tested for nitrates. Results indicated that 169 wells (36%) had a detectable level less than 2 ppm of nitrate. Background levels of nitrate in well water are considered 2 ppm. Nitrate levels greater than 2 ppm but less than 10 ppm were found in 141 samples (31%). This range of results indicates a well is being influenced by some activity on the land surface within the well's zone of contribution. Nitrate levels which exceeded the 10 ppm enforcement standard were found in 11 samples. Developing fetus and children under the age 6 months are at risk from elevated nitrate levels in drinking water. Also, elevated nitrate levels may indicate that other harmful substances may be present. Nitrates in groundwater come from fertilizers, animal wastes, natural decay of vegetation, or failing septic systems. Results do not indicate a pattern of groundwater contamination that can be linked to specific sources of nitrate.

Atrazine

All samples collected (457) were tested for atrazine. Detectable levels of atrazine were present in 67 samples (15%), with no sample exceeding the 3 ppb PAL. Atrazine is a pesticide commonly used for broad-leaf weed control for corn. It is classified as a possible carcinogen. As with nitrate analytical results, no specific source of atrazine contamination is indicated by the results.

Turbidity

Analysis for the presence of turbidity was conducted on 138 samples (30%). Results of the analysis indicated 95 samples (69%) had detectable levels of turbidity. Turbidity itself is not harmful and is used as a parameter for the testing of surface water clarity. Groundwater is not turbid unless unfiltered surface water is rapidly entering the aquifer through sinkholes, thin soils, etc. At present no Enforcement Standard (ES) or PAL are associated this parameter.

Chloride

Analysis for the presence of chloride was conducted on 138 samples (30%). Every sample tested had a detectable level of chloride. Of the 138 samples analyzed, 79 samples (57%) had levels greater than the natural background level of 10 ppm. Chloride does not pose a health risk. It originates from road salts, failing septic systems, animal wastes, and fertilizers. Levels of chloride greater than 10 ppm may indicate that harmful substances may also be present in the groundwater. No ES or PAL are associated with this parameter.

Results of Nonpoint Source Inventories Surface Water

Animal Lot Runoff Impacting Surface Water

Runoff carrying a variety of pollutants from animal lots and other livestock feeding, loafing, and pasturing areas to surface waters is a significant source of pollutants in the streams and receiving waters of the Red River/Sturgeon Bay Priority Watershed. Livestock operations inventoried totaled 192 animal lots. All animal lots were evaluated for their potential to impact surface water. It was determined that 125 animal lots contribute approximately 4669 pounds of phosphorus per year to the watershed's surface water resources (table 3-2). Most of the oxygen-demanding pollutants and nutrients associated with these operations drain via concentrated flow paths to creeks and/or wetlands.

Table 3-2. Animal Lot Inventory Results - Surface Water

Subwatershed		Number of Barnyards	Total Phosphorous[1] (lbs)
Strawberry Creek	(SC)	2	53
Sturgeon Bay	(SB)	6	89
Larson Creek	(LC)	6	388
Keyes Creek	(KC)	19	448
Sugar Creek	(SR)	16	412
Renard Creek	(RC)	21	882
Fabry Creek	(EC)	6	245
Red River	(RR)	34	1544
Gilson Creek	(GC)	15	608
	Totals	125	4669

[1] Based on Annual Phosphorus Loads

Sources: Door County SWCD and Kewaunee and Brown County LCDs.

Winter Spread Manure

A comprehensive inventory was completed to determine the number of high hazard acres each farm with livestock has in the Red River/Sturgeon Bay Priority Watershed. High hazard acres are defined as cropland which has a slope greater than 9%, within the 10 year flood plain or within 200 feet of a stream, or where surface water runoff concentrates, such as drainage ditches or established waterways. Manure spread on these acres during the winter months is very susceptible to runoff. A summary of the methods used for the inventory can be found in Appendix A. Approximately 4505 acres are considered "high hazard" for winter spread manure affecting surface waters.

Upland Erosion and Sediment Delivery

Intensive agricultural practices have caused considerable amounts of eroded soil to reach the streams, wetlands and the receiving waters of the watershed. Upland sediment sources were evaluated through an inventory of all land uses for the watershed (approximately 114 square miles). The results of this inventory are summarized in table 3-3. Areas which were mapped as closed depressions, approximately 25 square miles, were excluded from the surface water inventory and will be addressed in the groundwater inventory result section. An estimated 12,002 tons of soil per year are delivered from cropland to wetlands or streams in the watershed. The Urban Runoff section of this chapter will address sediment loading from the city of Sturgeon Bay. Uplands are the source of 91 percent of the sediment delivered to surface waters. Table 3-3 summarizes upland sediment loading by land use for all subwatersheds.

Streambank Erosion

Streambank erosion contributes 4% of the total sediment to surface waters in the watershed. Approximately 14 miles of streams were evaluated. Significant erosion has occurred and/or aquatic habitat and water quality is degraded along approximately 5 miles of streambank. An estimated 544 tons of sediment are eroding into streams annually. See table 3-4 for streambank inventory results.

Table 3-3. Summary of Upland Sediment Loading to Surface Water: Red River/Sturgeon Bay Priority Watershed

Subwatershed			Cropland	Other	Totals
Strawberry Creek	SC	Acres	316	3,255	3,571
		Sediment	218 tons	21 tons	239 tons
Sturgeon Bay	SB	Acres	272	2,649	2,921
		Sediment	76 tons	268 tons	344 tons
Larson Creek	LC	Acres	1,984	5,232	8,111
		Sediment	739 tons	484 tons	1,223 tons
Keyes Creek	KC	Acres	5,059	11,057	16,116
		Sediment	1,577 tons	650 tons	2,227 tons
Sugar Creek	SR	Acres	6,646	3,544	10,190
		Sediment	3,312 tons	516 tons	3,828 tons
Renard Creek	RC	Acres	4,145	3,293	7,438
		Sediment	1,581 tons	200 tons	1,781 tons
Fabry Creek	EC	Acres	1,614	2,042	3,656
		Sediment	798 tons	402 tons	1,200 tons
Red River	RR	Acres	8,120	3,488	11,608
		Sediment	3236 tons	N/A	3,236 tons
Gilson Creek	GC*	Acres	3,426	4,452	7,878
		Sediment	465 tons	NA	465 tons*
	Totals	Acres	32,477	39,012	71,489
		Sediment	12,002 tons	2,541 tons	14,543 tons

* A portion of Gilson Creek Subwatershed did not have the sediment delivery model (WinHusle) run. The number represents Kewaunee County Portion of Gilson Creek.

Table 3-4. Streambank Inventory Results: Red River/Sturgeon Bay Watershed Streambank Erosion and Habitat Degraded

Subwatershed	Inventoried Streambank Length (feet)	Eroded Sites (feet)	Trampled Sites (feet)	Slumped Sites (feet)	Cattle Access (feet)	Total Sediment Loss Tons/Year	% Bank Degraded From E,T,S	% of Total Bank Erosion in Watershed
Strawberry Creek (SC)	-----	-----	-----	-----	-----	-----	-----	-----
Sturgeon Bay (SB)	-----	-----	-----	-----	-----	-----	-----	-----
Larson Creek (LC)	13,700	875	1,200	-----	1,200	25	15%	7%
Keyes Creek (KC)	4,314	173	200	-----	1,925	16	9%	1%
Sugar Creek (SC)	14,549	3,545	1,544	-----	2,978	123	35%	18%
Renard Creek (RC)	17,302	1,888	4,478	-----	11,892	141	37%	23%
Fabry Creek (EC)	5,941	900	-----	-----	-----	29	15%	3%
Red River (RR)	9,738	5,115	1,000	45	1,000	158	63%	22%
Gilson Creek (GC)	8,660	5,500	800	300	800	27	76%	24%
Totals	74,204	17,996	9,222	345	19,795	544	37%	100%

Source: Door County SWCD, Kewaunee and Brown LCDs

Results of Nonpoint Source Inventories
Groundwater

Animal Lots Impacting Groundwater

Animal lots are a major component of agriculture in the Red River/Sturgeon Bay Priority Watershed. Infiltration and/or runoff from animal lots can carry nonpoint source pollutants, particularly bacteria and/or nitrates, to the groundwater. Because of the concern of groundwater contamination from animal lots in this project, all animal lots were inventoried and evaluated for their potential to impact groundwater. A total of 192 operations were inventoried. Site conditions which have the greatest potential to impact the watershed's groundwater resource are located in areas which: have shallow soils, less than 60 inches in depth to bedrock and/or the water table at the site and/or down slope; have soils with low pollutant attenuation potential; are located in an internally drained area; and/or have a principal outlet or other bedrock features in the area. Of the 192 animal lots inventoried and evaluated, 96 sites meet the groundwater criteria. Of the 96 sites which meet the criteria, 67 sites meet the soil depth to bedrock and/or water table while 38 sites meet the criteria mentioned for a closed depression with a principal outlet and 30 sites meet the criteria for a closed depression without a principal outlet.

Each site may meet more than one of the criteria. ie; a site located in a closed depression without a principal outlet may also meet criteria for soil depth as depicted in Table 3-6. Therefore some animal lots which meet the criteria in Table 3-5 also meet the criteria in Table 3-6. Table 3-5 details the inventory results for the shallow soils to bedrock and water table, while table 3-6 details the inventory results for internally drained area with and without a principal outlet.

Table 3-5. Barnyard Site Matrix for Shallow Soils to Bedrock or Water Table

Site Conditions Soil Depth-Water Table Depth	DOWN SLOPE CONDITIONS SOIL DEPTH - WATER TABLE DEPTH 1 [0"]	2 [1-12"]	3 [12-24"]	4 [24-60"]	5 [>60"]	Eligible[1] Sites Total
A [0"]	0	0	0	0	0	0
B [1-12"]	0	10	0	4	0	14
C [12-24"]	0	0	7	5	1	13
D [24-60"]	0	2	0	14	4	20
E [>60"]	2	16	2	Ineligible Sites 32	Ineligible Sites 93	20
Eligible Sites Total[1]	2	28	9	23	5	Eligible[1] Sites 67

NOTE: There were 4 animal lots which meet Natural Resources Conservation Service specs. and were rated as an E5 site.
[1] Eligibility will be explained in Chapters 4 and 5.

Table 3-6. Barnyard Site Matrix for Closed Depressions With and Without a Principal Outlet

	DOWN SLOPE CONDITIONS SOIL DEPTH - WATER TABLE DEPTH					
Site Conditions Soil Depth-Water Table Dept	1 [0"]	2 [1-12"]	3 [12-24"]	4 [24-60"]	5 [>60"]	Eligible[1] Sites Total
A [0"]	0 --- 0	0 --- 0	0 --- 0	0 --- 0	0 --- 0	0 --- 0
B [1-12"]	0 --- 0	2 --- 0	0 --- 0	4 --- 0	0 --- 0	6 --- 0
C [12-24"]	0 --- 0	0 --- 0	2 --- 3	0 --- 0	0 --- 1	2 --- 4
D [24-60"]	0 --- 0	0 --- 0	0 --- 0	4 --- 4	0 --- 1	4 --- 5
E [>60"]	0 --- 0	2 --- 0	0 --- 1	Ineligible Sites 6 --- 7	Ineligible Sites 18 --- 13	26 --- 21
Eligible Sites Total[1]	0 --- 0	4 --- 0	2 --- 4	14 --- 11	18 --- 15	Eligible[1] Sites 38 --- 30

NOTE: The top value in each of the matrix positions represents sites located in a closed depression with a principal outlet. The bottom value represents sites in a closed depression without a principal outlet.

[1] Eligibility will be explained in Chapters 4 and 5.

Manure Storage Sites

Livestock wastes that are not stored in properly designed structures or properly sited locations can have a serious impact on the groundwater. Rainfall and snowmelt on an unprotected manure stack can generate runoff, which can enter the watershed's groundwater. Unconfined manure stored on thin soils can be a source of pollutants infiltrating directly into the groundwater. Impacts from this source of nonpoint pollutants are the same as those described in the Animal Lots Impacting Groundwater section (page 3-12).

Each livestock operation in the project area was inventoried for its manure storage status. Information was collected on the type of storage present, the soil depth at the storage site and soil depth down slope from the storage site. If a storage system was not present, it was assumed that manure was stored at the barn cleaner on occasion. This assumption is based on the inability to daily spread during deep snow cover, or when fields are extremely soft during the spring thaw, or as a result of management technique. There were a total of 192 sites inventoried

and evaluated for manure storage stacking. Of the 192 sites, 98 meet the criteria outlined in the Animal Lot Impacting Groundwater section. Table 3-7 details the inventory results for the shallow soils to bedrock and water table. Table 3-8 details the inventory results for internally drained areas with and without a principal outlet.

Table 3-7. Manure Storage Site Matrix for Shallow Soils to Bedrock or Water Table

	DOWN SLOPE CONDITIONS SOIL DEPTH - WATER TABLE DEPTH					
Site Conditions Soil Depth-Water Table Depth	**1 [0"]**	**2 [1-12"]**	**3 [12-24"]**	**4 [24-60"]**	**5 [>60"]**	**Eligible[1] Sites Total**
A [0"]	0	0	0	0	0	0
B [1-12"]	1	8	0	2	0	11
C [12-24"]	0	1	8	5	0	14
D [24-60"]	0	4	0	17	3	24
E [>60"]	2	13	4	Ineligible Sites 35	Ineligible Sites 89	19
Eligible[1] Sites Totals	3	26	12	24	3	Eligible[1] Sites 68

NOTE: There were 8 sites which have a manure storage facility which meet Natural Resource Conservation Service specs. and were rated as an E5 site.

[1] Eligibility will be explained in Chapters 4 and 5.

Table 3-8. Manure Storage Site Matrix for Closed Depressions With and Without a Principal Outlet

	DOWN SLOPE CONDITIONS SOIL DEPTH - WATER TABLE DEPTH					
Site Conditions Soil Depth-Water Table Depth	1 [0"]	2 [1-12"]	3 [12-24"]	4 [24-60"]	5 [>60"]	Eligible[1] Sites Total
A [0"]	0 --- 0	0 --- 0	0 --- 0	0 --- 0	0 --- 0	0 --- 0
B [1-12"]	0 --- 0	2 --- 0	0 --- 0	2 --- 0	0 --- 0	4 --- 0
C [12-24"]	0 --- 0	0 --- 0	2 --- 3	0 --- 0	0 --- 0	2 --- 3
D [24-60"]	0 --- 0	0 --- 0	0 --- 0	4 --- 4	1 --- 1	5 --- 5
E [>60"]	0 --- 0	1 --- 0	0 --- 1	Ineligible Sites 6 --- 9	Ineligible Sites 21 --- 10	25 --- 20
Eligible Sites[1] Total	0 --- 0	3 --- 0	2 --- 4	12 --- 13	19 --- 11	Eligible[1] Sites 39 --- 28

NOTE: The top value in each of the matrix positions represents sites located in a closed depression with a principal outlet. The bottom value represents sites in a closed depression without a principal outlet.

[1] Eligibility will be explained in Chapters 4 and 5.

Winter Spread Manure

A comprehensive field condition inventory was completed for all farms which have livestock. The inventory assessed: a farm's soil capacity to attenuate pollutants; the density of mapped bedrock features; if the farm or part of a farm was located in a closed depression with or without a principal outlet, (a feature where surface water runoff flows into the bedrock), the density of fracture traces; and the number of animal units present at the time the farm's inventory was completed. High hazard areas are defined as those lands which have a high field groundwater pollution potential value equal to or greater than 430. Also, any farm with a point value of 200 for closed depressions with a principal outlet regardless of the total value is defined as high hazard area. Manure spread on these areas during the winter months, when the fields are snow covered, or when the soils are frozen, may impact groundwater quality. A summary of the methods used for the inventory can be found in Appendix A. Of the 192 sites inventoried, approximately 160 farms have a high field groundwater pollution potential and are

considered "high hazard" for winter spread manure impacting groundwater. Table 3-9 summarizes the inventory results.

Table 3-9. Field Groundwater Pollution Potential*

Subwatershed	Total Number Farms with Value ≥ 430	Total Number Farms with CD w/PO Value ≥ 200	Total Number Farms with Value < 430
Strawberry Creek (SC)	1	0	1
Sturgeon Bay (SB)	8	7	0
Larson Creek (LC)	13	10	0
Keyes Creek (KC)	34	8	2
Sugar Creek (SR)	21	1	6
Renard Creek (RC)	21	0	6
Fabry Creek (EC)	6	0	0
Red River (RR)	25	0	13
Gilson Creek (GC)	12	0	4
Brussels Depression (BD)	19	17	0
TOTAL	160	43	32

* See Appendix A for field groundwater pollution potential methods.
CD = Closed Depression
PO = Principal Outlet

Upland Erosion and Sediment Delivery to Closed Depressions With Principal Outlets

Sediment delivered to the watershed's groundwater is a concern. Eroding soil particles, moved by surface water runoff, carry pollutants. When surface water runoff enters a principal outlet in the bedrock, groundwater quality is impacted. Bacteria, certain forms of fertilizers, and certain forms of herbicides are attached to sediments. Therefore it is important that these concerns are addressed. Intensive agricultural practices cause eroded soil to reach the principal outlets of closed depression areas in the watershed. Approximately 25 square miles or 16,000 acres of land area were identified as closed depressions. These areas were inventoried for the presence of principal outlets. It was determined that 19.75 square miles or 12,635 acres drain into some form of a "rock-hole opening" which is considered a principal outlet. Upland sediment sources were evaluated through an inventory of all landuses in the closed depression areas which have a principal outlet. The results of this inventory are summarized in table 3-10. An estimated 1516 tons of soil per year are delivered to principal outlets from croplands.

Table 3-10. Upland Erosion and Sediment Delivery to Principal Outlets in Closed Depressions

Subwatershed	Total Acres	Sediment Delivered Tons/Year
Sturgeon Bay (SB)	3,882	465 tons
Larson Creek (LC)	5,634	416 tons
Keyes Creek (KC)	1,103	127 tons
Brussels Depression (BD)	2,016	508 tons
TOTAL	12,635	1,516 tons

Water Resource Objectives

The "Surface Water Quality Appraisal Workgroup" and the "Groundwater Quality Appraisal Workgroup" included staff from Door County Soil and Water Conservation Department, Kewaunee County Land Conservation Department, Brown County Land Conservation Department, city of Sturgeon Bay Public Works Department, Sturgeon Bay Utilities, DNR-Lake Michigan District Office, DNR-State Office, DATCP-SWRM section, University of Wisconsin-Green Bay, and UWEX-Natural History and Geologic Survey. The two groups developed the water quality objectives for the Red River/Sturgeon Bay Priority Watershed. The Surface Water Quality Appraisal Workgroup developed surface water quality objectives for the watershed and for each subwatershed. The Groundwater Quality Appraisal Workgroup developed groundwater quality objectives for the watershed and the Sturgeon Bay Wellhead Zone of Contribution. Each workgroup developed the objectives from current water quality information. The watershed

objectives are listed below and the subwatershed objectives are listed in the following Subwatershed Descriptions section.

Overall Water Quality Objective

The stated objective of the Red River/Sturgeon Bay Priority Watershed for surface and ground water has two primary facets. First is the treatment of sites which are adversely impacting water quality from nonpoint sources. Second is the proactive installation of water quality best management practices at sites where there exists a reasonable potential for water quality degradation. It is understood the proactive protection of the project area's water quality is more cost efficient than the after-the-fact addressing of the impaired waters. Proactive educational efforts and information dissemination is also an integral component of this overall objective.

Surface Water Objectives

Surface water resources in the watershed often show extensive nonpoint source pollution problems. High levels of nutrients and bacteria are often present in the water samples taken throughout the watershed during runoff events. Stream beds are often covered with silt and sediment. Many of the watersheds streams are flashy during runoff events and flood easily. The objectives for the surface waters were developed from this information and information presented in Chapter Two. The Surface Water Objectives are:

1. Reduce the levels of nutrients and bacteria loaded from the watershed barnyards and winter spread manure by a high level.

2. Stabilize flow rates of the watershed's creeks by implementing land management practices which increase infiltration rates in areas where the groundwater contamination potential is low. In areas of high groundwater contamination potential, the use of land management practices which increase the surface detention of runoff will be used to stabilize flow rates of the creeks.

3. Maintain or develop stream woodland and/or grassland corridors by developing buffers through the use of stream corridor easements/irrevocable leases. Corridors also provide wildlife habitat.

4. Reduce gully erosion/sedimentation by 50%.

5. Treat milkhouse waste in areas of surface water quality concerns.

Groundwater Objectives

The primary use of the groundwater in the Red River/Sturgeon Bay Priority Watershed is for the public and private drinking water supplies. Sturgeon Bay Combined Utilities serves approximately 10,000 people and uses groundwater as their source of water. In addition, approximately 5,000 full time residents obtain their water supplies from private wells. Also, as noted in chapter two of this document, residency increases substantially during the summer

months. This is due in part to shoreline developments. Given the water supply use, the following two objectives are set for this project in relation to the groundwater:

1. In areas where the groundwater has been classified as "safe", the objective is to protect the beneficial uses of the groundwater within the project area from the impacts of nonpoint sources of pollution.

2. In areas where the groundwater has been shown to be contaminated, the objective is to decrease the frequency of contaminated wells in the project area affected by the nonpoint sources of pollutants.

Because of the high standards of quality required for a potable water supply, these objectives will be met only through a very high level of cooperation from the landowners and a high level of control at each nonpoint source site. Several innovative management practices for the control of nonpoint source pollution have been developed in response to the groundwater problems in the project area. These alternative practices will be eligible for cost-sharing through the Red River/Sturgeon Bay Priority Watershed Project.

It is recognized that the Red River/Sturgeon Bay Priority Watershed Project will not eliminate all of the groundwater quality problems that have occurred or will occur in the project area. As a result of the physical setting, some water quality problems will likely take place no matter how high a level of control of the nonpoint pollutant sources is obtained. However, a successful project will substantially reduce the contaminant loading to the groundwater in the area.

It is important to note that the objectives are set for the project area's groundwater, not the project area's water supply (which is the water in the wells). Although the "groundwater" and the "water supply" are completely connected, this distinction is made because a contaminated well does not need to be located in order to justify the need for a nonpoint source control practice. Rather, an observation that polluted water from the surface is entering the aquifer through shallow soils, a karst or an associated feature is justification for a nonpoint source control practice. This distinction is necessary because of the complicated flow pattern of water in a karst bedrock situation. It is very difficult to know the source of water found in a well and a specific pollutant source is difficult to identify.

In the Red River/Sturgeon Bay Project many of the nonpoint source concerns center around the livestock waste management and cropland infiltration, which are sources for both bacteria and nitrates to the groundwater. The word "safe" in the objectives statements means that no bacteria, a nitrate level below 10 mg/l, a zero turbidity value, and an atrazine or lead level below the PAL, was present in water used for drinking. Ideally, no water which has come in contact with animal waste should be allowed to enter the groundwater. From a practical standpoint, this cannot be assured, even with the proper control practices. The application of the established objectives then will be to minimize the potential for contaminated runoff entering the groundwater.

Groundwater Objectives For The City Of Sturgeon Bay

The Sturgeon Bay Utilities is in the process of identifying a well head zone of contribution (ZOC) for the city of Sturgeon Bay. The goals of this project area are; determine the area of land which contributes to the wells of the city of Sturgeon Bay, decrease the levels of nonpoint source pollution within the zone of contribution, increase landowner participation rates within the zone of contribution, and use the ZOC boundary maps for future projects. The project is contracted to the Natural History and Geologic Survey and is expected to be completed in 1996. This project is being funded by the DNR, the Door County SWCD, and the Sturgeon Bay Utilities. After the ZOC is delineated, the Watershed's boundary will be automatically altered, without a plan revision to this document, to include any land which is not currently in the watershed or in the ZOC.

Landowners located within the redefined watershed boundary shall be eligible for all Red River/Sturgeon Bay programs as defined for the original project area. It is understood that a portion of the Upper Door Priority Watershed project area will be included in the redefined Red River/Sturgeon Bay Priority Watershed project area. Landowners who did not participate in the Upper Door Priority Watershed will be given an opportunity to participate in the Red River/Sturgeon Bay Priority Watershed. BMPs which were not available in the Upper Door Priority Watershed will be available in the Red River/Sturgeon Bay Priority Watershed redefined area.

As part of the effort to reduce the level of nonpoint source pollution within the ZOC, the Sturgeon Bay Utilities will offer cost-share assistance to landowners for the implementation of BMPs. Cost-share monies provided by the Sturgeon Bay Utilities will be used as local matching funds for BMPs. If monies are made available they will be used to increase the state cost-share levels of BMPs. BMP cost-share levels are discussed in chapter 5 of this document.

Subwatershed Discussions

Strawberry Creek Subwatershed

The Strawberry Creek Subwatershed is approximately 5.6 square miles of area which is located in the northeast corner of the watershed. This subwatershed consists of two creeks which outlet to the waters of Sturgeon Bay: Strawberry Creek and an unnamed intermittent stream (T27N, R26E, S16, NESW). Areas which drain directly to the waters of Sturgeon Bay are common.

This subwatershed's boundary may be altered in 1996, or later, to meet the city of Sturgeon Bay's well head zone of contribution. Any alterations to the existing boundary will only increase the size of this subwatershed, since the current boundary is the true surface water boundary. Any increase in total land area in this subwatershed will warrant additional inventory work.

Strawberry Creek is a perennial warm water forage fish classified stream that supports an annual fall salmon run. The DNR maintains an egg taking facility 3/4 miles up stream from the creek's mouth. The eggs taken at this facility support the entire Wisconsin Salmon Fingerling Stocking Program. Cold water fish species are common in the lower reaches of this creek. A section of this creek has been straightened (ditched) which significantly decreased aquatic life habitat. DNR Fish Management staff have noted that this stream has become "flashy" during spring runoff and storm events. (See figure 2-3.) Dissolved oxygen concentrations remained above 6 mg/l during the appraisal monitoring period (1992-1993). Habitat evaluations ranked this stream as good aquatic life habitat.

The Unnamed Creek is a small intermittent limited forage fish classified stream. Macrophytes (large aquatic plants) in this stream are abundant. Silt has covered much of the stream bed. A macroinvertebrate sample in the fall of 1992 received a biotic index value of 7.45 which rates this stream as fairly poor water quality with significant organic pollution.

The waters of Sturgeon Bay are limited by soft sediment and nuisance macrophyte growth.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 2 animal lots which contribute 53.1 pounds of phosphorus, annually.

- The upland sediment delivery in this subwatershed is 239 tons annually, or 1.6 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.

- This subwatershed contains 23 high hazard acres of cropland which should not be spread with manure during the winter. The inventory of high hazard acres was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains an unknown number of animal lots which meet the criteria for a high potential to contaminate the groundwater. This is due to the potential change in the subwatershed boundary to accommodate the ZOC.

- This subwatershed contains an unknown number of manure storage sites which meet the criteria for a high potential to contaminate the groundwater. This is due to the potential change in the subwatershed boundary to accommodate the ZOC.

- There is 1 farm with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following surface water resource management objectives are recommended for Strawberry Creek Subwatershed:

1. Maintain and improve water quality and aquatic life in the streams by improving overall habitat conditions by:

   - reducing sedimentation rates by a high level
   - reducing nutrient/phosphorus loading by a high level
   - enhancing existing or degraded wetlands which act as filtering areas, protect the stream channel, and help maintain the stream's base flow

2. Decrease soft sediment build-up and nuisance macrophyte growth in Sturgeon Bay waters by reducing sediment and nutrient loading from streams, direct drainage and urban runoff.

3. Reduce nutrients, suspended solids, and toxic compounds in the urban stormwater runoff to the waters of Sturgeon Bay.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Strawberry Creek Subwatershed:

1. Develop the well head zone of contribution for the city of Sturgeon Bay and change subwatershed boundary to correspond with the well head zone of contribution.

2. Inventory and evaluate all lands/land uses which are included in this subwatershed as a result of any boundary change, for their potential to contaminate the groundwater.

3. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

4. Properly abandon wells not currently in use or are a groundwater quality concern.

5. Treat milk house waste in areas which are considered eligible or are a groundwater concern.

6. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

Sturgeon Bay Subwatershed

The Sturgeon Bay Subwatershed is approximately 11.1 square miles of area which is located in the northeast region of the watershed. Approximately 3.9 square miles of the subwatershed are surface drained. The remainder, approximately 7.2 square miles, are internally drained.

Samuelson Creek and an unnamed intermittent stream are the only major tributaries in this subwatershed. Both streams flow mostly through an urban area and outlet to the waters of Sturgeon Bay. The remaining area is considered direct drainage to the waters of Sturgeon Bay.

This subwatershed's boundary may be altered in 1996, or later, to meet the city of Sturgeon Bay's well head zone of contribution. Any alterations to the existing boundary will only increase the size of this subwatershed, since the current boundary is the true surface water boundary. Any increase in total land area in this subwatershed will warrant additional inventory work.

Samuelson Creek is a flashy intermittent limited forage fish classified stream. This stream received a fair aquatic life habitat rating. The rocky bottom substrate is completely covered with filamentous algae and periphyton. This stream is limited by minimal base flow, dense algae growth, and urban stormwater runoff.

The Unnamed Creek is a small intermittent unclassified stream. This stream has been intensely channelized through the west side of Sturgeon Bay. No appraisal was completed for this stream. Observations by Door County SWCD staff notes that macrophytes (large aquatic plants) in this stream are abundant. Silt has covered much of the stream bed.

The waters of Sturgeon Bay are limited by soft sediment and nuisance macrophyte growth.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 6 animal lots which contribute 89.2 pounds of phosphorus, annually.

- The upland sediment delivery in this subwatershed is 344 tons annually, or 2.3 percent of the entire watershed load. Cropland is the primary source of sediment in this subwatershed.

- This subwatershed contains approximately 194 high hazard acres of cropland which should not be spread with manure during the winter. The inventory of high hazard acres was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 6 or more animal lots which meet the criteria for a high potential to contaminate the groundwater (an unknown number of animal lots which may become part of this subwatershed after the city of Sturgeon Bay well head zone of contribution is delineated).

- This subwatershed contains 6 or more manure storage sites which meet the criteria for a high potential to contaminate the groundwater (an unknown number of manure storage sites which may become part of this subwatershed after the city of Sturgeon Bay well head zone of contribution is delineated).

- There are 8 areas mapped as internally drained with a principal outlet. This represents approximately 6.1 square miles or 3882 acres of land area. The mapped internally drained areas deliver approximately 456 tons of sediment to the principal outlets annually.

- There are 8 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resources Objectives

The following surface water resource management objectives are recommended for Sturgeon Bay Subwatershed:

1. Maintain and improve water quality and aquatic life in the streams by improving overall habitat conditions by:

    - reducing sedimentation rates by a high level

    - reducing nutrient/phosphorus loading by a high level

    - enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

2. Decrease soft sediment build-up and nuisance macrophyte growth in Sturgeon Bay waters by reducing sediment and nutrient loading from streams, direct drainage and urban runoff.

3. Reduce toxic compounds in the urban stormwater runoff to the waters of Sturgeon Bay.

4. Develop an aquatic plant management plan for the waters of Sturgeon Bay to identify sensitive areas for aquatic life and high value plants.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Sturgeon Bay Subwatershed:

1. Develop the well head zone of contribution for the city of Sturgeon Bay and change subwatershed boundary to correspond with the well head zone of contribution. Alterations to the boundary will only occur if additional lands are delineated.

2. Inventory and evaluate all land/land uses which are included in this subwatershed as a result of any boundary change, for their potential to contaminate the groundwater.

3. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

4. Properly abandon wells which are not currently in use or are a groundwater quality concern.

5. Treat milk house waste in areas which are considered eligible.

6. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

7. Reduce the level of sediment delivered to principal outlets by a high level.

Larson Creek Subwatershed

The Larson Creek Subwatershed is approximately 23.0 square miles of area which is located in the north region of the watershed. Approximately 14.2 square miles of the subwatershed are surface drained. Approximately 8.8 square miles or 5634 acres are internally drained. Larson, May and Lost Creeks are classified as intermittent streams and are the major tributaries in this subwatershed. All streams flow through a rural area. Larson and May Creeks outlet to the waters of Sand Bay, while Lost Creek outlets in Sawyer Harbor. The remaining area is considered direct drainage to the waters of Sturgeon Bay.

Larson Creek is a 4 mile long intermittent warm water forage fish classified stream. This stream received a fair aquatic life habitat rating. Silt has covered much of the stream bed. This stream receives a fair amount of sediment, indicated by the turbid water during rain events. A high concentration of suspended sediments was observed on March 3, 1993 during snow melt. This stream is limited by minimal base flow, dense algae growth, sedimentation from stream bank erosion caused by cattle access, sedimentation from upland erosion, and nutrients from barnyard/feedlot runoff.

May Creek is a 3 mile long intermittent limited forage fish classified stream. This stream received a fair ranking for aquatic life habitat. Filamentous algae is abundant on the hard substrate and silt and soft sediment cover most of the stream bed. Fish use this stream for spring spawning runs. This stream is limited by minimal base flow, dense algae growth, sedimentation from stream bank erosion caused by cattle access, sedimentation from upland erosion, and nutrients from barnyard/feedlot runoff.

Lost Creek is a 2.5 mile long intermittent limited forage fish classified stream. This creek received a fair aquatic life habitat rating. Observations by Door County SWCD staff notes that macrophytes (large aquatic plants) in this stream are abundant. Silt has covered much of the stream bed. A local golf course may be contributing nutrients to this creek. Also, the County of Door operates a landfill in this creek's watershed. Suspended sediments (colloid) are evident in the runoff from the landfill during runoff events. The DNR reviewed the landfill site during

1993. This stream is limited by minimal base flow, dense algae growth, sedimentation from the landfill and upland crop fields, and nutrients from the golf course.

The water of Sawyer Harbor is limited by soft sediment and nuisance macrophyte growth.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 6 animal lots which contribute 387.5 pounds of phosphorus, annually.
- The upland sediment delivery in this subwatershed is 1223 tons, annually, or 8.4 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.
- Streambank erosion contributes 25 tons of the sediment annually.
- This subwatershed contains approximately 345 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 12+ animal lots which meet the criteria for a high potential to contaminate the groundwater.
- This subwatershed contains 12+ improper manure storage sites which meet the criteria for a high potential to contaminate the groundwater.
- There are 3 areas mapped as internally drained with a principal outlet. This represents approximately 8.8 square miles or 5634 acres of land area. The mapped internally drained areas deliver approximately 416 tons of sediment to the principal outlets, annually.
- There are 13 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Larson Creek Subwatershed:

1. Maintain and improve water quality and aquatic life in the streams and Sawyer Harbor by improving overall habitat conditions by:
    - reducing sedimentation rates by a high level
    - reducing nutrient/phosphorus loading by a high level

- enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

2. Decrease soft sediment build-up and nuisance macrophyte growth in Sawyer Harbor waters by reducing sediment and nutrient loading from streams and direct drainage.

3. Reduce nutrient loading from the golf course.

4. Reduce sedimentation from the landfill area.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Larson Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Keyes Creek Subwatershed

The Keyes Creek Subwatershed is approximately 30.4 square miles of area which is located in the northern region of the watershed. Approximately 26.5 square miles of the subwatershed are surface drained. Approximately 3.9 square miles (2483.5 acres) are considered internally drained. This watershed consists of four streams which drain to the waters of Little Sturgeon Bay.

Keyes Creek is a 7 mile long perennial stream which originates in a spring network and flows through the Gardner Swamp Wildlife Area before discharging into Little Sturgeon Bay. The lower reaches support a warm water sport fishery and forage fishery, while the upper reaches are classified as a Class I and II trout stream. Portions of this creek have been ditched or are pastured. Aquatic life habitat evaluations ranged from good to fair. Macroinvertebrate samples received a biotic index value of 7.53 and 7.60 which rates Keyes Creek as poor water quality with very significant organic pollution. Runoff samples collected during 1993 showed very high levels of bacteria in the stream. Dissolved oxygen monitoring during the summer of 1993 documented water quality standard violations on several occasions. This stream is limited by

sedimentation, minimal stream flow, nutrients which cause dense algae and plant growth, erosion from stream bank pasturing, lack of quality in-stream aquatic habitat due to stream channelization, and low dissolved oxygen levels.

Malvitz Creek is an intermittent warm water forage fish classified stream. This stream received a fair aquatic life habitat rating. Silt and sediment is not a problem in this stream bed. This stream is limited by minimal base flow.

Twin Harbor Creek is an intermittent warm water forage fish classified stream. Silt and sediment is not a problem in this stream bed. Filamentous algae is abundant on the rocky substrate. This stream is limited by minimal base flow, dense algae growth, low dissolved oxygen levels, sedimentation from stream bank erosion, and sedimentation from upland erosion.

Krueger Creek is a small intermittent limited forage fish classified stream. This stream received a fair aquatic life habitat rating. Filamentous algae is abundant on the rocky substrate. This stream is limited by minimal base flow, dense algae growth, sedimentation from stream bank erosion, and sedimentation from upland erosion.

The water of Little Sturgeon Bay is limited by soft sediment build-up and nuisance macrophyte growth.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 19 animal lots which contribute 448 pounds of phosphorus, annually.

- The upland sediment delivery in this subwatershed is 2227 tons annually, or 15.4 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.

- Streambank erosion contributes 16 tons of the sediment annually.

- This subwatershed contains approximately 481 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 21 animal lots which meet the criteria for a high potential to contaminate the groundwater.

- This subwatershed contains 21 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.

- There is 1 area mapped as internally drained with a principal outlet. This represents approximately 1.7 square miles or 1103 acres of land area. The mapped internally drained areas deliver approximately 127 tons of sediment to the principal outlets annually.

- There are 33 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Keyes Creek Subwatershed:

1. Improve water quality and aquatic life in the streams and Little Sturgeon Bay by improving overall habitat conditions by:

   - reducing sedimentation rates by a high level

   - reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth

   - enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

   - reducing streambank erosion

2. Decrease soft sediment build-up and nuisance macrophyte growth in Little Sturgeon Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

3. An aquatic plant (macrophyte) survey and a comprehensive water chemistry study should be conducted for the waters of Little Sturgeon Bay. Also, a comprehensive aquatic plant management plan should be completed.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Keyes Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Sugar Creek Subwatershed

The Sugar Creek Subwatershed is approximately 14.8 square miles of area which is located in the central region of the watershed. Approximately 14.5 square miles of the subwatershed are surface drained. Approximately 0.3 square miles (192 acres) are considered internally drained. Green Bay is the receiving waters.

Sugar Creek is the only major tributary in this subwatershed. It is a 9 mile long warm water forage fishery perennial stream. The upper reaches flow intermittently and are marshy, whereas, the lower reach flows continuously and has a more stable rubble substrate. Habitat evaluations ranged from good to fair for aquatic life. Macroinvertebrate samples received biotic index values of 6.26 and 6.74 which is fair to fairly poor water quality with significant organic pollution. This creek receives considerable amounts of nutrients, sediments, and bacteria during runoff events as indicated by water samples collected. This creek is subject to flooding and becomes very turbid and muddy during runoff events. Sections of the creek have been ditched, are pastured, or have feed lots next to the creek.

Sugar Creek is limited by nutrient loading from feedlot runoff, sediment erosion from streambank pasturing, and lack of quality in-stream habitat due in part to channelization, sedimentation, and flooding.

The near shore waters of Green Bay are limited by soft sediment build-up.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 16 animal lots which contribute 412 pounds of phosphorus, annually.
- The upland sediment delivery in this subwatershed is 3828 tons, annually, or 26.3 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.
- Streambank erosion contributes 183 tons of the sediment annually.
- This subwatershed contains approximately 480 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 9 animal lots which meet the criteria for a high potential to contaminate the groundwater.
- This subwatershed contains 7 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.

- There are 21 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Sugar Creek Subwatershed:

1. Improve water quality and aquatic life in the streams and near shore waters of Green Bay by improving overall habitat conditions by:

    - reducing sedimentation rates by a high level

    - reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth

    - enhance existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

    - reducing streambank erosion

2. Decrease soft sediment build-up and nuisance macrophyte growth in Green Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Sugar Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Renard Creek Subwatershed

The Renard Creek Subwatershed is approximately 11.5 square miles of area which is located in the central region of the watershed. Approximately 11.1 square miles of the subwatershed are surface drained. Approximately 0.4 square miles (256 acres) are considered internally drained. Green Bay is the receiving waters.

Renard Creek is the major tributary of this subwatershed. It is a 6 mile long warm water forage fishery perennial stream. The upper reaches flow intermittently and flood easily while the lower reach flows continuously and has a more stable rubble substrate. Habitat evaluations ranked from fair to poor for aquatic life. Macrophytes and filamentous algae are extremely dense in some locations. Macroinvertebrate samples received biotic index values of 2.56 to 4.35 which rate as fairly poor to very good water quality with very significant to possible slight organic pollution. This creek receives considerable amounts of nutrients, sediments, and bacteria as indicated by water samples collected. This creek is subject to flooding and becomes very turbid and muddy during runoff events. Sections of the creek have been ditched, are pastured, or have feedlots next to the creek.

Silver Creek is a flashy intermittent stream. Filamentous algae covers the sparse rocky substrate. Aquatic life habitat was ranked as poor.

The tributaries in this subwatershed are limited by sediment from streambank pasturing, minimal stream flow, lack of quality in-stream aquatic habitat, high nutrient loading from feedlot runoff, excessive macrophyte and algae growth, flooding and sedimentation.

The near shore waters of Green Bay is limited by soft sediment build-up.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 21 animal lots which contribute 882.4 pounds of phosphorus, annually.
- The upland sediment delivery in this subwatershed is 1781 tons annually, or 12.3 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.
- Streambank erosion contributes 82 tons of the sediment annually.
- This subwatershed contains approximately 450 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 11 animal lots which meet the criteria for a high potential to contaminate the groundwater.

- This subwatershed contains 12 improper manure storage sites which meet the criteria for a high potential to contaminate the groundwater.

