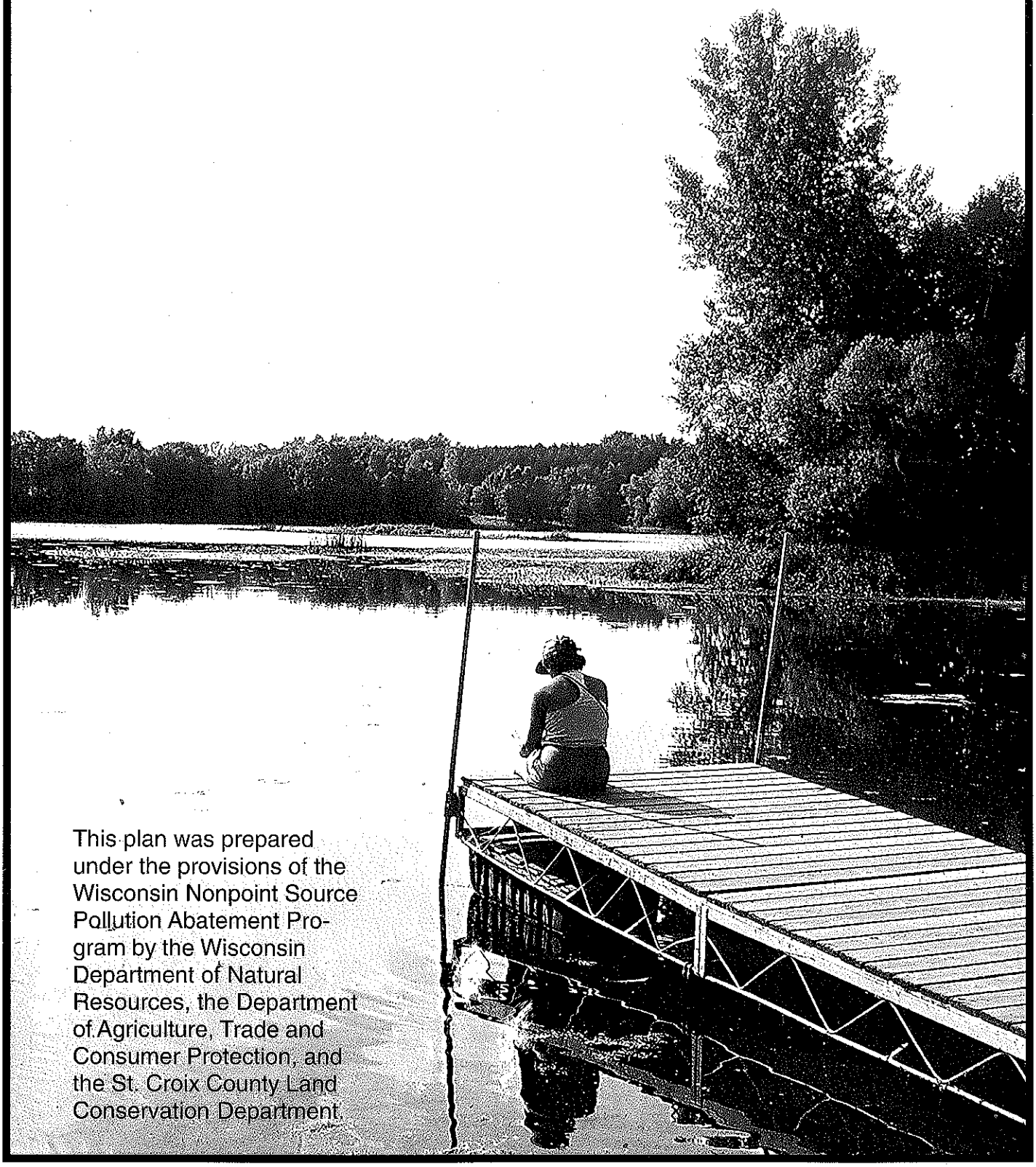
Nonpoint Source Control Plan for the St. Croix County Lakes Cluster Priority Watershed Project



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

Watershed Plan Organization Information

Natural Resources Board

1996

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Nonpoint Source Control Plan for the St. Croix County Lakes Cluster Priority Watershed Project

The Wisconsin Nonpoint Source Water Pollution Abatement Program

Plan approved
April 1997

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection,
St. Croix County Land Conservation Department
and
Polk County Land Conservation Department

Publication WT-496-97

For copies of this document please contact:

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Watershed Plan Credits

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April 8, 1997

IN REPLY REFER TO:

Robert M. Boche, Chair
St.Croix County Board of Supervisors
1101 Carmichael Road
Hudson, WI 54016

SUBJECT: St. Croix County Lake Cluster Priority Watershed Plan Approval

Dear Mr. Boche,

I am pleased to approve the St. Croix County Lakes Cluster Priority Watershed Management Plan prepared through the Wisconsin Runoff Management Program. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan was prepared in conjunction with the Department of Agriculture, Trade and Consumer Protection. The plan went before the Land and Water Conservation Board on April 8, 1997, and was approved at that time. I am also approving this plan as an amendment to the St. Croix River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the St.Croix County Land Conservation Department staff who participated in preparing this plan. We look forward to assisting the LCD and other units of government in the watershed in the implementation of the St. Croix County Lakes Cluster Priority Watershed plan.

Sincerely,

George E. Meyer
Secretary

Congratulations!

cc: Alan Tracy, DATCP
Robert Uphoff, LWCB
Charles Christenson, St. Croix County LCD
Arthur Jensen, St. Croix County LCC Chair
Keith Foye, DATCP
Gordon Stevenson, DNR, WR/2
Cindy Hoffland, DNR, CF/8
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Karen Voss, WCR
Lynne Hess, DATCP
Craig Jameson, Squaw Lake Dist. Chair
John Eiring, Bass Lake Dist. Chair
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April 8, 1997

IN REPLY REFER TO:

Gerald Handlos, Chair
Polk County Board of Supervisors
100 Polk Plaza
Balsam Lake, WI 54810

SUBJECT: St. Croix County Lake Cluster Priority Watershed Plan Approval

Dear Mr. Handlos,

I am pleased to approve the St. Croix County Lakes Cluster Priority Watershed Management Plan prepared through the Wisconsin Runoff Management Program. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan was prepared in conjunction with the Department of Agriculture, Trade and Consumer Protection. The plan went before the Land and Water Conservation Board on April 8, 1997, and was approved at that time. I am also approving this plan as an amendment to the St. Croix River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Polk County Land Conservation Department staff who participated in preparing this plan. We look forward to assisting the LCD and other units of government in the watershed in the implementation of the St. Croix County Lakes Cluster Priority Watershed plan.

Sincerely,

George E. Meyer
Secretary

Congratulations!

cc: Alan Tracy, DATCP
Robert Uphoff, LWCB
Jeff Timmons, Polk County LCD
Richard Coen, Polk County LCC Chair
Keith Foye, DATCP
Gordon Stevenson, DNR, WR/2
Cindy Hoffland, DNR, CF/8
Dan Simonson, WCR
John Paddock, WCR
Karen Voss, WCR
Lynne Hess, DATCP

RESOLUTION ADOPTING THE ST. CROIX LAKES NONPOINT SOURCE PRIORITY WATERSHED PLAN

RESOLUTION NO. 3(97)
ST. CROIX COUNTY, WISCONSIN

RECEIVED MAY 2 1997 DNR

WHEREAS, the St. Croix Lakes Cluster Watershed was designated by the Department of Natural Resources in 1994, under the Wisconsin Nonpoint Source Water Pollution Abatement Program; and

WHEREAS, the St. Croix County Land Conservation Department in cooperation with the Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection conducted a detailed inventory of the land use within the watersheds in 1995 and 1996; and

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

WHEREAS, a public informational meeting and an official Public Hearing was conducted on March 10, 1997; and

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

WHEREAS, the County wishing to receive cost sharing grants for landowners in the watershed must first adopt the St. Croix Lakes Cluster Watershed Plan.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Supervisors of the County of St. Croix, that the St. Croix Lakes Cluster Watershed Nonpoint Source Priority Watershed Plan be adoption and the implementation of the plan begin as soon as possible.

FISCAL IMPACT: Costs to the County for implementation of this watershed plan are reimbursed 100% by the State except for 30% of the cost of office equipment, materials and supplies.

Dated this 4th day of March, 1997.

Offered by: LAND CONSERVATION COMMITTEE

Negative	Affirmative
	Dean Gruenewald
	Vernon Bull
	Art Jensen
	Chris. Bethke
	James Lacy

ADOPTED ON: 3-18-97

ATTEST: Sue E. Nelson
Sue E. Nelson
County Clerk

OFFICE OF
Polk County Clerk
SHARON SCHIEBEL
Courthouse
Balsam Lake, Wisconsin 54810

STATE OF WISCONSIN)
) ss
COUNTY OF POLK)

I, Sharon Schiebel, County Clerk for Polk County do hereby certify that the attached is a true and correct copy of Resolution No. 16-97 which was adopted by the Polk County Board of Supervisors on March 19, 1997.

Sharon Schiebel
Sharon Schiebel
County Clerk

RESOLUTION 16-97
ADOPTING THE ST. CROIX LAKES CLUSTER
NONPOINT SOURCE PRIORITY WATERSHED PLAN

WHEREAS, the St. Croix Lakes Cluster Watershed was designated by the Department of Natural Resources in 1994, under the Wisconsin Nonpoint Source Water Pollution Abatements Program; and

WHEREAS, the St. Croix Land Conservation Department in Cooperation with the Polk County Land Conservation Department, Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection conducted a detailed inventory of the land use within the watershed in 1995 and 1996; and

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

WHEREAS, a public informational meeting and an official Public Hearing was conducted on March 10, 1997; and

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

WHEREAS, the County wishing to receive cost sharing grants for landowners in the watershed must first adopt the St. Croix Lakes Cluster Watershed Plan.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Supervisors of the County of Polk, that the St. Croix Lakes Cluster Watershed Nonpoint Source Priority Watershed Plan be adopted and the implementation of the plan begin as soon as possible.

FISCAL IMPACT: St. Croix County will administer the St. Croix Lakes Cluster Watershed Plan and therefore no costs will be incurred by Polk County for implementation of this watershed plan.

EFFECTIVE DATE: 18th Day of March, 1997.

Submitted at the request of the Land Conservation Committee.

Approved as to form: Robert L. Hachey

Date Submitted to
County Board March 18, 1997

County Board Action Adopted

SUBMITTED BY:

Richard C. Poe

Violet M. Wright

John Bonnepuce

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SUMMARY

Introduction

The purpose of the Nonpoint Source Control Plan developed for this project is to assess the nonpoint pollutants in the St. Croix County Lakes Cluster watershed and guide the implementation of control measures. Nonpoint source control measures and education are needed to meet very specific water resource objectives designed to protect and enhance the surface and groundwater in the watershed.

Nonpoint source (runoff) pollution cannot be easily traced to a single point of origin such as a point source effluent discharge from a wastewater treatment plant or industrial plant. Nonpoint source pollution occurs when rainwater or snow melt flows across the land and picks up soil particles, organic wastes, fertilizers or other pollutants and carries them to surface and/or groundwater. These soil particles and organic wastes contain phosphorus and nitrogen, the same compounds found in commercial fertilizers. Phosphorus is the nutrient of greatest concern that is delivered to the four lakes that make up this project, Bass, Perch, Squaw and Baldwin-Pine. Soil particles also contribute significant sediment loads to the lakes, primarily through upland and shoreline erosion. Nonpoint source pollution has contributed to a significant decrease in the water quality of Squaw and Baldwin-Pine Lakes, and threatens currently good water quality conditions in Bass and Perch Lakes.

The Nonpoint Source Pollution Control Plan for the St. Croix County Lakes Cluster Priority Watershed was prepared by the Department of Natural Resources (DNR), the Department of Agriculture, Trade & Consumer Protection (DATCP), and the St. Croix and Polk County Land Conservation Departments (LCDs). The DNR selected the St. Croix County Lakes Cluster watershed as a priority watershed project through the state's Nonpoint Source Water Pollution Abatement Program in 1994. The St. Croix Lakes project joins approximately 86 similar watershed projects statewide in which runoff control measures are being planned and implemented. The Nonpoint Source Water Pollution Abatement Program was created in 1978 by the state Legislature. The program provides financial and technical assistance to landowners and local governments to reduce nonpoint source pollution.

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

General Characteristics

The St. Croix County Lakes Cluster Priority Watershed Project covers approximately 20 square miles, and is made up of four separate lakes and their watersheds. Although these lakes are in relatively close proximity to each other, they are located within three different large scale watersheds within the St. Croix River Basin. The smallest lake covers 42 acres, and the largest, about 420 acres. The four lakes have about 18 miles of shoreline combined.

Water quality in Bass and especially Perch Lakes is considered to be very good for this region of Wisconsin. Both are designated as outstanding resource waters of the state. They are the deepest of the lakes, with Perch Lake being deep enough to support a stocked cold water trout fishery. Their deepness and relatively small watershed sizes have contributed to the water quality that is enjoyed on these lakes.

Squaw and Baldwin-Pine Lakes often exhibit very poor water quality conditions. Both have a history of winter kills prior to installation of aeration systems, and both are affected by heavy algae growth. Sediment core studies on Squaw Lake have shown that water quality deteriorated very rapidly between 1940 and the late 1980's, most likely due to changing agricultural practices. Sinkholes in Baldwin-Pine Lake have caused it to periodically drain. This lake also receives significant sediment loads carried from uplands by intermittent tributary streams. Both Squaw and Baldwin-Pine Lakes are shallow, with relatively large watersheds - factors that contribute to their water quality problems. Since the installation of an aeration system on Squaw Lake, it is considered to be one of the better fisheries in the area. Rehabilitation of the fishery on Baldwin-Pine Lake is underway, and fishing is expected to be excellent there in the future.

Approximately 30 percent (6 square miles) of the St. Croix Lakes watershed (Squaw Lake subwatershed) lies in Polk County, and 70 percent (14 square miles) within St. Croix County. For the purposes of this project, the St. Croix County Lakes Cluster Watershed is subdivided into four lake subwatersheds. Each subwatershed conveys surface water to one of the four lakes in the St. Croix County Lakes Cluster (see Map 1-1).

In general, these watersheds have not been subjected to much historical wetland drainage, so opportunities for true wetland restoration may be limited. However, existing wetlands can be improved by providing buffers from the adverse impacts of grazing and cropping. A wetland and wildlife habitat inventory was done to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration. There are over 700 acres of existing wetland in the watersheds, and an additional 100 acres of prior converted or farmed wetlands. Most wetland acres are in the Squaw and Baldwin-Pine Lakes watersheds.

Groundwater is held in thick, permeable layers of soil and rock, called aquifers. The principal aquifers of the St. Croix Lakes watershed are the sand-and-gravel and sandstone aquifers. The sand-and-gravel aquifer yields moderate quantities of water to wells, and the sandstone aquifer is highly productive. Regional groundwater flow in St. Croix County is generally from east to west. Local, shallow groundwater flow varies in each of the lake watersheds according to site-specific conditions. At Perch Lake, it roughly mirrors the topography of the land surface and flows "downhill" or down gradient toward the lake. Around Bass Lake, groundwater flows from northeast to southwest. Groundwater flow in the Squaw Lake watershed is generally from the north to the south. In the Baldwin-Pine watershed, groundwater flow mirrors the regional flow, from east to west.