- There are 20 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Renard Creek Subwatershed:

1. Improve water quality and aquatic life in the streams and near shore waters of Green Bay by improving overall habitat conditions by:

    - reducing sedimentation rates by a high level

    - reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth

    - enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

    - reducing streambank erosion

2. Decrease soft sediment build-up and nuisance macrophyte growth in Green Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Renard Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Fabry Creek Subwatershed

The Fabry Creek Subwatershed is approximately 5.1 square miles of area which is located in the south central region of the watershed. This subwatershed did not have any internally drained areas which met the mapping qualifiers. Green Bay is the receiving waters.

Fabry Creek is the tributary of this subwatershed. It is a 1 mile long high gradient limited forage fishery intermittent tributary. Habitat evaluations ranked this creek as fair. This creek receives considerable amounts of nutrients, sediments, and bacteria indicated by water samples collected. This creek is subject to flooding and becomes very turbid and muddy during runoff events. Sections of the creek have been ditched, are pastured, or have feed lots next to the creek.

The near shore waters of Green Bay are limited by soft sediment build-up.

Surface Water Nonpoint Source Pollutants

- The Fabry Creek Subwatershed contains 6 animal lots which contribute 245 pounds of phosphorus, annually.
- The upland sediment delivery in this subwatershed is 1200 tons, annually, or 8.2 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.
- Streambank erosion contributes 29 tons of the sediment annually.
- This subwatershed contains approximately 146 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 3 animal lots which meet the criteria for a high potential to contaminate the groundwater.
- This subwatershed contains 2 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.
- There are 6 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Fabry Creek Subwatershed:

1. Improve water quality and aquatic life in the stream and near shore waters of Green Bay by improving overall habitat conditions by:

- reducing sedimentation rates by a high level
- reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth
- enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

2. Decrease soft sediment build-up and nuisance macrophyte growth in Green Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for Fabry Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Red River Subwatershed

The Red River Subwatershed is approximately 20 square miles of area which is located in the south central region of the watershed. This subwatershed did not have any large internally drained areas. Green Bay is the receiving waters.

Red River is the major tributary of this subwatershed and is a 9 mile long limited forage fishery classified stream. The lower reaches, approximately 2 miles long, are classified as perennial while the remainder is classified as intermittent. Aquatic life habitat evaluations ranked this stream as fair. This stream receives considerable amounts of nutrients and sediments. This stream becomes very turbid and muddy during runoff events. Sections of the creek have been ditched, are pastured, or have feed lots next to it.

Macco Creek is a 1 mile long, high gradient, limited forage fish classified intermittent stream. A habitat evaluation ranked this stream as fair. Stream bank erosion is a significant problem along this stream.

The near shore waters of Green Bay are limited by soft sediment build-up.

Surface Water Nonpoint Source Pollutants

- This subwatershed contains 34 animal lots which contribute 1544 pounds of phosphorus, annually.
- The upland sediment delivery in this subwatershed is 3236 tons, annually, or 22.3 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.
- Streambank erosion contributes 126 tons of the sediment annually.
- This subwatershed contains approximately 1,025 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 10 animal lots which meet the criteria for a high potential to contaminate the groundwater.
- This subwatershed contains 11 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.
- There are 26 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Red River Subwatershed:

1. Improve water quality and aquatic life in the streams and near shore waters of Green Bay by improving overall habitat conditions by:
    - reducing sedimentation rates by a high level
    - reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth
    - enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow
    - reduce streambank erosion

2. Decrease soft sediment build-up and nuisance macrophyte growth in Green Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for the Red River Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

Gilson Creek Subwatershed

The Gilson Creek Subwatershed consists of Bader and Gilson Creeks and is approximately 12.3 square miles of area. This Subwatershed is located in the southern region of the watershed. Green Bay is the receiving waters.

Gilson Creek is a 4 mile long stream and is classified as a warm water forage fishery in the lower reaches below the escarpment. Spring pools in the upper reaches may support brook trout. The creek flows through a wetland in the upper reaches. Habitat evaluations ranked this creek as fair. Macroinvertebrate samples received biotic index values of 6.86 and 4.57 which rate as fairly poor to good water quality with significant organic pollution. This creek is limited by minimal stream flows, bacteria, high sediment loads, and streambank erosion.

Bader Creek is a 2.5 mile long, high gradient, warm water forage fish classified intermittent stream. A habitat evaluation rated this stream as fair to poor. Streambank erosion is a significant problem along this stream. The stream bed is mostly rubble and other stable habitat. This creek is also known as Brown/Kewaunee for inventory purposes.

The near shore waters of Green Bay are limited by soft sediment build-up.

Surface Water Nonpoint Source Pollutants

- The Gilson Creek Subwatershed contains 15 animal lots which contribute 608.2 pounds of phosphorus, annually.

- The upland sediment delivery in this subwatershed is 465 tons, annually, or 3.2 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed.

- Streambank erosion contributes 27 tons of the sediment annually.

- This subwatershed contains approximately 1,363 high hazard acres of cropland which should not be spread with manure during the winter. The inventory was limited to lands owned/operated by farms with livestock.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 5 animal lots which meet the criteria for a high potential to contaminate the groundwater.

- This subwatershed contains 6 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.

- There are 10 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Surface Water Resource Objectives

The following water resource management objectives are recommended for Gilson Creek Subwatershed:

1. Improve water quality and aquatic life in the streams and near shore waters of Green Bay by improving overall habitat conditions by:

    - reducing sedimentation rates by a high level

    - reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth

    - enhancing existing or degraded wetlands which act as filtering area, protect the stream channel, and help maintain the streams base flow

    - reduce streambank erosion

2. Decrease soft sediment build-up and nuisance macrophyte growth in Green Bay waters by reducing sediment and nutrient loading from streams and direct drainage.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for the Gilson Creek Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality control measures.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements or critical area stabilization.

Brussels Depression Subwatershed

The Brussels Depression Subwatershed is 5.4 square miles (3467 acres) of area which is located in the east central region of the watershed. This subwatershed is entirely drained internally. This area has a complex of three major closed depressions which drain to sink holes. The village of Brussels is located in this subwatershed and all residents of the subwatershed use the local aquifer as their source of drinking water. The receiving waters for this subwatershed is the Silurian age dolomite aquifer.

Groundwater Nonpoint Source Pollutants

- This subwatershed contains 19 animal lots which meet the criteria for a high potential to contaminate the groundwater.

- This subwatershed contains 19 manure storage sites which meet the criteria for a high potential to contaminate the groundwater.

- There are 3 areas mapped as internally drained with a principal outlet. This represents approximately 3.2 square miles or 2016 acres of land area. The mapped internally drained areas deliver approximately 508 tons of sediment to the principal outlets annually.

- There are 17 farms with a field groundwater pollution potential of equal to or greater than 430 or with an internally drained potential of greater than 200.

Groundwater Resource Objectives

The following groundwater resource management objectives are recommended for the Brussels Depression Subwatershed:

1. The overall objective of the groundwater component is to treat all animal lots, improper manure storage sites, and farms with a high field groundwater pollution potential which are deemed eligible for groundwater quality.

2. Properly abandon wells which are not currently in use or are a groundwater quality concern.

3. Treat milk house waste in areas which are considered eligible.

4. Develop buffer areas around sinkholes, rockhole openings, and other associated bedrock features through the use of easements and critical area stabilization.

5. Reduce the level of sediment delivered to principal outlets by a high level.

Urban Runoff Discussions

Urban runoff carries a variety of pollutants, including heavy metals (lead, copper, zinc, cadmium and chromium) and a large number of toxic organic chemicals (polychlorinated biphenols, polycyclic aromatic hydrocarbons, pesticides and many others). Other substances in urban runoff include sediment, nutrients, bacteria, and other contaminants like *Cryptosporidium*, the parasite that made 403,000 people sick in Milwaukee in 1993.

Runoff from urban areas also affects stream characteristics. For example, as pavement and rooftops prevent rainwater and snowmelt from soaking into the ground, water runs off the surface at a much higher rate. Stream flows peak at much higher levels than prior to urban development. Consequently, in some areas groundwater recharge is reduced and dry-weather stream flows decrease to below minimum levels needed to sustain fish and aquatic life.

In effect, urban runoff produces flashy streams with temperatures and chemical characteristics which limit aquatic life and recreational uses. Streambank erosion may increase as flow extremes occur. Flooding of adjacent property may also occur, often bringing about channelization and/or lining with concrete to accommodate flood flows or relocation of buildings to prevent flood damages. This destroys the natural stream system and speeds the transport of storm water and runoff pollutants downstream.

In addition to these typical urban nonpoint sources, there are numerous other sources, including shoreline erosion, in-place sediment contamination, runoff from illegal or careless waste disposal, and construction erosion. Each of these represent potential causes of stream, lake and groundwater use impairment.

The purpose of the urban nonpoint source inventory and analysis was to identify which causes and related sources are critical constraints to achieving water quality goals and which ones are only minor contributors. Urban nonpoint sources described below include runoff from established urban areas, construction sites, and future (post-construction) urban areas.

Storm Water Drainage Characteristics: The delivery of pollutants to streams, bedrock crevices, sinkholes, aquifers and bayshore areas from established urban areas depends on the types of urban land uses, the types of storm water conveyance systems, and urban pollution prevention practices. Each factor is discussed below.

1. Urban Land Uses: Table 3-11 summarizes the type and extent of urban land uses for Sturgeon Bay. Urban land uses and their estimated pollutant generation rates are shown in Table 3-12. Commercial areas, industrial areas and highways are the largest sources of sediment, lead, and zinc on a per acre basis. Medium density residential areas (two to six housing units per acre) are less important sources of sediment and lead, but are significant sources of pesticides, bacteria, and household or automotive maintenance products which are sometimes dumped into ditches and storm drains. Low density residential areas (less than two housing units per acre) are important where the improper use and disposal of pesticides, fertilizers, and automotive products occur.

Table 3-11. Urban Land Uses for Sturgeon Bay: 1993.

Subbasin	Land Use in Acres								
	Residential Density[1]			Com	Ind	Transp	Inst	Open Space	Total
	Low	Med	High						
Little Creek	135	290	38	155	15	0	100	295	1,028
Big Creek	45	50	15	11	0	65	4	369	559
Samuelson Creek	22	20	0	0	0	6	0	171	219
Bradley Lake	48	156	4	5	7	0	3	147	370
Direct Drainage East Side	67	213	94	80	105	0	10	66	635
Direct Drainage West Side	127	387	3	137	195	79	17	748	1,693
TOTAL	444	1,116	154	388	322	150	134	1,796	4,504

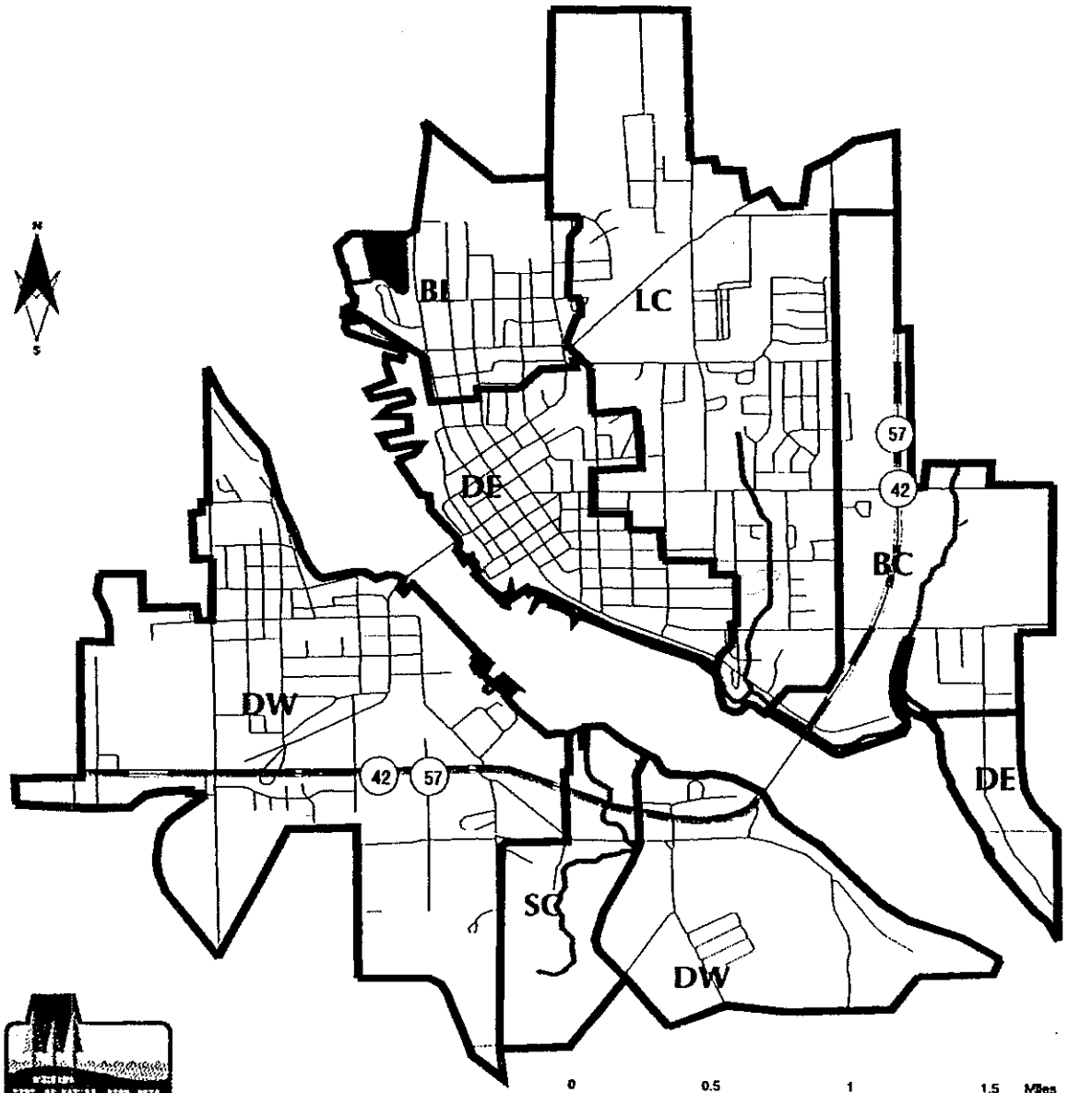
[1] Residential densities: Low (less than 2 units per acre), Med (2-6 units per acre), High (more than 6 units per acre).
Source: DNR

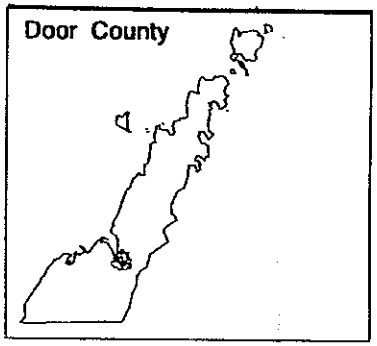
Table 3-12. Estimated Pollutant Generation Rates From Urban Land Uses Without Control Practices

Land Use	Unit Area Load (pounds/acre/year)				
	Sediment	Phosphorus	Lead	Zinc	Other Concerns
Highways	980	1.0	0.5	2.7	volatile organics
Industrial	960	1.5	0.5	1.5	volatile organics
Commercial	960	1.5	0.5	1.5	volatile organics
Shopping Centers	440	0.5	0.5	1.5	volatile organics
High Density Residential	490	1.1	0.3	0.8	pesticides
Medium Density Residential	220	0.5	0.04	0.1	pesticides
Low Density Residential	11	0.04	0.01	0.01	pesticides
Parks	3	0.03	0.01	**	pesticides
Construction Sites	40,000	**	**	**	none

** = pollutant loads were not estimated.
Source: DNR Source Loading and Management Model (SLAMM).

Fig. 3-1: Sturgeon Bay Stormwater Subbasins





PROJECT AREA

Stormwater Subbasin
River or Stream
Highway
Local Roads

SUBBASINS

BC = Big Creek

BL = Bradley Lake

DE = Direct Drainage East

DW = Direct Drainage West

LC = Little Creek

SC = Samelson Creek

Wisconsin Department of Natural Resources
Bureau of Water Resources Management
October 1994

Nominal Scale 1:39423

The pollutants in urban runoff depend on the configuration of "source areas." Source areas—characterized by streets, parking lots, rooftops and lawn areas—are present in different proportions, depending on land use patterns. For example, residential areas contain more lawn area than commercial areas, while commercial areas have more rooftop, street, and parking lot surfaces. Lawns can be important sources of fertilizers and pesticides. Rooftop areas are important sources of zinc and deposited atmospheric pollutants. Their connection to the storm drainage system may be direct or indirect, depending on the use of downspouts, grassed areas, drain tiles, etc. Streets are sources of significant amounts of lead, cadmium, sediment, and other pollutants, depending on their condition and the amount of traffic.

2. Storm Water Conveyance: Storm water is most commonly conveyed to streams, bays, lakes and sinkholes through a combination of gutters, roadside ditches, grassed swales, storm sewers and impoundments. Gutters and storm sewers transport runoff rapidly with no pretreatment or filtering of the runoff before it enters streams. Properly designed grassed swales generally reduce runoff volume because of infiltration, and sod vegetation serves to remove some pollutants from runoff before they flow into streams or shallow aquifers.

   The types and amounts of pollutants transported by runoff depend on the way that pollutant-bearing surfaces are connected to the storm drainage system. For example, commercial parking areas and arterial streets deliver the highest concentrations of lead, asbestos, cadmium, and street sediment because normally these areas are drained by storm sewers that discharge directly to streams or bayshore areas.

3. Urban Pollution Prevention Practices: These are practices that prevent pollutants from being transported in runoff. Vacuum street sweeping, for example, removes some of the particulate pollutants from street and parking lot surfaces before they can be delivered to surface waters. Repeated street sweeping of commercial and industrial areas in the early spring provides additional benefits. Other sweeping is primarily cosmetic, and serves little to reduce urban pollutant loads.

   Preventing lawn care chemicals, leaf litter and pet wastes from being carried by runoff to nearby streams and drainageways is important. Fertilizer runoff and other waste residues can enrich surface waters with nutrients and promote excessive weed and algae growth.

Storm Water Pollutant Discharges: Established urban areas and their respective amounts and types of pollutant loads are shown in Table 3-13. Three pollutants (sediment, phosphorus, and lead) were chosen to characterize the type and severity of urban nonpoint pollution.

Commercial, industrial and freeway areas have the highest unit/area/year pollutant loads, producing the most significant amounts of suspended solids, metals and other urban toxic pollutants. This occurs primarily because of the large impervious area these land uses occupy. Medium density (two to six housing units per acre) and multi-family residential areas also generate significant quantities of toxic pollutants, sediment and phosphorus.

Table 3-13. Estimated Storm Water Pollutant Discharges for city of Sturgeon Bay: 1993.

Subbasin	Area		Lead		Phosphorus		Sediment	
	Acres	%	Pounds/Yr	%	Pounds/Yr	%	Pounds/Yr	%
Little Creek	1,028	23	142	24	553	25	277,200	23
Big Creek	559	12	49	8	138	6	90,137	8
Samuelson Creek	219	5	6	1	24	1	10,900	1
Bradley Lake	370	8	17	2	122	6	48,700	4
Direct Drainage East	635	14	139	23	517	24	273,244	23
Direct Drainage West	1,693	38	251	42	846	38	490,400	41
TOTAL	4,504	100	604	100	2,200	100	1,190,581	100

Source: DNR

Construction Site Erosion and Sedimentation: Construction site erosion and sedimentation is a water quality concern in most urban watersheds. It can destroy aquatic communities in streams and lakes and reduce the capacity of storm water conveyance systems resulting in localized flooding. Moreover, any water quality improvements occurring through implementation of nonpoint source control practices in downstream areas can be negated by construction erosion upstream.

Predicting rates of construction site erosion is difficult. On some sites, erosion rates exceeding 75 tons/acre/year can occur. This rate of erosion is much greater than occurs on the most severely eroding croplands and more than 60 times the sediment loading rate from post-construction commercial and industrial areas. Often the close proximity of construction sites to storm sewers or other drainageways serving urban areas results in nearly all of the sediment being delivered to streams.

An analysis of construction site erosion in Sturgeon Bay was conducted using land use inventory data provided by McMahon and Associates. The average annual amount of land under construction for the period 1993 to 2013 was estimated by quantifying historical changes in urban land use and population projections. Development, totaling 100 acres, is estimated to occur at an average rate of about 5 acres annually.

Average annual sediment loading to streams from construction erosion for 1993 to 2013 conditions was determined by multiplying the amount of land planned for construction by an average of 20 tons/acre/year. This rate of erosion and sediment control is based on observed land development patterns and generalized climatic conditions. It is estimated that in the years between 1993 and 2013, construction erosion will contribute about 100 tons per year of sediment (about 16 percent of total sediment load from urban nonpoint sources) to streams, bays and groundwater in the project area.

Enforcing state and local ordinances can be an effective means to reduce construction site erosion and its adverse water quality impacts. In 1986, the DNR and the League of Wisconsin

Municipalities cooperatively developed a model ordinance for the control of construction site erosion (DNR, 1987). It contains provisions for planning, designing, installing and maintaining erosion control practices. It also contains guidance for administering and enforcing the ordinance.

Developers are governed by state regulations (Ch. 144 Wis. Stats.) set forth by the Department of Industry, Labor and Human Relations (DILHR) for erosion control on sites with one and two family dwellings; and the DNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit regulations for sites greater than five acres. The city of Sturgeon Bay enforces the DILHR regulations for controlling construction site erosion and sedimentation. A need exists for developing an erosion control ordinance for multi-family, commercial, and industrial sites less than 5 acres.

Despite these regulations, several potential impediments to effective erosion control exist. For example, developers sometimes perceive erosion control as an add-on cost and not a built-in cost of construction, enforcement is often done only in response to complaints, maintenance of erosion control is often poor, sedimentation basin designs consume large areas where vacant land is often scarce, unnecessary grading and excavation is commonplace, soil is routinely tracked onto roads because preventative measures are not a high priority for builders, and there is sometimes confusion about who is responsible for installing erosion control practices.

A construction site erosion and sedimentation control strategy is described in Chapter 5. In addition, workshops are held by the University of Wisconsin -Extension to provide opportunities for learning and problem-solving among developers, builders, excavators, concerned citizens, municipalities, and other units of government.

Storm Water Management: The city of Sturgeon Bay was surveyed regarding its current storm water management practices and policies. In most cases, local authorities do not require installation of storm water management practices through ordinances or policy. Exceptions include limited requirements for storm water best management practices (BMPs), such as storm water detention ponds in some newer developments.

New (Post-Construction) Urban Areas: The 100 acres of urban development expected to occur between 1993 and 2013 will result in about 51 acres of new residential land uses and 49 acres of new industrial land uses. The resultant runoff pollutant discharge for future, new land uses under a no-controls scenario would represent an estimated 2,900 pounds per year sediment, 5 pounds per year phosphorus , and 1.4 pounds per year lead.

Table 3-14. Estimated Sediment Sources (in Tons/Year) for city of Sturgeon Bay: 1993.

Subbasin	Total	Established Urban Areas	Construction Sites	New (Post-Construction) Urban Areas
Little Creek	156	139	17	< 0.1
Big Creek	53	45	8	< 0.1
Samuelson Creek	10	5	5	< 0.1
Bradley Lake	31	24	7	< 0.1
Direct Drainage East	139	137	2	< 0.1
Direct Drainage West	307	245	61	1.24
TOTAL	696	595	100	1.44

Source: DNR

Other Pollution Sources

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

Municipal and Industrial Point Sources of Pollution

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface water resources. The Sturgeon Bay Utilities has a municipal wastewater treatment plant that discharges to Sturgeon Bay waters. Chapter 147, Wis. Stats., requires any person discharging pollutants into the waters of the state to obtain a Wisconsin Discharge Elimination System (WPDES) Permit.

Sturgeon Bay Utilities Wastewater Treatment Plant: This WWTP was built in 1981 by the city of Sturgeon Bay. Treatment of wastewater is through an activated sludge process with final sludge application on agricultural lands outside the watershed boundary. The system is presently operating under its design capacity and services approximately 9200 residents of Sturgeon Bay. All processed water is discharged to the waters of Sturgeon Bay. As part of the Red River/Sturgeon Bay Priority Watershed, Sturgeon Bay Utilities developed a sewer service plan which projects future needs for sewer service, defines the procedures for reviewing boundary and plan amendments, identifies environmental corridors to be protected, and provides a basis for community officials to direct community growth and protect environmental, social and economic concerns.

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

The Phosphorus Rule was passed in June, 1992 by the DNR Board. It was approved by the legislature in Fall, 1992. The Rule requires both municipal and industrial point sources with surface water discharge points to remove phosphorus from their effluents to 1.0 ppm. Industries that generate 60 pounds of phosphorus per month and municipalities that generate 150 pounds per month must comply. It will take 3–8 years before all facilities are on line. Implementation of this Rule should reduce the phosphorus load from the point sources in the Red River/Sturgeon Bay Watershed.

Failing Septic Systems

Septic systems consist of a septic tank and a soil absorption field. Septic systems fail due to soil type, location of system, poor design or maintenance. Generally, in the Red River/Sturgeon Bay Watershed, the majority of soils are not suitable for conventional septic tank soil absorption systems. The dense glacial tills associated with the Kewaunee-Kolberg-Manawa Soils of the watershed do not accept enough moisture for an effective absorption system. As a result, throughout the watershed there are many surface discharge systems where soil absorption

systems have failed. This presents a surface water quality problem. Landspreading of septic waste during the winter months can also create surface water quality problems.

Septic systems located in areas of the watershed with the Summerville-Longrie-Omena soil series risk groundwater contamination problems due to the characteristic fractured bedrock and the shallow depth to bedrock. Pollutants from septic system discharges are nitrates, bacteria, viruses and hazardous materials from household products.

Door, Brown, and Kewaunee Counties have been using the Wisconsin Fund since 1981. The Wisconsin Fund is a Private Sewage System Replacement Grant Program offering financial assistance designed to help eligible homeowners and small business operators offset the costs of replacing a failing septic system. The program is administered by the County's Sanitarian or Zoning Department. The grant program applies to principle residences and small businesses built prior to July 1, 1978, and is subject to income and size restrictions. Seasonal homes are not eligible for participation in this program. Interested individuals should contact their county sanitarian or zoning department for more information.

Solid Waste Disposal Sites

The Door County Landfill is the only operating landfill operation and is located in the Nasewaupee township, T28N-R25E, SEC 34. The landfill opened January 1, 1992 and will continue to operate until January 1, 2000. Door County Solid Waste has purchased additional property adjacent to the landfill property for future landfill need considerations. Groundwater contamination problems do not exist at the site monitoring wells. Private water supplies do not reveal any contamination.

Petroleum Storage: Leaking Underground Storage Tank (LUST) Sites

The Wisconsin Remedial Response Site Evaluation Report (PUBL-SW-144-91) lists the sites identified through the LUST program.

Other Contaminated Sites

The Wisconsin Remedial Response Site Evaluation Report also has the Inventory of Sites or Facilities Which May Cause or Threaten to Cause Environmental Pollution and the Spills Program List which includes sites or facilities identified under the Hazardous Substance Spill Law.

Land Application of Municipal and Industrial Wastes

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

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

Snow Disposal Site

The city of Sturgeon Bay currently disposes of it's snow, removed from the city streets in an area of the Big Creek subwatershed. This area is within 1000 feet of the stream's channels. Chlorides, oil, and other potential contaminants may be entering the stream which is outleted in the Sturgeon Bay waters. It is suggested that a comprehensive monitoring project be conducted at this site to quantify the snow disposal operation impact on Big Creek's water quality.

Orchards and Lead Arseniate Pesticide Mixing Sites

The concern of lead and arsenic contamination in the soil and the groundwater of the project area is from the existence of old cherry and apple orchard operations and lead arsenate mixing sites. Lead arsenate was the principal pesticide in the fruit growing industry prior to the 1960s. Powdered lead arsenate was mixed with water and subsequently transported to and sprayed on the orchards. The DNR became concerned with water quality impacts from old orchards and mixing sites in 1984 after wells located near old orchards became contaminated with lead. Studies conducted on old orchards and lead arsenate mixing sites, located in the Upper Door Priority Watershed project area, concluded that many of these sites had elevated lead and arsenic levels in the soil, which if not attenuated, could be a source of groundwater contamination. Site clean up activities and potential locations of orchards were conducted.

Orchards

As part of the comprehensive inventory for the Red River/Sturgeon Bay Priority Watershed, old cherry and/or apple orchards were inventoried. This was completed using aerial photos from 1938, 1961, and 1967. All orchards identified were mapped. The highest concentration of orchards were located in the townships of Sturgeon Bay and Nasewaupee. No large scale orchards were located outside of these two townships.

Lead Arsenate Mixing Sites

The comprehensive inventory also included a survey of individuals who were involved in the fruit growing industry prior to the 1960s. The survey assisted with locating the abandoned mixing sites. The conclusion of the survey identified 22 abandoned mixing sites which are concentrated in the townships of Sturgeon Bay and Nasewaupee.

All information from the orchard and lead arsenate mixing site studies will be digitized into a usable format for public distribution.

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

Introduction

This chapter describes the management actions developed to meet the pollution reduction goals established during the water resource appraisal process. Also, this chapter describes the criteria which determine the eligibility of each pollutant source for cost-share funding through the nonpoint source program.

Management Categories

Nonpoint source control needs are addressed by assigning "management categories" to potential nonpoint source pollution sites (animal lots, manure storage sites, the winter spreading of manure, sediment delivered from upland fields, stream bank and/or stream bank habitat degradation sites). Management categories define which nonpoint sources are eligible for financial and/or technical assistance under the priority watershed project. Categories are based on the amount of pollution generated by a source, the pollution potential to impact groundwater, and the feasibility of controlling the source. Management category eligibility criteria for surface water quality is expressed in terms of: the number of pounds of phosphorus delivered to the surface waters, annually; unsuitable acres which are winter-spread with manure, annually; the number of tons of sediment delivered to surface waters from eroding uplands and streambanks, annually; the number of feet of streambank degraded by cattle which have access to a given stream. Management category eligibility for groundwater is expressed in terms of: depth of soil to bedrock or water table; location in a mapped closed depression with or without a principle outlet; location in proximity to a channelized flow path to the city of Sturgeon Bay wellhead zone of contribution; if a farm has lands for the winter spreading of animal manure; or tons of sediment delivered to the groundwater from eroding upland crop fields. A general definition of each management category is given below followed by the criteria which defines the management categories for each nonpoint source pollutant.

The criteria used to define these management categories will be verified and/or updated at the time that the county staff visit a site. A source may change management categories depending on the conditions found at the time of the site visit. It is important to note that a management category may be revised until the time the landowner implements a BMP which will control the source of pollution. Any increase in the level or the creation of new sources of pollution resulting from a change in landuse or management which renders the installed BMP ineffective and/or requires new controls must be controlled at the landowners expense during the cost-share

agreement operation and maintenance period.

Additional critical site criteria will be included in the Red River/Sturgeon Bay Priority Watershed Implementation Plan, without an amendment to this Plan, to incorporate any action taken implementing the recommendations of the Animal Waste Advisory Committee (AWAC) or any subsequent efforts and/or legislation initiated to implement related recommendations. The recommendations and/or legislation will be used to formulate additional critical site criteria in the project area. The additional critical site criteria will include the concept of AWAC Water Quality Management Areas, which include surface water corridors and specific groundwater sites.

Management Category Critical Sites

As described in WI Status s.144.25(4)(g)(8.)(a.m.), "critical site" are those sites that are significant sources of nonpoint source pollution upon which best management practices must be implemented to obtain the water quality objectives as stated in priority watersheds' implementation plan. Nonpoint sources of pollution in this category contribute or are likely to contribute a significant level of pollutant(s) which impact surface and/or ground water. Reduction of the pollutant load is required by landowners with critical sites.

Reduction of the pollution loading from a critical site can be approached by two separate methods. The first method will be to have a landowner/operator sign a cost-share agreement for the implementation of BMPs to reduce the nonpoint pollution to the established target levels. Staff will place emphasis on this approach. The second method provides technical assistance to the landowner/operator without a cost-share agreement to facilitate the installation of best management practices and/or management changes which result in the site no longer meeting the criteria for a critical site as per NR 120.09(5)(a). The BMP or management change may or may not be a formally designed practice. This method will be implemented if the landowner/operator is not willing to implement all the management category I BMPs.

The installation of best management practices to address nonpoint sources in the Critical Site Category are eligible for funding and/or technical assistance under the priority watershed project. As a condition of funding, *all* sources in the Management Categories of Critical Sites and I must be controlled. A landowner also may voluntarily participate in any Management Category II component of the priority watershed project if all Management Category Critical Sites and I nonpoint source pollutants are controlled.

Management Category I

Nonpoint sources included in this category contribute a significant amount of the pollutants impacting surface water and/or the groundwater of the priority watershed. Reducing their pollutant load is essential for achieving the priority watershed project's water quality objectives.

The installation of best management practices to address nonpoint sources in Category I are eligible for funding and/or technical assistance under the priority watershed project. As a condition of funding, *all* sources in Management Category I must be controlled if a landowner wants to participate in any Management Category I or II component of the priority watershed project.

Management Category II

Sources in this category contribute a lesser pollutant load to surface and/or groundwater of the priority watershed than those included in Management Category Critical Sites and I. However, control of these sources is needed to achieve water quality objectives of the priority watershed project. The need is based on offsetting the level of nonpoint source pollutants which are not controlled under the voluntary approach of the project.

Inclusion of sources in Management Category II on cost-share agreements is optional, although the success of the priority watershed project may depend on their control.

Management Category III

The installation of best management practices to control nonpoint sources in this category are not eligible for funding under the priority watershed project but will remain eligible for technical assistance if requested. Conditions in this category do not contribute a significant pollution load to the surface and/or groundwater.

Changes to Management Category Status

A change in the site management category designation may occur if one or more of the following conditions applies:

- the site no longer meets the current management category criteria.
- the site has had best management practices implemented in accordance with the cost-share agreement.
- with authorization from the respective unit of government County Conservationist/Department Administrator, a sites management category designation may change from a management category I to a management category II.

Criteria for Eligibility and Management Category Designation

Animal Lot Runoff Impacting Surface Water

To achieve the surface water quality objectives in the Red River/Sturgeon Bay Priority

Watershed Project, the pollutants contained in animal lot runoff must be controlled (table 4-1). A 74 percent reduction of animal lot runoff, which discharges to the surface water, is necessary in all subwatersheds to meet the stated objectives. A total of 192 animal lots were inventoried and evaluated for their potential to impact the watersheds' surface water resources. It was determined that a total of 125 livestock operations impact the surface waters of the watershed. The remaining animal lots (67) impact only the watersheds' groundwater resources. Table 4-2 summarizes the number of animal lots in each management category along with the pounds of phosphorus which can be reduced if appropriate control measures are implemented.

Critical Site criteria designates animal lots which deliver equal to or greater than 50 pounds of phosphorus to the surface waters, annually. Animal lots in this category will be required to reduce the annual phosphorus loading, to the surface waters, to less than 10 pounds in order to reach the pollution reduction target. There are 32 animal lots in this category.

Category I criteria designates animal lots which deliver equal to or greater than 40 pounds and less than 50 pounds of phosphorus to the surface waters, annually. Animal Lots in this category will need to reduce annual phosphorus loading, to the surface water, to less than 10 pounds in order to reach the pollutant reduction target. There are 8 animal lots in this category.

Category II criteria designates animal lots which deliver less than 40 pounds and greater than or equal to 10 pounds of phosphorus to the surface waters, annually. These operations will need to reduce their annual phosphorus loading to the surface waters to less than 10 pounds to be eligible for cost-sharing. There are 46 animal lots in this category.

Category III criteria designates animal lots which are annually delivering less than 10 pounds of phosphorus to the surface waters. There are 39 animal lots in this category. Animal lots in this category will not be eligible for cost-share assistance but will remain eligible for technical assistance if requested by the landowner/operator.

Table 4-1. Animal Lot Runoff Eligibility Criteria for Surface Water

Management Category	Phosphorus (lbs.) Delivered per Animal Lot	Number of Animal Lots	Phosphorus Reduced[1] (lbs.)	Percent Reduction
Critical Site	greater than or equal to 50 lbs	32	2820	60
I	greater than or equal to 40 lbs and less than 50 lbs	8	265	6
II	greater than or equal to 10 lbs and less than 40 lbs	46	341[2]	8
III	less than 10 lbs	39	0	0
	TOTALS	125	3426	74%

not pol. ld goal

[1] The values in this column represent the number of pounds of phosphorus which can be reduced to the target level of ten pounds for each animal lot.

[2] Reduction in phosphorus (P205) may be less than represented in the table due to landowners not signing a C/S agreement and/or implementing practices.

Table 4-2. Animal Lots and Eligibility Criteria per Subwatershed

Subwatershed	Total Phos. Load (lbs.)	Critical Site		Category I		Category II		Category III Lots (#)
		Lots (#)	Reduced[1] (lbs.)	Lots (#)	Reduced (lbs)	Lots (#)	Reduced (lbs.)	
Strawberry Creek SC	53	0	0	1	36	0	0	1
Sturgeon Bay SB	89	0	0	0	0	4	19	2
Larson Creek LC	388	2	277	1	35	2	13	1
Keyes Creek KC	448	4	205	1	32	6	42	8
Sugar Creek SR	412	2	125	1	32	8	65	5
Renard Creek RC	882	9	596	0	0	7	54	5
Fabry Creek EC	245	3	205	0	0	0	0	3
Red River RR	1544	9	1132	2	69	11	67	12
Gilson Creek GC	608	3	280	2	61	8	81	2
Totals	4669	32	2820	8	265	46	341	39

[1] "Control" represents the projected reduction to the target level of ten pounds per animal lot in annual phosphorus delivered, from all lots in a subwatershed, to the surface waters.

Animal Lots Impacting Groundwater

To achieve the groundwater quality objectives in the Red River/Sturgeon Bay Priority Watershed Project, the groundwater pollution impact from animal lot site infiltration needs to be reduced or eliminated. All animal lots in the watershed, a total of 192, were rated for groundwater pollution potential. It was determined that 96 animal lots impacted the groundwater resources. Additional animal lots may be contributing nonpoint source pollution to the groundwater. Table 4-3 summarizes the management category eligibility criteria and table 4-4 summarizes the number of animal lots in each management category.

Critical Site designates animal lots with one or more of the following criteria:

- has less than or equal to 24 inches of soil to bedrock or the water table at the site and down slope from the site;
- is located in a mapped closed depression and is within 300 linear feet of a channelized flow path draining into a principal outlet;
- is located in the city of Sturgeon Bay wellhead zone of contribution (ZOC) and is is located within 300 linear feet of a channelized flow path which drains into a rock hole opening.
- is located outside the ZOC and is located within 300 linear feet of a channelized flow path to the ZOC which drains directly into a rock hole opening.

There are 19 animal lots in this category.

Category I designates animal lots with one or more of the following criteria:

- has greater than 24 inches and less than or equal to 36 inches of soil at the lot and/or less than or equal to 24 inches of soil down slope from the site;
- is located in a mapped closed depression with a principal outlet, regardless of the soil depth conditions;
- is located in the city of Sturgeon Bay well head zone of contribution (ZOC);
- is located outside the ZOC but is within 1320 linear feet of the ZOC and has surface water discharge into the ZOC in an area with a high potential for impacting groundwater based on soil depth to bedrock, water table, and/or bedrock features.

There are 74 animal lots in this category.

Category II designates animal lots which are located in a mapped closed depression, which does not have a principal outlet, and has soil conditions of less than or equal to 60 inches at the lot and down slope from the site. There are 3 animal lots in this category.

Category III criteria designates animal lots with one or more of the following criteria:

- greater than 36 inches of soil at the site and greater than 24 inches of soil down slope from the site.
- animal lots located in a mapped closed depression with greater than 60 inches of soil at the site and down slope from the site.

There are 96 animal lots in this category.

Table 4-3. Eligibility Criteria For Animal Lots Impacting Groundwater

Management Category	Animal Lots Soil Depth to Bedrock and/or Water Table		Animal Lots Located in a Mapped Closed Depression	
	Criteria	Animal Lots (#)	Criteria	Animal Lots (#)
Critical Site	any site with soil depth of ≤ 24" @ site and @ DS	19	any lot in a MCD and within 300' of a channelized flow to a PO or any lot in ZOC within 300' of a channelized flow to a RHO or any lot outside of ZOC within 300' of a channelized flow to ZOC into a RHO	Un-known[1]
I	any lot with soil depth of > 24" and ≤ 36" @ site and/or ≤ 24" @ DS	48	any lot in a MCD with a PO regardless of soil depth or any lot in ZOC or any lot outside of ZOC within 1320' of ZOC which drains to ZOC to an area with high potential to impact groundwater	39
II	NO CATEGORY II FOR SOIL DEPTH	0	any lot in a MCD without a PO with soil depth ≤ 60" @ lot and DS	17
III	any lot with soil depth of > 36" @ site and > 24" @ DS	125	any lot in a MCD without a PO with soil depth > 60" @ lot and DS	13

[1] The criteria for this column was set after the inventory was completed. All animal lots will be evaluated for this criteria during the site verification visit.

DS = Down Slope from site
MCD = Mapped Closed Depression
PO = Principal Outlet, see Appendix B for complete definition
RHO = Rock Hole Opening
ZOC = Sturgeon Bay well head zone of contribution

Table 4-4. Animal Lots and Management Categories per Subwatershed

Subwatershed		Critical Sites Lots (#)	Category I Lots (#)	Category II Lots (#)	Category III Lots (#)
Strawberry Creek	SC	0	0	0	2
Sturgeon Bay	SB	0	6	0	2
Larson Creek	LC	1	11	0	1
Keyes Creek	KC	5	15	1	14
Sugar Creek	SR	1	8	0	18
Renard Creek	RC	6	5	0	16
Brussels Depression	BD	1	18	0	0
Fabry Creek	EC	1	2	0	3
Red River	RR	2	8	0	29
Gilson Creek	GC	2	1	2	11
	Totals	19	74	3	96

Manure Storage Criteria for Field Conditions - Surface Water

To achieve the surface water quality objectives for the Red River/Sturgeon Bay Priority Watershed, the practice of winter spreading of animal manure in certain areas of the watershed must be eliminated.

To determine if a farming operation has adequate level of low hazard cropping acres to spread animal manure during the winter months (periods of snow covered, frozen, or saturated conditions) a field rating was completed. See Appendix A for field rating methods. The field rating identified high hazard acres where animal manure should not be spread during the winter months. These acres have the greatest potential to impact the surface water quality. The result of the field ratings determines if the farming operation has an excess of high hazard acres to safely winter spread animal manure. There are 120 farming operations which were determined to have excess of high hazard acres.

If a farming operation has an excess high hazard acreage, as determined through a field rating, that farm is eligible for cost-sharing of a nutrient management plan (NRCS spec. 590). If the nutrient management plan demonstrates that all animal manure produced by the farming operation can not be winter spread without causing a surface water quality impact, that operation is eligible for the cost-sharing of a manure storage facility or other management techniques as approved by the SWCD/LCD. Cost-sharing will be based on the least cost system that will eliminate the surface water quality impact. Options include, but are not limited to: the construction of a short term manure storage facility (capacity of no less than 90 days manure production and in accordance with NRCS Std 313); the construction of a long term manure storage facility (capacity of no less than 210 days manure production and in accordance with

NRCS Std. 313 or 425); a properly sited unconfined manure stack; the reduction in the number of animals; the rental of additional lands; or giving the volume of manure, which can not be spread safely without causing a surface water quality impact to a neighboring farm which can use the additional manure in accordance with a nutrient management plan.

A manure storage facility or the utilization of other management techniques as approved by the SWCD/LCD will be considered a Management Category I if the farm operator receives cost-sharing for the development of a nutrient management plan and that plan determines that all animal manure can not be safely winter spread. Also, if the runoff from manure at the site is adversely impacting surface waters, that site will be considered a management category I and will be eligible for cost-sharing. The local unit of government will make the determination of eligibility. There is no Category II criteria for manure storage for surface water.

Table 4-5 is a summary of the criteria for cost-share eligibility for the implementation of a best management practice. Table 4-6 is a summary of all field ratings completed for the watershed which are eligible for the development of a nutrient management plan (in accordance with NRCS Std. 590).

Table 4-5. Manure Storage Rating for Surface Water

Management Category	Eligibility Criteria	Number of Sites (#)
I	Exceeds NRCS Std. 590 (Excess High Hazard Acres)	120
III	Does Not Exceed NRCS Std. 590 (Adequate Low Hazard Acres)	52

Table 4-6. Nutrient Management Plans In Need Of Development

Subwatershed		Total (#) NMP	Excess High Hazard Acres
Strawberry Creek	SC	5	23
Sturgeon Bay	SB	6	194
Larson Creek	LC	7	345
Keyes Creek	KC	18	481
Sugar Creek	SR	18	480
Renard Creek	RC	18	450
Fabry Creek	EC	5	146
Red River	RR	28	1025
Gilson Creek	GC	15	1363
	Totals	120	4505

Landowners receiving cost-share funds for a manure storage facility or nutrient management are required to adopt a nutrient management plan (in accordance with NRCS Std.590). Additionally, manure removed from cost-shared storage facilities designed to hold greater than 6 months volume of manure production, shall not be spread on frozen, snow covered, or saturated ground (as stated in NR 120).

Manure Storage Criteria for Site Condition - Groundwater

To achieve the groundwater quality objectives in the Red River/Sturgeon Bay Priority Watershed Project, the groundwater pollution potential for manure storage site infiltration and/or runoff must be reduced or eliminated (table 4-7). There are 192 livestock operations in the watershed which are rated for groundwater pollution potential.

Critical Site designates manure storage sites with one or more of the following criteria:

- has less than or equal to 24 inches of soil to bedrock or the water table at the site and down slope from the site;
- is located in a mapped closed depression which is within 300 linear feet of a channelized flow path draining into a principal outlet;
- is located in the city of Sturgeon Bay wellhead zone of contribution (ZOC) and is is located within 300 linear feet of a channelized flow path which drains into a rock hole opening.
- is located outside the ZOC and is located within 300' of a channelized flow path to the ZOC which drain directly into a rock hole opening.

There are 21 manure storage sites in this category.

Category I designates manure storage sites with one or more of the following criteria:

- has greater than 24 inches and less than or equal to 36 inches of soil at the site and/or less than or equal to 24 inches of soil down slope from the site;
- is located in a mapped closed depression with a principal outlet, regardless of the soil depth conditions;
- is located in the city of Sturgeon Bay well head zone of contribution (ZOC);
- is located outside the ZOC but is located within 1320 linear feet of the ZOC and has a surface water discharge into the ZOC in an area with a high potential for impacting groundwater based on soil depth to bedrock, water table, and/or bedrock features.

There are 73 manure storage sites in this category.

Category II designates manure storage sites which are located in a mapped closed depression, which does not have a principal outlet, and has soil conditions of less than or equal to 60 inches at the site and down slope from the site. There are 18 manure storage sites in this category.

Category III criteria designates manure storage sites with one or more of the following criteria:

- greater than 36 inches of soil at the site and greater than 24 inches down slope from the site.

- located in a mapped closed depression with greater than 60 inches of soil at the site and down slope from the site.

There are 94 manure storage sites in this category.

Table 4-7 summarizes the criteria for each management category. Table 4-8 summarizes the number of manure storage sites which are in each management category per subwatershed.

Table 4-7. Eligibility Criteria for Manure Storage Sites Impacting Groundwater

Management Category	Manure Storage Site Soil Depth to Bedrock and/or Water Table		Manure Storage Site Located in a Mapped Closed Depression	
	Criteria	Sites (#)	Criteria	Sites (#)
Critical Site	any site with soil depth of ≤ 24" @ site and @ DS	21	any site in a MCD and within 300' of a channelized flow to a PO, or any site in ZOC within 300' of a channelized flow to a RHO, or any site outside of ZOC within 300' of a channelized flow to ZOC into a RHO	Un-known[1]
I	any site with soil depth of ≤ 36" @ site and/or ≤ 24" @ DS	46	any site in a MCD with a PO regardless of soil depth, or any site in ZOC, or any site outside of ZOC within 1320' of ZOC which drains to ZOC to an area with high potential to impact groundwater	39
II	NO CATEGORY II FOR SOIL DEPTH	0	any site in a MCD without a PO with soil depth ≤ 60" @ site and DS	18
III	any site with soil depth of > 36" @ site and > 24" @ DS	125	any site in a MCD with soil depth > 60" @ site and DS	10

[1] The criteria for this column was set after the inventory was complete. All sites will be evaluated for this criteria during the verification visit.

DS = Down Slope From the site
MCD = Mapped Closed Depression
PO = Principal Outlet
RHO = Rock Hole Opening
ZOC = Sturgeon Bay well head zone of contribution

Table 4-8. Manure Storage Sites and Management Categories per Subwatershed.

Subwatershed	Total Sites (#)	Critical Sites (#)	Category I Sites (#)	Category II Sites (#)	Category III Sites (#)
Strawberry Creek SC	2	0	0	0	2
Sturgeon Bay SB	8	0	6	0	2
Larson Creek LC	13	1	10	1	1
Keyes Creek KC	36	6	14	1	15
Sugar Creek SR	26	1	6	0	19
Renard Creek RC	27	8	4	0	15
Brussels Depression BD	19	1	18	0	0
Fabry Creek EC	6	0	2	0	4
Red River RR	39	2	11	0	26
Gilson Creek GC	16	2	2	2	10
Totals	192	21	73	4	94

Manure Storage Criteria for Field Conditions - Groundwater

The eligibility for the cost-sharing of a manure storage facility is also based on a field rating system. The field rating system, detailed in Appendix A, identifies areas of the watershed which have the potential to impact groundwater quality if animal manure is winter spread. To achieve the groundwater quality objectives, the winter spreading of animal manure in these areas of the watershed must be abated. Table 4-9 summarizes the management category criteria and table 4-10 summarizes the number of animal lots in each management category.

Critical Site criteria designates farms with a field rating for a closed depression with a principal outlet of greater than or equal to 200 and the landowner/operator practices winter spreading of animal manure. Ceasing the winter spreading of animal manure in the closed depression with a principal outlet relieves the landowner of critical site status. There are 43 farms in this category.

Category I criteria designates a farm with one or more of the following:

- an overall field rating of greater than or equal to 430;
- a farm with field rating of greater than or equal to 200 for closed depressions with a principal outlet, regardless of the total field rating;
- a farm with a field(s) in the city of Sturgeon Bay wellhead zone of contribution regardless of the field rating.

There are 117 farms in this category.

There is no management category II criteria.

Category III criteria designates any farm with a field rating of less than 430 and a closed depression rating of less than 200. There are 32 farms in this category.

Table 4-9. Manure Storage Eligibility Based On Field Ratings

Management Category	Criteria
Critical	Any farm with a closed depression with a principal outlet field rating value of ≥ 200 and winter spreads manure
I	Any farm with a overall field rating value of ≥ 430, any farm with a closed depression with a principal outlet field rating of ≥ 200 and does not winter spread manure, or any farm with field(s) in the city of Sturgeon Bay ZOC
III	Any farm with an overall field rating of < 430 and a closed depression field rating of < 200

Table 4-10. Manure Storage Facility Needs Based On Field Ratings per Subwatershed[1]

Subwatershed		Total Sites (#)	Critical Sites (#)	Category I Sites (#)	Category III Sites (#)
Strawberry Creek	SC	2	0	1	1
Sturgeon Bay	SB	8	8	0	0
Larson Creek	LC	13	10	3	0
Keyes Creek	KC	36	8	25	3
Sugar Creek	SR	26	2	19	5
Renard Creek	RC	27	0	21	6
Brussels Depression	BD	19	15	4	0
Fabry Creek	EC	6	0	6	0
Red River	RR	39	0	26	13
Gilson Creek	GC	16	0	12	4
	Totals	192	43	117	32

[1] Six farms had contiguous land which is winter spread from two livestock operations. There was no clear break in the land to rate it as two independent units. Therefore, the operations were assigned identical field rating values.

Cropland Sediment Sources Impacting Surface Water

Upland soil erosion from cropland contributes a majority of the sediment load to the watersheds' streams and receiving waters. Approximately 14,500 tons of sediment are eroding from upland sources. To achieve the surface water quality objectives, a 33 percent reduction in the amount of sediment delivered to the surface waters from eroding cropland fields is targeted. This would reduce the sediment load by approximately 3900 tons. All croplands that are contributing sediment to surface waters at a rate of equal to or greater than 0.35 tons/acre/year will need to be reduced below the target of 0.35 tons/acre/year if the surface water quality objectives for the watershed are to be met.

Two approaches for sediment control from upland sources will be eligible for cost-sharing:

1. The first approach is a "field by field" method. Sediment delivery must be controlled on all fields which have sediment rates at or above the established criteria for management categories critical sites and I.

2. The second approach is a "whole farm" method. This method may be utilized if the first method does not meet the desired sediment reduction goal(s) or the installation of the needed BMPs in the "field by field" method is determined to be impracticable, and with the approval of the appropriate unit of government's County Conservationist. If this method is utilized, then the "whole farm" average sediment delivery rate must be below the 0.35 tons/acre/year target. Individual fields with excessive sediment delivery rates shall have the sediment delivery rate reduced as practicable under the "field by field" method before the application of the "whole farm" approach, which applies practices to Management category II fields.

Critical Site criteria designates cropland fields which are contributing greater than or equal to 0.6 tons/acre/year of sediment and are eroding above the soil loss tolerance level "T". See Appendix B for definition of soil loss tolerance. Sediment control measures may reduce the level of sediment delivered to the surface waters by approximately 1900 tons. This represents 16% of the total sediment delivered to the surface waters. Approximately 1974 acres of cropland are included in this category.

Management category I criteria designates agricultural fields which are contributing greater than or equal to 0.6 tons/acre/year of sediment and are eroding at or below the soil loss tolerance "T". Sediment control measures may reduce the level of sediment delivered to the surface waters by approximately 1699 tons. This represents 14% of the total sediment delivered to the surface waters. Approximately 4443 acres of cropland are included in this category.

Management category II criteria designates agricultural fields which are contributing greater than or equal to 0.35 tons/acre/year of sediment and less than 0.6 tons/acre/year of sediment to the watersheds' surface waters. Sediment control measures may reduce the level of sediment delivered to the surface waters by approximately 341 tons. This represents 3% of the total sediment delivered to the surface waters. Approximately 6210 acres of cropland are included in this category. See table 4-11.

Table 4-11. Cropland Sediment Erosion Criteria for Surface Water

Management Category Control	Eligibility Criteria Sediment Delivery (tons/acre/year)	Sediment Delivered (tons/acre/year)	Percent Control
Critical Site	Soil Loss > T and S.D. ≥ 0.6 Tons/Acre/Year	2590	13
I	S.D. ≥ 0.6 Tons/Acre/Year	3237	12
II	S.D. ≥ 0.35 Tons/Acre/Year and < 0.6 Tons/Acre/Year	341	2
III	S.D. < 0.35 Tons/Acre/Year	5651	0

T = Soil loss tolerance
SD = Sediment delivery
Source: Door Co. SWCD, Kewaunee Co. and Brown Co. LCDs.

Table 4-12. Cropland In Need Of Sediment Control Which Impacts Surface Water per Subwatershed

Subwatershed		Total Sediment Delivered (tons/yr)	Critical Sites			Management Category I		
			Acres	Control[1] (tons/yr)	Control[2] (%)	Acres	Control[1] (tons/yr)	Control[2] (%)
Strawberry Creek	SC	218	0	0	0	0	0	0
Sturgeon Bay	SB	76	11	22	29	0	0	0
Larson Creek	LC	739	191	239	32	69	47	3
Keyes Creek	KC	1577	140	166	11	603	216	14
Sugar Creek	SR	3312	269	294	9	2116	756	11
Renard Creek	RC	1581	183	171	11	721	253	16
Fabry Creek	EC	798	45	38	5	363	152	19
Red River	RR	3236	1135	970	30	571	275	8
Gilson Creek	GC	465	0	0	0	0	0	0
	Totals	12,002	1974	1900	16	4443	1699	14

Table 4-12 Cont.
Cropland In Need Of Sediment Control Which Impacts Surface Water per Subwatershed

Subwatershed		Management Category II			Management Category III	Estimated
		Acres	Control[3] (tons/yr)	Control[2] (%)	Acres	Control[4] (%)
Strawberry Creek	SC	90	2	1	226	1
Sturgeon Bay	SB	42	1	1	219	6
Larson Creek	LC	403	20	3	1321	23
Keyes Creek	KC	1068	6	0	3248	20
Sugar Creek	SR	1540	132	4	2721	30
Renard Creek	RC	1312	85	5	1929	32
Fabry Creek	EC	391	27	3	815	27
Red River	RR	1361	67	2	5053	38
Gilson Creek[5]	GC	3	1	0	3423	0
	Totals	6210	341	3	18,995	33

[1] Control means the reduction of sediment delivered after applicable BMPs are installed.
[2] Percent control represents the portion of the overall sediment delivery control for the management category.
[3] Control in management category II is assumed to be one half the possible control since management category II is strictly voluntary.
[4] The estimated control column represents a the overall reduction in sediment delivered on a percent basis.
[5] Gilson Creek Subwatershed inventory data does not include Brown County. Data will be available in 1996.

Cropland Sediment Sources Impacting Groundwater

If the groundwater quality objectives of the Red River/Sturgeon Bay Priority Watershed Project are to be met, sediment delivery in closed depressions to principal outlets must be reduced. Upland soil erosion from cropland fields, which are located in closed depressions, contributes a significant amount of sediment to the groundwater. A goal of the watershed project is to bring all cropland fields located in closed depressions, which are contributing sediment to principal outlets, down to the lowest level of sediment delivery possible.

Critical Site criteria designates all cropland fields in a closed depression with a principal outlet which have a sediment delivery rate of greater than or equal to 0.60 tons/acre/year and a soil loss value of greater than the soil loss tolerance (T). Sediment control measures may reduce the amount of sediment delivered to the groundwater by approximately 135 tons. This represents 9% of the total sediment delivered to the groundwater. Approximately 163 acres are included in this category.

Category I site criteria designates all cropland fields in a closed depression with a principal outlet which have a sediment delivery rate of greater than or equal to 0.60 tons/acre/year and a soil loss value of less than to the soil loss tolerance (T). Sediment control measures may reduce the amount of sediment delivered to the groundwater by approximately 263 tons. This represents 17% of the total sediment delivered to the groundwater. Approximately 603 acres

are included in this category.

Category II site criteria designates all cropland fields in a closed depression with a principal outlet which have a sediment delivery rate of less than 0.60 tons/acre/year regardless of the soil loss tolerance (T). Sediment control measures may reduce the amount of sediment delivered to the groundwater by approximately 174 tons. This represents 11% of the total sediment delivered to the groundwater. Approximately 1910 acres are included in this category.

There are no management category III fields in closed depressions with principal outlets.

Table 4-13 summarizes all management category criteria and table 4-14 summarizes cropland field acreage with sediment delivery meeting management category criteria per subwatershed.

Table 4-13. Cropland Sediment Delivery Eligibility Criteria for Groundwater

Management Category	Eligibility Criteria For Sediment Delivery (tons/acre/year)	Sediment Delivered (tons/year)	Percent Control[1]
Critical Site	Soil Loss > T and S.D. ≥ 0.6 Tons/Acre/Year	193	12
I	S.D. ≥ 0.6 Tons/Acre/Year	490	15
II	S.D. < 0.6 Tons/Acre/Year	890	4
III	No Sites	0	0

[1] Control represents the overall reduction in sediment delivery if best management practices are installed.
T = soil loss tolerance
S.D. = sediment delivery
Source: Door Co. SWCD, Kewaunee Co and Brown Co. LCD.

Table 4-14. Croplands Targeted for Sediment Control Which Impacts Groundwater per Subwatershed.

Subwatershed		Total Sediment Delivered (tons/yr)	Critical Sites			Management Category I		
			Acres	Control[1] (tons/yr)	Control[2] (%)	Acres	Control[1] (tons/yr)	Control[2] (%)
Sturgeon Bay	SB	4	0	0	0	0	0	0
Larson Creek	LC	428	0	0	0	24	9	2
Keyes Creek	KC	447	95	95	30	83	51	16
Brussels Depression	BD	678	68	39	8	495	203	40
	Totals	1557	163	135	8	603	263	15

Table 4-14 Cont.
Croplands Targeted for Sediment Control Which Impacts Groundwater per Subwatershed.

Subwatershed		Management Category II			Estimated Control[4] (%)
		Acres	Control[3] (tons/yr)	Control[2] (%)	
Sturgeon Bay	SB	35	2	0	50
Larson Creek	LC	76	26	2	8
Keyes Creek	KC	316	22	1	37
Brussels Depression	BD	1432	124	8	54
	Totals	1859	174	11	38

[1] Control means the reduction of sediment delivered after applicable BMPs are installed.
[2] Percent control represents the portion of the overall sediment delivery control for the management category.
[3] Control in management category II is assumed to be one half the possible control since management category II is strictly voluntary.
[4] The estimated control column represents the overall reduction in sediment delivered on a percent basis.

Solution Feature Stabilization

If the groundwater quality objectives for the Red River/Sturgeon Bay Priority Watershed are to be met, the areas which surround solution features should be stabilized with a permanent vegetative cover. Permanent vegetative covers, surrounding a solution feature, remove pollutants suspended in runoff water by reducing the flow rate. Slow flow rates allow heavier particles to settle out of the runoff water and allow finer particles to settle out by attaching to the vegetation and soil particles.

As part of the inventory process, karst solution features, which are expressed on the land surface, were identified. A total of 301 large scale solution features were identified during the inventory process. Karst solution features include sinkholes, rock hole openings and associated channel features. See Appendix B for definitions.

Category I includes solution features which meets one or more of the following criteria:

- a rock hole opening of 1 square foot or greater in size.
- a rock hole opening located in a closed depression of 100 square feet or greater in size.
- an associated channel with a cross-sectional area of 3 square feet or greater in size.

Category II includes solution features which meets one or more of the following criteria:

- a rock hole opening of less than 1 square foot in size.

- a rock hole opening located in a closed depression which is less than 100 square feet in size;

- an associated channel with a cross-sectional area of less than 3 square feet in size.

Gully Erosion and Sediment Delivery

Soil erosion which forms gullies was not identified as a significant problem in this watershed, but is recognized to be a significant problem in specific locations within a subwatershed. A field inventory of soil erosion in the form of gullies was not completed during the inventory process. During the implementation phase of the watershed project, SWCD/LCD staff will evaluate fields to determine if gullies delivering sediment to the surface and/or groundwater are present. The gullies identified as a sediment source will be considered a management category I for cost-sharing of best management practices. Sediment sources for management category I will be reduced by a minimum of 50%. All other gully erosion will be considered management category II.

Nutrient and Pest Management (NPM)

Landowners in the Red River/Sturgeon Bay Priority Watershed will be encouraged to participate in a NPM program to change farm management related to the over application of nutrients and pesticides. Participating landowners will receive cost-sharing for up to three years to implement a nutrient management plan. Farms which implement a nutrient management plan will also be eligible to participate in pest management.

Livestock operations listed in tables 4-2, 4-4, 4-6, 4-8, and 4-10, which are classified as a management category critical site, I or II, are required to implement a nutrient management plan if cost-sharing for the installation of a best management practice is received. Operations which are identified in the aforementioned tables, which are classified as a management category II, will be encouraged to participate in a nutrient management program.

Nutrient and pesticide management program participation will not be restricted to livestock operations which implement animal waste management practices. Cost-sharing will be provided to any agricultural producer for the development of a nutrient/pesticide management plan(s).

Landowners with a pre-existing manure storage facility shall be considered a management category I for nutrient management.

Nutrient and/or Pesticide plans may be prepared by private crop consultants, landowners/ land operators, or the SWCD/LCD but must meet NRCS Standard 590 and 595. Any plan developed by a private crop consultant or a landowner must be submitted to and approved by the Door County SWCD, Kewaunee County LCD and/or Brown County LCD. Records shall be kept showing progress towards reducing the use of fertilizer and pesticides.

Other practices that are singularly eligible for cost-sharing are soil and manure testing, crop scouting, and spill control basins for pesticide handling. Cost-sharing rate of 50% is given for

all nutrient and pesticide management practices except 70% on spill control basins.

Streambank Protection

Streambank Erosion

Streambank erosion contributes a portion of the overall sediment delivered to streams in the watershed. There are sites which contribute a significant sediment load to streams in the watershed. Most sites which have significant erosion are located near the mouth of the stream where waters have the greatest velocity. Since many streambank erosion sites are a result of alterations to the upstream watershed and not activities at the erosion site exclusively, the management category critical sites and I will be limited to those which are the direct result of the landowners management and/or due to livestock access. Other controls for sediment delivery from streambank erosion may be required as part of a cost-share agreement. Table 4-15 summarizes the management category criteria and table 4-16 summarizes the number of sites in each category.

Management category critical site criteria designates any site with a stream segment, or multiple stream segments, which have an accumulated sediment delivery rate of greater than or equal to 9 tons/year and results from the landowner management and/or are due to livestock access to the streambanks.

Management category I criteria designates any site with a stream segment, or multiple stream segments, which have an accumulated sediment delivery rate of greater than or equal to 3 tons/year and less than 9 tons/year and results from the landowner management and/or are due to livestock access to the streambanks.

Management category II criteria designates any site with a stream segment, or multiple stream segments, which have an accumulated sediment delivery rate of less than 3 tons/year and results from the landowner management and/or are due to livestock access to the streambanks or any other segment, or multiple stream segments with an accumulated sediment delivery rate of greater than or equal to 3 tons/year without livestock access.

Management category III criteria designates any site(s) with a stream segment, or multiple stream segments, which delivers less than 3 tons/year without livestock access.

Streambank Habitat

Unlimited livestock access to streams is a significant source of streambank erosion and also a source of wildlife habitat degradation. This is not a wide spread practice in the watershed, although there are sites which need to be addressed.

Management category I criteria designates any streambank(s) which are trampled by livestock.

Management category II criteria designates any streambank(s) which have livestock access.

See table 4-15 for streambank eligibility criteria and table 4-16 for additional information on streambank eligibility.

Table 4-15. Streambank Eligibility Criteria for the Red River/Sturgeon Bay Watershed

Management Category	Criteria
Streambank Erosion	
Critical	any stream segment or multiple stream segments with an accumulated sediment delivery rate of ≥ 9 tons/year and is a result of landowner/operator management or livestock access.
I	any stream segment or multiple stream segments with an accumulated sediment delivery rate of ≥ 3 tons/year and < 9 ton/year and is a result of landowner/operator management or livestock access.
II	any stream segment or multiple stream segments with an accumulated sediment delivery rate of < 3 tons/year and is a result of landowner/operator management or livestock access or any stream segment or multiple stream segments with an accumulated sediment delivery rate of ≥ 3 tons/year without livestock access.
III	any stream segment or multiple stream segments with an accumulated sediment delivery rate of < 3 tons/year and no livestock access.
Streambank Habitat	
I	any streambank with trampled banks from livestock.
II	any streambank with livestock access.

Sources: Door County SWCD, Kewaunee and Brown County LCDs

Table 4-16. Streambank Erosion Eligibility for the Red River/Sturgeon Bay Watershed

Subwatershed	Number (#) of Sites and Length						# of Sites with Cattle Access & Length	
	Critical Site	Feet	Category I	Feet	Category II	Feet	Cattle Access	Feet
Strawberry Creek SC	0	0	0	0	0	0	0	0
Sturgeon Bay SB	0	0	0	0	0	0	0	0
Larson Creek LC	1	2590	0	0	1	1385	1	1200
Keyes Creek KC	0	0	0	0	4	3273	2	1925
Sugar Creek SR	1	3146	1	412	8	11716	3	2637
Renard Creek RC	2	4698	1	2658	9	8607	2	10799
Fabry Creek EC	0	0	0	0	3	5296	0	0
Red River RR	0	0	1	1000	7	8298	0	0
Gilson Creek GC	1	1400	0	0	0	0	1	80
Total	5	11834	3	4070	32	38575	9	17362

Well Abandonment

Wells can serve as a conduit for transporting contaminated surface water directly to the groundwater. A well which is improperly constructed, damaged, no longer in use, or is a groundwater concern should be abandoned properly. To accomplish this task all wells which meet the criteria mentioned will be considered a management category I.

Milking Center Waste Control Systems

To achieve both the surface and groundwater quality objectives of the Red River/Sturgeon Bay Priority Watershed milk house wastes must be controlled.

Management Category I criteria designates sites which have less than or equal to 24 inches of soil to bedrock and/or the water table for groundwater, have a surface outflow into a channel which is routed to the watersheds' surface water, or are outleted in a closed depression with a principal outlet.

Management Category II criteria designates sites which have greater than 24 inches of soil and less than or equal to 36 inches of soil at the site for groundwater.

Wetland Restoration

There will be no Category I for wetland restoration. All inventoried wetlands, 111 sites, will

be Category II for restoration. See Chapter Two, table 2-5 for wetland inventory details.

Wetland restoration is an eligible best management practice for the purpose of controlling nonpoint sources of pollution. Secondary benefits of wetland restoration may be the enhancement of fish and/or wildlife habitat.

Wetland restoration includes: the plugging or breaking up of existing tile drainage systems, the plugging of open channel drainage systems, other methods of restoring the pre-development water levels of an altered wetland, and/or the fencing of wetlands to exclude livestock.

Wetland restoration is an eligible practice when it is applied to any of the following conditions:

1. Cultivated hydric soils with tile or open channel drainage systems.

2. Pastured wetlands or riparian corridors of streams.

3. Prior converted wetlands.

In addition to the criteria described above, landowners must control all "Management Category I" sources (through a cost-share agreement) to be eligible for wetland restoration easements through the watershed project.

Land Easements/Irrevocable Leases

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

- Shoreline Buffers
- Critical Area Stabilization
- Wetland Restoration

Although easements and leases are not considered best management practices, they can help achieve desired levels of nonpoint source pollution control in specific conditions. Easements and leases will be used to support best management practices and enhance landowner cooperation. The benefits of using easements or leases in conjunction with a management practice are:

- Easements or leases established in areas of sinkholes, rock holes, and/or associated channels provide an area where non-point source pollution can be filtered out of surface water runoff before it enters the groundwater.
- Riparian easements/leases which provide fish and wildlife habitat along with pollutant reduction.

- Easements are perpetual and leases may not be for less than 20 years, so the protection is longer term than a management practice by itself;

- An easement or lease may allow for limited public access. However, the primary justification of an easement or lease must be for water quality improvement.

Within the Red River/Sturgeon Bay Priority Watershed, easements or leases shall be considered in the following situations:

1. Easements or leases will be strongly recommended to support critical area stabilization and/or shoreline buffers in areas of rock-hole openings (sinkholes, bedrock openings and associated channels) specifically in areas with one or more of the following conditions:

   - there is a rockhole opening of 1 square foot or greater in size.

   - there is a rockhole opening where the area bounded by the associated depression is 100 square feet or greater in size.

   - there is a rockhole channel where the channel cross-sectional area is 3 square feet or greater in size.

2. Easements or leases will be recommended to support critical area stabilization and/or shoreline buffers in areas of rockholes whenever one or more of the following conditions exists:

   - there is a rockhole opening of less than 1 square foot in size.

   - there is a rockhole opening where the area bounded by the associated depression is less than 100 square feet in size.

   - there is a rockhole channel where the channel cross-sectional area is less than 3 square feet in size.

3. Easements or leases will be strongly recommended to exclude livestock from grazed wetlands or along streambanks within the watershed whenever one or more of the following conditions exist:

   - there is any grazing of wetlands.

   - livestock are within 60 feet of stream(s).

   - streambanks are trampled.

4. When elimination of row cropping and the establishment of permanent vegetative cover will stabilize a critical area or establish a shoreline buffer. Easements or leases are strongly recommended whenever:

- Row cropping is occurring within 60 feet or less of the stream(s)
- Fields up gradient from stream have a sediment delivery rate of greater than 0.35 tons/acres/year

5. To support eligible wetland restorations.

6. When a barnyard or animal feedlot is located in a stream corridor.

In addition to the criteria described above, participating landowners must control all management category critical sites and I sources to be eligible for an easement or lease through the watershed project.

Property Acquisition

As per NR 120.186, nonpoint source program funds may be used to acquire; property or an interest in property to support the construction of urban structural practices or, property which contributes or is likely to contribute nonpoint source pollution and where water quality objectives of the property or interest in the property are deemed cost effective. The use of this management tool will be consistent with the objectives of the project Implementation Plan.

Ordinances

Animal Waste Storage Ordinance

Door, Kewaunee, and Brown Counties all have an animal waste storage ordinance in place. The ordinances apply to all types of manure storage facilities, manure pumps, and/or any alterations to an existing facility.

Non-Metallic Mining Ordinance

All units of government in the Red River/Sturgeon Bay Priority Watershed project are encouraged to adopt a non-metallic mining reclamation ordinance.

Urban Management Alternatives

Developing a management strategy requires an understanding of each alternative and its pollution reduction potential. The alternative actions described below provide a menu of options for the city of Sturgeon Bay to consider when planning to meet project goals. Combined with one another, these alternatives are the building blocks for project success.

Alternative Actions for Storm Water Pollution Control from Established Urban Lands

Established urban land uses produce differing amounts of storm water pollutants and flow. Those urban land uses considered "high-impact" were identified. Two factors were used to identify high-impact urban land uses: the unit per area rate (pounds/acre/year) that each land use produces pollutants, and the portion of the total urban pollutant load (pounds/year) produced by each land use.

Four management scenarios were considered for each subbasin in the city of Sturgeon Bay. These alternatives present a range of management options, including:

1. Do nothing.

2. Street sweeping once per week in spring on all high-impact land uses.

3. Detain runoff from 50 percent of high-impact land uses.

4. Detain runoff from 70 percent of high-impact land uses.

The evaluation of management scenarios assumes that water quality detention ponds trap sediment particles 20 microns or larger, resulting in about a 50 percent control of suspended sediment and about 30 percent control of phosphorus and heavy metals. Existing levels of street sweeping and grassed swale drainage are accounted for in evaluating these alternatives. This evaluation determines the management program for reducing the mass loading of sediment, phosphorus and heavy metals to achieve water quality goals for Sturgeon Bay, its tributaries and Lake Michigan.

Alternative Actions for Sediment Pollution Control from Construction Sites

Two levels of management were evaluated for construction sites:

1. Manage construction sites with best management practices that are 70 percent effective in controlling off-site sedimentation.

2. Manage construction sites with best management practices that are 50 percent effective in controlling off-site sedimentation.

Streambank and Shoreline Erosion Control Alternatives

Alternatives for achieving desired sediment control on eroding streambanks and shorelines have not been evaluated but will be required as part of feasibility studies prepared prior to installing streambank and shoreline erosion control practices. For purposes of this plan, it is assumed that streambank and shoreline stabilization techniques will control all or nearly all of the potentially eroding sediment at sites where practices are installed. In addition, peak stream flows can be reduced by installing storm water detention ponds upstream, thereby reducing streambank erosion below.

Overview of Management Needs

A summary of management needs for established urban area runoff, construction site and streambank and shoreline erosion controls are presented below.

Sediment and Nutrient Control for Storm Water Discharged to Surface Waters and Groundwater

The management alternatives evaluation indicated that structural BMPs for runoff pollution control in established urban areas are needed in several areas of the watershed project area to achieve pollutant reduction goals. In addition, the city of Sturgeon Bay will be expected to conduct the "core" activities of the plan described in Chapter 3, including urban pollution prevention and educational activities.

Storm Water Toxicity Controls Practices in Established Urban Areas

The use of runoff pollution control BMPs in established urban areas to reduce toxics loadings was evaluated to determine if this additional step is warranted and cost-effective. The analysis concluded that management of established urban areas for sole purposes of reducing toxics loading to streams and nearshore lake areas is not needed because of the affect of other prescribed practices, such as those to control storm water sediment.

Sediment Control for Construction Sites

Construction site erosion control throughout the watershed project area is important to achieving sediment reduction goals. It is expected that the rate of construction activity will remain steady in the future. Without at least a 50 percent control of the sediment from these sites, construction site erosion will remain a significant source of sediment in the watershed project area.

Sediment Control For Eroding Streambanks and Shorelines

Streambank and shoreline erosion occurs sporadically along portions of Little Creek in the city of Sturgeon Bay. This erosion is caused primarily by the changing stream hydrology which is characterized as moderately flashy, having increasing volumes and peak flows. This exposes and erodes the banks, destroying the natural conditions needed for healthy aquatic communities. Also, the channel is partially scoured during heavy rainfall events, displacing in-stream cover

such as rocks and logs and flushing away aquatic life as well. In addition, a small amount of weathering of bayshores results in minor sediment impacts to the bay.

Approximately 200 feet of streambank erosion on Little Creek was targeted as medium priority for management. No bayshore erosion sites were identified as priority sites. Sites located in residential areas and woodlands may be impractical to control because access may be a limited in some of these areas. In woodland areas, site preparation for structural controls may require disturbing undeveloped areas. As a result, sites located in these areas may need further evaluation. Options include structural controls such as riprap, shaping and seeding, fiber rolls and other bioengineering techniques. Less intrusive measures such as brush cutting to increase light penetration and vegetation establishment may also be effective. Foregoing control all together may be necessary if the degree of site disturbance needed to install practices offsets the benefits to the stream.

Reducing Excessive Stream Flows and Maintaining Adequate Base Flows

Hydrologic analyses have not been conducted to investigate the effect of management alternatives on reducing and preventing streambank erosion and bed scour, or on maintaining stream base flows. These studies will need to be conducted as part of feasibility studies for runoff pollution control in established urban areas (see Chapter 5 for cost-share eligibility).

Specific Management Recommendations

The recommended runoff pollution control program for the city of Sturgeon Bay consists of several components discussed below. Each component contains specific recommendations and identifies the sub-basin(s) to which they apply.

Construction Site Erosion Control

This part of the plan identifies the actions needed for effective construction erosion control programs throughout the urban watershed project area. These actions are needed to control erosion from newly developing areas, urban redevelopment projects in established urban areas, and installation and/or maintenance of roadways, bridges and buried utilities.

State and Federal Requirements

Wisconsin State Statutes 101.65, 101.651, and 101.653 establish a statewide construction site erosion control ordinance. Currently, inspection and enforcement measures for erosion control on construction sites for one and two family dwellings will be administered by the Wisconsin Department of Industry, Labor, and Human Relations (DILHR). Other provisions to be included on a statewide erosion control ordinance are being developed under a DNR - DILHR Memorandum of Understanding (MOU). One of the major provisions that is being discussed in the MOU is agency responsibility for residential, commercial, and industrial developments

with ground disturbances of 5 acres or greater as required by U.S. Environmental Protection Agency (EPA) storm water regulations.

Currently, DILHR has been authorized to enforce erosion control measures for one and two family dwellings in areas that have adopted the Uniform Dwelling Code. At this time, areas with populations less than 2,500 are not mandated to regulate construction site erosion for one and two family dwellings.

Construction erosion control is accomplished most effectively through a local erosion control ordinance, locally administered building codes, practice standards and application guidelines, an effective administrative program and effective enforcement. Training programs are needed for staff administering ordinances and developers who are responsible for installing and maintaining the erosion control practices.

General Requirements

Ordinances must meet the applicability and content requirements of NR 120.16 dealing with erosion control. The "Model Construction Site Erosion Control Ordinance," developed cooperatively by the DNR and the League of Wisconsin Municipalities (DNR, 1987), and suggested changes to the model ordinance (set forth by Mr. James H. Schneider, League Legal Counsel, in the March 1989 issue of "The Municipality") will be used as guides to determine adequacy of ordinances. Erosion control practice standards and applicability criteria should be consistent with those set forth in the Wisconsin Construction Site Best Management Practice Handbook (DNR, 1989). Education and training activities needed to control construction site erosion are described in Chapter 6.

Specific Needs of The City of Sturgeon Bay and Developers

The following is a list of specific needs that units of governments and developers should address in maintaining an effective construction site erosion control program.

- The city needs to review (and modify where needed) their existing ordinance to assure effective penalties for non-compliance and responses to concerns of citizens, inspection staff and developers.

- The city needs to identify and fill staffing and training needs for effective ordinance administration and enforcement.

- The city needs to evaluate their permit fee schedule to investigate ways to raise revenue to support effective enforcement activities.

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

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

A construction site erosion control implementation program is described in Chapter 5 under the Core Program Roles and Responsibilities section. An erosion control information and education strategy is described in Chapter 6.

Streambank and Shoreline Erosion Control

Management criteria developed for eroding streambanks are based primarily on the rate at which sediment is being released into streams by the cutting action of stream flows. Secondary considerations include stream channel obstructions and riparian habitat degradation. Sites eroding at rates greater than 3 tons per year are eligible for cost-sharing. Only one site on Little Creek about 500 feet above the mouth at Sturgeon Bay was identified as eligible for state cost-sharing.

If removal or deterioration of concrete channels, dams and other in-stream structures occurs, it can be anticipated that newly exposed streambank and shorelines may become significant sediment sources. When this occurs, the DNR and the city's representative will jointly evaluate the severity of the source and assign it a management recommendation. Eligibility of these sources for technical and financial assistance will be in accordance with the assigned management recommendation.

Storm Water Pollution Control in Established Urban Areas

The runoff pollution control program for established urban areas is based on the pollution reduction goals for sediment, nutrients and toxic constituents. The following is the rationale and description of the activities needed to meet those goals.

General Requirements

The long-term management goal for all sub-basins is to achieve a high level of control of pollutants for established high-impact land uses. This requires the equivalent of providing wet detention (or a corresponding level of infiltration based on an equivalent amount of pollutant removal) for 70% of all high-impact land use areas (see table 4-17). Wet detention and infiltration practices should be located where land availability and soil conditions are suitable for providing a high level of control and where groundwater quality would not be threatened.

Feasibility studies will be needed to select the site specific infiltration and wet detention practices called for in this plan. The cost and complexity of studies will vary, depending on the availability of land for locating practices and the compatibility of the existing storm drainage networks with land available for BMPs. Assistance available to communities under the priority watershed project to develop nonpoint source controls in established urban areas is presented in Chapter 5.

The city of Sturgeon Bay has about 4,500 acres of established urban lands in the watershed project area. Approximately 916 acres are in land uses considered high impact, i.e., those needing water quality management in order to achieve project goals. To meet the pollutant reduction goals of this plan, the equivalent of 5 acres of water quality detention ponds are needed to serve existing and future commercial, industrial, highway and high density residential uses, consuming approximately 10 acres of land. These practices, along with previously described streambank stabilization measures and other core and segmented activities described in Chapter 3, are the plan recommendations for the city of Sturgeon Bay.

Table 4-17. Management Alternatives and Pollution Reduction Potentials

Management Alternative	Estimated Percent Reduction		
	Sediment	Phosphorus	Lead
Wet Detention for 70% of High-impact Land Use Areas	35	20	25
Wet Detention for 50% of High-impact Land Use Areas	25	15	20
Street Cleaning Once per Week in Spring on All High-Impact Land Use Areas	20	10	15

Source: DNR

Table 4-18. High-impact Land Uses and Estimated Pond Acres Needed.

Subbasin	High-impact Land Uses	High-impact Land Use Acres	Estimated Detention Pond Acres[1]
Little Creek	Commercial	155	0.7
Big Creek	Highway	65	0.5
Samuelson Creek	Future Industrial	49	0.3
Bradley Lake	None	0	0.0
Direct Drainage East	Commercial	80	0.3
	Industrial	105	0.6
	High Density Residential	94	0.2
Direct Drainage West	Commercial	137	0.6
	Industrial	195	1.1
	Highway	79	0.6
TOTAL	-	959	4.9

[1] Storm water detention ponds or equivalent infiltration practices to control 50% (20 micron control) of suspended solids from high-impact land uses. Land requirements generally twice the size of pond.