The St. Croix County Lakes Cluster Watershed population is estimated to be about 900 persons. The entire watershed population lives in rural unincorporated areas. Population in the watershed is growing rapidly. All towns and villages have a growth rate over the past decade of about 19 percent. Regional trends suggest that the watershed's population will continue to expand.

Rural land uses predominate in the watershed. Agriculture is the predominant land use in the Baldwin-Pine and Squaw watersheds, and is also present in the Bass and Perch watersheds. Woodlands and grasslands are common, particularly in the Bass, Perch and Squaw watersheds. Low density residential development is a rapidly growing land use in the Bass and Perch watersheds. The perimeter of Squaw Lake is also developed, and residential growth is anticipated in all the watersheds. Table S-1 summarizes land uses in the lake watersheds.

Table S - 1. Summary of Land Uses in the St. Croix County Lakes Cluster Watershed

St. Croix County Lakes Cluster - Watershed Land Uses (acres)										
Land Use	**Bass**		**Perch**		**Squaw**		**Baldwin-Pine**		**Total**	
	Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Crop	912	32%	29	8%	4087	61%	2142	67%	7,170	55%
Pasture	258	9%	63	18%	523	8%	256	8%	1,100	8%
Natural Area	224	8%	25	7%	159	2%	44	1%	452	3%
Wetland	65	2%	3	<1%	471	7%	167	5%	706	5%
Forest	470	17%	125	36%	1194	18%	298	9%	2,087	16%
Developed	411	15%	47	14%	110	2%	148	5%	716	6%
Open Water	484	17%	51	15%	152	2%	133	4%	820	6%
Total	2824	100%	343	100%	6696	100%	3188	100%	13,051	100%

Sources: DNR , West Central Wisconsin Regional Planning Commission, St. Croix Co. LCD

Sources of Nonpoint Pollution

The St. Croix County Land Conservation Department collected data on agricultural lands, barnyards, shorelands and residential areas in the watershed. This data was used to estimate the pollutant potential of these nonpoint sources. The following is a summary of the inventory results.

Upland Sediment and Nutrient Inventory

* Nearly 6,000 acres, or about 44%, of the watershed land area were inventoried.

* An estimated 860 tons of sediment is delivered from cropland to the four subwatershed lakes on an annual basis. This is a major source, and accounts for 98 and 85% of the sediment loads to Squaw and Baldwin-Pine lakes, respectively, although in all lakes,

phosphorus is the pollutant of primary concern. For Bass and Perch Lakes, upland sediment is a minor source, accounting for 7% and less than 1% respectively.

* An estimated 3,800 pounds of phosphorus associated with upland sediments are delivered to the four subwatershed lakes annually. This accounts for 82% for Baldwin-Pine, 29% for Squaw, 12% for Bass, and 8% for Perch Lake of the annual phosphorus load.

Barnyard Runoff Inventory

* Thirteen barnyards and animal lots were inventoried, about 75% of all barnyards.

* An estimated 176 pounds of phosphorus are delivered to the lakes and wetlands in the watershed annually from barnyards. This load comprises only 0 to 3 % of the phosphorus load in each of the lake watersheds.

Nutrient Management Inventory

* Squaw and Baldwin-Pine subwatersheds have an estimated 817 winter spread acres, delivering an estimated 1494 pounds of phosphorus to these lakes. This accounts for in Squaw, 40%, and in Baldwin-Pine, 8% of the phosphorus load.

Shoreline Erosion Inventory

* The entire shoreline of all four lakes, about 18 miles were inventoried.

* An estimated 624 tons of sediment from 72 eroding sites are deposited to the lakes annually. This accounts for in Perch, 98%; Bass, 88%; Baldwin-Pine, 15% and Squaw, 1% of the annual sediment load. Exceedingly high water levels on Bass and Perch Lakes partially account for excessive shoreline erosion, and declining water levels may correct some of the erosion sites.

* The phosphorus load associated with this sediment is 513 pounds, or for Perch, 41%, Bass, 34%, Baldwin-Pine, 6% and Squaw less than 1% of the annual load.

Wetlands Inventory

* An inventory was conducted using maps and air photographs to determine acreage within the watershed. An estimated 700 acres of existing wetlands were inventoried, with an additional 100 acres of either prior converted or farmed wetlands that are potentially available for restoration. Most wetlands are in the Squaw and Baldwin-Pine watersheds.

Groundwater Inventory

* Of the 43 private wells in the watershed that were tested for nitrates, 21 tested over the Preventive Action Limit (PAL) or 2 mg/L, and of these, 2 were above the Enforcement Standard (ES) Health Advisory Level of 10 mg/L.

Rural Residential Inventory

* An estimated 450 acres of low to medium density residential development were inventoried. Pollutant load coefficients, based on those derived from the Source Loading and Management Model (SLAMM), were used to determine contributions of suspended solids and phosphorus to the four lakes. This source delivers 180 pounds of phosphorus to the lakes, and accounts for in Bass, 21%, Perch, 7%, Squaw and Baldwin-Pine less than 1% of the phosphorus load.

* If new construction and suburban development trends continue, Bass and Perch Lakes will likely be adversely affected -- especially through sediment loads from construction sites -- unless local governments adopt and enforce ordinances such as construction site erosion control.

Project Goals

Goals for Bass and Perch Lake watersheds are protection oriented, for both water quality and other components of the lake ecosystem:

- Maintain and enhance current good water quality conditions
- Protect and improve shallow water and terrestrial habitat along the shoreline
- Protect and enhance existing aquatic plant beds
- Protect and restore wetland habitat
- Maintain or moderately improve the fishery

Goals for Squaw and Baldwin-Pine Lake watersheds are improvement oriented and include:

- Moderately improve current poor to very poor water quality conditions
- Substantially improve shallow water and terrestrial habitat along the shoreline
- Improve and expand existing aquatic plant beds
- Protect and restore wetland habitat
- Maintain or moderately improve the fishery

For all lakes, another goal is to protect and enhance the groundwater resource from nonpoint source pollutants, including through sinkholes or other internally drained areas.

Phosphorus Objective

Phosphorus is the pollutant of greatest concern for the lakes in this project. Its presence in excess amounts in the lakes is the primary cause of poor water quality conditions. To reduce overall phosphorus delivered to the lakes by 30% for Bass and Baldwin-Pine, 47% for Squaw and 75% for Perch Lake, the following will need to be achieved:

* Eliminate winterspread manure in areas of channelized or concentrated flow, for a reduction of 594 pounds of phosphorus.

* Reduce winterspread manure on cropland not suited for winterspreading by 25% in Squaw and Baldwin-Pine Lake watersheds, for a reduction of 225 pounds of phosphorus.

* Reduce phosphorus runoff from residential areas by 50% for Bass and Perch Lakes, for a reduction of at least 82 pounds of phosphorus.

* Reduce phosphorus runoff from barnyards in the watershed by 80% for Bass and 50% for Squaw and Baldwin-Pine Lakes, for a reduction of at least 92 pounds of phosphorus.

* Reduce the phosphorus delivered to lakes in the watershed from soil erosion in agricultural uplands by at least 25% for Bass, Squaw and Baldwin-Pine Lakes. This would result in a phosphorus load reduction of 952 pounds.

* Reduce the phosphorus delivered to lakes in the watershed from shoreline erosion by at least 50% for Bass and Squaw, 75% for Perch and 80% for Baldwin-Pine Lakes. This

can be achieved by reaching the sediment reduction objective, and would result in a phosphorus load reduction of 331 pounds.

* An additional 25% reduction in phosphorus loading to Squaw and Baldwin-Pine Lakes may be achievable through creation of detention and infiltration areas, dependent upon the results of a hydrologic engineering feasibility study, as described in the *Hydrology Restoration Objective,* below.