Source: DNR

Best Management Practices

Four general classes of management practices are used to reduce the adverse impacts of runoff from urban areas. These include: source reduction practices, water quality detention practices, infiltration practices, and streambank and shoreline erosion control practices.

Source Reduction Practices: These practices are meant to reduce the generation of urban pollutants as close to the source as possible. At a minimum, pollutants are controlled prior to being washed from urban surfaces by rainfall and snowmelt.

Source controls are generally non-structural, relying instead on changes in lifestyle by urban residents. Reducing the amount of automobile traffic is an example of a source control, as automobiles are the source of many urban pollutants. Current policies requiring removal of lead from gasoline and asbestos from automobile brake linings are also examples of source controls. Other source controls that should be used as part of the Red River Sturgeon Bay Priority Watershed Project include, but are not limited to:

- Reduce the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff.
- Remove pet wastes immediately from lawns, sidewalks, and streets to reduce bacterial contamination of urban runoff.
- Control the timing and reduce the amount and type of fertilizer and pesticide applications in urban areas (e.g. use no-phosphorus fertilizers).
- Dispose of automobile waste fluids such as radiator water and engine oil appropriately, keeping them out of the storm drainage system.
- Remove street dirt, leaves and debris from catch basins, streets and parking lot surfaces through municipal street maintenance and leaf collection programs.
- Control land use through zoning, which, in part, considers on-site suitability for storm water management practices to meet water quality, habitat, and flood prevention objectives.
- Control construction site erosion.
- Minimize use of street de-icing compounds.
- Reduce the amount of motorized traffic.

- Reduce the areal extent of parking lots.

- Encourage urban developments to take place on lands within sewer and water service area boundaries.

Source controls that prevent the discharge of pollutants (example: substitution of non-phosphorus lawn fertilizers for use in watersheds with eutrophic lakes) are the most effective. Citizen action that leads to this type of control is an important component of any strategy to reduce nonpoint pollution.

Source controls that rely on better pollution prevention practices, such as pet waste control programs, oil recycling, and responsible use of pesticide products can also be initiated locally. These types of controls are inexpensive and important for any program to reduce urban nonpoint pollution. Information and education efforts presented in Chapter 6 are critical in supporting these "grass roots" approaches to solving urban water quality problems.

Storm Water Detention Practices: Wet detention ponds effectively control particulate pollutants and can be designed to control peak flow discharges as well. Consequently, ponds can be employed to serve many needs, including removal of pollutants, control of flooding and/or storm water flows that may be causing streambank erosion and streambed scour. These ponds have limited effectiveness in controlling pollutants dissolved in storm water and cannot effectively reduce the total storm water volume or enhance stream base flows. Wet ponds can be situated near a small source area such as a parking lot, but they are more commonly used to control runoff from larger areas with a combination of land uses.

Infiltration Practices: Reducing pollutant transport to surface waters involves reducing the amount of urban storm water reaching streams and groundwater primarily from impervious surfaces. This can be accomplished by increasing the infiltration of storm water into the soil and ground layers. Storm water infiltration on a suitable site can effectively reduce nonpoint pollution. In addition, infiltration can help stabilize the hydrology of small urban streams by replenishing groundwater, much of which is ultimately discharged to surface water. Infiltration practices can be used with wet detention facilities to augment pollutant removal effectiveness or reduce pond size.

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

Unfortunately, few sites in the watershed project area are appropriate for infiltration practices. A minimum separation distance of three feet between the bottom of the infiltration device and the groundwater or bedrock is generally required. Heavy or poorly drained soils limit the effectiveness or practical use of infiltration devices. Slopes may limit the use of grassed swales in residential areas. Runoff from residential rooftops and driveways, rooftops in institutional,

commercial, and non-manufacturing industrial areas can generally be infiltrated with little risk of groundwater contamination.

Runoff from parking lots in institutional areas, commercial areas and separate employee or visitor parking lots in non-manufacturing industrial areas can be routed through infiltration devices but require some type of pretreatment. Infiltration devices in these areas should be monitored to assure that groundwater contamination is not occurring. Highly contaminated runoff, such as that from commercial and industrial storage and loading areas should not be routed through infiltration practices.

Streambank and Shoreline Erosion Control Practices: Generally, these practices include seeding and shaping for areas with minor erosion problems. Rapidly eroding sites, extensive areas of erosion, or areas with steep or high streambanks may require more stable materials. These include bioengineering (use of fiber materials and vegetation), rock riprap, gabions, or other structural practices with the ability to withstand higher stream flows.

Easements: See pages 4-24 through 4-26 for a description of easements and eligibility criteria

Wetland Restoration: Wetland restoration is an eligible best management practice for the purpose of controlling nonpoint source pollution. Secondary benefits of wetland restoration include the enhancement of recreation, wildlife, and fish habitat. Wetland restoration includes the design of wetland basins, the modification of existing drainage systems,or other methods of restoring the pre-development conditions of an altered wetland.

Performance Standards and Design Criteria for Structural Practices in Established Urban Areas

The guidelines in this section are presented to facilitate the design, review, and approval phases required before controls can be installed and cost-shared through the nonpoint source program. The design standards contained in this section are preliminary, and may need to be supplemented by engineering references and design manuals. Also, the DNR Nonpoint Source and Land Management staff should be contacted prior to the start of practice design activities, in accordance with NR 120.

To meet water resources objectives for waters of Sturgeon Bay, its principal tributary streams, and nearshore lake areas, the combined effect of all practices must achieve at least a 25 percent reduction of pollutant loads from established urban areas and reduce to the maximum extent possible pollutant loads from new development and redevelopment. In addition, existing urban storm water flows must be reduced sufficiently in all parts of the project area to help any stream restoration efforts. Conformance of individual practices to the following guidelines will assure that the total level of control is adequate, provided the recommended plan is fully implemented.

Standards: The following preliminary standards should be used to guide the design of individual practices. They will be superseded by standards developed as part of the model ordinance for storm water management, which is being prepared by the DNR.

1. Wet detention ponds in established urban areas should be designed to control at least 50 percent of the incoming suspended sediment load. This will be achieved by trapping the 20 micron or larger particle size. This will provide a moderate level of control of heavy metal loads from lands tributary to the pond. Where retrofitted, ponds should be located to control runoff coming primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses.

2. Wet detention ponds in existing urban areas should contribute to reducing stream velocities and minimize erosion and streambed scour.

3. Wet detention ponds in planned urban areas should prevent increases in peak flows and duration of peak flows for the 2-year, 24-hour storm.

4. Infiltration devices in existing and planned urban areas should infiltrate all runoff from the one-inch storm where soils are suitable for infiltration. Infiltration basins and grassed swales are most effective, since they control runoff from all impervious surfaces (roofs, streets, parking lots) in the contributing area. Where retrofitted, these devices should be located to control runoff coming primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses. In locating practices, infiltration rates should be carefully considered as they are a prime determinant of the pollution control effectiveness.

5. Infiltration devices in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

6. Infiltration devices in planned urban areas should prevent increases in peak flows and durations of peak flows for the 2-year, 24-hour storm at pre-development levels.

Design Criteria: NR 120.14(22) requires that the Department of Natural Resources participates in the practice design process, and approve detailed practice designs. Selected preliminary design criteria for wet detention ponds and infiltration devices are presented in table 4-19.

Pretreatment and groundwater monitoring in the practice design for infiltration devices is generally required. Providing pretreatment for these devices will greatly reduce required maintenance to reduce clogging and restore infiltration. Pretreatment could be a sediment trap, a wet detention pond, a grass filter strip, or street sweeping. Practices should be equipped with groundwater monitoring wells to assure that groundwater contamination remains within acceptable bounds.

Finally, all detention and infiltration practices should be equipped with signs that clearly identify that the site contains urban storm water pollutants. Such signs should also carry warnings, where appropriate, against using storm water treatment facilities for swimming, consumptive fishing, wading, dumping of wastes, or any other activity that could endanger public health.

Environmental and Public Health Concerns

Public concern has been expressed about the potential economic, environmental and public health impacts of storm water detention ponds. Concern has been expressed about the toxicity of sediments and water in wet detention ponds and the danger posed to humans and wildlife. Concern was also expressed about the disposal of contaminated sediments and the costs which may be incurred in finding and utilizing suitable disposal technology.

Information was collected in 1990 about the water and sediment quality in a wet detention pond serving a mixed residential and commercial area in Madison, Wisconsin. This information is discussed below as it relates to these public concerns. It is important to recognize that sediment and water quality may vary between detention ponds serving the same general land uses, due to differences in the specific mix of tributary land uses and spills or illegal connections to the storm sewer system. Caution should also be used in applying these data to ponds serving more intensive land uses, such as industrial areas.

Detention Pond Water Quality: Samples were collected on each of nine different days between early May and late June. The study evaluated three heavy metals (lead, zinc, copper), bacteria, polycyclic aromatic hydrocarbons (PAHs), pesticides, and phthalate esters.
Metals concentrations measured in the pond were compared to the chronic toxicity standards for warm water fish and aquatic life; bacteria concentrations were compared to the standard for full body contact recreation; insecticide concentrations were compared to acute toxicity criteria for water fleas; PAH concentrations were compared to the human cancer criterion, and phthalate ester concentrations were compared to the human threshold criterion.

The study concluded that PAHs, pesticides, and phthalate ester concentrations in the pond water did not exceed the applicable criteria on any of the dates sampled. Bacteria concentrations were found to significantly exceed the recreational standard on several sampling dates, with the greatest concentrations soon after rainfall events. All heavy metals, however, were found to occasionally exceed the applicable standard. Lead concentrations exceeded the chronic toxicity standard for all samples. Copper and zinc concentrations exceeded the chronic toxicity standard about 25 percent of the time. All metals concentrations were between one and 1.5 times the chronic toxicity standard, but well below the acute toxicity standards.

In addition to these tests, acute toxicity was evaluated through a 24-hour exposure bioassay test using water fleas as the test organisms. All samples tested completely negative, showing 0 percent mortality.

In summary, the water in ponds receiving runoff from commercial and residential areas should not be a concern except for the human health hazard associated with bacterial contamination. Ponds should not be used for any type of contact recreation. Although aquatic life will develop in these ponds, consumptive fishing should be discouraged as an added precaution.

Table 4-19. Selected Preliminary Design Criteria for Wet Detention Basins and Infiltration Devices.

Practice	Design Criteria			
Wet Detention Basins	Size: (% of total drainage area)	Land Use	90% control of suspended solids (% of total drainage area)	50% control of suspended solids (% of total drainage area)
		Freeways	2.8	1.0
		Industrial	2.0	0.8
		Commercial	1.7	0.6
		Institutional	1.7	0.6
		Residential	0.8	0.3
	Pond Depth: ≥ 5 feet of permanent pond			
	Safety Shelf: ≥ 10 feet around pond perimeter			
	Sideslope: ≥ 5:1			
	Shape: ≥ 3:1 length to width ratio			
	Vegetated buffer width: ≥ 25 feet			
	Depth to groundwater: ≥ 3 feet (all soil types)			
Grass Swales	Gradient: ≥ 0.5% and ≤ 5%			
	Sideslopes: ≥ 3:1			
	Depth to groundwater: ≥ 3 feet (all soil types)			
	Velocity: ≤ 6 feet per second			
	Infiltration rates: ≥ 0.5 inch per hour			
	Vegetative cover: dense, water-tolerant, erosion-resistant grasses			
	Other: prevent compaction and clogging before and after construction			
Infiltration Devices	Depth to groundwater: ≥ 3 feet (all soil types)			
	Width: wider than deep			
	Distance to water supply wells: ≥ 100 feet or as needed			
	Infiltration rates: ≥ 0.5 inches per hour			
	Pretreatment: grass filter strip, detention basin, sediment trap, etc.			
	Other: prevent compaction and clogging before and after construction			

Source: DNR

Detention Pond Sediment Quality: Assuming a sediment accumulation rate of one to two inches per year and a pond storage depth of two feet, most wet detention ponds will require periodic dredging about once every 15-20 years. The quality of pond sediments is a concern in part because it will determine options for disposing of contaminated sediments.

The concentrations of eight heavy metals (lead, cadmium, zinc, copper, nickel, arsenic, chromium, and cyanide) were measured in sediment taken from a detention pond serving a mixed residential and commercial area in Madison, Wisconsin. The concentrations were evaluated to determine whether the sediments could be landspread or placed in a conventional land fill, as opposed to requiring disposal in a special hazardous waste landfill at a significantly greater cost.

None of the eight metals tested from the commercial/residential area would require disposal at a hazardous waste landfill under Wisconsin state law. Only one metal, lead, showed any potential of posing a hazardous waste problem. Upon further testing, using the EP Toxicity Test and the TCLP Test, concentrations of this metal were found to pose no hazard.

The options for disposal were either landspreading or burying in a conventional landfill. In order to evaluate the suitability of sediments for landspreading, metals criteria set forth in NR 204 Wis. Adm. Code (Municipal Sludge Management) were used. Concentrations of lead in detention pond sediments are well below the limit of 250 mg/kg (milligrams per kilogram) specified in NR 204. Concentrations of cadmium throughout the pond are also well below the 10 mg/kg threshold specified in NR 204.

CHAPTER FIVE
Local Government's Implementation Program

Introduction

This chapter identifies the means for implementing the rural and urban management actions for nonpoint source pollution control described in the previous chapter. It is divided into two major sections. The first describes the counties' nonpoint source implementation strategy for rural areas. The second section contains the elements of the city of Sturgeon Bay nonpoint source pollution control implementation strategy for the urban and developing portions of the watershed. See Chapter Three for information regarding other pollution sources. The success of this priority watershed project depends on the aggressive implementation of these nonpoint source pollution control strategies.

More specifically this chapter identifies:

- The agencies and units of government responsible for carrying out the identified tasks.
- The best management practices (BMPs) necessary to control pollutants on eligible sites identified in Chapter Four.
- The cost-share budget.
- The cost containment policies.
- The cost-share agreement reimbursement procedures including administrative procedures for carrying out the project.
- Staffing needs including total hours per year and number of staff to be hired.
- Schedules for implementing the project.
- The involvement of other programs.
- The project budget including the expense for cost-sharing; and staffing for technical assistance, administration, and the information and education program.

Project Participants: Roles and Responsibilities

Landowners and Land Operators

Owners and operators of public and private lands are important participants in the priority watershed program. They will adopt BMPs which reduce levels of nonpoint source pollution and protect and enhance the watershed's groundwater resources, the watershed's surface water resources, wildlife habitat and other resources. Landowners and land operators in the watershed who are eligible for cost-share assistance through the priority watershed program include: 1) individuals; 2) Door, Kewaunee, and Brown Counties; 3) the city of Sturgeon Bay; 4) other governmental units described in NR 120.02(18); 5) corporations; and 6) the State of Wisconsin.

Door, Kewaunee, and Brown Counties are the local units of government responsible for implementing this plan in rural areas of the Red River/Sturgeon Bay Priority Watershed.

The Door County Soil and Water Conservation Department (SWCD), Kewaunee County Land Conservation Department (LCD), and Brown County Land Conservation Department (LCD) will act for their respective County Board and will be responsible contractually and financially to the State of Wisconsin for management of the project in their specific counties. The County SWCD or LCD will coordinate the activities of all other agencies involved with the rural portion of the project.

The specific responsibilities for the counties are summarized below:

- Identify a person to represent the county during implementation of the project.
- The critical site notification process will begin, as identified in NR 120, within 6 months of signing the nonpoint source grant agreement. The county's strategy for contacting landowners is included, in this chapter.
- Develop farm conservation plans consistent with the needs of the project.
- 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.
- For lands the counties own or operates, enter into cost-share agreements with the DNR to reduce the identified nonpoint source pollution to the acceptable level, as defined in chapter 4, and fulfill their obligations as a cost-share recipient.
- Design best management practices and verify that they have been properly installed.
- Review and/or prepare nutrient management plans (NRCS Spec 590) and develop a follow-up procedure to verify plan(s) implementation.
- Reimburse cost-share recipients for the eligible costs of installing BMPs at the rates

consistent with administrative rules and those established in this plan.

- Prepare and submit annual work plans for activities necessary to implement the watershed project. The Door County SWCD, Kewaunee County LCD, and Brown County LCD will submit a workload analysis and grant application to the DATCP as required in s. 144.25.

- Prepare and submit the annual resource management report, which is required under NR 120.25(2) to the DNR and the DATCP. The annual resource management report is used to monitor the watershed project implementation by tracking changes in the nonpoint source inventory, and quantifying pollutant load reductions which result from installing BMPs.

- Participate in the annual watershed project review meeting.

- Conduct the information and education activities identified in this plan.

Department of Natural Resources

The role of the DNR is identified in s. 144.24, Stats. and NR 120, Wis. Adm. Code (NR 120). The Department has been statutorily assigned the overall administrative responsibility for the Wisconsin Nonpoint Source Pollution Abatement Program. The Department's role is summarized below.

Project Administration

Project administration includes working with the counties to ensure that work commitments required during the 10 year project implementation phase can be met. The DNR will participate in the annual work planning process with the county.

The Department reviews cost-share agreements signed by the county and the participating landowners for installing BMPs. The DNR provides guidance when questions arise concerning the conformance of proposed activities with the statutes, administrative rules, and the watershed plan.

Financial Support

Financial support for implementation of the priority watershed project is provided to each county 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 the governments own or operate.

Project Evaluation

The DNR has responsibility for priority watershed project monitoring and evaluation activities. These efforts determine if changes in water quality occur as best management practices and other pollution controls are installed or implemented. The water quality evaluation and monitoring strategy for the Red River/Sturgeon Bay Priority Watershed is included in Chapter Eight. The DNR documents the results of monitoring and evaluation activities in interim and final priority watershed project reports.

Technical Assistance

The DNR provides technical assistance to the county on the design and application of best management practices. This assistance is primarily for urban areas.

Other Responsibilities

These include:

- The Lake Michigan Region Nonpoint Source Coordinator will arrange for DNR staff to assist county staff with site reviews to determine the impacts of nonpoint sources on wetland quality. Assistance will need to be requested by the appropriate county SWCD/LCD.

- Assisting county staff to integrate wildlife and fish management concerns into selection and design of BMPs.

- If requested assist county SWCD/LCD staff with the development of easements or irrevocable leases. SWCD/LCD staff will determine individual site's appropriateness and eligibility for cost-sharing of an easement.

Department of Agriculture, Trade and Consumer Protection

The role of the DATCP is identified in s. 144.25, stats., ch. 92 stats., and NR 120. In summary, the DATCP will:

- 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.

- Personnel from DATCP, located at the NRCS Area Technical Center, will provide staff training and engineering assistance for best management practices if requested and if staff time is available.

- If requested, assist the SWCD/LCD staff with the information and education activities or tasks described in this plan.

- Assist county SWCD/LCD staff with the annual workload analysis and grant applications for work conducted under the priority watershed project.

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

- If the need arises, assist county staff with the evaluation of site specific practicality of implementing rural best management practices.

- Provide technical and engineering assistance to counties for agricultural BMPs.

Natural Resource Conservation Service (NRCS)

This agency works through the local SWCD/LCD to provide technical assistance for planning and installing conservation practices. NRCS personnel will work with the county staff to provide assistance with technical work when requested and if NRCS staff time is available. Personnel from NRCS staff located at the NRCS Area Technical Center will provide staff training and engineering assistance for best management practices. Efforts will be made to coordinate the Red River/Sturgeon Bay Priority Watershed Project with the conservation compliance and other conservation provisions of the 1985 and subsequent Federal Farm Bills.

University of Wisconsin Extension (UWEX)

County and Area Extension agents will provide support in conducting a public information and education program aimed at increasing voluntary participation in the project. This will include assistance to carry out the information and education activities identified in this plan.

Farm Service Agency (FSA)

FSA administers federal programs intended for the stabilization of the prices paid producers for agricultural products and administers federal funds for rural soil and water and other resource conservation activities. The Agricultural Conservation Program (ACP) which is administered by CFSA will, to the extent possible, be coordinated with the watershed project. In addition other conservation incentives will be used whenever possible to control nonpoint sources of pollution.

Agricultural Best Management Practices (BMPs)

BMPs Eligible For Cost-Sharing And Their Rates

Best management practices are those practices identified in NR 120 which are determined in this watershed plan to be the most effective controls of the nonpoint sources of pollution. The practices eligible for cost-sharing and the cost-share rates for each BMP are listed in tables 5-1 and 5-2.

The design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use specific standard specifications included in the NRCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14. The Department may approve alternative BMPs and design criteria based on the provisions of NR 120.15. Regarding alternative agricultural BMPs, those implemented on cropland fields to control soil erosion and/or sediment delivery, this approval is developed in consultation with the DATCP.

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

Best Management Practices must be installed within the boundaries of the watershed project area. The exception is any farmer who has cropland within the watershed area and who's farmstead is within 1.5 miles of the watershed boundary.

Table 5-1. State Cost-Share Percent (%) Rates for Best Management Practices[1]

BEST MANAGEMENT PRACTICES	STATE COST-SHARE RATE
Field Diversions and Terraces	70%
Grassed Waterways	70%
Critical Area Stabilization	70% [2 *]
Shoreline Buffers	70% [2 *]
Wetland Restoration	70% [2 *]
Shoreline and Streambank Protection	70% [2 *]
Grade Stabilization Structures	70% [*]
Agricultural Sediment Basins	70%
Barnyard Runoff Management	70%
Animal Lot Abandonment/Relocation	70%
Manure Storage Facilities	70% [3]
Animal Waste Storage System Abandonment	70%
Livestock Fencing	50%
Milking Center Waste Control Systems	70%
Roofs for Barnyard Runoff Management & Manure Storage Facilities	70% [*]
Runoff Collection Basin	70% [5 *]
Cattle Mounds	70%
Intensive Grazing Management	70% [4]
Well Abandonment	70% [5 *]
Total Confinement	70% [5 6]
Nutrient and Pesticide Management	50% [7]

[1] Table 5-2 shows BMPs cost-shared at a flat rate.
[2] Easements or irrevocable leases may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter Four for an explanation of where easements or irrevocable leases may apply.
[3] Maximum cost-share amount is $35,000 for manure storage. The first $20,000 of costs are calculated at 70%, the remainder is calculated at 50%.
[4] Watering systems may not exceed $2,000 of cost-sharing.
[5] See Alternative Best Management Practices presented in this Chapter.
[6] The total allowable cost-share monies will be limited to the estimated cost-share grant for an animal lot runoff control system which would have been installed.
[7] This practice can only be cost-shared for three years. Pesticide spill control basins have a state cost-share rate of 70%.
[*] These practices may be eligible for an increase in state cost-share rates, to 80%, if local matching funds are used and provided the conditions of s.144.25(8)(h) Stats are met.

Table 5-2. Practices Using a Flat Rate for State Cost-Share Funding

BEST MANAGEMENT PRACTICES	FLAT RATE
Contour Farming	$ 9.00/ac [1]
Contour Strip Cropping	$ 13.50/ac [1]
Field Strip Cropping	$ 7.50/ac [1]
Cropland Protection Cover (Green Manure)	$ 25.00/ac [1&5]
High Residue Management	$ 55.50/ac [2&4]
High Residue Management	$ 18.50/ac [3&4]

[1] Wildlife habitat restoration components of this practice are cost-shared at 70%.
[2] $18.50 per acre for 3 years, or $55.50, of reduced tillage on continuous row croplands.
[3] $18.50 per acre for one year only for reduced tillage on crop rotations involving hay.
[4] This system requires the implementation of nutrient management
[5] $25.00 per acre for up to 3 years

Economic Hardship

A landowner or land operator may be eligible for a higher level of cost-sharing of certain BMPs if the landowner/operator has a debt-to-asset ratio of more than 60 percent and can verify this to the appropriate unit of government and the DNR with a signed statement from an accredited financial institution. The rate and maximum amount of cost-sharing under a cost-share agreement may be exceeded only for manure storage facilities and/or barnyard runoff management systems with written approval from the DNR. Under the provisions of economic hardship, the following percentage payment rates and maximum payments apply:

- Manure Storage Facilities - for the first $20,000 of cost - 85%
- Manure Storage Facilities - for the remaining costs - 75%
- Barnyard Runoff Management Systems - 85%

The maximum grant for economic hardship cases for the construction of manure storage facilities and barnyard runoff management systems may not exceed $45,000. Landowners who meet the Economic Hardship definition may want to contact the Wisconsin Housing and Economic Development Authority's Nonpoint Source Pollution Loan Guarantee Program.

BMPs Eligible For Cost-Sharing and Conditions

The following is a description of the BMPs identified in tables 5-1 and 5-2 and the conditions which they may apply. A detailed description of these practices can be found in NR 120.14.

Contour Farming

Contour farming is the farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour. This practice is applied on cropland fields where soil erosion and/or sediment delivery are above the acceptable level as described in chapter 4 of this document.

Contour and Field Stripcropping

Contour or Field Stripcropping is the growing of crops in a systematic arrangement of strips or bands, usually on the contour, in alternate strips of close grown crops, such as grasses or legumes, and row crops. All operations from seed bed preparation to harvest are within the confines of the strips. This practice is applied on cropland fields where soil erosion and/or sediment delivery are above the acceptable level as described in chapter 4 of this document.

High Residue Management

A high residue management system leaves substantial amounts of crop residue on the soil surface after crops are planted. The minimum amount of ground cover after planting shall be at least 30%. It is utilized in two situations; one for continuous (at least 3 consecutive years) row crops, the other for short crop rotations (no more than 2 years corn and small grains and hay) or for the establishment of forages and small grains. This practice is applied on cropland fields where soil erosion and/or sediment delivery are above the acceptable level as described in chapter 4 of this document. Also, the use of this BMP will require the cost-share recipient to implement a nutrient management plan.

Critical Area Stabilization

Critical area stabilization includes the planting of suitable vegetation (trees, shrubs, and/or sod) and other treatment deemed necessary to stabilize a specific location and will be appropriate for controlling and/or stabilizing lands which are producing non-point sources of pollutants and lands which are draining to the surface waters and/or groundwater.

Grassed Waterways

A grassed waterway is a natural or constructed channel which is shaped, graded, and/or established with suitable cover (permanent sod) to prevent ephemeral gully or gully erosion by runoff waters.

Grade Stabilization Structure

A structure used to reduce the grade in a channel which protects the channel from erosion or prevents the formation or advance of gullies.

Livestock Fencing

The exclusion of livestock from woodlots from livestock grazing, by fencing or other means. This practice will be implemented in areas which are determined to be causing a sediment load and/or soil erosion.

Shoreline and Streambank Protection

Shoreline and streambank protection is the stabilization and protection of stream or lake banks from soil erosion and livestock. This practice includes streambank riprap, streambank shaping and seeding, stream crossings, livestock watering, fencing and/or fish habitat structures. This practice may also include plans and practices to manage or exclude livestock from the stream corridor.

Terraces

Terraces are a system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent excessive soil erosion and reduce the level of sediment delivery.

Field Diversions

A field diversion is used to divert water from areas where it is in excess or is doing erosion damage to a location where it can be discharged safely.

Barnyard Runoff Management - Surface Water

A barnyard runoff management system eliminates or reduces the volume of surface runoff water from contacting manure on the barnyard. This system will also reduce the volume of pollutants by settling manure solids out of the runoff water or filtering runoff waters which have contacted manure. The effectiveness of structural measures such as diversions and/or rain gutters, which redirects surface runoff away from the animal lot, will be utilized first. If these measures do not reduce the annual phosphorus load below the target level of 10 pounds, additional structural measures will be utilized. Additional measures will include filter strips, settling basins, partial paving of the lot, and/or the use of walls. The structures collect, convey, filter and/or temporarily store runoff water from a barnyard. All conditions and/or structural practices in this section maybe amended due to unforeseen circumstances.

Barnyard Runoff Management - Groundwater

A barnyard runoff management system eliminates or reduces the volume of surface runoff water from contacting manure on a barnyard before it affects groundwater. Also, this system will reduce the volume of pollutants by settling manure solids out of the runoff water or filtering runoff waters which have contacted manure.

A barnyard which meets the management category critical sites or 1 criteria for depth to bedrock

and/or water table or mapped closed depressions with or without a principal outlet will be eligible for cost-sharing for, but not limited to, one or more of the following structural and non-structural practices:

- complete paving of the animal lot area
- roof gutters
- roof(s)
- runoff collection basin
- animal lot abandonment with relocation
- animal lot abandonment without relocation

Sites which meet the management category 2 criteria for mapped closed depressions with or without a principal outlet but are in management category 3 for depth to bedrock and/or water table will be eligible for one or more of the following structural and non-structural practices:

- partial or complete paving of the animal lot area to support a settling basin and walls
- filter strip
- diversions
- roof gutters
- roof, if determined to be the least cost alternative
- runoff collection basin
- animal lot abandonment with relocation

All conditions and/or structural practices mentioned in this section maybe amended due to unforeseen circumstances.

Manure Storage Facility - Surface Water

A manure storage structure is used for the storage of a volume of animal manure which can not be winter spread without impacting the watershed's surface water resources, or is used to eliminate runoff from a site which directly impacts the surface waters. A manure storage facility will not be constructed unless a nutrient management plan (NMP) identifies the need for a facility and the NMP demonstrates that the volume of manure to be stored can be safely applied. A minimum size requirement for a manure storage facility will be as follows: a 90 day storage capacity for short term storage, a minimum storage capacity of 210 days for a long term storage.

The maximum storage capacity that will be cost-shared is 365 days of manure generation.

The following structural components will be eligible for cost-sharing:

- water tight concrete structure
- runoff collection basin
- roof(s)
- an approved liquid system
- animal lot abandonment with relocation
- animal lot abandonment without relocation

All conditions and/or structural practices mentioned in this section maybe amended due to unforeseen circumstances.

Manure Storage Facility - Groundwater

A manure storage structure is used for the storage of a volume of animal manure. Livestock operations where this practice applies are those where a potential for groundwater impact exists when manure is stockpiled and/or winter spread on fields that have a high potential to impact the groundwater. As described in chapter 4 of this document, there are two sets of criteria for manure storage facility cost-sharing eligibility based on groundwater, site conditions and field conditions.

In the case of a manure storage facility system installed for groundwater quality protection, any site which meets the management category critical site or 1 criteria for soil depth to bedrock and/or water table or for closed depressions with or without a principal outlet, will be required to eliminate or retain all runoff water. Structural and non-structural practices eligible for cost-sharing include, but are not limited to:

- water tight concrete systems
- an approved liquid system
- roof gutters
- roof(s)
- runoff collection basin
- animal lot abandonment with relocation

- animal lot abandonment without relocation

For sites meeting the management category 2 criteria for mapped closed depressions with or without a principal outlet but are in management category 3 for depth to bedrock and/or water table will be eligible for the following structural and non-structural practices:

- water tight concrete structure
- runoff collection basin
- roof gutters
- roof(s)
- an approved liquid system
- animal lot abandonment with relocation
- animal lot abandonment without relocation

All conditions and/or structural practices mentioned previously in this section maybe amended due to unforeseen circumstances.

If a farm is eligible for cost-sharing for a manure storage facility based on the groundwater field rating, or the groundwater site conditions, earthen unlined or earthen lined manure storage facilities will not be eligible for the cost-sharing. The ineligibility recognizes that observed bedrock features (such as sinkholes, crevices and crevice surface expressions, fractures and fracture traces, and shallow soils) in an area indicates that additional unobserved and unmapped bedrock features are likely present in the same area posing a greater threat to groundwater.

Protective design and construction measures in addition to the minimums included in NRCS standards 313 (Waste Storage Structures), 358 (Waste Transfer), and 425 (Waste Storage Pond) of the Technical Guide will be required by the LCD/SWCD as a condition of cost-share eligibility to adequately protect the groundwater quality and public health of the project area. Additional required design and construction measures will address all potential structural, geologic, environmental, operation management and mismanagement concerns which may result in a facility or liner failure and discharge or leakage to the groundwater.

Additional protective design and construction measures include, but are not limited to, concrete and synthetic membrane liners exclusively or in combination with other materials. Areas of greatest concern for liner failure include agitation locations, areas to facilitate bedding removal, facility bottoms, partial or complete concrete sides, and other heavy use locations. Each proposed manure storage will be evaluated on a site by site basis by the LCD/SWCD with the emphasis being on the highest level groundwater quality protection. The greater the density, or the more significant, the bedrock features, the greater the emphasis placed on additional protective design and construction measures.

Agricultural Sediment Basins

An agricultural sediment basin is a structure designed to reduce the transport of sediment eroded from high hazard agricultural fields and other pollutants to surface waters and wetlands. In areas where there is a *high hazard for surface runoff water to infiltrate into the groundwater,* sediment basins will need to be clay lined to decrease the pollution potential.

Shoreline Buffers

A shoreline buffer is a permanently vegetated area immediately adjacent to lakes, streams, wetlands, channels, principal outlets, and rock hole openings. They are designed and constructed to manage nonpoint sources or to filter pollutants from nonpoint sources prior to entering the surface or groundwater.

Animal Lot Abandonment Without Relocation

Abandonment of an animal lot without relocation is the permanent abandonment of an animal lot without the relocation of livestock to a different site. Abandonment without relocation will be an applicable practice for sites which meet management category critical site criteria, as described in chapter 4 of this document, from the on set of the implementation phase. Management category 1 sites will be eligible for this practice beginning in the fourth year of the implementation phase. If a site is classified as a management category II and does not include any management category critical sites or I for animal waste management, that site will be ineligible for this practice unless authorization is received from the DNR Nonpoint Source Coordinator.

If a site is abandoned without relocation, all eligible BMPs needed to control nonpoint sources of pollution associated with animal wastes, which are in management category critical sites, I, and II, will be utilized to calculate cost-sharing. The amount of cost-sharing which a cost-share recipient will receive for this practice will be generated from the average cost method, as described in the cost containment section of this chapter. To receive cost-sharing for this BMP a site must be in existence at the time of the animal lot inventory or for a minimum of 3 years.

An integral component of this practice is stabilization of the site after the abandonment has been implemented. This includes, but is not limited to; the proper abandonment of all wells used for the operation, the removal of all animal waste from the site, and the planting of a permanent sod cover of all disturbed areas. Cost-sharing will be provided for the site stabilization.

Other conditions of this practice include the implementation of all best management practices for the reduction of cropland sedimentation and stream bank erosion. Also, the cost-share recipient shall implement a nutrient management plan on all property under his/her control.

The cost-share recipient shall submit a detailed written animal dispersal plan to the appropriate governmental unit prior to any cost-share fund disbursement. The plan must include a list of all the locations which the animals will be moved to. As a condition of the animal lot abandonment without relocation practice, livestock can not be relocated to a site which will significantly contribute to surface and/or groundwater quality degradation.

Animal Lot Abandonment With Relocation

Relocation of an animal lot means the relocation of all livestock from one site to a suitable site to minimize the amount of pollutants from the animal lot to the surface and/or groundwater. This practice will be limited to sites which meet the management criteria for animal waste management for critical sites, management category I or management category II. Also, the site which will receive the relocated livestock must be within 1.5 miles of the watershed boundary, if the new site is outside of the watershed, unless the land which the new site is on is contiguous with the land of the relocated site. The cost-share recipient shall abandon the site permanently. Cost-sharing will be provided for the reconstruction or replacement of the buildings and other structures necessary for the relocation of the animal lot subject to the limitations described in NR 120.14(18). The cost-share limitations for the replacement structures may not exceed the appraised value of the structures to be abandoned. The appraisal of all structures identified above, will be conducted by a Wisconsin certified real estate appraiser and will include only the portions of the structure needed to operate the animal lot to be relocated. The appraisal will include the remaining life expectancy of the structures to be abandoned. If animal lot abandonment with relocation is cost-shared through the watershed project, the relocation site must be approved by the appropriate unit of government.

All needed runoff control best management practices must be installed on the lot which receives the relocated livestock. Cost-sharing will be provided for the installation of all needed best management practices on the animal lot which receives the relocated livestock. Cost-sharing will be limited for best management practices (BMP) implemented at the relocation site which are necessitated by the relocated livestock. The cost-share grant may not exceed the estimated cost-share grant of the BMP which would have been installed at the abandoned site.

An integral component of this practice is stabilization of the site after the abandonment has been implemented. This includes, but is not limited to; the proper abandonment of all wells used for the operation abandoned, the removal of all animal waste from the site, and the planting of a permanent sod cover of all disturbed areas. Cost-sharing will be provided for site stabilization of the abandoned site.

Wetland Restoration

Wetland restoration is the construction or removal of a berm or destruction of tile lines or drainage ditches to re-create conditions which are suitable for wetland vegetation. The cost-sharing of this practice will be limited to all wetlands identified on the wetland inventory, table 2-5.

Nutrient Management

Nutrient management is the management and crediting of all nutrients from the application of manure and commercial fertilizers, and crediting of nutrients from legumes. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface or groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing. Cost-share recipients shall

implement a nutrient management plan if any animal waste handling systems, a high residue management system or animal lot abandonment with or without relocation are implemented.

Pesticide Management Spill Control Basin

Pesticide management is the management of; the handling, disposal, and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning and spill control basins with liquid-tight floors for pesticide handling areas. This system may be implemented by a landowner/operator if they are implementing a nutrient management system.

Animal Waste Storage System Abandonment

Animal waste storage abandonment is the proper abandonment of leaking or improperly sited manure storage systems including, but not limited to; a system with the bottom at or below the groundwater table, a system which fills with groundwater, or a system which leaks into the bedrock. This practice will be cost-shared on sites which are abandoned with or without relocation.

Milking Center Waste Control System

Milking center waste control systems include, not are not limited to, a piece of equipment, practice, or combination of practices installed for the purpose of reducing the quantity and treatment of milk house waste water. This BMP may be applied to a site which discharges into the surface waters, where a current system is failing, or the site has less than 36 inches of soil depth to bedrock or water table at the site or point of discharge.

Roofs for Barnyard Runoff Management and Manure Storage Facilities

A roof and supporting structure may be constructed specifically to prevent rain and snow from contacting manure. This practice will only be applied to sites which will or have installed a barnyard runoff management system and/or a manure storage facility. A roof structure may not be enclosed unless the SWCD/LCD receives written approval from the DNR. For further information pertaining to the definition of "enclosed" refer to NR 120.14(20).

Cattle Mounds

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

Intensive Grazing Management

Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period with a high animal density followed by a period suitable to allow for the recovery of the vegetation. Special provisions for the implementation and cost-sharing

of this practice exist for sites located in areas with a groundwater pollution concern:

- A site specific grazing plan will need to be submitted to the SWCD/LCD. Site specific resource needs will need to be included in this plan. Resource needs may include, but are not limited to, restrictions relating to wet conditions, fencing, scheduling, and/or wildlife habitat.

- Supplemental feeding (ie. sileage, grains, etc.) of livestock older than 5 months will not be allowed in any part of the rotational grazing system.

Easements and Irrevocable Leases

Easements and irrevocable leases not considered a Best Management Practice, easements/leases are useful tools for the support of best management practices and their applicability is defined in Chapter Four, Management Actions.

Alternative Best Management Practices

- Well Abandonment - This best management practice includes the proper abandonment of wells, by a registered professional well driller, pump installer, or plumber, which are considered to be a groundwater quality hazard. The proper abandonment means the procedure identified in NR 812.26, Well and Drillhole Abandonment, WI Administration Code. Cost-sharing will be calculated at 70 % of the eligible cost and may increase the state cost-share level, as per NR 120.18(c), if local matching funds are made available.

- Runoff Collection Basin - This best management practice includes a water tight structure used to store all runoff water which contacts manure from an animal lot or a manure storage facility. The conditions where a no runoff situation is applicable are identified in the best management practice section of this chapter. This practice will not be considered part of a manure storage facility for cost-share purposes. Cost-sharing will be calculated at 70 % of the eligible costs and may increase the state cost-share level,as per NR 120.18(c), if local matching funds are made available.

- Total Confinement of Livestock - This best management practice includes, but is not limited to, the needed alterations of an existing structure or the construction of a new structure for the sole purpose of total confinement of all livestock. Cost-sharing will be limited to 70% of the estimated cost, not to exceed the estimated cost-share grant of the animal lot runoff control system which would have been installed. The estimated costs for the animal lot will be provided by the SWCD/LCD.

Under some circumstances, practices may be recommended that are not included on the BMP list. Administrative Rule NR 120.15 provides for alternative practices where necessary to meet the water resource objectives identified in the watershed plan. The Department shall identify in the nonpoint source grant agreement the design criteria and standards and specifications where

appropriate, cost-share conditions, and cost-share rates for each alternative best management practice.

BMPs Not Cost-Shared

BMPs not cost-shared, but which shall be included on the cost-share agreement if necessary to control the nonpoint sources, are listed in NR 120.17(2). Several examples are included below.

- That portion of a practice to be funded through other programs.
- Practices previously installed and necessary to support cost-shared practices.
- Changes in crop rotations and other activities normally and routinely used in growing crops or which have installation costs that can be passed on to potential consumers.
- Changes in location of unconfined manure stacks involving no capital cost.
- Manure spreading management.
- Other activities the DNR and the Counties determine are necessary to achieve the objectives of the watershed project.

Activities and Sources of Pollution Not Eligible For Cost-share Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically listed in NR 120.17(2). The following is a list of ineligible activities most often inquired about for cost-sharing in rural areas.

- Operation and maintenance of cost-shared BMPs.
- Actions which have drainage of land or clearing of land as the primary objective.
- Practices already installed, with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner.
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Stats. (including livestock operations with more than 1,000 animal units, or livestock operations issued a notice of discharge under ch. NR 243).
- Septic system controls or maintenance.
- Dredging activities.
- Silvicultural activities.

- Bulk storage of fertilizers and pesticides.

- Activities and structures intended primarily for flood control.

- Practices required to control sources which were adequately controlled at the time of the cost-shared practice installation, with the exception of those that occur beyond the control of the landowner.

- Other practices or activities determined by DNR not to meet the objectives of the program.