Sediment Objective

Shoreline erosion is the predominant source of sediments to Bass and Perch Lakes, while upland erosion is the predominant source for Squaw and Baldwin-Pine Lakes. Erosion control is needed to reduce the amount phosphorus transported to the lakes with sediment, and to protect shoreline and shallow water habitat. To reduce overall sediment delivered to the lakes by 50% for Bass, 25% for Squaw and Pine Lakes and by 75% for Perch lake, the following will need to be achieved:

* Reduce sediment delivered to the lakes from agricultural uplands by at least 25% for Bass, Squaw and Baldwin-Pine Lakes. To achieve this, the load will need to be reduced by 214 tons.

* Reduce shoreline erosion by a minimum of 50% for Bass and Squaw, 75% for Perch and 80% for Baldwin-Pine Lakes. Sediment from shorelines will need to be reduced by at least 412 tons.

* In addition to correcting eroding shoreline sites, preferably with the use of bioengineering where feasible, shoreline habitat protection or restoration will be necessary. Maintaining or developing lake woodland and grassland buffers will provide wildlife habitat, canopy, bank stabilization and sediment reduction.

Groundwater Objective

To protect and enhance the groundwater resource in the St. Croix County Lakes watershed, the following objectives will need to be achieved:

* Implement Best Management Practices as appropriate to protect and enhance groundwater quality.

* Proper abandonment of unused wells as per NR 120 and NR 812.

* Reduce over-application of pesticides.

* Reduce the over-application of commercial and organic fertilizers and the application of winterspread manure on unsuitable cropland.

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

Hydrology Restoration Objective

To reduce excessive nutrient loading to Squaw and Baldwin-Pine Lakes in high spring runoff years and during other high rainfall events, the following will need to be achieved:

* The Department will undertake an engineering and feasibility study of the Squaw Lake watershed to determine whether diversion, detention or infiltration structures can be designed, constructed and maintained to temporarily detain, infiltrate and trap nutrients from an estimated 30 to 50% of spring runoff volumes. Hydraulic modeling will be necessary to determine the feasibly of this approach, and where best management practices may be located within the watershed. The need for additional hydraulic engineering study in the Baldwin-Pine watershed will be assessed at the completion of the Squaw Lake study.

* Maintain existing (640 acres) and restore prior converted or farmed (95 acres) wetlands to slow the release of water to the lakes.

* Create and maintain woodland and grassland corridors through buffers, wildlife habitat plantings and conservation easements, all of which will help decrease peak flooding and increase infiltration of precipitation into the soil.

* Increase cropland best management practices which will increase infiltration and promote incorporation into the soil, and reduce winterspreading of manure.

Community Education and Action Objective

To develop community action to foster change that promotes sustained long-term improvement and protection of the St. Croix County Lakes watershed resources.

* Watershed staff should continue to pursue increased awareness and understanding about the watershed pollution reduction process by working with the lake districts, lake associations and individual landowners.

* Foster understanding by lake users and property owners of shoreland zoning and shoreland land uses compatible with a healthy lake ecosystem.

* Foster understanding at the county and township levels regarding the effects of new development on sediment delivery and the tools available to deal with it.

* Facilitate the continued presence and enthusiasm of the Citizens Advisory Committee to provide another vehicle of awareness and stewardship of the watershed over time.

Impact and Scope of Critical Sites

* Of the 13 barnyards inventoried, none were designated critical sites based on phosphorus delivery criteria for critical sites.

* Of the estimated 7,000 acres of cropland in the watershed, 45 acres (5 landowners) have been identified as critical for sediment control.

* Of the 73 shoreland sites inventoried, 21 have been identified as critical sites for sediment and phosphorus control.

* Of the estimated 800 acres of cropland in the watershed that receive winterspread manure, approximately 17 acres (6 landowners) have been identified critical for phosphorus control. These are winterspread areas of concentrated or channelized flow,

and it is expected that the number of acres will increase with additional field investigations.

* When hydrologic analysis of Squaw Lake is completed, or by 18 months after plan approval, a determination will be made as to whether additional critical sites will be identified for runoff control. Identification of additional critical sites will depend on 1) identification of sites where best management practices can be designed to divert, store or infiltrate runoff, 2) development of a long term plan for maintenance of best management practices, 3) an evaluation of progress made in the Squaw Lake watershed toward meeting phosphorus reduction objectives. The applicability of the Squaw Lake engineering study to Baldwin-Pine lake will be evaluated to determine if further engineering study in the Baldwin-Pine watershed is needed. Progress toward meeting objectives of the plan as a whole will be evaluated, and objectives for phosphorus reduction will be adjusted if needed due to the outcome of the hydraulic analysis.

Management Actions

The St. Croix County LCD staff will contact all landowners who are eligible to receive cost sharing during the project's 9-year implementation. Management classifications are determined based on the level of pollution control needed to achieve water quality objectives in the watershed. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that specific source is necessary if the pollutant reduction goals for the project are to be met. Nonpoint sources which are eligible, but not critical, contribute less of the pollutant load, but are included in cost sharing eligibility to further insure that water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost-share assistance.

The St. Croix County LCD will assist landowners in applying Best Management Practices (BMPs). Practices range from alterations in farm management (such as changes in manure spreading and crop rotations) to engineered structures (such as clean water diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations. Staff will also work with the county and landowners to promote effective construction site erosion control and shoreland zone management.

Landowner Eligibility

Cropland Erosion

In appraising the condition of the lakes in the St. Croix Lakes project, sediment and phosphorus loading from eroding fields was found to be a pollutant inhibiting the quality of the watershed ecosystem for Squaw and particularly Baldwin-Pine lakes. However, through conducting an inventory of the existing field erosion situation, nearly all fields are shown to be farmed at very low sediment delivery rates to the lake. For these reasons, critical acres were designated as those with sediment delivery rates of 0.3 ton/acre/year or more for Bass and Perch subwatersheds and 1 ton/acre/year or more for Squaw and Baldwin-Pine subwatersheds. Only 45 critical acres were identified, in the Bass subwatershed.

Landowners will be considered "eligible" to receive cost sharing for cropping practices if they own fields with sediment delivery rates down to .01 ton/acre/year to encourage widespread adoption of

pollution control management practices and because the sediment delivery sources are very widespread even at these low delivery rates.

Table S-2 Cropland Sediment

Management Category	Sediment Delivery (tons/acre/yr.)	Acres
Critical	≥ .3 (Bass,Perch) ≥ 1 (Squaw, Pine)	45 (Bass) (5 landowners)
Eligible	> 0.01	7200

Barnyard Runoff

To maintain cost effectiveness, only those landowners with barnyard sites delivering more than 50 pounds (Squaw and Baldwin-Pine) or 10 pounds (Bass and Perch) of phosphorus to surface water on an annual basis will be eligible for a complete barnyard runoff management system. No barnyards have been identified that meet these criteria. Landowners with barnyards delivering less than these amounts annually will be eligible to receive lower cost clean water diversions and roof gutters (17 barnyards).

Table S-3 Barnyard Runoff

Management Category	Phosphorus (lbs./year)	Number of Barnyards
Critical	> 50 (Squaw, Pine) >10 (Bass, Perch)	0
Eligible	All (Clean water diversions)	17

Nutrient and Pest Management

Nutrient loading from cropped fields in the St. Croix County Lakes watersheds was found to be a major source of phosphorus, especially inhibiting the quality of Squaw and Baldwin-Pine Lakes. Some of the phosphorus load reaches the lakes in conjunction with phosphorus-rich runoff and sediments delivered from uplands. This accounts for 82% of the phosphorus load in Baldwin-Pine, 29% in Squaw and 12% in Bass Lake watersheds. All cropped lands will be "eligible" for nutrient and pest management planning, to encourage adoption of practices to reduce phosphorus delivery.

Spring runoff from acres winterspread with manure were found to be another major source of phosphorus, especially to Squaw Lake (42% of annual phosphorus load) and Baldwin-Pine Lake (8% of annual phosphorus load). A variety of approaches will be needed to address this nutrient source, including promotion of alternative manure management strategies including manure storage and manure brokering, and temporary detention and infiltration of spring runoff, and grassed waterways, filter strips or easements to provide buffers for areas of concentrated flow.

Intermittent waterways or areas of concentrated flow have been designated "critical" for winterspreading of manure. Inventories have identified 17 acres (6 landowners) in the Squaw Lake watershed, though it is expected that the number of acres will increase with further inventory work.

Table S-4 Nutrient Management

Management Category	Description	Acres
Critical	Winterspread acres in areas of concentrated flow	at least 17 (5 landowners)
Eligible	All cropped acres	7200, including 800 winterspread

Shoreline Erosion

Nutrient and sediment loading from eroding shorelines in the St. Croix County Lakes watersheds was found to be a major source of pollutants, especially threatening the quality of Bass and Perch Lakes. Exceedingly high water levels in the last several years have aggravated this problem, and to some extent, when water levels recede, eroding sites may correct themselves. Therefore, the emphasis will be on lower cost practices such as bioengineering and establishment of vegetation to establish shorelines resilient to fluctuating water levels. Eroding sites that are delivering 10 tons of sediment or more annually, or receding laterally at 1 foot or more per year have been designated "critical". Of the 72 inventoried eroding sites, 21 are critical. However, some of these sites may not be considered critical, if it is determined that there is no human use impact that is contributing to the erosion, or if there is no cost effective means of correcting the erosion. Sites eroding at 1 to 10 tons per year are designated as "eligible" (27 sites).

Table S-5 Shoreline Erosion

Management Category	Description	Number of sites
Critical	>10 T/yr eroding, or >1 ft/yr lateral recession	21
Eligible	1-10 T/yr eroding	27

Streambank and Gully Erosion

Gully erosion has been determined to not be a significant nonpoint source in the St. Croix County Lakes watersheds. A gully may be designated "critical" if it delivers 10 tons/year or more of sediment, and can be cost effectively corrected. Active gullies eroding more than 1 ton/year will be eligible to receive cost-share.

Table S-6 Gully Erosion

Management Category	Description	Number of Sites
Critical	>10 T/yr, delivered to lake	None identified
Eligible	Active gullies eroding >1 T/yr	N/A

Project Implementation

Project implementation is scheduled to begin in May 1997 and continue for a period of 9 years. Implementation will consist of continuous educational programming for watershed residents, individual farm conservation planning, the signing of cost-share agreements, and practice installation.

Table S-7 Total Project Costs: St. Croix County Lakes Cluster Priority Watershed

Activity	State Share	Local Share
Cost-Share Funds: Practices	699,390	282,360
Cost-Share Funds: Easements	180,000	0
Local Assistance Staff Support	513,000	0
Information/Education Activities (staff not incl.)	21,000	0
Other (travel, supplies, etc.)	13,800	6,000
Engineering Assistance	4,000	0
Total	1,431,190	288,360

* Estimates based on 75% participation.

Information and Education

The St. Croix County LCD will have responsibility for conducting an information and education program during the sign-up and implementation phases of the project. Citizen Advisory Committee members will take an active role in this effort as well. Education activities will be directed to all residents of the St. Croix County Lakes Cluster Watershed. In addition to building awareness about the St. Croix County Lakes Priority Watershed project, the primary objectives of the education plan are to:

* To foster understanding about the hydrology and ecosystems of the lakes and their watersheds. This includes past-present-future uses of the lake watersheds (oral histories), cause and effects (positive and negative effects caused by different human activities), and how the lakes have changed over time.

* To increase understanding about the economics of best management practices.

* To increase understanding of the effects of new construction, household and lawn practices for rural, non-farm residents.

* To foster an environmental ethic and stewardship among watershed residents by providing the understanding, knowledge and skills necessary to implement solutions to local water quality resource problems.

Conservation Planning and Contracting

Conservation planning and cost-share agreements for installing BMPs will be available to landowners for the first five years of the implementation phase . Voluntary participation will be emphasized throughout the project. Sites determined as critical will be a priority. Other sites will be targeted for pollution control using ongoing inventory information. All practices on agreements must be installed before the project is scheduled to end. Landowners must maintain practices for at least 10 years from the installation of the final practice listed on the cost-share agreement.

Cost-share agreements are recorded with the register of deeds, and in the event of property being sold, the new landowner will be required to install and maintain the remaining best management practices. Practices can be installed as soon as a landowner signs a cost-share agreement with the St. Croix or Polk County Land Conservation Department.

Project Implementation Costs

The DNR will award grants to St. Croix County for the cost sharing of BMPs, staff support and educational activities. Table S-7 includes estimates of the financial assistance needed to implement nonpoint source controls in the St. Croix County Lakes Cluster Watershed, assuming a 75-percent participation rate of eligible landowners.

Project Evaluation and Monitoring

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

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

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

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

CHAPTER ONE
Purpose, Legal Status and General Description

Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources. The 20-square-mile St. Croix County Lakes Cluster Watershed, located in St. Croix and Polk Counties, was designated a "priority watershed" in 1994. The primary objective of this project is to reduce nonpoint source pollution loads and to enhance and protect the water quality of the lakes in the St. Croix County Lakes Cluster Watershed. The St. Croix County Lakes Cluster Watershed is made up of four separate lakes and their watersheds. These lakes are in relatively close proximity to each other within the St. Croix River Basin. The smallest lake watershed is less than one square mile in size, and the largest, about nine square miles.

Nonpoint sources of pollution include: eroding agricultural lands, eroding streambanks and lakeshores, runoff from livestock wastes, agricultural practices, erosion from developing areas, and runoff from established residential areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through rainfall runoff or seepage, and snow melt.

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

- The DNR administer the program in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP). Wisconsin is divided into 330 discrete hydrologic units called watersheds. These watersheds are assessed for water quality concerns as part of a comprehensive basin planning program. Watersheds with a high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Designation as a priority watershed project enables special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution.

- A priority watershed project is guided by a plan prepared cooperatively by the DNR, DATCP and local units of government, with input from a local citizen's advisory committee. Project staff evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to

meet specific water resource objectives. The plan guides implementation of these practices in an effort to improve water quality.

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

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

- Informational and educational activities are developed to encourage participation.

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

Legal Status of the Nonpoint Source Control Plan

The St. Croix County Lakes Cluster Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 281.65 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared through the cooperative efforts of the DNR, DATCP, St. Croix and Polk County Land Conservation Departments, local units of government, and the St. Croix County Lakes Cluster Watershed Citizen 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 and will be used as a guide to implement measures to achieve desired water quality conditions. If a discrepancy occurs between this plan and the statutes or the administrative rules, or if statutes or rules change during implementation, the statutes and rules will supersede the plan. This watershed plan does not in any way preclude the use by local, state or federal governments 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 283 and 281 of the state statutes to regulate significant nonpoint pollution sources in the project area.

This priority watershed plan was approved by DNR following approvals by St. Croix and Polk Counties and the Land and Water Conservation Board (LWCB).

Amendments to the Plan

This plan is subject to the amendment process under NR 120.08(4) for substantive changes. The Department of Natural Resources will make the determination with the local sponsors if a proposed change will require a formal plan amendment.