Cost-Share Budget

Costs of Installing BMPs

The estimated quantity and types of best management practices required to meet the water quality objectives of the priority watershed project are listed in tables 5-3, 5-4, 5-5, and 5-6. Tables 5-3, 5-4, and 5-5 identify the best management practice estimated needs for Door, Kewaunee, and Brown Counties, respectively. Table 5-6 identifies the comprehensive best management needs for the Red River/Sturgeon Bay Priority Watershed.

The capital cost of installing the BMPs are listed in the aforementioned tables assuming landowner participation rates of 75% and 100%. Past priority watershed project experience statewide, and by the Door County SWCD, Kewaunee County LCD, and Brown County LCD, demonstrates that landowner participation will be below the 100% level. Also, included in the tables are the units of measurement and the estimated cost per unit for the BMPs listed. The unit costs for each BMP was estimated from information generated from ongoing priority watershed projects, which include the Upper Door and East River and costs provided by the DNR. The costs from BMPs installed were estimated from the cost from the installation year with no inflationary value(s) included, therefore they represent 1995 costs.

The capital cost of installing the Best Management Practices and Easements/Leases in the Red River/Sturgeon Bay Priority Watershed is estimated to be $ 14,440,444, assuming 75% participation.

- The estimated state funds necessary to cost-share this level of control will be $10,139,130.

- The estimated local share provided by cost-share recipients will be $4,301,314.

At a 100% level of participation, the capital cost of installing the Best Management Practices is estimated to be $19,253,917.

Easement/Irrevocable Leases

Chapter 4 identifies where nonpoint source program funds can be used to purchase easements

or irrevocable leases. The estimated cost of purchasing easements and irrevocable leases on eligible lands in Red River/Sturgeon Bay Priority Watershed is shown in table 5-6. The estimated cost on a per county basis can be found in tables 5-3, 5-4, and 5-5. At a 75% participation rate, the estimated purchase price of easements and irrevocable leases on eligible lands would be $56,250. At a 100% participation rate, the estimated cost for easements and irrevocable leases would be $75,000. The easement and irrevocable lease costs would be paid for entirely by the state. However, it is very difficult to determine landowner response to and acceptance of easements and irrevocable leases as a management tool. Easements and irrevocable leases are a relatively new tool in the priority watershed program. Therefore, it is very difficult to estimate cost.

Table 5-3. Cost-Share Budget Needs for Rural Management Practices in Red River/Sturgeon Bay Priority Watershed Door County

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Upland NPS Control								
Change in Crop Rotation	16,061 ac	10,713	NA[3]	0	0	0	0	0
Contour Cropping	6,557 ac	4,526	9.00	40,734	40,734	[2]	30,551	[2]
Field Strip Cropping	4,653 ac	3,123	7.50	23,423	23,423	[2]	17,567	[2]
Contour Strip Cropping	4,653 ac	3,123	13.50	42,161	42,161	[2]	31,620	[2]
High Residue Managmenet[4]	5,892 ac	3,931	55.50	218,171	218,171	[2]	163,628	[2]
High Residue Management[5]	3,035 ac	2,024	18.50	37,444	37,444	[2]	28,083	[2]
Critical Area Stabilization	326 ac	245	260.00	63,700	44,590	19,110	33,443	14,333
Grass Waterways	56 ac	42	4550.00	191,100	133,770	57,330	100,328	42,998
Field Diversions & Terraces	15,540 ft	11,655	5.20	60,606	42,424	18,182	31,818	13,636
Grade Stabilization Structures	4 ea	2	8,450.00	16,900	11,830	5,070	8,873	3,803
Agricultural Sediment Basin	23 ea	17	19,500.00	331,500	232,050	99,450	174,038	74,588
Nutrient & Pesticide Management[6]	39,397 ac	29,018	18.00	522,324	261,162	261,162	195,871.5	195,871.5
Shoreline and Streambank Protection	210 ac	165	195.00	32,175	22,523	9,653	16,892	7,239
Wetland Restoration	15 ea	13	2,600.00	33,800	23,660	10,140	17,745	7,605
Livestock Fencing	5 ea	3	1,500.00	4,500	2,250	2,250	1,688	1,688
Pesticide Mgmt Spill Control Basins	25 ea	15	5,000.00	75,000	52,500	22,500	39,375	16,875
Subtotal				1,693,538	1,188,792	504,947	891,595.5	378,711.5
Animal Waste Management								
Barnyard Runoff Mgmt - Groundwater	86 ea	73	37,280.00	2,721,440	1,905,008	816,432	1,428,756	612,324
Runoff Collection Basin	39 ea	26	9,758.00	253,708	177,596	76,112	133,197	57,084
Manure Storage Fac. - Groundwater[7]	167 ea	110	35,484.00	3,903,240	2,732,268	1,170,972	2,049,201	878,229
Roofs for Barnyard Runoff Mgmt & Manure Storage Facilities	60 ea	40	24,517.00	980,680	686,476	294,204	514,857	220,653
Barnyard Runoff Mgmt-Surface Water	51 ea	22	16,000.00	352,000	246,400	105,600	184,800	79,200
Bnyd Runoff Mgmt-Roof Gutters	52 ea	22	1,500.00	33,000	23,100	9,900	17,325	7,425

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local	75% Participation State Share	75% Participation Local
Bnyd Runoff Mgmt-Clean Wtr Diversion	36 ea	15	2,500.00	37,500	26,250	11,250	19,688	8,438
Manure Storage Fac. - Surface Water[7]	19 ea	6	35,484.00	212,904	149,033	63,871	111,775	47,903
Intensive Grazing Management	20 ea	10	7,000.00	70,000	49,000	21,000	36,750	15,750
Milking Center Waste Control Systems	125 ea	105	5,000.00	525,000	367,500	157,500	275,625	118,125
Animal Lot Abandonment/Relocation[9]	45 ea	35	60,000.00	2,100,000	1,470,000	630,000	1,102,500	472,500
Subtotal				11,189,472	7,832,631	3,356,841	5,874,474	2,517,631
Streambank Erosion Control								
Shape and Seeding	6,525 ft	3,154	5.00	15,770	11,039	4,731	8,279	3,548
Livestock Fencing	19,795 ft	17,995	2.00	35,990	25,193	10,797	18,895	8,098
Riprap	649 ft	251	30.00	7,530	5,271	2,259	3,953	1,694
Remote Watering System	16 ea	13	700.00	9,100	6,370	2,730	4,778	2,048
Well Abandonment	150 ea	100	500.00	50,000	35,000	15,000	26,250	11,250
Cattle Mounds	20 ea	10	1,500.00	15,000	10,500	4,500	7,875	3,375
Subtotal				133,390	93,373	40,017	70,030	30,013
Easements/Irrevocable Leases	15 ea	11	5,000.00	55,000	55,000	[8]	41,250	[8]
Subtotal				55,000	55,000	[8]	41,250	[8]
Other[10]	100 ea	75	5,000.00	375,000	262,500	112,500	196,875	84,375
Subtotal				375,000	262,500	112,500	196,875	84,375
Totals				13,446,400	9,432,296	4,014,305	7,074,224.5	3,010,730.5

[1] Total Cost to install needed BMPs.
[2] Local share consists of labor and any additional equipment costs.
[3] N.A. means that cost-share funds are not available for this practice.
[4] This practice is reduced tillage on continuous row and long rotational cropland and represents 3 years of cost-sharing at $15/acre.
[5] This practice is reduced tillage on short rotational croplands or for the establishment of forage crops. Cost-sharing is limited to 1 year.
[6] This practice is nutrient management on all rented and owned land for landowners/operators of farms with a cost-shareable waste management system. Cost-sharing is limited to 3 years at $6.00/acre of eligible costs. Pesticide management was not included in the estimate.
[7] Maximum cost-share is set at $35,000/system.
[8] Local share consists of labor
[9] This practice represents the buildings and other structure which need to be replaced for an abandonment with a relocation.
[10] Other may include new BMPs adopted after the plan has begun implementation or property acquisitions.

Source: Door County SWCD, Kewaunee County LCD, Brown County LCD, and the DNR

Table 5-4. Cost-Share Budget Needs for Rural Management Practices in Red River/Sturgeon Bay Priority Watershed Kewaunee County

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Upland NPS Control								
Change in Crop Rotation	16,061 ac	3,565	NA[3]	0	0	0	0	0
Contour Cropping	6,557 ac	1,354	9.00	12,186	12,186	[2]	9,140	[2]
Field Strip Cropping	4,653 ac	1,020	7.50	7,650	7,650	[2]	5,738	[2]
Contour Strip Cropping	4,653 ac	1,020	13.50	13,770	13,770	[2]	10,328	[2]
High Residue Management[4]	5,892 ac	1,307	55.50	72,539	72,539	[2]	54,404	[2]
High Residue Management[5]	3,035 ac	674	18.50	12,469	12,469	[2]	9,352	[2]
Critical Area Stabilization	326 ac	55	260.00	14,300	10,010	4,290	7,508	3,218
Grass Waterways	56 ac	10	4,550.00	45,500	31,850	13,650	23,888	10,238
Field Diversions & Terraces	15,540 ft	2,642	5.20	13,738	9,617	4,122	7,213	3,091
Grade Stabilization Structures	4 ea	1	8,450.00	8,450	5,915	2,535	4,436	1,901
Agricultural Sediment Basin	23 ea	4	19,500.00	78,000	54,600	23,400	40,950	17,550
Nutrient & Pest Mgmt[6]	39,397 ac	7,202	18.00	129,636	64,818	64,818	48,614	48,614
Shoreline and Streambank Protection	210 ac	30	195.00	5,850	4,095	1,755	3,071	1,316
Wetland Restoration	15 ea	1	2,600.00	2,600	1,820	780	1,365	585
Livestock Fencing	5 ea	1	1,500.00	1,500	750	750	563	563
Pesticide Mgmt-Spill Control Basins	25 ea	5	5,000.00	25,000	17,500	7,500	13,125	5,625
Subtotal				443,188	319,689	123,700	239,770	92,776
Animal Waste Management								
Barnyard Runoff Mgmt - Groundwater	86 ea	9	37,280.00	335,520	234,864	100,656	176,148	75,492
Runoff Collection Basin	39 ea	7	9,758.00	68,306	47,814	20,492	35,861	15,369
Manure Storage Fac. - Groundwater[7]	167 ea	30	35,484.00	1,064,520	745,164	319,356	558,873	239,517
Roofs for Bnyd Runoff Management & Manure Storage Facilities	60 ea	10	24,517.00	245,170	171,619	73,551	128,714	55,163
Barnyard Runoff Mgmt - Surface Water	51 ea	20	16,000.00	320,000	224,000	96,000	168,000	72,000
Barnyard Runoff Mgmt - Roof Gutters	52 ea	20	1,500.00	30,000	21,000	9,000	15,750	6,750

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local	75% Participation State Share	75% Participation Local
Bnyd Runoff Mgmt-Clean Wtr Diversion	36 ea	15	2,500.00	37,500	26,250	11,250	19,688	8,438
Manure Storage Fac. - Surface Water[7]	19 ea	3	35,484.00	106,452	74,516	31,936	55,887	23,952
Intensive Grazing Management	20 ea	5	7,000.00	35,000	24,500	10,500	18,375	7,875
Milking Center Waste Control Systems	125 ea	10	5,000.00	50,000	35,000	15,000	26,250	11,250
Animal Lot Abandonment/Relocation[9]	45 ea	5	60,000.00	300,000	210,000	90,000	157,500	67,500
Subtotal				2,592,468	1,814,727	777,741	1,361,046	583,306
Streambank Erosion Control								
Shape and Seeding	6,525 ft	2,271	5.00	11,355	7,949	3,407	5,961	2,555
Livestock Fencing	19,795 ft	1,000	2.00	2,000	1,400	600	1,050	450
Riprap	649 ft	398	30.00	11,940	8,358	3,582	6,269	2,687
Remote Watering System	16 ea	2	700.00	1,400	980	420	735	315
Well Abandonment	150 ea	25	500.00	12,500	8,750	3,750	6,563	2,813
Cattle Mounds	20 ea	5	1,500.00	7,500	5,250	2,250	3,938	1,688
Subtotal				46,695	32,687	14,009	24,516	10,508
Easements/Irrevocable Leases	15 ea	2	5,000.00	10,000	10,000	[8]	7,500	[8]
Subtotal				10,000	10,000	[8]	7,500	[8]
Other[10]	100 ea	17	5,000.00	85,000	59,500	25,500	44,625	19,125
Subtotal				85,000	59,500	25,500	44,625	19,125
Totals				3,177,351	2,236,603	940,950	1,677,457	705,715

[1] Total Cost to install needed BMPs.
[2] Local share consists of labor and any additional equipment costs.
[3] N.A. means that cost-share funds are not available for this practice.
[4] This practice is reduced tillage on continuous row and long rotational cropland and represents 3 years of cost-sharing at $15/acre.
[5] This practice is reduced tillage on short rotational croplands or for the establishment of forage crops. Cost-sharing is limited to 1 year.
[6] This practice is nutrient management on all rented and owned land for landowners/operators of farms with a cost-shareable waste management system. Cost-sharing is limited to 3 years at $6.00/acre of eligible costs. Pesticide management was not included in the estimate.
[7] Maximum cost-share is set at $35,000/system.
[8] Local share consists of labor
[9] This practice represents the buildings and other structure which need to be replaced for an abandonment with a relocation.
[10] Other may include new BMPs adopted after the plan has begun implementation or property acquisitions.

Source: Door County SWCD, Kewaunee County LCD, Brown County LCD, and the DNR

Table 5-5. Cost-Share Budget Needs for Rural Management Practices in Red River/Sturgeon Bay Priority Watershed Brown County

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Upland NPS Control								
Change in Crop Rotation	16,061 ac	1,783	NA[3]	0	0	0	0	0
Contour Cropping	6,557 ac	677	9.00	6,093	6,093	[2]	4,570	[2]
Field Strip Cropping	4,653 ac	510	7.50	3,825	3,825	[2]	2,869	[2]
Contour Strip Cropping	4,653 ac	510	13.50	6,885	6,885	[2]	5,164	[2]
High Residue Management[4]	5,892 ac	654	55.50	36,297	36,297	[2]	27,223	[2]
High Residue Management[5]	3,035 ac	337	18.50	6,235	6,235	[2]	4,676	[2]
Critical Area Stabilization	326 ac	26	260.00	6,760	4,732	2,028	3,549	1,521
Grass Waterways	56 ac	4	4,550.00	18,200	12,740	5,460	9,555	4,095
Field Diversions & Terraces	15,540 ft	1,243	5.20	6,464	4,525	1,939	3,393	1,454
Grade Stabilization Structures	4 ea	1	8,450.00	8,450	5,915	2,535	4,436	1,901
Agricultural Sediment Basin	23 ea	2	19,500.00	39,000	27,300	11,700	20,475	8,775
Nutrient & Pest Mgmt[6]	39,397 ac	3,177	18.00	57,186	28,593	28,593	20,475	20,475
Shoreline & Streambank Protection	210 ac	15	195.00	2,925	2,048	878	1,536	658
Wetland Restoration	15 ea	1	2,600.00	2,600	1,820	780	1,365	585
Livestock Fencing	5 ea	1	1,500.00	1,500	750	750	563	563
Pesticide Mgmt - Spill Control Basins	25 ea	5	5,000.00	25,000	17,500	7,500	13,125	5,625
Subtotal				227,420	165,358	62,263	123,049	45,727
Animal Waste Management								
Barnyard Runoff Mgmt - Groundwater	86 ea	4	37,280.00	149,120	104,384	44,736	78,288	33,552
Runoff Collection Basin	39 ea	6	9,758.00	58,548	40,984	17,564	30,738	13,173
Manure Storage Fac. - Groundwater[7]	167 ea	27	35,484.00	958,068	670,648	287,420	502,986	215,565
Roofs for Barnyard Runoff Management & Manure Storage Facilities	60 ea	10	24,517.00	245,170	171,619	73,551	128,714	55,163
Barnyard Runoff Mgmt - Surface Water	51 ea	9	16,000.00	144,000	100,800	43,200	75,600	32,400
Barnyard Runoff Mgmt - Roof Gutters	52 ea	10	1,500.00	15,000	10,500	4,500	7,875	3,375

Best Management Practices	Watershed Total	BMP Need	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local	75% Participation State Share	75% Participation Local
Bnyd Runoff Mgmt-Clean Water Diversion	36 ea	6	2,500.00	15,000	10,500	4,500	7,875	3,375
Manure Storage Fac. - Surface Water[7]	19 ea	10	35,484.00	354,840	248,388	106,452	186,291	79,839
Intensive Grazing Management	20 ea	5	7,000.00	35,000	24,500	10,500	18,375	7,875
Milking Center Waste Control Systems	125 ea	10	5,000.00	50,000	35,000	15,000	26,250	11,250
Animal Lot Abandonment/Relocation[9]	45 ea	5	60,000.00	300,000	210,000	90,000	157,500	67,500
Subtotal				2,324,746	1,627,323	697,423	1,220,492	523,067
Streambank Erosion Control								
Shape and Seeding	6,525 ft	1,100	5.00	5,500	3,850	1,650	2,888	1,238
Livestock Fencing	19,795 ft	800	2.00	1,600	1,120	480	840	360
Riprap	649 ft	0	30.00	0	0	0	0	0
Remote Watering System	16 ea	1	700.00	700	490	210	368	158
Well Abandonment	150 ea	25	500.00	12,500	8,750	3,750	6,563	2,813
Cattle Mounds	20 ea	5	1,500.00	7,500	5,250	2,250	3,938	1,688
Subtotal				27,800	19,460	8,3400	14,597	6,257
Easements/Irrevocable Leases	15 ea	2	5,000.00	10,000	10,000	[8]	7,500	[8]
Subtotal				10,000	10,000	[8]	7,500	[8]
Other[10]	100 ea	8	5,000.00	40,000	28,000	12,000	21,000	9,000
Subtotal				40,000	28,000	12,000	21,000	9,000
Totals				2,629,966	1,850,141	780,026	$1,386,638	$584,051

[1] Total Cost to install needed BMPs.
[2] Local share consists of labor and any additional equipment costs.
[3] N.A. means that cost-share funds are not available for this practice.
[4] This practice is reduced tillage on continuous row and long rotational cropland and represents 3 years of cost-sharing at $15/acre.
[5] This practice is reduced tillage on short rotational croplands or for the establishment of forage crops. Cost-sharing is limited to 1 year.
[6] This practice is nutrient management on all rented and owned land for landowners/operators of farms with a cost-shareable waste management system. Cost-sharing is limited to 3 years at $6.00/acre of eligible costs. Pesticide management was not included in the estimate.
[7] Maximum cost-share is set at $35,000/system.
[8] Local share consists of labor
[9] This practice represents the buildings and other structure which need to be replaced for an abandonment with a relocation.
[10] Other may include BMPs adopted after the plan has begun implementation or property acquisition.

Source: Door County SWCD, Kewaunee County LCD, Brown County LCD, and the DNR

Table 5-6. Cost-Share Budget Needs for Rural Management Practices in Red River/Sturgeon Bay Priority Watershed Combined Door/Brown/Kewaunee Counties

Best Management Practices	Watershed Total	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Upland NPS Control							
Change in Crop Rotation	16,061 ac	NA[3]	0	0	0	0	0
Contour Cropping	6,557 ac	9.00	59,013	59,013	[2]	44,260	[2]
Field Strip Cropping	4,653 ac	7.50	34,898	34,898	[2]	26,173	[2]
Contour Strip Cropping	4,653 ac	13.50	62,816	62,816	[2]	47,112	[2]
High Residue Management[4]	5,892 ac	55.50	327,006	327,006	[2]	245,255	[2]
High Residue Management[5]	3,035 ac	18.50	56,148	56,148	[2]	42,111	[2]
Critical Area Stabilization	326 ac	260.00	84,760	59,332	25,428	44,499	19,071
Grass Waterways	56 ac	4550	254,800	178,360	76,440	133,770	57,330
Field Diversions & Terraces	15,540 ft	5.20	80,808	56,566	24,242	42,424	18,182
Grade Stabilization Structures	4 ea	8450	33,800	23,660	10,140	17,745	7,605
Agricultural Sediment Basin	23 ea	19,500	448,500	313,950	134,550	235,463	100,913
Nutrient & Pest Mgmt[6]	39,397 ac	18	709,146	354,573	354,573	265,930	265,930
Shoreline & Streambank Protection	210 ac	195	40,950	28,665	12,285	21,499	9,214
Wetland Restoration	15 ea	2600	39,000	27,300	11,700	20,475	8,775
Livestock Fencing	5 ea	1500	7,500	3,750	3,750	2,813	2,813
Pesticide Mgmt-Spill Control Basins	25 ea	5000	125,000	87,500	37,500	65,625	28,125
Subtotal			2,364,145	1,673,637	690,708	1,255,229	518,033
Animal Waste Management							
Barnyard Runoff Mgmt - Groundwater	86 ea	37,280	3,206,080	2,244,256	961,824	1,683,192	721,368
Runoff Collection Basin	39 ea	9758	380,562	266,393	114,169	199,795	85,628
Manure Storage Fac. - Groundwater[7]	167 ea	35,484	5,925,828	4,148,080	1,777,748	3,111,060	1,333,311
Roofs for Barnyard Runoff Management & Manure Storage Facilities	60 ea	24,517	1,471,020	1,029,714	441,306	772,286	330,980
Barnyard Runoff Control - Surface Water	51 ea	16,000	816,000	571,200	244,800	428,400	183,600
Barnyard Runoff Mmnt-Roof Gutters	52 ea	1500	78,000	54,600	23,400	40,950	17,550

Best Management Practices	Watershed Total	Cost/ Unit	Total[1] Cost	100% Participation State Share	100% Participation Local	75% Participation State Share	75% Participation Local
Bnyd Runoff Mgmt-Clean Water Diversion	36 ea	2500	90,000	63,000	27,000	47,250	20,250
Manure Storage Fac. - Surface Water[7]	19 ea	35,484	674,196	471,937	202,259	353,953	151,694
Intensive Grazing Management	20 ea	7000	140,000	98,000	42,000	73,500	31,500
Milking Center Waste Control Systems	125 ea	5000	625,000	437,500	187,500	328,125	140,625
Animal Lot Abandonment/Relocation[9]	45 ea	60,000	2,700,000	1,890,000	810,000	1,417,500	607,500
Subtotal			16,106,686	11,274,680	4,832,006	8,456,011	3,624,006
Streambank Erosion Control							
Shape and Seeding	6,525 ft	5	32,625	22,838	9,788	17,128	7,341
Livestock Fencing	19,795 ft	2	39,590	27,713	11,877	20,785	8,908
Riprap	649 ft	30	19,470	13,629	5,841	10,222	4,381
Remote Watering System	16 ea	700	11,200	7,840	3,360	5,880	2,520
Well Abandonment	150 ea	500	75,000	52,500	22,500	39,375	16,875
Cattle Mounds	20 ea	1500	30,000	21,000	9,000	15,750	6,750
Subtotal			207,885	145,520	62,366	109,140	46,775
Easements/Irrevocable Leases	15 ea	5000	75,000	75,000	[8]	56,250	[8]
Subtotal			75,000	75,000	[8]	56,250	[8]
Other[10]	100 ea	1500	500,000	350,000	150,000	262,500	112,500
Subtotal			500,000	350,000	150,000	262,500	112,500
Totals			19,253,716	13,518,837	5,735,080	10,139,130	4,301,314

[1] Total Cost to install needed BMPs.
[2] Local share consists of labor and any additional equipment costs.
[3] N.A. means that cost-share funds are not available for this practice.
[4] This practice is reduced tillage on continuous row and long rotational cropland and represents 3 years of cost-sharing at $15/acre.
[5] This practice is reduced tillage on short rotational croplands or for the establishment of forage crops. Cost-sharing is limited to 1 year.
[6] This practice is nutrient management on all rented and owned land for landowners/operators of farms with a cost-shareable waste management system. Cost-sharing is limited to 3 years at $6.00/acre of eligible costs. Pesticide management was not included in the estimate.
[7] Maximum cost-share is set at $35,000/system.
[8] Local share consists of labor
[9] This practice represents the buildings and other structure which need to be replaced for an abandonment with a relocation.
[10] Other may include BMPs adopted after the plan has begun implementation or property acquisition.

Source: Door County SWCD, Kewaunee County LCD, Brown County LCD, and the DNR

Cost Containment Procedures

Chapter NR 120 requires that cost containment procedures be identified in this plan. Two methods of cost containment, sealed bids and average costs, will be used in the Red River/Sturgeon Bay Priority Watershed Project. Cost-share recipients will be given the opportunity to choose the method of cost containment to be used for their project. If the actual installation costs exceed the amount of cost-sharing determined by the bidding or the average cost method, the amount paid to the cost-share recipient may be increased. Any increase or decrease in cost-sharing shall be documented and the change in cost-sharing shall be approved by the appropriate County. Appropriate documentation regarding the need for changes will be submitted to the DNR.

Sealed Bids

The cost-share recipient will have a choice to utilize a sealed bid system for any or all BMPs installed under their cost-share agreement. If the sealed bid method of cost containment is chosen, then sealed bids will be required by the SWCD/LCD, on behalf of the cost-share recipient for any structural BMP if the estimated total cost, as determined by the county SWCD/LCD, exceeds $3,000.00. Bids will not be required for BMPs with an estimated cost of equal to or less than $3,000.00. Cost-sharing on projects with an estimated cost of less than $3,000.00 shall be limited to the estimated cost-sharing. If this is unacceptable to the landowner prior bids will be required. The SWCD/LCD will request sealed bids, on behalf of the cost-share recipient, from qualified contractors to be opened on a specific date. All bids must be received by the SWCD/LCD by the specified date on the notification for the bid request. The SWCD/LCD has the right to reject any bid and all bids if they are not submitted by a qualified contractor or if they are not within 125% of the estimated cost, as determined by the SWCD/LCD. A minimum of two bids for each BMP identified on the cost-share agreement will be required. Cost-sharing will be based on the lowest bid or the second lowest bid provided the second lowest bid does not exceed 125% of the appropriate unit of governments estimate for the BMP. In cases where the SWCD/LCD receives only one bid, the respective county will determine if the bid constitutes an appropriate bid for the project. Appropriate means the bid is within a 125% range of the estimated cost, as determined by the SWCD/LCD, for the project. If the lone bid received is not deemed appropriate, the respective county SWCD/LCD, on behalf of the cost-share recipient, shall request additional sealed bids from qualified contractors. The cost-share recipient may choose not to request additional bids. At this point the respective county SWCD/LCD will limit the cost-sharing based on the estimated cost method described below.

Estimated Costs

The cost-share recipient will have a choice to utilize an estimated cost system for any or all BMPs installed under their cost-share agreement. If this method of cost containment is to be used, an estimated cost for each BMP will be prepared by SWCD/LCD staff. The maximum cost-sharing eligible for the BMPs shall be calculated based on the actual BMP installation costs, not to exceed the maximum eligible cost-sharing of the estimated cost of the BMP.

Estimated project costs have been developed from watershed project experience by the Door County SWCD, Kewaunee County LCD, and Brown County LCD. Cost-share funding will be determined from the estimated cost for BMP's identified in table 5-1 and will be reviewed periodically with appropriate changes being made as needed.

BMPs using flat rates are shown in table 5-2. The rates shown are the state's share of the practice installation costs.

In-kind Service Rates

Each county SWCD/LCD will develop an in-kind service schedule to be used for reimbursement of in-kind service contributions, which are provided by the cost-share recipient, for the installation/construction of a BMP. Activities which may be indirectly necessitated by the installation/construction of the practice, which are not directly related to the actual installation/construction of the practice, shall be considered non-cost-shareable contributions.

Cost-share calculations shall be based on the hourly rates for cost-share recipients labor and equipment adopted by the respective County. In-kind contributions not included on the adopted list(s) shall be cost-shared at rates which are the lowest cost rate or material available, if supplied by a source other than the cost-share recipient. The cost-share rate shall be the lower of a comparison of bid prices received for the same task(s) and the actual hours claimed by the cost-share recipient. In-kind contributions for labor shall not exceed that which is considered reasonable and/or customary for a given task.

Landowner Contact Strategy and Procedures

Notification and Status of Critical Sites

Landowners with sites meeting the criteria for management category critical sites are required, through s. 144.25, Stats to achieve the pollution reduction goal for their site through the installation of BMPs, elimination of the source, or through other methods.

All critical sites will be verified, by SWCD/LCD staff. Verification includes confirming that the site continues to meet the criteria for critical sites and that the landowner has not signed a cost-share agreement. The verification process will begin within the first six months after this plan has been approved by the DNR. As part of the verification process, the SWCD/LCD shall inventory any additional lands in the watershed, which were not inventoried and are under the same ownership as the sites which meet the critical site criteria. These findings shall be reported in writing to the DNR as soon as possible.

Within 60 days after the verification findings of a critical site have been completed and the site continues to meet the criteria for critical sites, notification of the status will be sent by certified mail to the landowner by the SWCD/LCD or the DNR. This process will start with the higher ranked critical sites and proceed to the lower ranked critical sites in each respective county. The notification process will continue for a period of 5 years or until all landowners and/or land

operators with critical sites have been notified, whichever is first.

A site is no longer considered a critical site if one of the following conditions applies: the site no longer meets the criteria for critical sites or the site has had BMPs implemented in accordance with the cost-share agreement.

In accordance with s.144.025(2)(u), (2)(v), and (2)(w), Stats., the SWCD/LCD and/or the DNR may issue a notice of intent to a landowner of a site who fails to install the needed BMPs to reduce the level of pollution to an acceptable level.

All units of government involved in the Red River/Sturgeon Bay Priority Watershed Project shall limit cost-share funding from any and all other funding sources to that which a landowner/ operator of a critical site would have received from the priority watershed project, if the landowner/operator exceeds the 36 month period of cost-share availability as noted in NR 120.09(2)(a). This limit includes DATCP cost-share funding resulting from NR 243 Notice of Discharges.

The notification sent to a landowner with a critical site will include the following information:

- The 36 month period of cost-share availability which will include the dates of the beginning and end of the 36 month period. The consequence of cost-share level reductions of 50%, after the 36 month period has passed. Landowners will be given at least 12 months of cost-share availability from the time the landowner receives notification to remain a critical site.

- Landowners face the potential consequences of either ch. NR 243, (for all animal wastes) or 144.025(2)(u), (v), or (w), Stats., (for sediment delivery and/or streambank erosion), that the landowner may face if no action is taken within 36 months after receipt of the notification letter and the site continues to meet the critical site criteria. Those potential consequences are:

  (1) For critical sites caused by animal wastes:

  - All site information will be turned over to the DNR for processing.

  - The landowner will receive a notice of discharge (NOD) form the DNR.

  - Failure to implement corrective measures as outlined in the NOD within the specified time frame (maximum allowable time frame equals two years as per NR 243.23(1)(d)) will result in the landowner needing to apply for a WPDES permit.

  - If the landowner does not apply for the WPDES permit, the DNR will notify the landowner of the consequences in accordance with s.144.025(2)(u), (2)(v), and (2)(w), Stats., the DNR will issue a notice of intent to issue a notice requiring the installation of the identified BMPs to a landowner of a site.

(2) For critical sites caused by sedimentation and/or stream banks:

- All site information will be turned over to the DNR for processing.

- The DNR will prepare a notice of intent to issue the order to abate pollution caused by nonpoint source pollution. The notice of intent shall include the expected date of pollution abatement.

- Failure to implement corrective measures as outlined in the notice of intent by the date identified in the notice, the DNR will issue orders to abate the nonpoint source pollution.

- Landowners have the right to appeal the designation as a critical site through a written request to the County Land Conservation Committee (LCC). This request must be received within 60 days of receipt of the notification letter.

Critical Site Designation Appeals Process

The owner or operator of a site designated as a critical site may appeal the critical site designation to the Land Conservation Committee of the County in which the site is located. If the site is located in more than one County the appeal shall be submitted to the LCC of the County in which the largest portion of the site is located. The appeal shall be in writing. The written appeal must be received within 60 days of the landowner receipt of the notification letter. The LCC shall:

- Provide the appellant with a hearing and give reasonable notice of the hearing to the appellant, the DNR, and the DATCP.

- The hearing shall be conducted as an informal hearing. Section 68.11(2) does not apply to the hearing.

- The hearing shall be held in a place convenient to the appellant.

- Within 60 days of the hearing, the DNR and DATCP may submit a report and recommendation to the LCC concerning the issues at the hearing.

- The LCC may affirm or reverse the designation of the site as a critical site. The LCC shall limit it's appeal affirmation consideration to whether the critical site designation is consistent with critical site criteria established in the Implementation Plan. The LCC shall consider whether governmental representatives erred in their verification of the site conditions and or management. Loss of profit or pecuniary hardship is not grounds for affirmation of an appeal. Violations by or appeals granted to other appellants shall not justify affirmation of an appeal.

- An appeal shall stay all proceedings in furtherance of the action appealed from until the appellant has received a decision and has exhausted the entire appeal process.

- Following the hearing the LCC shall render a decision in writing within 45 days of receiving the DNR and DATCP reports/recommendations, or notification by the DNR and DATCP that they do not intend to submit a report/recommendations or the conclusion of the 60 day DNR and DATCP report/recommendation period.

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

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

The SWCD/LCD shall postpone notification to any landowner who signs a cost-share agreement and continues to comply with the implementation schedules described in the cost-share agreement as per s. NR 120.13(4)(d).

Critical Sites Summary

Criteria for the control of non point source pollution from: animal lots which impact surface water quality; animal lots which impact groundwater quality; manure storage sites which impact groundwater quality; winter spread manure impacting groundwater quality; sedimentation impacting surface water, sedimentation impacting ground water; and streambank erosion all have critical site management categories. Landowners may have more than one critical site on their property, ie; animal lot and streambank erosion sites. In addition, some critical sites are located on rented property and are not the result of the landowners management, but rather that of the land operator. Table 5-7 summarizes the number of critical sites by category for each county and the watershed. It is important to note that the line titled "Landowners with critical site(s)" is the total number of landowners with critical sites and not the number of critical sites in the watershed.

Table 5-7. Summary of Management Category Critical Sites In The Red River/Sturgeon Bay Priority Watershed

	Total Project	Door County	Kewaunee County	Brown County
Landowners With Inventoried Property in The Watershed Project	616[1]	445	159	12[1]
Landowners With Critical Site(s)	168[1]	115	47	6[1]
% of Total	27.3%	25.8%	29.6%	50%[1]
Landowners with Critical Site(s) by Category:[2]				
Animal Lot Runoff - 32 Surface Water 16 Groundwater	48	33	10	5
Manure Storage Site - Groundwater	20	16	2	2
Manure Storage Field Rating - Groundwater	39	39	0	0
Sedimentation - 17 Groundwater 51 Surface Water	68[1]	31	37	[1] Unknown
Streambank - Surface Water	5	4	0	1
Total number of critical sites	180	123	49	8

[1] Incomplete data. Field inventory data not available. Brown County will collect during the Implementation Phase
[2] Some Landowners have critical sites in more than one category

Management Category I and II Landowner Contact Strategy

The following procedure will be used to make landowner contacts of landowners not contacted under the critical site notification process.

- The process of contacting landowners with management category I and II sites shall begin with a high ranked site in each respective county, and proceed through the remainder of the implementation period. The contact will be through a personal farm visit. The contact discussion and subsequential mailings will include how the landowner can participate in the project.

- The county SWCD/LCD will continue to make follow-up contacts with eligible (Management Category I and II) landowners and operators until they have made a definite decision regarding participation in the program. Efforts will be made to encourage reluctant landowners to participate in the project.

- As a minimum and a last effort, the county SWCD/LCD will contact all eligible landowners not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up period.

- Throughout the process the SWCD/LCD will assist landowners who are interested in participating in the project if contacted by the landowner prior to the county initiated contact.

Cost-Share Agreement Reimbursement Procedures

Nonpoint Source Grant Agreement and Administration

General Information

The Nonpoint Source Grant Agreement is the means for transmitting funds from the DNR (through the Nonpoint Source Program) to Door, Kewaunee, Brown Counties and the city of Sturgeon Bay for use in funding the state's share of cost-share agreements. Cost-share agreements are the means to transmit funds from the county to the landowners.

A portion of the Nonpoint Source Grant is forwarded to counties to allow each county to set up an "up front" account. Funds from this account are used by each county to pay landowners after practices are installed through the project. As this account is drawn down, the county will request reimbursements from DNR to replenish the account. The county will submit reimbursement requests on a quarterly basis or sooner if needed. This reimbursement schedule will insure that the "up front" account balance is maintained at an adequate level. The Nonpoint Source (NPS) Grant Agreement will be amended annually to provide funding needed for cost-sharing for the year. The funds obligated under cost-share agreements may never exceed the total funds in the NPS Grant Agreement.

Fiscal Management Procedures, Reporting Requirements

The units of government participating in the Red River/Sturgeon Bay Priority Watershed are required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used by the respective unit of government for the watershed project. The records of all watershed transactions must be retained for 3 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.

Cost-share Agreement and Administration

Purpose and Responsibilities

Consistent with s. 144.25, Stats. and NR 120, Wis. Adm. Code, cost-share funding is available to landowners for a percent of the costs of installing BMPs to meet the project objectives. Landowners who do not have a critical site(s) will have the length of the project implementation, or 10 years after formal approval of the watershed plan to enter into cost-share agreements (CSA). Cost-share agreements may not be signed before a Nonpoint Source Grant has been signed. Special provisions for cost-share agreements with critical sites exist as noted in NR

120.13(4) and will be discussed in the section of this chapter, titled Notification and Status of Critical Sites. Practices included on cost-share agreements must be installed within the schedule agreed to on the cost-share agreement. Practices must be maintained for a minimum of ten years from the date of the certification of the installation of the final practice included in the cost-share agreement. Special circumstances may warrant a longer operation and maintenance period.

The cost-share agreement is a legal contract between the landowner and the respective unit of government. 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 program but that are essential to controlling pollution sources (such as changes in crop rotations). These items will be completely listed in the conservation plan and the conservation plan is tied to the CSA via addendum 2 of the CSA. Once the CSA is signed by both parties, they are legally bound to carry out the provisions in it.

If landownership changes, the cost-share agreement remains with the property and the new owner is legally bound to carry out the provisions. NR 120.13(9) and (10) has more information on changes of landownership and the recording of cost-share agreements.

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 SWCD/LCD offices to determine if any permits are required. The landowner is responsible for acquiring the needed permits prior to installation of practices.

The cost-share agreement binds the appropriate county to provide the technical assistance needed for the planning, design, and verification of the practices on the cost-share agreement which they are a party, and to provide the cost-share portion of the practice costs.

The appropriate county is responsible for enforcing compliance of a cost-share agreement 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. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time. The appropriate county will check for compliance with practice maintenance provisions annually on all practices which have been installed as part of the Red River/Sturgeon Bay Priority Watershed. The county must check maintenance at its own expense after the Nonpoint Source Agreement has lapsed, unless state funding for this activity becomes available at any time during the implementation or monitoring phase of this project.

Cost-Share Agreement Special Conditions

As an integral component of a cost-share agreement there are special conditions which must be

addressed. NR 120.13 outlines the required state conditions. The county may also include special provisions on a cost-share agreement. Check with your local unit of government for any additional special cost-share conditions. As a minimum, landowners and/or land operators shall meet the following watershed project conditions while implementing the best management practices listed on their cost-share agreement.

- Landowners and/or operators will be required to treat all critical sites and management category I sites identified for their operation(s) as part of cost-share agreement.

- Landowners and/or operators with a site meeting the critical site criteria shall begin installation of applicable BMPs within eighteen months and be completed within four years following the date the cost-share agreement signed by both parties.

- As a requirement of critical sites, an annual progress report of pollution reduction must be submitted to the appropriate SWCD/LCD.

- In no case can supplemental feeding of livestock occur off the constructed barnyard runoff management system for sites which meet the following management criteria; critical sites, category I or on any site where off barnyard feeding defeats the purpose of the installed BMP.

- Animal lot abandonment of a site requires that the landowner/operator agrees to abandon the site permanently for livestock purposes and agrees that no livestock can be housed, bred, raised, or pastured at the site to be abandoned. The agreement shall state that ten or less animals will be considered pets and not livestock and shall be permitted on the property to be abandoned provided that no more than four animals exceed 200 pounds in live weight.

  If a cost-share agreement or amendment(s) include an abandonment best management practice and ownership changes for the parcel or a portion of the parcel, and the new parcel is greater than or equal to 20 acres, the new owner of the parcel will be allowed the number of pets identified in the agreement. If the new parcel is less than 20 acres, the landowner will be allowed to maintain 10 pets, none may exceed 200 pounds live weight. This restriction will be applicable to all land divisions of the parcel(s) identified on the agreement.

- All rented land must be included in a conservation plan.

Procedure for Developing a Cost-share Agreement

Eligibility for cost-sharing is verified following a site visit, using the criteria described in Chapter Four.

The development of farm conservation plans will be the primary method used to develop 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, and 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.

The cost-share agreement specifies the items listed in the farm conservation plan that are necessary to reduce the nonpoint sources of pollution. The conservation plan and cost-share agreement will document existing management which must be maintained to protect water quality.

The following procedure will be used by the SWCD/LCDs for developing and administering agreements. Below are the steps from the initial landowner contact through the completion of BMP maintenance.

1. Landowner and county staff meet to discus the watershed project, NPS control practice needs, and coordination with conservation compliance provisions if applicable.

2. Landowner agrees to participate with the watershed project.

3. A farm conservation plan is prepared by the county.

4. The landowner agrees with the plan, a Cost-share Agreement is prepared and both documents are signed by the landowner and the county. A copy of the Cost-share Agreement (CSA) will be sent to the DNR Lake Michigan District Nonpoint Source Coordinator and a copy will be given to the landowner. The CSA will be recorded by the county with the County Register of Deeds.

5. Practices are designed by the county SWCD/LCD staff, or their designee, and a copy of the design is provided to the landowner.

6. The landowner shall follow the cost containment policy and have the SWCD/LCD request sealed bids on their behalf or hire the contractor of their choice if using the average cost method.