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

Wisconsin's Pollution Discharge Elimination System (WPDES) Storm Water Permit Program is administered by DNR's Bureau of Wastewater Management under Chapter 283 of the Wisconsin Statutes. This program is separate from the Nonpoint Source program and applies to certain classes of dischargers statewide as identified in NR 216. In cases where the programs do overlap, implementation grants may only apply to activities identified in the watershed plan. Practices to control construction site erosion and storm water runoff from new development are not eligible for cost sharing. In industrial areas, cost sharing is available as specified in NR 120.10 (1)(g) — only in the non-industrial parts of facilities where a problem has also been identified in the priority watershed plan.

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the St. Croix County Lakes Cluster project began in 1995. The following information gathering and evaluation activities were completed during this stage:

- Determine the conditions and uses of groundwater, streams, and lakes.
- Inventory types of land uses and severity of nonpoint sources affecting groundwater, streams and lakes.
- Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions. This has been completed through the ongoing integrated resource management planning efforts in the St. Croix River Basin.
- Determine nonpoint source controls and other measures necessary to improve and/or protect water quality.
- Prepare and gain approval of a program for local implementation of the project so that plan recommendations would be carried out.

Implementation Phase

The implementation phase of the St. Croix County Lakes Cluster Priority Watershed Project began following review of the draft priority watershed plan, a public hearing, and approval by the DNR, the Land and Water Conservation Board (LWCB), and the Board of Supervisors for St. Croix and Polk Counties. Public review during plan development occurred primarily through the efforts of the St. Croix County Lakes Cluster Watershed Citizen Advisory Committee.

During the implementation phase:

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

- In the rural portions of the watershed, the St. Croix County LCD contacts eligible landowners to determine their interest in installing best management practices identified in the plan.

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

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

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

Location and Community Information

The St. Croix County Lakes Cluster Watershed is located in western St. Croix and Polk Counties. It covers approximately 20 square miles, and is made up of four separate lakes, Bass, Perch, Squaw and Baldwin-Pine, and their watersheds. These lakes are in relatively close proximity to each other and are located in the St. Croix River Basin. The smallest lake watershed is less than one square mile in size, and the largest, about nine square miles.

Civil Divisions

The St. Croix County Lakes Cluster Watershed lies within St. Croix and Polk Counties. No incorporated areas are included within the watershed boundaries. Unincorporated areas include portions of ten townships. Bass Lake watershed lies within the St. Croix County Towns of St. Joseph and Somerset. Perch Lake watershed is in the Town of St. Joseph. Squaw Lake watershed lies in the St. Croix Town of Star Prairie, and the Polk County Towns of Farmington, Osceola and Nye.

Baldwin-Pine watershed lies in the St. Croix County Towns of Erin Prairie, Hammond, Emerald and Baldwin. Public land within the watershed includes a 254 acre Waterfowl Production Area at the north end of Bass Lake.

Population Size and Distribution

The St. Croix County Lakes Cluster Watershed population is estimated to be about 900 persons. The entire watershed population lives in rural unincorporated areas. Population in the watershed is growing rapidly. All towns and villages have a growth rate over the past decade of about 19 percent. Regional trends suggest that the watershed's population will continue to expand.

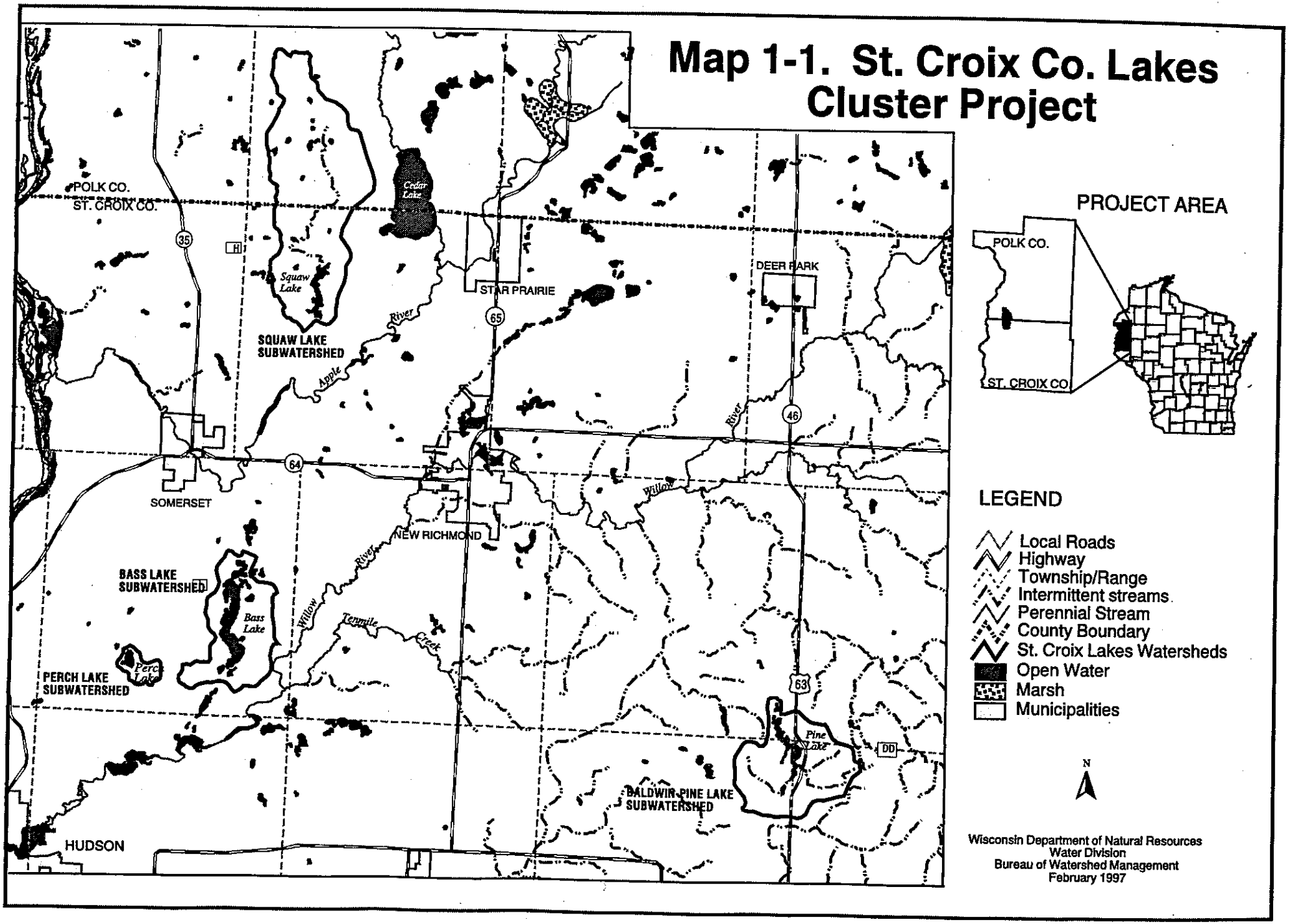
Land Uses

Rural land uses predominate in the watershed. Agriculture is the predominant land use in the Baldwin-Pine and Squaw watersheds, and is also present in the Bass and Perch watersheds. Woodlands and grasslands are common, particularly in the Bass, Perch and Squaw watersheds. Low density residential development is a rapidly growing land use in the Bass and Perch watersheds. The perimeter of Squaw Lake is also developed, and residential growth is anticipated in all the watersheds. Table 1-1 summarizes land uses in the lake watersheds.

Table 1-1 Summary of Land Uses in the St. Croix County Lakes Cluster Watershed

St. Croix County Lakes Cluster - Watershed Land Uses (acres)										
Land Use	Bass		Perch		Squaw		Baldwin-Pine		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Crop	912	32%	29	8%	4087	61%	2142	67%	7,170	55%
Pasture	258	9%	63	18%	523	8%	256	8%	1,100	8%
Natural Area	224	8%	25	7%	159	2%	44	1%	452	3%
Wetland	65	2%	3	<1%	471	7%	167	5%	706	5%
Forest	470	17%	125	36%	1194	18%	298	9%	2,087	16%
Developed	411	15%	47	14%	110	2%	148	5%	716	6%
Open Water	484	17%	51	15%	152	2%	133	4%	820	6%
Total	2824	100%	343	100%	6696	100%	3188	100%	13,051	100%

Sources: DNR , West Central Wisconsin Regional Planning Commission, St. Croix Co. LCD


Map 1-1. St. Croix Co. Lakes Cluster Project
POLK CO.
ST. CROIX CO.
Cedar Lake
Squaw Lake
SQUAW LAKE SUBWATERSHED
STAR PRAIRIE
DEER PARK
Apple River
Willow River
SOMERSET
NEW RICHMOND
BASS LAKE SUBWATERSHED
Bass Lake
Perch Lake
PERCH LAKE SUBWATERSHED
Willow River
Tenmile Creek
Pine Lake
BALDWIN-PINE LAKE SUBWATERSHED
HUDSON
35
64
65
46
63
H
DD
PROJECT AREA
POLK CO.
ST. CROIX CO
LEGEND
Local Roads
Highway
Township/Range
Intermittent streams
Perennial Stream
County Boundary
St. Croix Lakes Watersheds
Open Water
Marsh
Municipalities
N
Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
February 1997

CHAPTER TWO
Watershed Conditions and Objectives, Program Objectives, and Eligibility Criteria

This chapter discusses the physical characteristics, existing conditions, objectives and management categories for the water resources in the St. Croix County Lakes Cluster priority watershed. Information is presented for each subwatershed and by pollution source.

Physical Setting

Climate and Precipitation

The frequency, duration and amount of precipitation influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics, and the physical condition of waterways. The St. Croix County Lakes Cluster Watershed lies in the continental zone which is characterized by winters which are long and relatively cold and snowy and summers which are mostly warm with periods of hot humid conditions. Mean annual precipitation for the region is about 29 inches of rain and melted snow; the majority falls in the form of thunderstorms during the growing season (May-September). Most runoff occurs in February, March, and April when the land surface is frozen and soil moisture is highest.

Topography

Bass, Perch and Squaw Lakes are located in glacial end moraine. The landscape in these areas are rolling and hummocky; kettles or pits are common, and hold lakes or marshes. Steeply sloping shorelines on portions of these lakes make erosion a concern when land is disturbed or developed. Baldwin-Pine lake, the eastern-most lake in this cluster project, is located in glacial ground moraine. Topography here is more gently undulating (Borman, 1976).

Geology

The rocks and soils that control the movement and storage of groundwater in St. Croix county range from Precambrian bedrock to the glacial deposits and soils of the Quaternary age. Bedrock is overlain by glacial till throughout most of the county. Bedrock in the Bass, Perch and Squaw Lake areas is predominantly Cambrian sandstone, shale and dolomite, while in the Baldwin-Pine area, it is Ordovician sandstone and dolomite.

Dolomitic limestone has natural crevices and fissures which are the result of physical stress and chemical weathering. These crevices can be a potential threat to groundwater quality by acting as

conduits for pollutants. Sinkholes in Baldwin-Pine lake have caused drastic fluctuations in water levels in the lake over the years.

The unconsolidated Quaternary deposits overlying bedrock in St. Croix County are largely glacial sediments, but also include some alluvium and marsh deposits. The thickness of the glacial till varies greatly, ranging from 0 feet on hilltops and road cuts, to more that 450 feet near Perch Lake.

Soils

Soils in the western half of St. Croix County, including the Bass, Perch and Squaw Lake watersheds, are well drained to excessively well drained. They have medium to coarse textured surface layers, and moderate to very rapid permeability in the subsoil and substratum. Most of the Bass and Perch Lake watersheds are found in the Burkhardt-Chetek-Sattre association, a sandy loam suitable for hay, pasture and trees. This soil has low natural fertility and water capacity, and is subject to erosion and blowing. The Squaw Lake watershed is found primarily in the Amery-Cromwell and Sattre-Pillot-Antigo associations. These are sandy to silty loams, with moderate natural fertility and water capacity. Suitable uses range from pasture and woodlands to cash crops such as corn, soybeans and peas.

Soils in the Baldwin-Pine watershed include Santiago-Jewett-Magnor and Vlasaty-Skyberg associations. These soils are moderately well drained to poorly drained, nearly level to sloping, and medium textured. These silt loam soils are found on till plains. They have medium to high natural fertility and water capacity, and are used for corn, oats, hay, cash crops and dairying.

Water Resource Conditions and Goals

This section describes the general conditions of the surface and groundwater resources in the St. Croix County Lakes Cluster watershed. Descriptions of subwatersheds are also included and several tables provide summaries of the watershed's resources.

Water Use Classifications

Surface water quality standards and criteria are expressions of the conditions considered necessary to support biological and recreational uses. Water quality standards for recreational and biological uses are contained in Chapters NR 102, NR 104, and NR 105 Wisconsin Administrative Code.

Surface Water and Recreational Resources

For the purposes of this project, the St. Croix County Lakes Cluster Watershed is subdivided into four lake subwatersheds. Each subwatershed conveys surface water to one of the four lakes in the St. Croix County Lakes Cluster. The lakes and associated intermittent streams, wetlands, and ponds are shown in Map 1-1.

Subwatersheds in the St. Croix County Lakes Cluster Watershed

Bass Lake (BL)
Perch Lake (PL)
Squaw Lake (SQ)
Baldwin-Pine Lake (BP)

Streams

There are no perennial streams in this Priority Watershed Project. The Baldwin-Pine and Squaw Lake watersheds each contain about five miles of intermittent streams that can carry water during spring runoff.

Lakes

The St. Croix County Lakes Cluster Priority Watershed Project covers approximately 20 square miles, and is made up of four separate lakes and their watersheds. Although these lakes are in relatively close proximity to each other, they are located within three different large scale watersheds within the St. Croix River Basin. The smallest lake covers 42 acres, and the largest, about 420 acres. The four lakes have about 18 miles of shoreline combined.

Water quality in Bass and especially Perch Lakes is considered to be very good for this region of Wisconsin. Both are designated as outstanding resource waters of the state. They are the deepest of the lakes, with Perch Lake being deep enough to support a stocked cold water trout fishery. Their deepness and relatively small watershed sizes have contributed to the water quality that is enjoyed on these lakes.

Squaw and Baldwin-Pine Lakes often exhibit very poor water quality conditions. Both have a history of winter kills prior to installation of aeration systems, and both are affected by heavy algae growth. Sediment core studies on Squaw Lake have shown that water quality deteriorated very rapidly between 1940 and the late 1980's, most likely due to changing agricultural practices. Sinkholes in Baldwin-Pine Lake have caused it to periodically drain. This lake also receives significant sediment loads carried from uplands by intermittent tributary streams. Both Squaw and Baldwin-Pine Lakes are shallow, with relatively large watersheds - factors that contribute to their water quality problems. Since the installation of an aeration system on Squaw Lake, it is considered to be one of the better fisheries in the area. Rehabilitation of the fishery on Baldwin-Pine Lake is underway, and fishing is expected to be excellent there in the future.

A shoreline erosion inventory was done on the lakes to determine the amount of sediment being delivered from the shoreline. The results of this inventory are listed later in this chapter.

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. In general, these watersheds have not been subjected to much historical wetland drainage, so opportunities for true wetland restoration may be limited. However, existing wetlands can be improved by providing buffers from the adverse impacts of grazing and cropping. Wetland creation through blocking of drainage ways may have some water quality benefits through nutrient and sediment trapping.

Although water level fluctuations cause erosion and other problems for lake property owners, wetlands areas can benefit. The greatest wetland values tend to occur at lower water levels, when higher

percentages of emergents create favorable wildlife habitat. Where shoreline wetlands exist, they should be protected and encouraged for their habitat and buffering values.