7. Amendments to the CSA are made if they are determined necessary and if both parties (landowner and County) agree to the amendment(s).

8. The county SWCD/LCD staff shall oversee the practice installation.

9. The county shall verify if the installed BMP(s) meet the appropriate specification(s).

10. The landowner submits paid bills and proof of payment (canceled checks, receipts marked paid, and lien waivers) to the county.

11. Land Conservation Committees or their designated representative and if required, county boards, approve cost-share payments to landowners.

12. Checks are issued by the county to the respective landowners and project ledgers are

updated.

13. The county records the check amount, number, and date.

14. DNR reimburses the county for expended cost-share funds.

Submittal to the DNR

Cost-share agreements do not need prior approval from DNR, except in the following instances:

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

- For agreements or amendments where the cost-share amount for any single practice for a landowner exceeds $50,000 in state funds or when the total cost-share agreement amount and its amendments exceeds $100,000 in state funds.

- 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.

- For streambanks to be controlled using riprap or other materials with banks over 15 feet high, according to NR 120.14. If applications are similar to each other in content, they will be reviewed to determine if future applications need be subject to this approval procedure.

- For a roof(s) over a barnyard and/or a manure storage facility which is determined to be a management category 2 site and is determined by the county SWCD/LCD staff that the roof is not the least cost alternative but will supply a higher level of environmental protection.

Identifying Wildlife and Fishery Needs

The respective SWCD/LCD county staff will consult with DNR's Lake Michigan Region 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 in the county's opinion: fence rows, rock piles, wetlands, or other wildlife habitat components will be adversely affected by installation of agricultural BMPs.

The DNR staff will assist county staff, at the County's request, by:

- Identifying streambank protection practices that benefit fish and/or wildlife.

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

- 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.

- Providing technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat.

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

Local Assistance Grant Agreement Administration

General Information

The Local Assistance Grant Agreement (LAG) is a grant from the DNR to Door, Kewaunee, and Brown Counties and the city of Sturgeon Bay for staff and support costs. Consistent with NR 120, the counties and the city will use funds from the LAG for staff to implement the project and conduct information and education activities. Other items such as travel, training, and certain office supplies are also supported by the LAG. Further clarification of eligible costs supported by this grant is given in NR 120.21(4).

Grant Agreement Application Procedures

An annual review of the Local Assistance Grant Agreement is conducted through the development of an annual workload analysis by the counties and the city of Sturgeon Bay. This workload analysis estimates the work needed to be accomplished each year. The workload analysis is provided to the 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.

Fiscal Management Procedures, Reporting Requirements

Participating units of government are required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Red River/Sturgeon Bay Priority Watershed Project. The records of all watershed transactions must be retained for 3 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 an annual report to the DNR from the counties and the city of Sturgeon Bay. The annual report will include accomplishments regarding activities funded through the watershed project. Reimbursement requests may be included with the submittal of the annual project reports.

Staffing Needs and Budget

This section estimates the staffing and funding requirements for the implementation of the rural portion of the Red River/Sturgeon Bay Priority Watershed project.

Staffing needs for this project were generated from the listed BMPs presented in tables 5-3, 5-4, 5-5 and 5-6, needed to achieve the water quality objectives for the priority watershed. Table 5-8, represents the total estimated technical staff hours needed to design and implement each BMP identified, per county. The table was generated on a per county basis to determine the staffing requirements for implementation of the rural portion of the watershed project. Table 5-9 represents a summary of table 5-8 with additional staffing requirements included, such as; project management, clerical, Information and Education, staff training, and staff leave requirements. Table 5-8, represents an average hourly rate on a per BMP and project management basis. The hourly rates represented in tables 5-8 and 5-9 were generated from data maintained by the counties for the implementation of other priority watersheds.

The estimated required staffing hours are: Door County, 137,687; Kewaunee County, 40,922; and Brown County, 24,002. To begin the implementation phase, the state supported staffing level of the county per year shall be: Door County, 5 FTE; Kewaunee County, 1 FTE; and Brown County, 0.75 FTE.

The staffing costs for the implementation phase of this project are presented in table 5-8.

The information presented in tables 5-8 and 5-9 are only estimates of the staffing requirements. Changes in the priority watershed program during the implementation phase of this project may change the needs of this project. Also, the information presented assumes that the implementation phase will be of a uniform fashion; ie. the same number of BMPs installed in any given year.

Table 5-8. Staffing Requirements for the Red River/Sturgeon Bay Priority Watershed

Best Management Practices	Watershed Total	DOOR COUNTY			BROWN COUNTY			KEWAUNEE COUNTY		
		BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours
Upland NPS Control										
Change in Crop Rotation	16,061	10,713	.05	535.65	1,783	.05	89.15	3,565	.05	178.25
Contour Cropping	6,557	4,526	.18	814.68	677	.18	121.86	1,354	.18	243.72
Field Strip Cropping	4,653	3,123	.4	1,249.20	510	.4	204.00	1,020	.4	408.00
Contour Strip Cropping	4,653	3,123	.4	1,249.20	510	.4	204.00	1,020	.4	408.00
High Residue Management	5,892	3,931	.45	1,768.95	654	.45	294.30	1,307	.45	588.15
High Residue Management	3,035	2,024	.15	303.60	337	.15	50.55	674	.15	101.10
Critical Area Stabilization	326	245	.5	122.50	26	.5	13.00	55	.5	27.50
Grass Waterways	56	42	40	1,680.00	4	40	160.00	10	40	400.00
Field Diversion & Terraces	15,540	11,655	.04	466.20	1,243	.04	49.72	2,642	.04	105.68
Grade Stabilization	4	2	70	140.00	1	70	70.00	1	70	70.00
Agricultural Sediment Basin	23	17	110	1,870.00	2	110	220.00	4	110	440.00
Nutrient & Pest Mgmt	39,397	29,018	.45	13,058.10	3,177	.45	1,429.65	7,202	.45	3,240.90
Shoreline Buffers	210	165	24	3,960.00	15	24	360.00	30	24	720.00
Wetland Restoration	15	13	40	520.00	1	40	40.00	1	40	40.00
Livestock Fencing	5	3	16	48.00	1	16	16.00	1	16	16.00
Pest Mgmt-Spill Control Basins	25	15	80	1,200	5	80	400.00	5	80	400.00
Subtotal				28,986.08			3,722.23			7,387.30
Animal Waste Management										
Barnyard Runoff Mgmt - Groundwater	86	73	160	11,680.00	4	160	640.00	9	160	1,440.00
Runoff Collection Basin	39	26	80	2,080.00	6	80	480.00	7	80	560.00
Manure Storage Fac. - Groundwater	167	110	160	17,600.00	27	160	4,320.00	30	160	4,800.00
Roofs	60	40	80	3,200.00	10	80	800.00	10	80	800.00
Barnyard Runoff Mgmt - Surface Water	51	22	160	3,520.00	9	160	1,440.00	20	160	3,200.00
Bnyd Runoff Mgmt-Roof Gutters	52	22	24	528.00	10	24	240.00	20	24	480.00
Bnyd Runoff Mgmt-Clean Water Diversion	36	15	32	480.00	6	32	192.00	15	32	480.00
Manure Storage Fac. - Surface Water	19	6	160	960.00	10	160	1,600.00	3	160	480.00
Intensive Grazing Management	20	10	32	320.00	5	32	160.00	5	32	160.00
Milking Center Waste Systems	125	105	60	6,300.00	10	60	600.00	10	60	600.00
Animal Lot Abandonment/Relocation	45	35	120	4,200.00	5	120	600.00	5	120	600.00
Subtotal				50,868.00			11,072.00			13,600.00
Streambank Erosion Control										
Shape and Seeding	6,525	3,154	.1	315.40	1,100	.1	110.00	2,271	.1	227.10
Fencing	19,795	17,995	.05	899.75	800	.05	40.00	1,000	.05	50.00

Table 5-8 (continued)

Best Management Practices	Watershed Total	DOOR COUNTY			BROWN COUNTY			KEWAUNEE COUNTY		
		BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours
Riprap	649	251	.15	37.65	0	.15	0.00	398	.15	59.70
Remote Watering System	16	13	16	208.00	1	16	16.00	2	16	32.00
Well Abandonment	150	100	8	800.00	25	8	200.00	25	8	200.00
Cattle Mounds	20	10	24	240.00	5	24	120.00	5	24	120.00
Subtotal				2,500.80			486.00			688.80
Easements/Irrevocable Leases	15	11	120	1,320.00	2	120	240.00	2	120	240.00
Subtotal				1,320.00			240.00			240.00
Other[1]	100	75	16	1,200.00	8	16	128.00	17	16	272.00
Subtotal				1,200.00			128.00			272.00
Totals				84,874.88			15,648.23			21,916.10

Project Management	Watershed Total	DOOR COUNTY			BROWN COUNTY			KEWAUNEE COUNTY		
		BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours	BMP Need	Hourly Rate	Total Hours
Pre-contact Office Inventory	192	137	2	274.00	12	2	24.00	43	2	86.00
Landowner Contacts	576	411	3	1,233.00	36	3	108.00	129	3	387.00
Progress Tracking	192	137	2	274.00	12	2	24.00	43	2	86.00
Subtotal				1,781.00			156.00			559.00
Update Inventory	192	137	4	548.00	12	4	48.00	43	4	172.00
Subtotal				548.00			48.00			172.00
Conservation Planning	192	137	20	2,740.00	12	20	240.00	43	20	860.00
Cost-share Agreement Development	192	137	8	1,096.00	12	8	96.00	43	8	344.00
Critical Site Processing	168	115	32	3,680.00	6+	32	192.00	47	32	1,504.00
Subtotal				7,516.00			528.00			2,708.00
Plan Reviews & Status Reviews & Monitoring	1,920	1,370	3.5	4,795.00	120	3.5	420.00	430	3.5	1,505.00
Subtotal				4,795.00			420.00			1,505.00
Total				14,640.00			1,152.00			4,944.00
Grand Total				99,514.88			16,800.23			26,860.10

[1] May include archaeological site investigations or property acquisition.

Table 5-9. Summary Staffing Requirements for the Red River/Sturgeon Bay Priority Watershed

Activity	Project Years When Work Will Be Done	Door County	Brown County	Kewaunee County
Project & Financial Management	1-10	10,010	3,400	3,920
Clerical	1-10	7,000	1,000	3,920
Information & Education Program	1-10	9,200	600	3,920
Pre-Contact Office Inventory; Landowner Contracts & Progress Tracking	1-10	1,781	156	559
Update Inventory	1-10	548	48	172
Conservation Planning, Cost-Share Agreement Development, & Critical Site Processing	1-10	7,516	528	2,708
Plan Revisions & Monitoring	1-10	4,795	420	1,505
Practice Design & Installation	1-10			
Upland Sediment Control		28,988.08	3,724.23	7,387.30
Animal Waste Mgmt		50,868	11,072	13,600
Streambank Erosion Control		2,501	486	689
Easements/Irrevocable Leases		1,320	240	240
Other[1]	1-10	1,200	128	272
Leave	1-10	10,910	1,400	400
Training	1-10	1,050	800	600
Total LCD Workload		137,687.08	24,002.23	40,092.30
Estimated Staff Required for Years 1-5:		5	.75	1
Hours		52,000	15,600	20,800
Est. Staff Required for Years 5-10:		5	.75	1
Hours		52,000	15,600	20,800

[1] Includes archaeological site studies and property acquisition.

Implementation Schedule

Project Cost, Project Management Schedule, and Grant Disbursement

Total Project Cost

The state funding required to meet the rural nonpoint source pollution control needs of this watershed project are presented in table 5-10. The figures include the capital cost of practices, staff support, and easement/irrevocable leases. The information presented in table 5-10 assumes that the implementation phase will be completed in a uniform fashion. The estimated cost to the state is $13,306,880 and the estimated cost to landowners and others is $4,301,314.

This cost estimate is based on projections developed by the Door County SWCD, Kewaunee County LCD, Brown County LCD and the DNR. Historically, the actual expenditures for projects are less than the estimated costs. The factors affecting expenditures for this watershed project include: the time it takes to plan the project; the length of time the project is under implementation; the amount of cost-sharing that is actually expended; the number of staff working on the project; the amount of support costs; and the time local assistance is necessary.

Table 5-10. Total Project Costs at 75 percent Landowner Participation Rate

Item	Total Project	Costs (State Share)		
		Door County	Brown County	Kewaunee County
Cost-Share Funds: Practices	10,082,880	7,032,974	1,379,138	1,669,957
Cost-Share Funds: Easements/Irrevocable Leases	56,250	41,250	7,500	7,500
Local Assistance Staff Support	2,715,000	2,096,710	275,580	342,710
Information/Education Direct	131,000	101,000	15,000	15,000
Other Direct (travel, supplies, etc.)	278,000	208,000	28,400	41,600
Program Costs	43,750	29,750	8,000	6,000
Engineering Assistance				
Total	13,306,880	9,509,684	1,713,618	2,082,767

Source: Door County SWCD, Kewaunee County and Brown County LCDs

Project Management Schedule

Implementation of the Red River/Sturgeon Bay Priority Watershed project may begin in a county or the city of Sturgeon Bay with their respective unit of government's approval of this watershed plan, and the approvals of the Land and Water Conservation Board and the DNR. Failure of other units of government to approve the watershed plan or implement the project does not prevent the other units of government from proceeding with implementation. The Red River/Sturgeon Bay Priority Watershed project implementation period will last a minimum of ten years. The project includes a ten year period for contacting eligible landowners and signing cost-share agreements. The installation period for BMPs listed on the cost-share agreement may not extend beyond the grant period of the nonpoint source grant agreement for the watershed project.

Under extenuating circumstances, limited extensions for the installation period for practices on individual cost-share agreements will be approved by the DNR.

Grant Disbursement

The disbursement of the grants (Local Assistance and Nonpoint Source) to Door, Kewaunee, and Brown Counties will be based on an annual work load analysis and grant application process. The estimated grant disbursement schedule based on 75% participation by eligible landowners can be found in table 5-11.

Table 5-11. Door, Kewaunee, and Brown County Grant Disbursement Schedule at 75 percent Landowner Participation

Item	Total Project	Annual Grant Disbursement For 10 Years		
		Door County	Brown County	Kewaunee County
Cost-Share Funds: Practices	1,008,288	703,297	137,914	166,996
Cost-Share Funds: Easements/Irrevocable Leases	5,625	4,125	750	750
Local Assistance Staff Support	271,500	209,671	27,558	34,271
Information/Education Direct	13,100	10,100	1,500	1,500
Other Direct (travel, supplies, etc.)	27,800	20,800	2,840	4,160
Program Costs	4,375	2,975	800	600
Engineering Assistance				
Total	$1,330,688	$950,986	$171,362	$208,277

Source: Door County SWCD, Kewaunee County and Brown County LCDs

Involvement of Other Programs

Coordination With State and Federal Conservation Compliance Programs

The Red River/Sturgeon Bay Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by the DATCP, and the Federal Food Security Act (FSA) administered by the Natural Resource Conservation Service as much as possible and determined by the county. DATCP will assist the SWCD/LCD and the NRCS offices, if so requested, to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FSA on December 31, 1989.

Implementation and amendment of these conservation plans will be necessary during the implementation phase of the watershed project. Watershed project staff will inform FPP and NRCS staff of changes in plans resulting from management decisions and the installation of needed BMPs for nonpoint source pollution abatement. This comprehensive approach to farm planning will facilitate consideration of the various goals and objectives for all the programs in which the landowner participates.

Some eroding uplands in management categories I and II may need control in addition to that required for meeting sediment delivery targets in order to meet soil erosion program goals established through other state and federal programs. Where this occurs, technical and financial assistance from the Nonpoint Source Program can be used to support practice design and installation on these high hazard lands. This assistance applies only where the additional control needed to meet soil erosion goals can be achieved using low cost practices.

Implementation For The City Of Sturgeon Bay

The following section provide guidance on how the runoff pollution control program for the city of Sturgeon Bay will be implemented. It considers first, the activities of a "core" program for runoff pollution prevention. Then, the implementation of "segmented" activities of the management program--detention, stream restoration, infiltration --are presented.

Core Activities of the Management Program

The core activities include basic measures that can be implemented without further study. Adopting a core program is the first step in implementing the project. The city will need to commit to implementing the core program within the first three years of the project. This is a requirement to receive further technical and financial assistance from the DNR. This requirement applies only to the receipt of funds used directly by the city as a grantee, such as where the city installs, owns, and operates a BMP. It does not apply to those instances when the city acts as a grantor, passing cost-share funds through to private landowners. This means that individual landowners could receive cost-share funds from the DNR for the installation of BMPs prior to the city's agreement to conduct core activities.

The basic activities of the core program are:

- Effectively enforce the construction erosion control provisions in local ordinances based on the state model ordinance and state building codes. Develop construction erosion control ordinances for multifamily, commercial, and industrial sites which are less than 5 acres in size.

- Develop and implement a program of urban pollution prevention practices which reduce urban runoff pollution. This may include a combination of activities such as an information and education program, adoption of ordinances regulating pet wastes or changes in the timing and scheduling of leaf collection.

- Following the completion and adoption of the DNR Storm Water Management Guidebook (in preparation), *it is recommended* that a storm water management ordinance be incorporated into the core program.

Segmented Activities of the Management Program

The segmented activities include those requiring site specific investigations prior to installation (example: detention ponds needing an engineering feasibility study).

Importantly, the higher costs of implementing this portion of the management program will require the city to budget expenditures over the course of several years. Best management practices implemented under this portion of the program likely will include detention ponds, infiltration devices, stream bank erosion controls and other structural means for reducing urban runoff pollution. These components also include changes in schedules and equipment used for street sweeping.

The detailed studies will include engineering feasibility and other site specific investigations for existing and new development. The results will determine the best means for reducing urban nonpoint sources by more site specific application of the plan's recommendations.

The city can implement the segmented activities of the urban management strategy any time following development and initial implementation of the core program. However, cost-sharing will be limited to segmented program activities completed within the ten year implementation period.

The basic activities of the segmented program are:

- Conduct detailed engineering studies to determine the best means to implement runoff pollution control measures for established urban areas. These studies should consider more than one alternative and determine all local and state costs for each practice. This activity will also consider supplementary catch basin cleaning and street sweeping as components of the control strategy for established urban areas.

- Design and install BMPs for existing urban areas, including detailed engineering studies.

- Develop, as needed, storm water management plans for existing and planned urban development. These plans will identify the type and locations of BMPs.

- Adopt and enforce a storm water management ordinance consistent with the State's model storm water ordinance (in preparation).

Program Participants - Roles and Responsibilities

The specific roles and responsibilities for program participants are summarized below. The primary participants include local units of government (examples: city, county, local public works departments), the DNR, other state agencies, landowners and land operators. Where applicable, the roles and responsibilities are discussed with respect to the previously described core and segmented activities. As noted in Chapter 5, implementation can begin in the city of Sturgeon Bay following approval of this priority watershed plan by the City Council, DNR and the Wisconsin Land and Water Conservation Board.

Core Program Roles and Responsibilities

The following is a schedule for implementing the core activities of the nonpoint source control strategy for this priority watershed project. The city shall:

1. Identify a representative for the city within 30 days of the start of implementation.

2. Identify the roles and responsibilities of the county, city, developers, contractors, and landowners for controlling construction erosion in all areas of the watershed project area within 6 months of the start of implementation. Develop administrative

procedures, and determine staff needs to enforce construction erosion control ordinances and building codes in the city within 12 months of the start of implementation. Amend, as needed, current construction erosion control ordinances to address problems listed in Chapter III within 12 months of the start of implementation.

3. Develop and implement a community specific program of urban pollution prevention practices which reduce nonpoint source pollution. This may include but is not limited to a combination of information and education efforts, adoption of ordinances regulating pet wastes, and changes to the timing and scheduling of leaf and yard waste collection. The activities of the community specific program and a schedule for implementation will be negotiated by the local unit of government and the DNR within 12 months of the start of implementation.

4. Assist with the implementation of the information and education strategy as described in the Chapter 6.

5. Prepare and submit annual work plans for staff and activities necessary to implement the project.

6. Prepare and submit to the DNR an annual report for the purpose of monitoring project implementation.

7. Participate in the annual watershed project review meeting.

Segmented Program Roles and Responsibilities

The following is a schedule for the segmented activities of the nonpoint source control strategy for this priority watershed project. The city should:

1. Identify within 12 months of the start of implementation, the high priority sub-basins in the city wishes to address in existing and planned urban areas through the priority watershed project. This list can be amended throughout the 10 year project period.

2. Conduct engineering feasibility and site location studies for urban nonpoint source control practices in high priority areas for existing urban development. A commitment to implementing the recommendations will be required as a condition for financial assistance for these studies.

3. Adopt, administer, and enforce a storm water management ordinance within 12 months of the approval date of the state's model storm water management ordinance (in preparation).

4. Enter into cost-share agreements for eligible best management practices.

a. For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the local unit of government. The local unit of government will be required to:

   (1) Design or contract for the design of best management practices and verify proper BMP installation.

   (2) Request reimbursement from the DNR for practices installed by private landowners. Eligible BMPs must be listed in the cost-share agreement signed prior to construction .

   (3) Reimburse landowners for the eligible amount of cost-sharing.

   (4) Monitor landowner compliance with provisions of the cost-share agreement.

b. For practices installed and maintained by the city of Sturgeon Bay, the cost-share agreement is between the city and the DNR.

c. Practice maintenance is the responsibility of the grant recipient.

5. Develop alternative financing and implementation plans which describe the methods for raising revenue to administer local pollution control programs in the city.

6. Submit information needed for project evaluation to DNR.

Department of Natural Resources

The DNR has been assigned the overall administrative responsibility for the Wisconsin Nonpoint Source Water Pollution Abatement Program in s. 144.24, Stats. and s. NR 120, Wis. Adm. Code. (NR 120). This includes providing financial support for local staff and installation of management practices, assisting local units of government to integrate wildlife and fish management concerns into selection and design of BMPs, and conducting project evaluation activities. The DNR's role in assisting local units of government in carrying out the core and segmented activities are as follows:

DNR Core Program Roles and Responsibilities

1. Assist the city of Sturgeon Bay with the enforcement of construction erosion control provisions developed by the DNR - DILHR Memorandum of Understanding.

2. Review community specific programs of urban pollution prevention practices for nonpoint source control.

3. Review and approve annual work plans for staff and activities necessary to implement the project.

4. Review and approve annual project implementation reports.

5. Participate in the annual watershed project review meeting.

6. Track changes in urban pollutant loads using information supplied by local units of government.

DNR Segmented Program Roles and Responsibilities

1. Develop a model storm water management ordinance. Assist communities with adoption and enforcement of storm water management ordinances.

2. Assist the city with the development of priorities, schedules and requirements for segmented activities.

3. Participate in the selection of BMPs and approve practice designs. Review nonpoint source cost-share agreements signed by the city of Sturgeon Bay with eligible land owners.

4. Enter into nonpoint source cost-share agreements with the eligible lands the city of Sturgeon Bay owns or operates.

5. Review designs of urban nonpoint source BMPs for which cost-share agreements are signed.

6. Reimburse cost-share recipients for the eligible costs of installing BMPs at the rates consistent with administrative rules and those established in this plan.

Landowners and Land Operators

In many situations, private landowners will install BMPs on their property. Landowners are important participants in the urban implementation activities. Eligible landowners will participate in the project by signing cost-share agreements with local units of government. Maintenance responsibility can be assigned using agreements similar to those discussed above.

Door County SWCD

To enhance intergovernmental coordination within the watershed project, Door County SWCD will assist the city of Sturgeon Bay and the DNR in implementing the core program by:

1. Providing assistance to the city in implementing the information and education activities described in Chapter 6.

2. Providing assistance in construction erosion control training programs for local government staff, consultants, developers, contractors and builders.

3. For lands the county owns or operates, enter into grant agreements with DNR to correct identified nonpoint source problems and fulfill their obligations as a grant recipient.

4. Assist with the design of best management practices and verify proper practice installation if the city requests assistance and if SWCD staff are available.

University of Wisconsin Extension (UWEX)

Area extension agents will provide support in developing and conducting a public information and education program aimed at increasing voluntary participation in the project. These activities are described in Chapter 6 in the information and education strategy.

BEST MANAGEMENT PRACTICES (BMPS)

BMPs Eligible For Cost-Sharing And Their Rates

Best management practices are those practices identified in NR 120 determined in this watershed plan to be the most effective in reducing nonpoint sources of pollution. Design and installation of the best management practices must meet the conditions listed NR 120. Generally, these practices use standard specifications in the NRCS Field Office Technical Guide. The DNR may approve alternative best management practices and design criteria based on the provisions of NR 120.15 where necessary to meet the water resource objectives.

Specifications for the structural urban practices were described in Chapter 4. Application of these practices will be guided by technical assistance provided by the DNR. Eligible practices and state cost-share rates are listed in NR 120 and summarized below in Table 5-11A.

Table 5-11A. State Cost-share Rates for Urban Best Management Practices

Best Management Practice	State Cost-share Rate
Critical Area Stabilization[1]	70%
Grade Stabilization Structures	70%
Streambank and Shoreline Stabilization	70%
Shoreline Buffers[1]	70%
Wetland Restoration[1]	70%
Wet Detention Ponds[2]	70%
Infiltration Trenches and Basins[2]	70%
Grass Swales and Waterways[2]	70%
Street Sweeping[3]	50%
Catch Basin Cleaning[3]	50%

1. Easements may be used in conjunction with these practices.
2. Applies only to structures for established urban areas--those in existence prior to the date the DNR approves this watershed plan. The maximum cost-share rate for land acquisition, storm sewer rerouting, and removal of structures necessary to install structural urban best management practices is 50%
3. This is an alternative best management practice not listed in NR 120 of the Wisconsin Administrative Code. Includes only street sweeping and catch basins cleaning above 1994 levels.

Activities and Sources of Pollution Not Eligible for Cost-share Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically excluded in NR 120.10 and NR 120.17. The following is a partial list of ineligible activities for cost-sharing in urban areas:

1. Operation and maintenance of cost-shared best management practices (BMPs).

2. Construction erosion control practices.

3. Structural BMPs for new urban development--those whose construction activity commenced after DNR approval of this plan.

4. BMPs installed prior to signing cost-share agreement.

5 Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program, including industrial site run-off.

6. On-site septic system controls or maintenance.

7. Dredging activities.

8. Activities and structures intended primarily for flood control.

9. Minimum levels of street cleaning, catch basin cleaning, and leaf collection.

10. Actions which have drainage of land or clearing of land as the primary objective,

11. Practices already installed,with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner,

12. Bulk storage of fertilizers and pesticides,

13. Other practices or activities determined by DNR not to meet the objectives of the program.

Nonpoint Source Grant Agreement and Administration

The Nonpoint Source Grant Agreement is the means for transmitting funds from the DNR to local units of government to provide cost-sharing for installation of BMPs. In some cases the municipality will act only as a grantee. In this case, the municipality will use funds obtained under the grant agreement directly for practices it will install, own, and operate.

In other cases, the municipality will play an additional role as a grantor. In these situations, the municipality will pass the cost-share funds it has received from the DNR to private landowners who have responsibility for installing, operating, and maintaining the management practices. When this occurs, the municipality will enter into a separate cost-sharing agreement with the private landowner receiving the state funds.

The procedures for administering Nonpoint Source Grant Agreements and Cost-share Agreements appear in NR 120, Wis. Adm. Code.

Cost-share Agreement and Administration

Purpose and Responsibilities: Consistent with s. 144.25, Stats. and NR 120, cost-share funding is available to landowners and local units of government for a percent of the costs of installing BMPs to meet the project objectives. Cost-share agreements must be initiated within three years after formal approval of the watershed plan and are filed as part of the property deed. They may be amended throughout the 10 year project period.

Practices included in cost-share agreements must be installed within the schedule agreed to in the cost-share agreement. Unless otherwise approved, the schedule of installing BMPs will be within 5 years of signing of the cost-share agreement. Practices must be maintained for a minimum of fifteen years from the date of installing the final practice included in the cost-share agreement.

Local, state, or federal permits may be needed prior to installation of some BMPs. The areas most likely to need permits are wetlands and shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. The cost-share recipient is responsible for acquiring the needed permits prior to installation of practices.

The city of Sturgeon Bay will be responsible for enforcing 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. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time.

Identifying Wildlife and Fishery Needs

The city of Sturgeon Bay will consult with DNR's Lake Michigan District wildlife management and fisheries management staff to optimize the wildlife and fish management benefits of nonpoint source control BMPs. Specifically, the DNR will be contacted if:

- Stream bank protection practices or critical area stabilization practices are being considered.
- Wetlands or other wildlife habitat components will be adversely affected by installation of BMPs.

The DNR staff will assist by:

- Identifying stream bank protection practices that benefit fish and wildlife.
- Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.
- Providing technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat.
- Assisting to resolve questions concerning effects of nonpoint source BMPs on wetlands.

Cost Containment Procedures

Cost containment procedures for all local units of government involved in the implementation of the Red River/Sturgeon Bay Priority Watershed project are outlined on page 5-29.

Local Assistance Grant Agreement Administration

The Local Assistance Grant Agreement (LAG) information can be found on pages 5-40.

Table 5-12. Urban Implementation Activities Eligible for State Funding.

Activity	Cost-share Rate
Construction site erosion control ordinance revisions and amendments	100%
Development of storm water quality management plans[1]	100%
Engineering studies for existing urban areas and planned urban areas[1]	100%
Design and engineering for structural best management practices[1]	100%
Additional staff needed for supplementary street and catch basin cleaning[2]	100%
Development of alternative financing and administration strategies	100%

[1] Funding not available for components dealing exclusively with drainage and flood control.
[2] Funding is limited. Level of staffing based on a work plan submitted by local units of government and approved by the DNR.
Source: DNR

Budget and Staffing Needs

Project budget and staffing requirements are described below and summarized in tables 5-13 and 5-14.

Storm Water Planning and Engineering Feasibility Studies

Storm water planning and engineering feasibility studies will be needed for approximately 960 acres of established urban development in order to determine the type, size and location of BMPs. Most of these studies will probably be carried out by the private sector, with most of the cost borne by the DNR. The estimated costs of preparing these studies are presented in Tables 5-13 and 5-14. In making these estimates, a planning cost of $100/acre was estimated.

Detailed Engineering Designs

Once BMP feasibility studies are completed, detailed designs must be prepared. These designs will probably be prepared partly by the private sector and partly by staffs of local governments. The cost of site designs for structural practices located in existing urban areas is included in cost estimates presented in the following sections and in tables 5-12 and 5-13. Cost estimates are based on the assumption that designs are prepared by the private sector and funded 100 percent by the DNR.

Alternative Funding Sources

A substantial portion of the estimated costs of implementing this plan's management recommendations is for the construction of storm water management practices in existing urban areas to control pollutants discharged by a variety of land uses and activities. Where urban

structural practices are used to control storm water pollutants, state cost-sharing is limited and the burden falls heavily on local funding sources.

Some municipalities have endorsed a concept of distributing the cost of pollution control by developing a mechanism to charge those responsible for discharging the pollutants. In addition, municipalities have indicated a desire to pursue additional state or federal funding sources.

One way to distribute costs is to assess the sources of each storm water pollutant. This requires the identification of sources responsible for pollutant discharges. This plan endorses investigations that identify specific sources of urban storm water pollutants. If storm water pollutant dischargers cannot take actions to reduce runoff pollutants, they can be charged a portion of the local share of the cost of the BMP that would be installed by a downstream landowner or local unit of government.

This plan endorses continuing investigation into pollution control alternatives as well as development of alternatives for distributing local pollution control costs. Some of these alternatives, such as the collection and redistribution of fees at the state level and increased state funding for urban nonpoint source control practices should be investigated. Other alternatives, such as the creation of local utility districts should be investigated by municipalities.

Cost of Installing Structural Practices in Established Urban Areas

Factors that affect the cost of constructing BMPs to control pollutants in urban runoff include:

- labor rates
- land costs
- cost of relocating residences
- excavation costs
- cost of rerouting storm sewers

These costs vary from case to case. Land and labor costs will vary by community. In rare cases, residences and businesses in densely urbanized areas may be removed or relocated to allow space for BMPs. Excavation costs for underground structures, such as detention below parking lots or buildings, are several times greater than for surface structures. Finally, rerouting storm sewers to retrofitted BMPs can be costly.

Table 5-13 presents cost estimates for installing wet detention ponds and interim street and catch basin cleaning in established urban areas. It assumes detention will be implemented for 70 percent of all areas identified as high-impact (see Chapter 4, table 4-17). The total cost for installing these ponds ranges from $200,000 to $800,000 per surface acre of pond, including land purchases. The lower cost assumes that open land is available for purchase, but that extensive rerouting of the storm sewer system is required. The upper end of the cost range assumes that land is completely developed and condemnation of existing businesses or homes would be required. Both figures assume that design, excavation, inlet/outlet construction, and landscaping costs about $100,000 per surface acre of pond.

In all cases, the state share is limited to 50 percent of the land purchase, 70 percent of the cost for pond construction, 100 percent of design costs, and 50 percent of the cost of interim street and catch basin cleaning for efforts above 1994 levels. This equals an estimated average $350,000 of state assistance per surface acre of detention pond plus interim street and catch basin cleaning (based, in part, on true costs of similar projects in other urban areas) . The remaining costs, including annual operation and maintenance are not eligible for cost-sharing under the existing rules governing the state nonpoint source program. Operation and maintenance costs for detention ponds are estimated to be $2,000 per pond acre per year

Total Costs of BMPs in Established Urban Areas of City of Sturgeon Bay

Table 5-13 shows the estimated cost of recommended levels of wet detention for 70 percent of the high-impact urban land uses, including interim street and catch basin cleaning as part of a program that phases in detention. The state will fund 50 percent of the cost of street and catch basin cleaning above 1994 levels until structural practices are installed or the end of five years, whichever comes first. The total cost of treating established urban areas with BMPs recommended in this plan is about $2.3 million. The state share would be approximately $1.7 million and the local share an estimated $596,000 over eight years.

Cost of Preparing Construction Site Erosion Control Plan

This cost has not been estimated. It will be borne primarily by the private sector to meet requirements of local ordinances, state building codes and storm water permits.

Cost of Installing Construction Erosion Control Practices

It is estimated that construction site practices will average $250 per acre. Using this unit cost, an estimated $10,000 will be required to install construction site erosion control practices in Sturgeon Bay during the life of the project. All of this cost will be borne locally by the private sector to meet requirements of local ordinances, state building codes, and state storm water permits.

Cost of Reviewing and Amending Construction Erosion Control Ordinance

Staff funding is available on a limited basis to initially support this activity. Within five years, it is expected that the local government will charge building permit fees adequate to support enforcement and periodic updating of erosion control ordinances.

Cost of Developing Storm Water Management Ordinance

Likewise, the cost of additional staff for developing storm water management ordinances will be funded 50 percent by the DNR for the first five years. Permit fees should be structured so that continued funding is planned for enforcement of ordinances.

Table 5-13. Summary of Total Estimated Urban Project Costs

Item	State Share	Landowner Share[1]	City of Sturgeon Bay	TOTAL
Local Assistance Staff Support	100,000	0	0	100,000
Information and Education Direct Costs	14,000	0	0	14,000
Other Direct Costs (travel, supplies, etc.)	25,000	0	0	25,000
Subtotal	139,000	0	0	139,000
Cost-share Funds: Practices on Established Urban Areas[1,2]	1,715,000	0	596,000	2,311,000
Cost-share Funds: Streambank Stabilization[1]	14,000	0	6,000	20,000
Construction Site Erosion Control Practices ($250/acre)	0	10,000	0	10,000
Storm Water Planning and Engineering Feasibility Studies ($100/acre)[1]	67,000	0	29,000	96,000
Cost-share Funds: Easements	20,000	0	0	20,000
Subtotal	1,816,000	10,000	631,000	2,457,000
TOTAL	1,955,000	10,000	631,000	2,596,000

[1] A portion of the cost of practices on established urban areas, streambanks and storm water planning may be paid by private landowners instead of local governments.

[2] BMPs for established urban areas estimated at $350,000 state share per acre of wet pond. Pond costs include land purchases at 50% state cost-share rate, design work at 100% state share, installation at 70% state share, and interim street and catch basin cleaning at 50% state share. Local governments bear the additional cost of operation and maintenance which is estimated at $2,000 per pond acre per year (not included in the table).

Source: DNR

Table 5-14. Schedule of State Share Distributions for Urban Project Activities in City of Sturgeon Bay.

Item	TOTAL	Project Year			
		1	2	3	4-10
Local Assistance Staff Support	100,000	20,000	20,000	20,000	40,000
Information and Education Direct Costs	14,000	1,750	1,750	1,750	8,750
Other Direct Costs (travel, supplies, etc.)	25,000	5,000	5,000	5,000	10,000
Cost-share Funds: Practices on Established Urban Areas	1,715,000	214,000	214,000	214,000	1,073,000
Cost-share Funds: Streambank Stabilization	14,000	2,800	2,800	2,800	5,600
Storm Water Planning and Engineering Feasibility Studies	67,000	13,400	13,400	13,400	26,800
Cost-share Funds: Easements	20,000	4,000	4,000	4,000	8,000
TOTAL	$1,955,000	$260,950	$260,950	$260,950	$1,172,150

CHAPTER SIX
Information and Education Program

Objective

The objective of the Information and Education (I & E) Program is to improve water quality by maximizing landowner participation in the Red River/Sturgeon Bay Watershed Project.

Goals of the Program

To achieve the objective of clean water, the I & E program has been structured around the following goals:

- Increased awareness, understanding, and appreciation of the water resources in the Red River/Sturgeon Bay Priority Watershed.
- Increased understanding of the principles of water pollution, especially nonpoint source water pollution, and its impact in the Red River/Sturgeon Bay Priority Watershed.
- Increased awareness and understanding of Best Management Practices (BMPs) being promoted through the Red River/Sturgeon Bay Priority Watershed Project, including how these practices can lead to clean water and improved farm management.
- Increased awareness and understanding of the purpose, operation and benefits of the Red River/Sturgeon Bay Priority Watershed Project.

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

Audience

The primary audience of the I & E Program are priority watershed landowners who have been classified as eligible for project participation. Secondary audiences are priority watershed landowners that are not eligible for project participation, suppliers of services to the priority watershed, interest groups, and the general public.

Delivery Team

The Door County Soil and Water Conservation Department (SWCD) will take the lead responsibility for the delivery of the I & E Program. Other participating units of government, the University of Wisconsin-Cooperative Extension (UWEX), the DNR and the DATCP will provide supporting assistance.

Activities

A brief program explanation for each of the I & E Program activities is listed below.

Newsletters

The Red River/Sturgeon Bay Priority Watershed will utilize newsletters for the following purposes:

- To inform and educate landowners and residents
- To keep landowners and residents current on watershed developments
- As a means of taking a holistic approach to the project (urban and rural)
- Name recognition

The newsletters will be sent to all landowners and residents within the project area. They will emphasize the importance of the urban and rural communities working together to achieve a higher level of water quality. A minimum of two newsletters per year will be sent out for the duration of the project. The Door County SWCD will take the responsibility of producing the newsletters.

News Releases

News releases and announcements of I & E events will be provided to the local newspaper and radio stations. Topics will include, but are not limited to, project introduction, project status, rural and urban implemented practices, and community participation in the watershed program. The Door County SWCD will take the responsibility of contacting the news media. No release schedule will be established.

Landowner Surveys

The landowner surveys will be separated into four different groups: farming landowners, rural non-farm landowners, bay-front landowners and residents of the city of Sturgeon Bay. These surveys will be completed at the beginning and at the end of the watershed project to determine how the public perception of the watershed project has changed.

Presentations

If requested, watershed staff will conduct a presentation to any group who expresses interest in the watershed and/or water quality issues. The Door County Soil and Water Conservation Department will contact civic groups in the watershed to offer this service. Requests must be made with sufficient advance notice to ensure that SWCD staff will be available to conduct the presentation.

Stream Crossing Signs

Throughout the project area, perennial and intermittent waters cross county and state roads and highways. In an effort to increase public awareness, the names of these rivers and creeks will be posted along the roadways at 49 different locations.

Watershed Logo Signs

There will be four informative 4' x 8' signs placed in areas where traffic is at a high rate of speed. Their purpose is for project recognition. Another type of informative sign will be placed at public boat landings and county parks. This sign is 16" x 18" and includes the logo and telephone numbers for the public to call for more information about the project. There are eight of these signs. The last type of sign can be considered an educational sign. There will be six of these 3' x 5' signs that will include the watershed logo, a map of the project boundaries, a brochure holder and a short paragraph that explains a project or feature at the sign location.

Storm Drain Stenciling

The Storm Drain Stenciling program is an urban program where volunteers use spray paint to stencil a fish and the words "Dump no Waste--Drains to Bay" near the city's storm drains. The program is designed to teach the public where the storm water outlets and to deter the dumping of waste into storm drains. It also raises public awareness, gets residents involved and provides name recognition for the project. The stenciling will be performed throughout the project duration although no specific schedule will be followed.

Adopt-A-Stream

In an effort to clean up the rivers, creeks, and streams an Adopt-A-Stream program will be implemented. The program will utilize volunteers from youth groups, schools and businesses to assist with the stream clean-up. Trash collection will be the first step and depending on interest levels, insect and plant surveys may also be taken. This program will continue throughout the project duration although no specific schedule will be followed.

Project Display

A project display will be created for use at fairs, banks, schools or malls. The display will highlight urban and rural non-point source pollution problems and solutions. The display will be housed at the Door County SWCD and will be made available to other units of government participating in the project.

Slide Presentation

A slide presentation will be created for use at fairs, schools and meetings. The presentation will focus on rural nonpoint source pollution control measures. The Door County SWCD will create and house the presentation.

Portfolio

A picture album containing installed best management practices (BMPs) and manure handling equipment will be created. The album will be used as a visual aid when working with rural landowners who plan on stalling the BMPs. The Door County SWCD will create and house the portfolio.

Manure Storage Demonstration Project

A roofed manure storage facility will be constructed at the Door County Fair Park during the summer of 1995. The main purpose of the facility is I&E, a secondary benefit of the facility is to reduce nonpoint source pollution. Tours of the facility will be given to interested groups.

Manure Handling Video

A video of manure handling apparatus and operation will be compiled. This video will aid rural landowners when making decisions on how to handle their manure. The Door County SWCD will create and house the video.

Public Meetings

A minimum of two public meetings will be held. The first will be held after the inventory is complete to inform the public about the findings of the inventory and solicit their comments. The second meeting will be held after the watershed plan is written but before it is approved by the counties. The purpose of this gathering is to formally record peoples thoughts on the goals of the project. Both meetings will be advertised in the watershed newsletter, on the radio and in the paper.

Summary of Previously Completed I & E Activities

Several items of the I & E strategy were completed or started during the inventory phase. They are as follows:

- Watershed Fair - A porkie and pancake brunch, entertainment and informational displays. This event was used as a kick-off to the watershed project and for name recognition. There were 610 people in attendance.

- Project Brochures - The brochure gives an overview of the project and its goals. It was and will continue to be distributed to the public through local businesses by using brochure holders.

- Specialty Items - These items include pencils, pens, folders, refrigerator magnets, insulated mugs, baseball style hats and t-shirts. They were distributed at the Watershed Fair, the Door County Fair and through inventory contacts. Any remaining items will be distributed in the same manner.

- Nutrient Management Demo and Farmstead Improvement Field Day - This demonstration reviewed proper nutrient management, manure handling equipment, different types of manure storage structures, economics, and the watershed timetable. Although there is no set schedule, more field days are planned.

- Project Banner - This banner is used at fairs and will also be used along with the project display. It exhibits the project logo for the purpose of name recognition.

Table 6-1. Information and Education Budget

Activity	Total Number	Total Direct Costs
Newsletters	22	$36,800.00
News Releases	8	0
Landowner Surveys	11,400	3,300.00 (postage)
Stream Crossing Signs	92	4,430.00
Watershed Logo Signs	17	2,850.00
Storm Drain Stenciling	8	0
Adopt-A-Stream	8	0
Project Display	1	2,200.00
Slide Presentation	1	100.00
Portfolio	3	575.00
Manure Handling Video	1	10.00
Public Meetings	2	30.00
Watershed Fair	1	3,900.00
Project Brochures	8,000	1,730.00
Specialty Items	10,700	13,040.00
Field Day	3	775.00
Project Banner	1	335.00
Totals	30,268	$70,075.00

CHAPTER SEVEN
Integrated Resource Management Program

Introduction

The purpose of this chapter is to identify natural resource management issues and programs which directly or indirectly provide benefits for water quality and/or fish and wildlife resources. When these various issues and programs come together they provide resource management which spans a wide variety of resources, programs, and agencies.

While the primary purpose of the priority watershed project is to improve and protect water quality, there are also opportunities to enhance fish and wildlife habitat as Best Management Practices (BMPs) are designed and installed. Other programs also provide additional opportunities to protect and improve the same resources targeted through the priority watershed project. In many cases funding is available through other programs which will complement the goals of the watershed project.

The following discussion explains how various issues and programs can be employed to further the quality of resource management in the Red River/Sturgeon Bay Priority Watershed.

Fisheries

Most streambank BMPs can be implemented in a manner which enhances in-stream fish habitat as well as protect water quality. Many of the streams within the watershed only support fish communities composed of a variety of small non-game forage fish such as shiners and dace. These streams are not likely to permanently support game fish even when water quality is improved through the watershed project. They are either intermittent or are too small to support anything other than forage fish. However, forage fish are an important part of the stream. The Green Bay ecosystem and opportunities to enhance the forage fishery while designing and installing BMP's should not be overlooked. Some streams support sport fish such as trout, and habitat enhancement opportunities should be sought on these streams.

The installation of stream side BMP's and other management activities should be conducted in a manner which will benefit the native fish population of the stream regardless of whether it is a sport fishery or forage fishery.

- County staff should contact local DNR Fish Manager to generally determine how BMP's can be installed or modified to enhance habitat for forage fisheries.

- County staff should consult with the local DNR Fish Manager during design of practices along streams that support trout or other game fish.

Fuel Storage Tanks

Leaking fuel storage tanks can be a source of contamination for both groundwater and surface water. Description of programs funding removal and remediation of Leaking Underground Storage Tanks (LUSTs) can be obtained from:

Department of Natural Resources
1125 North Military Avenue
Green Bay, WI 54307
(414) 497-4034.

Water Wells

The Well Compensation Grant Program is available to provide financial assistance to individuals earning less than $45,000/year. The program provides financial assistance for the replacement of private water wells contaminated by a substance of public health concern other than nitrate or bacteria.

Landowners are encouraged to properly abandon improperly constructed or damaged wells and wells that are no longer in use. Landowners should contact their local county watershed project manager for further information on cost-sharing this practice.

Landowners who may be eligible for financial assistance for well replacement through the Well Compensation Grant Program may contact:

Department of Natural Resources
P.O. Box 7921
Madison, WI 53707-7921
(608) 266-5890

Forest Stewardship Program

The Forest Stewardship Program is administered by the Department of Natural Resources and the Farm Services Agency (FSA). The purpose of the program is to assist private forest landowners to more actively manage their forest and related resources; to keep these lands in a productive and healthy condition for present and future owners; and to increase the economic and environmental benefits of these lands. The Program is available for landowners who own a minimum of 10 acres but not more than 1000 acres of forest land.

Landowners who participate in the Forest Stewardship Program through the development of a forest stewardship plan will be eligible to apply for forest management technical and financial assistance through the Forest Stewardship Incentive Program (SIP) and to enroll their lands under the Wisconsin Managed Forest Law (MFL).

The SIP program provides 50%-75% reimbursement for forest management practices which protect soil and water quality or enhance fish and wildlife habitat.

The MFL allows landowners to claim tax credits for forest lands being actively managed according to a forest stewardship management plan.

The Forest Stewardship Program has obvious benefits for soil, water, and wildlife. Forest management practices can complement the priority watershed project by improving forest management.

Eligible forest landowners not currently participating in the Forest Stewardship Program are encouraged to participate. For further information on the Forest Stewardship Program contact your County Forester or the FSA office in your county.

Urban Green Space

Maintaining or creating open or green space can benefit water quality by creating a vegetative buffer between nonpoint pollution sources and water bodies. Urban green space may also provide wildlife habitat and improve the appearance of a community or neighborhood. This land may also provide multiple use areas that can be incorporated into stormwater management plans.

There are three grant programs administered by the DNR which provide funding for the acquisition of land in order to provide additional urban green space. The programs generally provide 50% matching grants. Each program is listed below:

Land and Water Conservation Fund (LAWCON) - This program is supported by Federal funds. The primary intent is to encourage the creation and interpretation of high quality outdoor recreational opportunities. Eligible projects include acquisition of land for public outdoor recreational areas; preservation of water frontage and open space; development of outdoor park and recreation areas and their support facilities.

Urban Green Space - This program provides funding for three major objectives: to provide open natural space in proximity to urban development; to protect from development land with scenic, ecological, or natural values in urban areas; and to provide land for noncommercial gardening in urban areas.

Aids for the Acquisition and Development of Local Parks - This program provides financial assistance to communities for acquiring and developing public outdoor recreation areas.

Counties, villages, cities, towns, school districts, and nonprofit conservation organizations are encouraged to explore the use of these programs to acquire and protect open areas. For further information on these programs contact:

DNR-Lake Michigan Region
Community Services Specialist
1125 North Military Avenue
Green Bay, WI 54307
(414) 497-4034

Agricultural Programs

US Department of Agriculture Programs such as the Conservation Reserve Program (CRP) and the Agricultural Conservation Program (ACP) provide funding for projects that have a direct impact on water quality. These programs will continue to be used in the project area and will provide an additional source of funding for landowners, particularly in those cases where a site is a nonpoint source of pollution but falls outside of the scope of funding availability for Management Category II sources.

The watershed project will be coordinated as much as possible with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by the Department of Agriculture Trade and Consumer Protection, and the Federal Food Security Act (FSA) administered by the Natural Resource Conservation Service. Conservation Farm Plans developed for all landowners in the FSA and FPP programs will need to be amended to include management decisions and the installation of needed BMP's for nonpoint source pollution abatement. This comprehensive approach to farm planning will facilitate consideration of the various goals and objectives for all the programs in which the landowner participates.

Land Records Modernization

Red River/Sturgeon Bay Priority Watershed maps and inventory data will be included in all unit of government's Geographic Information Systems/Land Information Systems (GIS/LIS) implementation efforts. Coordination of the priority watershed project with the GIS/LIS implementation programs will provide an effective delivery method of the watershed project to the public. Staff working on the watershed project will proceed with this coordinated effort as workload demands permit.

CHAPTER EIGHT
Project Evaluation

Introduction

This chapter summarizes the plan for monitoring the progress and evaluating the effectiveness of the Red River/Sturgeon Bay Priority Watershed Project. The evaluation strategy includes these components:

- Administrative review.
- Pollution reduction evaluation for surface water .
- An increase in public awareness and/or knowledge of groundwater pollution and pollution potentials.

Information on these components will be collected by the Door County SWCD, Kewaunee County LCD and Brown County LCD and reported on a regular basis to 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 the SWCD/LCDs to the DNR's Bureau of Community Assistance.

Administrative Review

Administrative reviews,which will be limited to an annual basis, will focus on the progress that Door, Kewaunee, and Brown Counties have made implementing the watershed project. The project will be evaluated with respect to accomplishments, financial expenditures, and staff time spent on project activities.

1. **Accomplishment Reporting**

   The SWCD/LCDs will provide the following data to the DNR on an annual basis, unless the DNR requests additional reports which will be limited to quarterly reports:

   - Number of personal contacts made with landowners.
   - Completed information and education activities.
   - Number of farm conservation plans prepared for the project.
   - Number of cost-share agreements signed.

- Number of farm conservation plan and cost-share agreement status reviews completed.
- Number of farms and acres of cropland checked for proper maintenance of BMPs.

In addition to these reports, representatives from the SWCD/LCDs will meet with the DNR staff annually to review progress and plan for the subsequent year.

2. **Financial Expenditures**

Door County SWCD, Kewaunee County LCD, and Brown County LCD will provide the following financial data to the DNR and the DATCP on a annual basis, unless the DNR requests additional reports which will be limited to quarterly reports:

- Number of cost-share agreements signed.
- Amount of money encumbered in cost-share agreements.
- Number of landowner reimbursement payments made for the installation of best management practices (BMPs), and the amount of money paid.
- Staff travel expenditures.
- Information and education expenditures.
- Expenditures for equipment, materials, and supplies.
- Expenditures for professional services and staff support costs.
- Total project expenditures for the SWCD/LCD staff.
- Amount of money paid for installation of BMPs, and money encumbered in cost-share agreements.

The SWCD/LCDs will also provide the DNR with the following financial data on an annual basis:

- Staff training expenditures.
- Interest money earned and expended.
- Total county SWCD/LCD budget and expenditures on the project.

3. **Time Spent On Project Activities**

Door County SWCD, Kewaunee County LCD, and Brown County LCD will provide time summaries to the DNR for the following activities on a quarterly basis:

- Project and fiscal management.
- Clerical assistance.
- Pre-design and conservation planning activities.
- Technical assistance: practice design, installation, cost-share agreement status review and monitoring.
- Educational activities.
- Training activities.
- Leave time.

Pollutant Load Reduction to Surface Water

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 BMPs. Key sources were identified for estimating changes in pollutant loads that reach surface, in the Red River/Sturgeon Bay Priority Watershed; upland sediment, runoff from barnyards, fields spread with manure, and streambank/shoreline erosion.

As described in Chapter Three, this plan calls for the following pollutant reductions for all subwatersheds:

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

Sediment Goal: Reduce overall sediment delivered by 33 percent to meet this goal, the following is needed:

- 33 percent reduction in sediment reaching streams from agricultural uplands in all subwatersheds.
- 47 percent reduction in streambank sediment delivered to all streams.

Phosphorus Goal: Reduce overall phosphorus load by 70 percent to meet this goal, the following is needed:

- 70 percent reduction in phosphorus pollutants from barnyards in all subwatersheds.
- 70 percent reduction in phosphorus pollutants from winter spread manure on "unsuitable" acres in all subwatersheds.

In addition, the project goal for restoration of degraded or prior converted wetlands is set at 10 percent. A watershed goal is set at 100 percent repair of streambanks, from erosion and unrestricted animal access.

Barnyard Runoff

Door County SWCD, Kewaunee County LCD, and Brown County LCD staff will use the BARNY (Modified ARS) model to estimate phosphorus reductions due to the installation of barnyard control practices. All counties will report the information to the DNR through CAMPS/FOCS system .

Upland Sediment Sources

Door County SWCD, Kewaunee County LCD, and Brown County LCD staff will use the WIN-HUSLE (Wisconsin Nonpoint Source Sediment Delivery Model) to estimate sediment reductions due to changes in cropping practices. The counties will use CAMPS/FOCS to provide data for the WINHUSLE model on a annual basis, as described above.

Streambanks

Door County SWCD, Kewaunee County LCD and Brown 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 BMPs.

Reduction of Pollutants to Groundwater

Key Nonpoint Sources for Evaluating Pollutant Potential Reductions

The purpose of the third evaluation component, pollution reduction to the groundwater, is to quantify the number of BMPs implemented for the protection of the groundwater. Door County SWCD, Kewaunee County LCD, and Brown County LCD will calculate the number of BMPs installed for groundwater protection. This number will be used to quantify the overall reduction in the potential for groundwater pollution.

Another component of the groundwater evaluation, is to qualify the increase in the public's awareness and/or knowledge of groundwater and groundwater quality in the Red River/Sturgeon Bay Priority Watershed prior to and after the projects implementation period. This task will be accomplished with the landowner surveys, which are to be developed by UWEX water quality specialists.

Each section of the Red River/Sturgeon Bay Priority Watershed populous will be asked to complete a landowner survey. Surveys were developed for; landowners who are active farmers, landowners who live in the rural areas, but do not participate in farming activities, landowners who live along the shoreline of the watershed's receiving waters and landowners who reside within the city of Sturgeon Bay boundaries.

APPENDIX A
Watershed Planning Methods

This appendix describes the steps and procedures used to prepare this plan. These are:

- Evaluating surface water quality.
- Assessing pollution sources impacting surface water.
- Evaluating groundwater quality.
- Assessing pollution sources impacting groundwater.
- Assessing pollution sources from urban areas.
- Establishing water resource objectives.
- Establishing pollution reduction goals.
- Developing a nonpoint source control strategy.
- Involving the public and local units of government.

Evaluating Surface Water Quality

The DNR is responsible for designating the biological uses that surface waters can support under proper management and prescribing the water quality required to sustain these designated uses. The DNR assists the local units of government with identifying the methods to implement, achieve and maintain those conditions.

The DNR's Lake Michigan District Water Resources Management staff conducted investigations of the existing quality and natural resource conditions for streams during 1993–1994. Their purpose was to evaluate water quality problems and establish a basis for setting water resources management objectives. Detailed assessment results are documented in the Red River/Sturgeon Bay Surface Water Resource Appraisal Report (Gansburg, 1994).

Data Collection

The following is a summary of the five elements comprising the surface water quality and aquatic habitat investigation.

Subwatershed Delineation and Stream Segmentation

Prior to collecting field data, the watershed was divided into 10 hydrologic subwatersheds. This was accomplished using 1"=2,000' (7.5 minute) U.S. Geological Survey quadrangle maps. These maps were also used to divide the perennial and intermittent stream network into segments. Stream segments were used to separate portions of waterways where either natural conditions or human-induced changes resulted in pronounced differences in stream character and/or water quality.

Stream Habitat Evaluation

Information characterizing stream habitat—including flow rate and depth, substrate quality, channel configuration, stability, and water temperature—was collected using techniques that the DNR developed. The data were evaluated using DNR's Stream Classification Guidelines (Ball, 1982).

Water Quality Assessment

Surface water quality was assessed through review of historical water chemistry data and an evaluation of bottom dwelling animals (macroinvertebrates) using the Hilsenhoff Biotic Index (Hilsenhoff, 1982). Extensive bacteria (fecal coliform) surveys were conducted to assess the suitability of surface waters for recreational use.

Fisheries Resource Assessment

Fish communities were assessed qualitatively using a combination of historical data (Fago, 1984) and information collected during this investigation. Resident fish populations in the streams, lakes, and impoundments were sampled using seines and electric shocking equipment.

Navigability and Recreational Use Determinations

The extent and degree to which streams are navigable was determined based on evidence of canoeing or boating, field data including evidence of stream alteration or use, and information that landowners or other local experts provided. Recreational uses were determined through field observations, file data and information from local users.

Data Interpretation

The data described above were used to determine the existing and potential biological and recreational uses for surface waters. The existing uses reflect present biological and recreational conditions. Potential uses reflect biological and recreational conditions that could be achieved under prescribed types and levels of management. Even though existing and potential uses of a surface water are the same, management programs can result in significant changes in the quality of the aquatic environment. Use classifications and supporting water quality standards used in evaluating water resource conditions are discussed below.

Biological Stream Use Classification

Biological stream use classes describe the fish species or other aquatic organisms which a stream system supports. Designation is based on the ability of a stream to provide suitable habitat and water quality conditions for fish and other aquatic life. The following biological stream use classification system was used statewide and was applied to surface waters in the Red River/Sturgeon Bay Priority Watershed.

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

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

Class I trout streams are high quality, and populations are sustained by natural reproduction.
Class II trout streams have some natural reproduction but may need stocking to maintain a desirable fishery.
Class III trout streams have no natural reproduction and require annual stocking of legal-size fish to provide sport fishing.

Surface Water Quality Standards and Criteria

Surface water quality standards and criteria are expressions of the conditions considered necessary to support biological uses. Water quality standards for biological uses are contained in Chapters NR 102, NR 104, and NR 105 Wisconsin Administrative Code.

In addition to these standards, other criteria were used to assess the suitability of surface waters for biological uses. Data characterizing stream size and accessibility were used to help determine the suitability and types of recreation a stream is capable of supporting. Information on current recreational use of surface waters (provided by users at public access points and discussions with local officials) was also used to assess suitability of surface waters for recreation.

Additional information used to assess the suitability of surface waters for biological uses includes recommended maximum nutrient levels, suspended solids concentrations and the extent to which streambeds are clogged with sediment.

Assessing Pollution Sources Impacting Surface Water

The purpose of the pollution source assessment is to identify the rural sources and quantities of pollutants impacting surface water. Rural pollutant sources assessed for this watershed are discussed below.

Rural Nonpoint Sources

Excessive quantities of sediment, nutrients, oxygen demanding substances, pesticides and bacteria are pollutants carried in runoff draining agricultural areas. These pollutants degrade surface water quality thereby restricting recreational and biological uses. The pollutants also degrade the groundwater quality making some drinking wells non-potable. The principal rural nonpoint sources evaluated in preparing this plan include:

- Animal lots impacting surface water.
- Manure storage sites impacting surface water.
- Eroding croplands delivering sediment to the surface waters.
- Areas contributing runoff of winter spread livestock manure to the surface water.
- Streambank erosion.

The Door County SWCD, Kewaunee County LCD, and Brown County LCD staff conducted inventories during 1993 and 1994. The SWCD/LCD's staff, in cooperation with the DATCP and the DNR completed the data analyses. Inventory and evaluation procedures are summarized below.

Animal Lots Impacting Surface Water

The SWCD/LCD staff mapped the locations of all animal lots in the watershed on 1982 1"=2,000' (7.5 minute) U.S. Geological Survey quadrangle maps. A field survey of each animal lot was conducted to collect information needed to determine the level of pollution.

The animal lot data was used in the "BARNY" Model (Baun, 1992), a modification of the barnyard runoff model, which the U.S. Department of Agriculture, Agricultural Research Service developed (Young, 1982). Information about the mass loading of total phosphorus annually was generated to evaluate the relative pollution loading of each animal lot. The livestock operations were ranked according to the phosphorus loading to the surface waters.

Upland Erosion and Sediment Delivery Impacting Surface Water

The Door County SWCD, Kewaunee County LCD, and Brown County LCD staff conducted the inventory on approximately 139 square miles of land, using existing data and field investigations. Cropland, pastures, grasslands, woodlands and other open (non-urban) land uses were investigated. Existing data sources included site specific farm conservation plans, 1"=660' scale aerial photographs, U.S. Geological Survey 1"=2,000' scale quadrangle maps and CFSA crop reports. 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 (WINHUSLE) Model (Baun & Snowden, 1992). The WINHUSLE model calculates the average annual quantity of eroded soil (sediment) reaching surface or groundwater from each farm field. The determination is made based on a "typical" year of precipitation. Estimated sediment delivery was used to assess the relative pollution potential of each farm field in the watershed.

Runoff From Areas Winter Spread With Livestock Waste Impacting Surface Water

This analysis was done to estimate the pollution potential associated with winter spreading livestock waste in the watershed. The information collected for the barnyard and upland erosion surveys was used in this evaluation.

This analysis was completed using a three-step process. First, the number of acres that each livestock operation needed to land spread manure was calculated for a seven-month period when manure cannot be incorporated into the ground because of frozen or saturated conditions. The amount of manure that each operation generated was based on the number and type of livestock.

Second, the land available to each livestock operation for winter spreading was characterized according to its environmental sensitivity. Lands having slopes equal to or greater than six percent or located within a floodplain were considered to have a high potential to deliver land spread manure to streams or wetlands during periods of spring thaw.

Third, the number of sensitive acres winter spread with manure was estimated for each livestock operation based on the number of acres needed for winter spreading and the proportion of lands available to the livestock operation determined to be environmentally sensitive. This number was used to indicate the relative pollution potential of each livestock operation due to runoff of winter spread manure.

Streambank Erosion

The Door County SWCD, Kewaunee County LCD and Brown County LCD staff conducted field surveys on approximately 14 miles of perennial and intermittent streams located in rural areas. The method used is a modification of the streambank erosion analysis included in Phase II of the Land Inventory Monitoring process used by the U.S. Department of Agriculture, Natural

Resource Conservation Service. At locations where erosion was occurring, the following information was recorded:

- Length of trampled or eroding bank.
- Vertical height.
- Estimated annual rate of recession.
- Adjacent land uses.
- Potential management measures.

The amount of sediment lost annually was calculated for each erosion site. In addition, areas adjacent to streams impacted by livestock, but which were not necessarily eroding at a high rate, were also noted.

Evaluating Groundwater Quality

As part of the watershed's groundwater quality appraisal, 457 private household well samples were collected by landowners or SWCD/LCD staff and analyzed by the WI State Lab of Hygiene. All samples were tested for the presences of nitrates and atrazine. In addition, selected wells were sampled for the presence of coliform bacteria, turbidity, chloride, and/or lead. Samples analyzed for the presence of lead were selected based on proximity to former or existing orchards and pesticide mixing sites. Chapter 4 outlines all results from the well testing program.

Assessing Pollution Sources Impacting Groundwater

The purpose of the pollution source assessment is to identify the rural sources and quantities of pollutants impacting groundwater. Rural pollutant sources assessed for this watershed are discussed below.

Rural Nonpoint Sources

Excessive quantities of sediment (turbidity), chloride, nitrates, pesticides, and coliform bacteria are pollutants from agricultural areas which impact the watershed's groundwater. These pollutants degrade the groundwater quality making some drinking wells non-potable. The principal rural nonpoint sources evaluated in preparing this plan include:

- Animal lots impacting groundwater.
- Manure storage sites impacting groundwater
- Areas of winter spread livestock manure impacting groundwater.

- Eroding croplands delivering sediment to principal outlets in closed depressions.

The Door County SWCD, Kewaunee County LCD, and Brown County LCD staff conducted inventories during 1993 and 1994. Inventory procedures are documented in the SWCD/LCD offices. The SWCD/LCD's and DNR staff completed the data analyses. Inventory and evaluation procedures are summarized below.

Animal Lots Impacting Groundwater

The SWCD/LCD staff mapped the locations of all animal lots in the watershed on 1982 1"=2,000' (7.5 minute) U.S. Geological Survey quadrangle maps. A field survey of each animal lot was conducted to collect information needed to determine the level of pollution each animal lot delivers to the groundwater.

The animal lot data collected was depth of soil to bedrock or water table at the site and depth of soil to bedrock or water table down slope from the site. Additional information gathered during the site visit included the destination of surface runoff waters, such as bedrock features expressed on the land surface or closed depressions. The livestock operations were ranked according to the potential to impact the groundwater, ie; an animal lot with thin soils (< 36") over bedrock have a greater potential to impact the groundwater than an animal lot with deep soils (> 60") over bedrock.

Manure Storage Sites Impacting Groundwater

The manure storage site data collected was depth of soil to bedrock or water table at the site and depth of soil to bedrock or water table down slope from the site. Additional information gathered during the site visit included the destination of the runoff waters, such as bedrock features expressed on the land surface or a closed depression. The livestock operations were ranked according to the potential to impact the groundwater, ie; a manure storage site with thin soils (< 36") over bedrock have a greater potential to impact the groundwater than a manure storage site with deep soils (> 60") over bedrock.

Runoff From Winter Spread Livestock Waste Impacting Groundwater

If contaminated water reaches the underlying dolomite bedrock, little or no filtering action takes place prior to the mixing of the contaminated water with the drinking water aquifer. The location, nature, and concentration of fracture traces, exposed bedrock and other solution features are thus major concerns in the Red River/Sturgeon Bay Watershed.

An intricate part of the watershed planning process was the collection of information on the various nonpoint sources of groundwater contamination. Staff was hired by the Door County SWCD, Kewaunee County LCD, and Brown County LCD to gather the actual field data. The data was analyzed by the groundwater quality appraisal workgroup. The inventory methods used for each pollutant source are described below.

During the inventories, areas of the project which drained into the groundwater system were identified. Runoff from these areas would most likely be detrimental to the groundwater quality. The sources of pollutants in these areas were compared only to each other for their potential to affect groundwater.

The relative importance of groundwater pollutant sources was determined independently of the relative importance of surface water pollutant sources.

Two methods were used in conducting the inventory for potential groundwater pollutants. First, the physical features in the project area that (could) increase the potential for groundwater contamination were examined. These features are discussed below along with a description of how each assessment was done.

Physical Feature Assessment Methods

Base Maps

In order to make assessments, two mosaic base maps were constructed for each township using the reduced scale soil survey sheets. This was done by reducing USDA Natural Resource Conservation Service Soil Survey sheets for the three Counties from their printed scale of 1" = 1,320' to 1" = 2,000'. The 1" = 2,000' scale was used because it matches the existing USGS topographic maps.

Fracture Traces Maps

A fracture trace is defined as a natural linear feature consisting of topographic (including straight stream sediments), vegetation, or soil tonal alignments which are visible primarily on aerial photographs and are expressed continuously for less than one mile. The fracture traces map was developed using stereo pair aerial photographs to locate the fracture traces. The photographs were observed for ten minutes per square mile for a maximum of two hours per session. The photographs were then observed out of stereo for any obviously missed fracture traces.

Many fracture traces were mapped in the Red River/Sturgeon Bay Watershed. The distribution ranged from very high densities with many intersections to isolated features to large areas where no fracture traces were identified.

The map produced by UW-Green Bay is a black line mylar overlay showing the locations of the fracture traces.

Exposed Bedrock and Solution Features

The exposed bedrock and solution feature maps was compiled with information gathered during field reconnaissance beginning in the spring of 1993, with the majority of the field work being conducted in the spring and summer of 1993.

Field workers conducted interviews with landowners, especially long-time farmers and hunters. Questions concerning karst features and the individual's familiarity with the area were asked. This information was field checked by the investigations for accuracy, location and descriptions.

The field investigators also checked fields, woodlots and suspicious areas independent of those identified through the interviews. Sinkholes, crevices, dolomite pavements, insurgent points, springs and caves were inventoried and mapped. Information was also obtained from a review of the limited published and unpublished literature.

The maps illustrate the location of exposed bedrock, quarries, sand and/or gravel pits, abandoned wells, open sinkholes or insurgent points, filled sinkholes, swallets (a form of sinkhole), springs, crevices, dolomite pavement, caves, historic karst features and areas with numerous features.

As with the fracture trace maps, the exposed bedrock and solution feature maps were prepared as a black line mylar overlay. These maps can be viewed at the local county SWCD/LCD for the respected county.

Closed Depression Maps

As a result of glaciation and karstic action, many areas within the Red River/Sturgeon Bay project area are internally drained, meaning that there is no surface outlet for the runoff water. In order to exit the closed topographic depression, runoff water must enter the groundwater system or leave through evaporation. The closed topographic depressions found in the watershed range in size from a few square feet to a couple square miles.

The locations of the large closed topographic depressions are of importance in considering potential groundwater contamination due to their function as contaminated water traps. These "traps" permit the water to enter the groundwater system.

Utilizing USGS 7.5 minute topographic maps with ten foot contour lines, the drainage areas were delineated. Field investigations by SWCD/LCD staff were conducted to locate other significant closed depressions.

Since closed depressions range greatly in size, only those which are large enough to be significant in terms of nonpoint source pollutant land use concerns were mapped. The larger closed depressions were often mapped in the upper end of the drainage areas.

The closed depression maps were prepared as black line mylar overlays (at a scale of 1" to 2,000') to correspond with the other resource maps that had been developed. A total of five township maps were completed.

Soil Attenuation Potential Maps

Water polluted by various land use activities often can be "cleansed" (to different degrees) as it moves from the surface downward through soil layers before reaching the groundwater.

Pollutants in the water react in different ways to a variety of physical and chemical properties of soils, determining both what quantity and which pollutants are removed from the water.

This process, which is called attenuation, involves factors such as holding essential plant nutrients for uptake by crops, immobilizing metals, and removing bacteria contained in animal or human wastes. These complex processes make the soil an integral part of groundwater protection from surface pollutants.

The pollution of groundwater can occur when either the attenuation capacity of the soil system is exceeded or when the system simply does not have sufficient attenuation capacity to treat the type or quantity of pollutants which are moving through it. In portions of the Red River/Sturgeon Bay Watershed, the preponderance of thin soils overlying fractured dolomitic limestone greatly reduces the attenuation capacity and accelerates the transport of polluted surface waters into the groundwater system.

In the project area, it was essential to evaluate the capacity of the soil system to remove pollutants as one component of the overall process to determine the susceptibility of the groundwater to contamination. A method was developed to assess the soil properties which play a role in the attenuation of potential groundwater pollutants. The results of this assessment were used to prepare the Soil Attenuation Potential Maps.

In assessing the potential of the soil for attenuation, six physical and chemical soil properties were given weighted values. These values were summed and soil mapping units with similar total point scores were placed into five groups which reflect differing attenuation potentials. Soil properties evaluated were 1) the organic matter content of the surface layer; 2) the pH of the surface layer; 3) the soil drainage class; 4) the permeability of the control section, which on soil maps is the top five-foot layer of soil, regardless of type; 5) the depth to bedrock, and 6) the depth to gravelly or cobbly substratum. Technical information for the rating system was obtained from the Door County Soil Survey Report (1978), Brown County Soil Survey Report (1974), Kewaunee County Soil Survey Report (1980), and current soil interpretation records.

The organic matter content of the soil is important because it increases the ability of the soil to 1) hold nutrients, making them available for plant uptake; 2) bond heavy metals, making them less soluble in water; and 3) absorb organic chemicals such as herbicides and pesticides. Also, it provides a valuable medium for soil microorganisms, which play an important role in the breakdown of organic wastes and pesticides. The pH of the soil is also included in the ranking since the processes mentioned above usually function better in a neutral or mildly alkaline soil pH system.

The effectiveness of the soil as a treatment/recycling system depends on the rate at which water moves through the soil. Thus, the permeability of the top five-foot layer of soil (the control section) was ranked. Soil drainage class, which indicates the high water table or zone of saturation was also an important factor considered. A deep, medium-textured, well-aerated soil offers the best opportunity for water to percolate through with maximum contact between potential pollutants and the mineral and organic fractions. Depth to bedrock and depth to gravelly or cobbly substratum were also evaluated. In the Red River/Sturgeon Bay Watershed

project, emphasis was placed on depth to bedrock than on any other factor evaluated because pollutants can move rapidly into groundwater supplies through the fractured dolomitic limestone common to the project area.

The reduced-scale mosaic base maps of the soil survey sheets described in the preceding section on shallow soils mapping were also used as the base map for the Soil Attenuation Potential Map. A mosaic base map was prepared, locating in color the soils identified in the five groups described above. The end product is a five-color overlay which can be used with nonpoint source location maps to identify groundwater pollution concerns. Five township maps were completed.

Field Groundwater Pollution Potential Rating System

The field groundwater pollution potential rating system was developed to provide a tool for the analysis of landuse impacts on groundwater quality. As part of the rating system, all maps described in the physical feature assessment section, were digitized by the DNR Bureau of Information Management - Geographical Services Section.

The field rating system included information on land owned and lands adjacent to lands owned/operated by livestock producers. Parcel boundaries and transitional area boundaries were traced onto a 1"=2000' base map and forwarded to BIM-GEO to be digitized. Each parcel of land was assigned a transitional area of 1320 linear feet from the actual property boundary. The transitional area is important to the rating system, since surface water runoff crosses property boundaries.

The field rating system also included information on the number of livestock a landowner and/or land operator(s) had on a parcel of land during the animal lot inventory. The number of livestock on each land parcel was used to develop a numerical value associated with the potential impacts from livestock.

The digitized map format and additional information, just outlined, allowed staff from the Door County SWCD, Brown and Kewaunee Counties LCDs, DATCP, and the DNR to develop a field rating system for the potential impacts to groundwater quality. The rating system developed, assigns a point value for each physical feature found within the property boundary and the transitional area. The highest point values assigned were for the closed depressions and the lowest point values assigned were for the livestock numbers. The following section outlines each component of the rating system.

Soil Attenuation

The percentage of each soil attenuation group in the parcel and in the transitional property was calculated. The percentages were then multiplied by a point value assigned to each attenuation group. The point values for the transitional property were 1/2 that of the parcel in question. Maximum point value = 300.

Bedrock Features

If mapped bedrock features were present on the parcel of land or in the transitional property a point value was assigned. Also, the density at which the fracture traces appear on the parcel or the transitional property were assigned a point value. The point values for the transitional property were 2/3 that of the parcel in question. Maximum point value = 350.

Closed Depressions

If a closed depression was present on the parcel of land, a point value was assigned for the percent of land associated with the closed depression. Also, if a principal outlet was present in the closed depression a point value was assigned. Maximum point value = 600.

Fracture Traces

If fracture traces were present on the parcel or the transitional property, a point value was assigned. Also, the density at which the fracture traces appear on the parcel and the transitional property were assigned point values. The transitional property fracture trace density point values are 1/2 that of the parcel. Maximum point value = 300.

Point Totals and Interpretation

The maximum value that a parcel of land could have is 1550 points. This includes a maximum value of 1175 points for the owned parcel and a maximum value of 375 for the transitional property.

This system allowed the groundwater quality appraisal workgroup to compare different parcels of land for potential groundwater quality impacts. The higher a point value assigned to a parcel of land, the greater the potential for impacting groundwater quality. The land parcels were ranked relative to each other. Closed depressions with principal outlets were used in addition to the rating system for an independent ranking.

An area which contains all five of the mapped features is considered to have the highest potential risk for groundwater pollution. Areas with most of the mapped features are considered areas of high potential risk for groundwater pollution. Exposed bedrock and shallow soils provide little or no filtering of the infiltrating tainted surface runoff waters. Sinkholes transport the contaminated surface waters directly into the groundwater system and the known location of one or more sinkholes can indicate that other unknown covered or filled sinkholes are also present. The occurrence of fracture traces in the area further indicates that the bedrock is highly creviced and that water transport in the bedrock will be rapid and pollutant filtration ineffective. If this same site is also located in a closed depression in which all surface runoff is internally drained, and there is no surface water outlet, all runoff-carried pollutants must be filtered prior to flowing into the bedrock feature or they will enter into the groundwater system. The greater the density of any of the three features mentioned above, the higher the groundwater pollution risk potential will be.

The other extreme case has soils present with good potential to attenuate groundwater pollutants, and none of the other bedrock features would be considered to have the lowest potential risk for groundwater pollution. This is not to say that groundwater pollution will not occur but rather the relative potential is less than other sites.

Ranking sites in between the two extreme cases just described is more difficult than selecting the two extreme cases. For example, the closed depression which is drained by a sinkhole(s) as the principal outlet has a very high potential to pollute groundwater whether or not shallow soils or any other bedrock features are found. However, a sinkhole draining a location with shallow soils would be of a higher concern than such a location with deep soils. Simply put, the more features found at a site the greater the potential for groundwater pollution.

Upland Erosion and Sediment Delivery Impacting Groundwater

The Door County SWCD staff conducted the inventory on approximately 19.75 square miles of land, which is mapped as closed depressions with a principal outlet, using existing data and field investigations. Cropland, pastures, grasslands, woodlands and other open (non-urban) land uses were investigated. Existing data sources included site specific farm conservation plans, 1"=660' scale aerial photographs, U.S. Geological Survey 1"=2,000' scale quadrangle maps and CFSA crop reports. 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, and channel type.

Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source (WINHUSLE) Model (Baun & Snowden, 1992). The WINHUSLE model calculates the average annual quantity of eroded soil (sediment) reaching groundwater from each farm field. The determination is made based on a "typical" year of precipitation. Estimated sediment delivery was used to assess the relative pollution potential of each farm field in the watershed.

Assessing Pollution Sources From Urban Areas

Nationwide investigations confirm that urban runoff can have a significant adverse impact on receiving waters. The result is that urban areas and activities can upset several important components of a stream including stream flow, habitat, water quality, bottom sediment quality, and stream biology (Pitt, 1987).

Pollutants carried in urban stormwater runoff include some of the same pollutants associated with rural nonpoint source runoff, such as; sediment, nutrients, oxygen demanding organic materials, bacteria, and pesticides. Other pollutants, many of which are potentially toxic, are transmitted to surface and groundwater primarily by urban runoff. These include heavy metals (lead, zinc, chromium, copper, cadmium and arsenic) and a wide range of hazardous organic compounds. Urbanization and channelization also causes devastating hydrologic changes in streams by reducing groundwater recharge and increasing the volume and peak of stream flow during storms. This results in flashy streams which destroy stable habitat for aquatic life and often

necessitates the conversion of natural streams into stormwater conveyance channels to reduce flood damages.

Principal urban nonpoint sources of pollution evaluated in preparing this plan include:

- Existing urban land uses.
- New urban development, including the potential for construction site erosion as well as increased pollutant loading from the newly established urban surfaces.

Stormwater pollutant concentrations, runoff volumes, and pollutant yields vary according to the urban land use (residential, commercial, industrial) and development characteristics (intensity of the development, stormwater conveyance system). The inventory of existing and planned urban areas was designed to quantify the urban land use and development characteristics for existing and planned urban development. This information was used to estimate the existing and future urban pollutant loads.

Existing Urban Areas: One study area was delineated in the watershed and included all of the incorporated area of the city of Sturgeon Bay and lands sufficient to accommodate planned future development. The study areas cover those portions of the watershed in Door County.

McMahon and Associates, Inc. was retained to provide assistance to the city of Sturgeon Bay with all aspects of the project inventory. As part of the inventory the city was delineated on 1"=400' scale aerial photos, digitized, quantified, and mapped existing land use categories.

New Urban Development: Potential new urban development areas were delineated, quantified, and mapped areas of planned development for each study area on 1"=400' scale maps. This information was based on existing land use configuration, Sturgeon Bay Utilities sanitary sewer service area plans, other land use plans where available and meetings with local officials to discuss information on committed or planned development projects. It was assumed that environmental corridors and isolated natural areas would not be urbanized.

The DNR used this information on existing and planned urban development in its Source Loading and Management Model (Pitt and Voorhees, 1989) to estimate urban nonpoint source loads for three pollutants—sediment, phosphorus, and lead (representing urban toxic materials). Information on existing pollutant loads was used to identify the magnitude and distribution of the current urban nonpoint source loadings and to identify high priority land uses responsible for most of these loads. Information on planned urban development was used to estimate the future pollution potential associated with uncontrolled development. The effectiveness of applying urban management practices to existing and planned urban areas was also evaluated to determine what level of management is needed to reduce current urban pollutant loads to acceptable levels.

The potential for construction site impacts was assessed based on the number of acres planned for development and the adequacy of existing local construction erosion control programs. The city of Sturgeon Bay provided the number of acres planned for development to the DNR.

Other Pollution Sources

Additional sources of surface water pollution beyond those discussed in this plan are degrading water quality in the watershed. These pollution sources have the potential of overshadowing improvements in water quality that might otherwise occur as a result of the priority watershed program.

The DNR conducted an inventory and evaluation of these other pollution sources. Inventory results and recommendations for alleviating the water quality impacts of these other pollution sources are documented in Chapter Four of this plan.

Establishing Surface Water Resource Objectives

Biological water resource objectives were established for each of the streams and bays in the watershed. These objectives identify how the project is anticipated to change the quality of the aquatic environment for recreational and biological uses. Factors considered in establishing water resource objectives include: existing water quality and aquatic habitat; factors or pollutants that may be preventing the surface water from reaching its full potential of supporting biological and recreational uses; and the practicality of reducing pollutants.

Establishing Groundwater Resource Objectives

Water resource objectives were established for the groundwater of the watershed. These objectives identify how the project is anticipated to protect or change the quality of the aquifer in the watershed. Factors considered while establishing the objectives were: the high standards required for potable water, existing water quality; factors or pollutants that may be preventing the aquifer from reaching its full potential; and the practicality of reducing pollutants; the level of landowner cooperation.

Establishing Pollution Reduction Goals

Nonpoint pollution reduction goals are estimates of the level of nonpoint source control needed to meet the water quality objectives identified in this plan. Pollution reduction goals and water resource objectives are established together since they are integrally related.

Nonpoint source pollution reduction goals contained in this plan are a refinement of recommendations contained in water quality management plan prepared by the DNR (DNR;1980, 1989-90, 1995).

The nonpoint source pollution reduction goals in this plan specifically target the control of nitrates, bacteria, sediment, phosphorus, and stream flow changes in rural areas and the control of sediment, phosphorus, and urban toxic materials in urban areas. Importantly, reducing the quantity of these substances reaching both the surface or groundwater decreases the amount of other substances such as pesticides which degrade water quality.

Water resource objectives presented in this plan recognize that pollution control and resource management efforts beyond the scope of the Wisconsin Nonpoint Source Water Pollution Abatement Program are needed to achieve the identified objectives. These will include implementation of other recommended management actions which the DNR establishes in the amended areawide water quality management plan for the Twin Door Kewaunee Basin.

Developing a Nonpoint Source Management Strategy

The final step in the planning process is the development of a strategy for achieving the nonpoint source pollution reduction goals identified in the plan. Several items are addressed in developing the management strategy including:

- Critical nonpoint pollution sources.
- Effective management practices and guidelines for use of state cost-share funds for practice installation.
- Responsibilities, estimated workloads and work schedules for local implementing agencies, and guidelines for use of state funds to support local implementation activities.
- Estimated cost of installing practices and supporting staff at the local level.
- Information and education needs.
- Project evaluation needs.

Identification of critical nonpoint sources eligible for cost-share and technical assistance under the Nonpoint Source Water Pollution Abatement (NPS) Program were determined by:

- Evaluating pollutant loading for each nonpoint source in the watershed.
- Determining the relative importance of controlling each source (animal lots, urban runoff, cropland erosion, etc.) to achieving the water resource objectives.
- Developing criteria to determine which sources need to be controlled.
- Applying the criteria to determine eligibility for participation in the priority watershed project.

This evaluation was carried out on a subwatershed and watershed basis for the rural and urban nonpoint sources. The result is a site specific ranking of nonpoint sources and a determination of financial and technical assistance to be made available through the nonpoint source program for the control of NPS pollution.

Involving the Public and Local Units of Government

The Door County, Kewaunee County, and Brown County Board of Supervisors and the city of Sturgeon Bay City Council convened a citizens advisory Ad Hoc committee to comment on this watershed plan. The advisory committee contains representatives from city of Sturgeon Bay, the three counties, towns in the watershed, environmental groups and interested citizens. This subcommittee primarily provided a liaison network to the citizens of the watershed and reviewed plan chapters.

Five technical work groups were convened to help with developing technical aspects of the plan: a surface water quality appraisal work group, a groundwater quality appraisal workgroup, a rural land resources inventory work group, an urban land resources inventory work group, and an integrated resources workgroup. These groups reviewed land and water resource assessment information, assisted in developing water resource objectives and pollution reduction goals and assisted in developing the pollution control strategies.

APPENDIX B
Glossary

ACUTE TOXICITY:
Any poisonous effect produced by a single short-term exposure to a chemical that results in a rapid onset of severe symptoms.

ADVANCED WASTEWATER TREATMENT:
The highest level of wastewater treatment for municipal treatment systems. It requires removal of all but 10 parts per million of suspended solids and biological oxygen and/or 50 percent of the total nitrogen. Advanced wastewater treatment is also known as "tertiary treatment."

AGRICULTURAL CONSERVATION PROGRAM (ACP):
A federal cost-sharing program to help landowners install measures to conserve soil and water resources. ACP is administered by the USDA FSA through county FSA committees.

ALGAE:
A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Therefore, algae effect the oxygen content of water. Nutrient-enriched water increases algae growth.

AMMONIA:
A form of nitrogen (NH_3) found in human and animal wastes. Ammonia can be toxic to aquatic life.

ANAEROBIC:
Without oxygen.

ANTIDEGRADATION:
A policy stating that water quality will not be lowered below background levels unless justified by economic and social development considerations. Wisconsin's antidegradation policy is currently being revised to make it more specific and meet EPA guidelines.

AREA OF CONCERN:
Areas of the Great Lakes identified by the International Joint Commission (IJC) as having serious water pollution problems.

AREAWIDE WATER QUALITY MANAGEMENT PLANS (208 PLANS):
A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve basin water quality. Each basin in Wisconsin must have a plan prepared for it, according to section 208 of the Clean Water Act.

ASSOCIATED CHANNEL:

A linear depression in the ground surface through which water flows, intermittently or continuously, into a rockhole depression or rockhole opening.

ASSOCIATED CHANNEL CROSS-SECTION:

The amount of surface of a two dimensional vertical plane within an associated channel positioned perpendicular to the centerline of an associated channel. The uppermost extent of the plane shall be a line extending between 2 associated channel edges.

ATTENUATION:

Water polluted by various land use activities often can be "cleansed" to different degrees) as it moves from the surface downward through the soil layers before reaching the groundwater.

AVAILABILITY:

The degree to which substances or pollutants are present in sediments or elsewhere in the ecosystem and are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by sediment. Oxygen content, Ph, temperature and other conditions in the water can affect availability.

BACTERIA:

Single-cell, microscopic organisms. Some can cause disease, but others are important in organic waste stabilization.

BASIN PLAN:

See "Areawide Water Quality Management Plan".

BENTHIC ORGANISMS (BENTHOS):

Organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP):

The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION:

The uptake and retention of substances by an organism from its surrounding medium and food. As chemicals move through the food chain, they tend to increase in concentration in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOCHEMICAL OXYGEN DEMAND (BOD):

A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. BOD_5 is the biochemical oxygen demand measured in a five day test. The greater the degree of pollution, the higher the BOD_5.

BIODEGRADABLE:
Waste that can be broken down by bacteria into basic elements. Most organic wastes such as food remains and paper are biodegradable.

BIOTA:
All living organisms that exist in an area.

BUFFER STRIPS:
Strips of grass or other erosion-resisting vegetation between disturbed areas and a principal outlet, stream, or lake.

CARCINOGENIC:
A chemical capable of causing cancer.

CATEGORICAL LIMITS:
All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/1 effluent limits for SS and BOD). For industry the level depends on the type of industry and the level of production. More stringent effluent limits are required, if necessary, to meet water quality standards.

CHLORINATION:
The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CLEAN WATER ACT:
See "Public Law 92-500."

CLOSED DEPRESSION:
An area of land surface which is internally drained with no surface outlet for runoff water. In order to leave the closed depression, runoff water must enter the groundwater system or leave through evaporation

CONSERVATION TILLAGE:
Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease.

CONSUMPTION ADVISORY:
A health warning issued by DNR and WDHSS that recommends people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT:
Some material that has been added to water that is not normally present. This is different from a pollutant, which suggests there is too much of the material present.

CONVENTIONAL POLLUTANT:
Refers to suspended solids, fecal coliform, biochemical oxygen demand, and Ph, as opposed to toxic pollutants

COST-EFFECTIVE:

A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA:

See water quality standard criteria.

DISINFECTION:

A chemical or physical process that kills organism that cause disease. Chlorine is often used to disinfect wastewater.

DISSOLVED OXYGEN (DO):

Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen often result from inadequate wastewater treatment. The DNR considers 5 ppm DO necessary for fish and aquatic life.

DREDGING:

Removal of sediment from the bottom of water bodies.

ECOSYSTEM:

The interacting system of the biological community and its nonliving surrounding.

EFFLUENT:

Solid, liquid or gas wastes (byproducts) that are disposed on land, in water or in air. As used in the Remedial Action Plan (RAP), effluent generally means wastewater discharges.

EFFLUENT LIMITS:

The DNR issues WPDES permits establishing the maximum amount of pollutant to be discharged to a receiving stream. Limits depend on the pollutant and the water quality standards that apply for the receiving waters.

ENVIRONMENTAL PROTECTION AGENCY (USEPA):

The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL REPAIR FUND:

A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EROSION:

The wearing away of the land surface by wind or water.

EUTROPHIC:

Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION:

The process of nutrient enrichment of a lake facilitating increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FECAL COLIFORM:

A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

FISHABLE AND SWIMMABLE:

Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FRACTURE TRACES:

A fracture trace is defined as a natural linear feature consisting of topographic (including straight streams sediments), vegetation, or soil tonal alignments which are visible primarily on aerial photographs and are expressed continuously for less than one mile.

GREEN STRIPS:

See buffer strip.

GROUNDWATER:

Underground water which fills internal passageways and pores of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

HABITAT:

The place or type of site where a plant or animal naturally lives and grows.

HEAVY METALS:

Metals present in municipal and industrial wastes that pose long-tern environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE:

A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

KARST:

A type of topography formed over limestone/dolomite by dissolving or solution. Characterized by disorganized surface drainage patterns, surface terrain with sinkholes and closed depressions, and underground drainage.

LANDFILL:

A conventional sanitary landfill is "a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading solid wastes in thin layers, materials at the end of each operating day". Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization chemical fixation encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LEACHATE:

The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

LOAD:

The total amount of materials or pollutants reaching a given local water body.

MACROPHYTE:

A rooted aquatic plant.

MASS:

The amount of material a substance contains causing it to have weight in a gravitational field.

MASS BALANCE:

A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC:

Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrohpic.")

MILLIGRAMS PER LITER (mg/1):

A measure of the concentration of substance in water. For most pollution measurement this is the equivalent of "parts per million".

MITIGATION:

The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses or replacing lost values.

NONPOINT SOURCE POLLUTION (NSP):

Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

NPS:
See nonpoint source pollution.

OLIGOTROPHIC:
Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

OUTFALL:
The mouth of a sewer, drain, or pipe where effluent from a wastewater treatment plant is discharged.

PATHOGEN:
Any infective agent capable of producing disease. It may be a virus, bacterium, protozoan, etc.

PELAGIC:
Referring to open water portion of a lake.

PESTICIDE:
Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

PH:
A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral, 0 being most acid, and 14 being most alkaline.

PHOSPHORUS:
A nutrient that, when reaching lakes in excessive amounts, can lead to overfertile conditions and algae blooms.

PLANKTON:
Tiny plants and animals that live in water.

POINT SOURCES:
Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION:
The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

PRETREATMENT:
A partial wastewater treatment required from some industries. Pretreatment removes some types of industrial pollutants before the wastewater is discharged to a municipal wastewater treatment plant.

PRINCIPAL OUTLET:
A principal outlet is a sinkhole or rockhole feature located in a closed depression which directly links surface water runoff to the groundwater.

PRIORITY POLLUTANTS:

A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major dischargers are required to monitor all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED:

A drainage area about 100,000 acres in size selected to receive Wisconsin Fund money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

PRODUCTIVITY:

A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

PUBLIC LAW 92-500 (CLEAN WATER ACT):

The federal law that sets national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all dischargers of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

PUBLIC PARTICIPATION:

The active involvement of interested and affected citizens in governmental decision-making.

PUBLICLY OWNED TREATMENT WORKS (POTW):

A wastewater treatment plant owned by a city, village or other unit of government.

RECYCLING:

The process that transforms waste materials into new products.

RETRO-FIT:

The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN:

Belonging or relating to the bank of a lake, river or stream.

RIPRAP:

Broken rock, cobbles, or boulders placed on the bank of a stream or shoreline to protect it against erosion.

ROCKHOLE:

Any depression or opening in the ground surface assocated with an opening in the underlying bedrock.

RULE:
Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF:
Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS:
The indirect effects that an action can have on the health of the ecosystem or the economy.

SECONDARY TREATMENT:
Two-stage wastewater treatment that allows the coarse particles to settle out, as in primary treatment, followed by biological breakdowns of the remaining impurities. Secondary treatment commonly removes 90% of the impurities. Sometimes "secondary treatment" refers simply to the biological part of the treatment process.

SEDIMENT:
Soil particles suspended in and carried by water as a result of erosion.

SEICHES:
Changes in water levels due to the tipping of water in an elongated lake basin whereby water is raised in one end of the basin and lowered in the other.

SEPTIC SYSTEM:
Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

SINKHOLE:
Cone-shaped depressions or holes, which are expressed on the land surface, with a subterranean passage developed by the solution process.

SLUDGE:
A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE:
Unwanted or discharged material with insufficient liquid to be free flowing.

SOLUTION PROCESS:
The enlargement of vertical crevices and horizontal bedding planes in the dolomite bedrock resulting from acidic infiltrating water contacting the dolomite causing a chemical reaction which dissolves the dolomite.

STANDARDS:
See water quality standards.

STORM SEWERS:

A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUSPENDED SOLIDS (SS):

Small particles of solid pollutants suspended in water.

SWALLET:

Sinkholes or rockhole which intercept a stream, diverting all or a portion of it to the groundwater.

"T" SOIL LOSS TOLERANCE:

T is the maximum average annual soil loss in tons/acre/year that is permitted on a given soil if it is to remain productive. In general, soil formation equals soil erosion loss at T value

TERTIARY TREATMENT:

See advanced wastewater treatment.

TOTAL MAXIMUM DAILY LOADS:

The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC:

An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE:

A chemical or mixture of chemicals which, through sufficient exposure, or ingestion, inhalation of assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TREATMENT PLANT:

See wastewater treatment plant.

TROPHIC STATUS:

The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

TURBIDITY:

Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX):
A special outreach, education branch of the state university system.

VARIANCE:
Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

WASTELOAD ALLOCATION:
Division of the amount of waste a stream can assimilate among the various dischargers to the stream. This limits the amount (in pounds) of chemical or biological constituent discharged from a wastewater treatment plant to a water body.

WASTEWATER:
Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE:
Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT:
A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY LIMITED SEGMENT:
A section of river where water quality standards will not be met if only categorical effluent standards are met.

WATER QUALITY CRITERIA:
A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY STANDARDS:
The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE:
When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

WATERSHED:
The land area that drains into a lake, river, or definable sinkhole.

WETLANDS:

Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WISCONSIN ADMINISTRATIVE CODE:

The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND:

A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state's taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for treatment plant construction, but three percent of this fund is available for repair or replacement of private, on-site sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution. Nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. $500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM:

A state cost-share program established by the State Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES):

A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

BIBLIOGRAPHY

Bachhuber, J.A., and W. Schuster, 1987. A Nonpoint Source Control Plan for the Upper Door Priority Watershed Project, WI DNR and Door County Soil and Water Conservation Dept.

Bagg, R.M., 1934. Report on Artesian Water Supplies, Sturgeon Bay, Door County, WI Unpublished report

Blanchard, M.C., 1988. Investigation of the Shallow Fractured Dolomite Aquifer in Door County, WI. Unpublished M.S. Thesis, UW-Madison.

Bradbury, K.R., 1982. Hydrogeologic relationships between Green Bay of Lake Michigan and onshore aquifer of Door County, Wisconsin. Ph.D. Dissertation, UW-Madison. 287 pp.

Bradbury, K.R., and M.C. Muldoon, 1989. Upper Door Priority Watershed Monitoring Project 1st Year Summary Report.

Bradbury, K.R., M.C. Blanchard, and M.A. Muldoon, 1988. Hydrogeology and Groundwater Geochemistry in Fractured Dolomite, Northeastern WI, Presented at the International Conference on Fluid Flow in Fractured Rocks, May 15-18, Atlanta GA.

Brown County Planning Commission, 1979. Brown County Water Plan: Evaluation and Update, A Supplement to the Brown County Water Plan.

Check, J.W., 1990. Trace Element Analysis of Door County Dolomite, Unpublished M.S. Thesis, UW-Green Bay.

In order to determine if lead in groundwater originates from soil-pesticide residues or from naturally occurring lead in the dolomite. A general survey of trace element concentrations was done in the dolomite rock. An attempt was also made to determine if there were observable stratigraphical or geographical patterns of trace element distributions. No significant patterns emerged with statistical analysis and it was concluded that lead levels are too low in the dolomite to be the source of lead in groundwater.

Cherkauer, D.S., P.F. McKereghan and L.H. Schalch, 1992. Delivery of Chloride and Nitrate by Groundwater to the Great Lakes: Case Study for the Door Peninsula, Wisconsin.

A finite -element transport model of the dolomite aquifer of the Door Peninsula of Wisconsin is used to determine mass loadings of chloride and nitrate delivered to Lake Michigan and Green Bay by groundwater. Verification of the model has not been possible due to lack of data.

Craig, K. 1989. Determination of Groundwater Discharge into Green Bay and Lake Michigan from Door County, Wisconsin. Unpublished M.S. Thesis, UW-Milwaukee, 125 pp.

Deller, H. and Stoelting, P., 1986. Wisconsin's Door Peninsula and Geomorphology. The Wisconsin Geographer, vol. 2, pgs 29-41.

Door County SWCD, 1985-1986. Mapping and description of 51 springs in the Upper Door Priority Watershed.

Door County SWCD, 1989, 1990. Agri-chemical Well Sampling. Unpublished well test data for nine Pesticides.

Door County SWCD, 1991, Orchard Soil: Lead and Arsenic Study. Unpublished report on collection and testing of orchard soils.

Door County SWCD, 1988. Unpublished UDPW well sample data of 141 wells for eight parameters.

Drescher, W.J., 1953. Groundwater Conditions in Artesian Aquifers in Brown County, WI. USGS Water-Supply Paper 1190.

Emmons, Pat, 1985. An Evaluation of the Bedrock Aquifer System in Northeastern WI, WGNHS Water Resources Investigation 85-4199.

Fetter, C.W., Jr., 1978. Hydrogeology of the Sturgeon Bay Area.

Reviews existing data on the hydrogeology of Sturgeon Bay to assess the potential for future groundwater development.

Gansburg, M., 1994. Red River/Sturgeon Bay Surface Water Resource Appraisal Report.

Hawk, K.E., 1991. Characteristics of Geology, Dwellings, and Households: Their Impact on Radon in Door County, Wisconsin Homes, Unpublished M.S. Thesis, UW-Green Bay.

The purpose of this study was to verify and characterize anomalously high radon occurrences in Door County homes. Fifty-five locations were surveyed and a subset of those were investigated to determine the cause of high radon readings. The exposed population were separated into socioeconomic, energy efficient, radon access and karst level categories. Presence of absence of karst features is shown to be statistically significant to radon levels.

Hutchison, K., 1992. Report on the Bacteriological Water Quality Monitoring of Door County Variance and Special Casing Approval Wells. WDNR Practice groundwater Monitoring Project.

One-hundred and ninety-two wells were sampled for total bacteria, nitrates, sulfates and

iron to determine if granting casing length variances in Door County resulted in bacteriologically unsafe wells. Twelve of the samples were analyzed for radium. Bacteriologically unsafe wells were scattered throughout the county and no correlation could be made from available data between casing depth and contamination. Of the 12 well samples analyzed for radium, 6 were collected from wells cased below the Maquoketa and 6 from the Silurian Dolomite. All six of the samples from the lower aquifer contained radium. Deeper wells had higher sulfate concentrations. Overall, 57 percent of the wells had iron concentrations exceeding the aesthetic standard. Nitrate problems were not documented.

Johnson, S.B., and R. Stieglitz, 1990. Karst Features of a Glaciated Dolomite Peninsula, Door County. Geomorphology, vol. 4, pgs 37-54.

A geologic investigation of the northern part of Door Peninsula, Wisconsin revealed that karstification of the Silurian aquifer is more extensive than previously believed. Sinkholes and small insurgent features, solution modified crevices, pavements, caves and springs were inventoried and mapped. These features are generally smaller and less densely developed than those in most limestone terrains: however, they are important to the geomorphology and water quality of the peninsula. Continental glaciation has strongly influenced both the distribution and the present surface morphology of the karst features. Ice scour has formed a stepped bedrock topography, contributed to pavement formation and may have removed some preglacial features. Deposition has plugged and masked features in places. In addition, subglacial water circulation, and ice loading and unloading have influenced karst development.

Karl, J.A., 1984. Results of Seismic and Resistivity Surveys of the Sturgeon Bay Utilities Ship Channel Site.

Fourteen seismic lines were shot in the Sturgeon Bay utilities ship canal to better characterize the site. Results show three layers: top soil, water table and bedrock. An area of high water resource potential lies in the northwest 40 acres where bed rock exceeds a depth of 100 from the surface.

Knowles, D.B., 1964. Groundwater Conditions in the Green Bay Area Wisconsin, 1950-1960, USGS Water Supply Paper 1669-J.

Knowles, D.B., F.C. Dreher and G.W. Whetstone, 1964. Water Resources of the Green Bay Area, Wisconsin. USGS Water-Supply Paper 1499-G.

Kraft, G., 1986. Unpublished plotting and categorizing of 1983, 1984 and 1985 SLOH Bacteriologically safe and unsafe wells of Door County N of Sturgeon Bay.

Krohelski, J.T., 1986. Hydrogeology and Groundwater-Water Use and Quality, Brown County, Wisconsin. USGS and WGNHS Information Circular 57.

Definitive publication on Brown County hydrogeology, and groundwater use and quality.

A three-dimensional model was used to simulate aquifer response to pumping from deep municipal and industrial wells in the lower Fox Valley. The study area for this report includes all of the Red River/Sturgeon Bay project and includes bedrock geologic, Pleistocene, recharge potential, and water table maps. Samples from 65 wells were analyzed for major cations and anions, metals, TOC, N, Temperature, pH, Specific Conductance, TDS and hardness. Groundwater in Brown County is a calcium bicarbonate type. Wells sampled between the Fox River and Silurian escarpment have elevated levels of sulfate and sodium. Wells finished in formations below the Silurian have elevated strontium and fluoride concentrations. Results of three dimensional modelling show groundwater recharge is mostly from underflow along the western boundary of the county and from leakage to the St. Peter aquifer. Model simulations indicate that if pumpage remains constant, the cone of depression could deepen.

McKereghan, P.F., 1988. Digital Simulation of Chloride Transport in the Silurian Dolomite Aquifer in Door County, Wisconsin, Unpublished M.S. Thesis UW-Milwaukee.

The finite-element model SUTRA was used to simulate chloride movement through the subsurface of Door County under saturated, steady-state conditions. Different land use scenarios were used to determine which sources have the most impact on groundwater quality and how changes in land use could reduce the amount of chloride delivered to Lake Michigan and Green Bay. Three rounds of well and spring samples were analyzed for chloride. The majority of the samples were from upper Door County. Source loading was estimated from previous work and during model calibration. Several conclusions were reached including: 1) total groundwater discharge is 5.8×10^4 m^3/day; 2) Lake Michigan receives 3.3×10^4 m^3/day and Green Bay receives 2.5×10^4 m^3/day; 3) total chloride load if 2.4×10^2 kg/day, of which Green Bay receives more due to higher population concentrations; 4) the model indicates the agricultural sources contribute 46% and septic systems 25% of the chloride entering the aquifer.

McMahon Associates, Inc., and C.W. Fetter Jr., 1984. Evaluation of Alternatives, Sturgeon Bay Well Contamination for Sturgeon Bay Utilities.

Looks at possible sources of contamination for Sturgeon Bay City Wells 5, 6, 8, and 9. Well 6 is down gradient of an abandoned landfill. Wells 5 and 8 are downgradient of concentrated housing outside of the sewage district. Well 9 is located near a sinking stream and old landfills possibly within the zone of contribution. Recommendations are made locations of new wells.

McMahon and Associates, Inc., Case History of Bacteriological Contamination of Groundwater in Door County.

Describes drinking water studies completed for Door County since 1955 to determine bacteriological contamination. The latest study described was done in 1978. Casing length is and its potential relationship to bacterial contamination is described.

McMahon Associates, 1986 Detailed Evaluation of Alternatives for the treatment of the

Groundwater Supply for the city of Sturgeon Bay.

Gives several alternatives for treatment of bacterial contamination in Sturgeon Bay wells. Ozone is recommended as a more flexible treatment method than chlorination.

McMahon Associates, 1991. Inc. Evaluation of Water Supply, Distribution and Storage Systems for the Sturgeon Bay Utilities.

The Sturgeon Bay groundwater supply was found to be under influence of surface water thus requiring treatment under Chapter NR 109, Wis. Adm. code. This code is currently under revision and will be renumbered to Ch. NR 809, Wis Adm. code which will be finalized in August of 1993. The report recommends the following: drilling of a new well near Well #11; development of a wellhead protection area; capital improvements to address problems with the distribution system and; extension of the sanitary sewer system into existing developed areas.

Nauta, R., 1987. A three-dimensional groundwater flow model of the Silurian Dolomite Aquifer of Door County Wisconsin. Unpublished M.S. thesis, UW-Madison, 105 pp.

Need, E. 1985. Pleistocene Geology of Brown County, Wisconsin, WGNHS Information Circular 48.

Nell, W.E., 1992. An Assessment of Atrazine Contamination in the Groundwater of a Karst Environment. Unpublished M.S. Thesis, UW-Green Bay.

Groundwater was sampled for atrazine and other pesticides.

Rasman, T., 1993. Aquatic Plant Survey Sturgeon Bay Channel & Surrounding Area.

Rosen, C.J. and M.J. Day, 1990. Glaciated Karst Terrain in the Door Peninsula of Wisconsin, Transaction of the Wisc. Acad. of Sci., Arts, and Letters, vol. 78, pgs 39-44.

Glaciated karst terrain is well developed in the Door Peninsula, a southeastward dipping hogback developed on the Silurian Niagaran dolomite. Much of the postglacial karst development is in the Burnt Bluff formation on the western side of the peninsula where the hydraulic gradient is steepest, joints are dilated, and the drift is thinnest. Regional joint sets at 25, 70, and 155 degrees have strongly influenced cave and sinkhole development.

Rosen, C.J., M.J. Day, and K. Piepenburg, 1987. Glaiokarst Depressions in the Door Peninsula, Wisconsin, Physical Geography, vol 8, No. 2, pp. 160-168.

Karst development is most pronounced on the west side of the Door Peninsula where drift cover is thin and percolating water is focused along joints and at intersections. Both dissolutional and mechanical processes assist in joint expansion and karst development.

Rovey, C.W. II, 1990. Stratigraphy and sedimentology of Silurian and Devonian carbonates, Eastern WI, with Implications for groundwater discharge into Lake Michigan. Unpublished Ph.D., UW-Milwaukee, 427 pp.

Ryling, R.W., 1961. A preliminary study to the distribution of saline water in the bedrock aquifers of eastern Wisconsin, USGS Information Circular No. 5.

The purpose of this study was to determine areas of saline groundwater in eastern Wisconsin. One-hundred and fifty-four wells were sampled over 21 counties, for sulfate, chloride and dissolved solids. Resulting maps show the distribution of the sample parameters. Cross-sections showing the vertical distribution of these contaminants were prepared. The regional pattern of distribution shows increasing concentration of sulfate and dissolved solids eastward. Locations of three areas of saline groundwater in Manitowoc, Sheboygan, and Milwaukee counties generally coincide with probable structural lows in water-bearing bedrock units of late Cambrian and Ordovician age.

Saunders, C.E., 1990. Groundwater Quality Monitoring at Two Barnyard Sites in a Karstic Area: Door County, Wisconsin. Unpublished M.S. Thesis UW-Green Bay.

Study background water quality after the installation of two manure holding facilities to gain a better understanding of the impact of such structures on groundwater quality. Samples were collected from observation wells, private wells and regional wells originally sampled as part of another study to characterize groundwater quality. Samples were analyzed for coliform bacteria, specific conductance, chloride, sulfate, nitrate-N, ammonium-N, potassium and turbidity. Both sites were located in the Upper Door Priority Watershed. One proposed structure was never installed. Results do not conclusively indicate that installation of manure holding ponds in Door County will improve or maintain groundwater quality.

Schalch, L.H. 1989. A digital simulation of nitrate transport within the dolomite aquifer system underlying Door County, WI. Unpublished M.S. Thesis, UW-Milwaukee. 145 pp.

Schneider, A.F., 1981. Late Wisconsin glaciation of Door County, Wisconsin. Abstracts with programs, GSA 93rd Annual Meeting, P. 316.

Seeger, B. 1989. Brown County Groundwater Resource Assessment and Management Recommendations, Fox Valley Water Quality Planning Agency.

Sherrill, M.G., 1978. Geology and Ground Water Door County, Wisconsin, with Emphasis on Contamination Potential in the Silurian Dolomite. WI DNR and USGS Water-Supply Paper 2047.

A description of Door County geology, hydrogeology and groundwater quality. Five plates characterize the bedrock, groundwater flow, surficial geology, geologic cross sections, Silurian dolomite aquifer water table map and contamination potential. The stratigraphic section consists of Cambrian sandstone, Ordovician sandstone and dolomite,

the Ordovician Maquoketa shale, and Silurian dolomite. Unconsolidated glacial deposits are thin to non-existent except in four preglacial bedrock valleys. The Silurian dolomite aquifer consists of the Niagara and Alexandrian dolomite formations which transmit groundwater through vertical joints and bedding planes. Wells which draw water from below the Maquoketa shale can have high sulfate, chloride, and dissolved solids concentrations.

Skinner, E.L. and R.G. Borman, 1973. Water Resources of Wisconsin - Lake Michigan Basin. USGS and WGNHS, Hydrologic Investigations Atlas HA-432.

Stieglitz, R.D., J.M. Moran, J.D. Harris, 1980. A Relict Geomorphological Feature Adjacent to the Silurian Escarpment in Northeastern Wisconsin. Wisc. Acad. Sci. Arts Letts. Trans., vol. 68, pgs 202-207.

A terrace-like bench and accumulation of coarse talus occur at the foot of the Silurian escarpment in northeastern Wisconsin. Talus slopes, now nearly stabilized, apparently were formed by ice-wedging and shattering of dolomite. Solifluction of loose rock materials apparently formed the bench. Absence of talus and bench forming processes today suggests development during and anomalously severe climatic episode, probably during the final Wisconsin glacial recession.

Stieglitz, R.D., and Schuster, W.E., 1985. Water quality and land development in a karst area: Door County, Wisconsin. Wisc. Acad. Rev., 132(1): 11-13.

Stieglitz, R.D., and Schuster, W.E., 1988. Water Quality Problems and Management in the Karst of Eastern Wisconsin, GAO^2, Section of Cave Geology and Geography of the National Speleological Society, pp 2-3.

Stieglitz, R.D., 1990. The Geologic Foundation of Wisconsin's Door Peninsula. In Hershbell, K. ed. Door County and Niagara Escarpment: Foundations for the Future, Wisconsin Academy of Sciences, Arts and Letters, Conference Proceedings, published February 1990.

This paper promotes use of zoning ordinances and subdivision regulations based on physical data to direct growth in Door County.

Stieglitz, R.D., 1984. Karst landforms of eastern Wisconsin. GSA, North-Central/Southeastern Sections, abstracts with program, vol. 16 No. 3, p. 200.

Stoll, R.C., 1988. Lead Concentration Variabilities of Private Water Supplies Located in Door County WI, Wi DNR.

Objectives of the study were to: 1) determine the variability of lead concentration in private wells; 2) determine the relationship between precipitation and lead concentrations in private wells; 3) determine if arsenic is present with the lead; and 4) summarize and display the data in a manner that predicts best sampling periods to identify worst case

situations. Twenty wells were sampled every six weeks and 30 wells were sampled twice a week for lead. Seventy-seven wells which had lead concentrations greater than 40 ppb were sampled for arsenic. Results are presented in a table and in box plots. Lead concentrations are highly variable over time and have little correlation to precipitation. No arsenic was detected.

Thwaites, F.T., K. Bertrand, 1957. Pleistocene Geology of the Door Peninsula, Wisconsin. Bull of GSA, vol. 68 pp 831-880.

USGS, 1985. An Evaluation of the Bedrock Aquifer System in Northeastern Wisconsin. Water-Resources Investigation Report 85-4199.

WDNR, 1989. Class V Underground Injection Well Inventory of Kewaunee County, Wisconsin.

Well test data for 60 wells and 5 springs from 1986 to 1988, in the UDPW from small basin study and UDPW Monitoring Project. Copy in Door County SWCD files.

WI DNR, 1988. Twin-Kewaunee River Basin Water Quality Management Plan.

Wiersma, J.H. and R.D. Stieglitz, 1989. Lead Migration from Contaminated Sites, Door County, Wisconsin. WDNR.

Soil and groundwater at a former pesticide mixing site was sampled for arsenic, copper and lead. The site was internally drained and had no surface water recharge. Metal contamination of the soil was restricted to the upper 20 to 25 centimeters. Six of 39 groundwater samples analyzed were found to contain lead.

Wiersma, J.H., Stieglitz, R.D., Metzler, G.M. and Cecil, D.L., 1986. Characterization of the shallow groundwater system in an area of thin soils and sinkholes (Door County, Wisconsin). Environ. Geol. Water Sci., vol. 8 (1/2): 99-104.

The interactions of surface and groundwater, and the role of solution features in water interchange were studied in a small drainage basin. The basin contained several large sinkholes and a nearby spring complex. Water flowing into two winks was traced and found to have a residence time of several hours. Water flowing into sinkholes and from the spring was sampled to identify the quality and seasonal trends in composition of the shallow groundwater. Indicator parameters were monitored. Sandy soils were most susceptible to sink development, whereas clay-rich soils have a lesser number of sinks. The loss of soil into sinkholes has impacted groundwater quality and reduced agricultural productivity through a reduction in tillable acreage and water retention capacity.

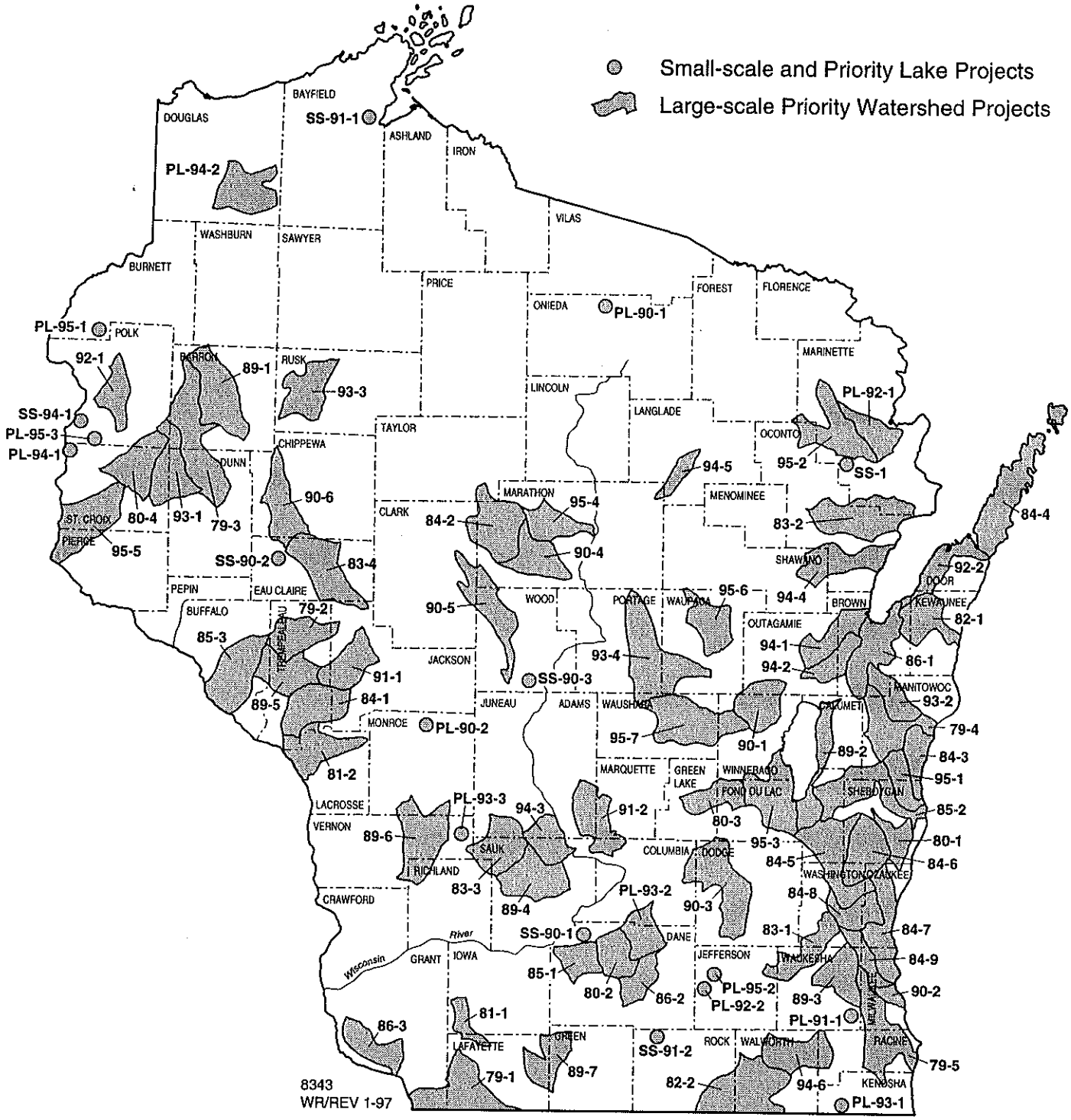
Wisniewski, T.F. and A. Filek, 1942. Report of a survey of Water Supplies, Water Distribution and Waste Disposal Methods in the Fruit Growing Areas of Door County. Unpublished SLOH Report, 32 pp.

Priority Watershed Projects in Wisconsin: 1996 - 1997

Year Selected-Map Number	Large-scale Priority Watershed Project	County(ies)
79-1	Galena River ♦	Grant, Lafayette
79-2	Elk Creek ♦	Trempealeau
79-3	Hay River ♦	Barron, Dunn
79-4	Lower Manitowoc River ♦	Manitowoc, Brown
79-5	Root River ♦	Racine, Milwaukee, Waukesha
80-1	Onion River ♦	Sheboygan, Ozaukee
80-2	Sixmile-Pheasant Branch Creek ♦†	Dane
80-3	Big Green Lake ♦	Green Lake, Fond du Lac
80-4	Upper Willow River ♦	Polk, St. Crox
81-1	Upper West Branch Pecatonica River ♦	Iowa, Lafayette
81-2	Lower Black River ♦	La Crosse, Trempealeau
82-1	Kewaunee River ♦	Kewaunee, Brown
82-2	Turtle Creek ♦	Walworth, Rock
83-1	Oconomowoc River ♦	Waukesha, Washington, Jefferson
83-2	Little River ♦	Oconto, Marinette
83-3	Crossman Creek/Little Baraboo River ♦	Sauk, Juneau, Richland
83-4	Lower Eau Claire River ♦	Eau Claire
84-1	Beaver Creek ♦	Trempealeau, Jackson
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark
84-3	Sevenmile-Silver Creeks ♦	Manitowoc, Sheboygan
84-4	Upper Door Peninsula ♦	Door
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac
84-7	Milwaukee River South	Ozaukee, Milwaukee
84-8	Cedar Creek	Washington, Ozaukee
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington
85-1	Black Earth Creek	Dane
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet
85-3	Waumandee Creek	Buffalo
86-1	East River	Brown, Calumet
86-2	Yahara River - Lake Monona	Dane
86-3	Lower Grant River	Grant
89-1	Yellow River	Barron
89-2	Lake Winnebago East	Calumet, Fond du Lac
89-3	Upper Fox River (Ill.)	Waukesha
89-4	Narrows Creek - Baraboo River	Sauk
89-5	Middle Trempealeau River	Trempealeau, Buffalo
89-6	Middle Kickapoo River	Vernon, Monroe, Richland
89-7	Lower East Branch Pecatonica River	Green, Lafayette
90-1	Arrowhead River & Daggets Creek	Winnebago, Outagamie, Waupaca
90-2	Kinnickinnic River (Milwaukee Basin)	Milwaukee
90-3	Beaverdam River	Dodge, Columbia, Green Lake
90-4	Lower Big Eau Pleine River	Marathon
90-5	Upper Yellow River	Wood, Marathon, Clark
90-6	Duncan Creek	Chippewa, Eau Claire
91-1	Upper Trempealeau River	Jackson, Trempealeau
91-2	Neenah Creek	Adams, Marquette, Columbia
92-1	Balsam Branch	Polk
92-2	Red River - Little Sturgeon Bay	Door, Brown, Kewaunee
93-1	South Fork Hay River	Dunn, Polk, Barron, St. Croix
93-2	Branch River	Manitowoc, Brown
93-3	Soft Maple/Hay Creek	Rusk
93-4	Tomorrow/Waupaca River	Portage, Waupaca, Waushara
94-1	Duck Creek	Outagamie, Brown
94-2	Apple/Ashwaubenon Creeks	Outagamie, Brown
94-3	Dell Creek	Sauk, Juneau
94-4	Pensaukee River	Shawano, Oconto
94-5	Spring Brook	Langlade, Marathon
94-6	Sugar/Honey Creeks	Walworth, Racine
95-1	Pigeon River	Manitowoc, Sheboygan
95-2	Middle Peshtigo/Thunder Rivers	Marinette, Oconto
95-3	Fond du Lac River	Fond du Lac, Winnebago
95-4	Lower Rib River	Marathon
95-5	Kinnickinnic River (St. Croix Basin)	St. Croix, Pierce
95-6	Lower Little Wolf	Waupaca
95-7	Pine & Willow Rivers	Waushara, Winnebago

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

Year Selected-Map Number	Priority Lake Project	County(ies)
PL-90-1	Minocqua Lake	Oneida
PL-90-2	Lake Tomah	Monroe
PL-91-1	Little Muskego, Big Muskego, Wind Lakes	Waukesha, Racine, Milwaukee
PL-92-1	Lake Noquebay	Marinette
PL-92-2	Lake Ripley	Jefferson
PL-93-1	Camp/Center Lakes	Kenosha
PL-93-2	Lake Mendota	Dane, Columbia
PL-93-3	Hillsboro	Vernon
PL-94-1	St. Croix County Lakes Cluster	St. Croix
PL-94-2	Upper St. Croix/Eau Claire River	Douglas
PL-95-1	Big Wood Lake	Burnett, Polk
PL-95-2	Rock Lake	Jefferson
PL-95-3	Horse Creek	Polk, St. Croix

♦ Project completed
† Sixmile-Pheasant Branch is being redone as part of the Lake Mendota project (PL-93-2).

Priority Watershed Projects in Wisconsin
1996-1997