A wetland and wildlife habitat inventory was done to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration. There are over 700 acres of existing wetland in the watersheds, and an additional 100 acres of prior converted or farmed wetlands. Most wetland acres are in the Squaw and Baldwin-Pine Lakes watersheds. Data were gathered from Natural Resource Conservation Service maps, air photos, and the DNR wetland inventory maps. Guidelines for wetland restoration, which will be a component of this project, are outlined at the end of this chapter. See table 2-1 for Wetland Inventory Summary.

Recreation

These lakes share in common their location within commuting distance of the Minneapolis/St. Paul metropolitan area. Bass and Squaw Lakes already have substantial and growing residential development within their watersheds. All the watersheds have the potential for rapid residential growth in the future.

Diverse and high-quality recreational opportunities on these lakes include fishing, boating, wildlife observation, and hiking. Recent acquisition of high quality park land on Perch Lake will improve access to this no-motor lake for quiet water activities. The Bass Lake boat landing is scheduled for improvements in 1997, to better accommodate the needs of many recreational users.

Table 2-1. Wetland Inventory Summary: St. Croix County Lakes Cluster Watershed

Subwatershed	Acres		
	Existing Wetlands	Prior Converted	Farmed Wetlands
Bass	65	1	0
Perch	3	0	0
Squaw	471	23	5
Baldwin-Pine	167	71	0
Totals	706	95	5

Groundwater Resources

Regional Aquifers

Groundwater is the sole source of drinking water in St. Croix County. Groundwater is stored underground in pore spaces and cracks within the soil and rock layers. Unconsolidated material and rock layers which hold groundwater are called aquifers. Aquifers receive and store water, and also discharge groundwater to lakes, streams, wetlands, and wells. Most domestic wells in the project area are between 100 and 200 feet, with some as deep as 350 feet. The two principle sources of groundwater in St. Croix County are the sand-and-gravel and sandstone aquifers.

The sand-and-gravel aquifer underlies the watersheds of Bass, Perch, and Squaw lakes. The aquifer consists of unconsolidated sand and gravel in glacial drift and alluvium. The saturated thickness of this aquifer ranges from 0 to more than 150 feet. Well yields are sufficient for domestic use wherever the sand-and-gravel aquifer is present.

The sandstone aquifer underlies the entire project area and serves as the sole groundwater source for the Baldwin - Pine Lake watershed. This aquifer is comprised of sedimentary bedrock including Cambrian sandstone and Ordovician sandstone and dolomite. Large well yields can be developed from the sandstone aquifer because of its generally great saturated thickness and total head (Borman, 1976).

Direction of Groundwater Flow

Regional groundwater flow in St. Croix County is generally from east to west. Local, shallow groundwater flow varies in each of the lake watersheds according to site-specific conditions. At Perch Lake, it roughly mirrors the topography of the land surface and flows "downhill" or down gradient toward the lake. Around Bass Lake, groundwater flows from northeast to southwest. Groundwater flow in the Squaw Lake watershed is generally from the north to the south. In the Baldwin-Pine watershed, groundwater flow mirrors the regional flow, from east to west (Borman, 1976).

Groundwater Quality

Groundwater quality in St. Croix County is generally considered good. The geology of St. Croix County, however, makes its water supply particularly vulnerable to contamination. Shallow depth to water, high soil infiltration rates, and oftentimes thin soils all increase the chances for surface contaminants to reach groundwater.

Point sources of contamination in the county include spills, leaking underground storage tanks, pesticide contamination sites, and old landfills. Nonpoint sources include agrichemicals, septage spreading, and road salt. Specific sites of these types of contamination have not been identified within the watershed boundaries of lakes in this priority watershed project (see the DNR St. Croix River Water Quality Management Plan, 1994).

The portion of the Baldwin-Pine Lake watershed west of Highway 63 is in a DATCP designated atrazine prohibition area. The DATCP is directed by ch. Ag 30 to create atrazine prohibition areas whenever it determines that supplementary atrazine use restrictions are needed to prevent or minimize groundwater contamination. The St. Croix County atrazine prohibition area encompasses atrazine detections in groundwater exceeding the enforcement standard (ES) of 3.0 parts per billion specified in ch. NR 140, Wis. Adm. Code.

In the dolomitic bedrock beneath part of St. Croix county, including the Baldwin-Pine watershed area, well-developed horizontal and vertical crevices increase the potential for groundwater contamination. These crevices enlarge over time, as naturally acidic rainwater seeps through them. Groundwater can be susceptible to contamination where surface water travels quickly through these cracks rather than being filtered through soil layers (see Lower Chippewa River Basin Water Quality Management Plan, 1996).

Sinkholes are cone-shaped depressions that can develop in this "karst" topography, through natural weathering processes. Baldwin-Pine Lake has a long history of problems with sinkholes. On an average of once in 30 years Baldwin-Pine Lake had experienced near complete dewatering from a major sinkhole developing in the bottom of the lake. Periodically, minor sinkholes have developed,

and have been repaired by local citizens or organizations acting alone or in conjunction with Department personnel.

In parts of Wisconsin, elevated nitrate levels in groundwater have been linked to agricultural practices, septage spreading, and faulty septic systems. As part of the watershed inventory, private well samples were collected and analyzed for nitrate (NO_3) + nitrite (NO_2). Sample analytical results are summarized in table 2-2. Samples analyzed for nitrate (NO_3) + nitrite (NO_2) showed concentrations ranging from not-detected to 14.5 parts per million or milligrams per liter (mg/L). The groundwater enforcement standard (ES) for nitrate is 10 mg/L. nitrate (NO_3) + nitrite (NO_2) concentrations above 2 mg/L exceed the states preventive action limit (PAL). The Enforcement Standard (ES) and Preventive Action Limit (PAL) are defined below.

Enforcement Standard (ES) Health Advisory Level: The concentration of a substance at which a facility regulated by COM (Dept. of Commerce, formerly DILHR), DATCP, DOT or DNR must take action to reduce the concentration of the substance in groundwater.
Preventative Action Limit (PAL): A lower concentration of a contaminant than the Enforcement Standard. The PAL serves to inform DNR of potential groundwater contamination problems, establish the level at which efforts to control the contamination should begin, a provide a basis for design codes and management criteria.

Two samples (2 percent) exceeded 10 mg/L and nineteen (45 percent) of the samples exceeded 2 mg/L. Results so far do not indicate a pattern of groundwater contamination that can be linked to specific sources of nitrate. These results do not represent the overall groundwater quality of the watershed.

The two wells where nitrates exceeded 10 mg/L were subsequently sampled for coliform bacteria, with one sample indicating "unsafe" levels. Coliform bacteria can be a drinking water problem where septic systems, land spreading of manure or barnyards are located upgradient (generally uphill) from a private well. Bacteria can enter the drinking water supply along the well casing of improperly constructed wells or through fracture flow. Generally, wells with high levels of bacteria can be rehabilitated.

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

Table 2-2. Well Sampling Results: St. Croix County Lakes Cluster Watershed

NITRATE						
	Number of Nitrate Samples		Number of Nitrate Samples		Number of Nitrate Samples	
Subwatershed	less than 2.0 mg/l	%	between 2.0 and 10.0 mg/l	%	greater than 10.0 mg/l	%
Bass Lake	11	46	13	54	0	0
Perch Lake	1	100	0	0	0	0
Pine Lake	4	57	3	43	0	0
Squaw Lake	6	60	3	30	2	10
Totals	22	52	19	45	2	4

Water Supplies

Water supplies for domestic and agricultural uses in the St. Croix County Lakes Cluster Watershed are obtained entirely from private groundwater sources. The sand-and-gravel (where present) and sandstone aquifers provide sufficient yields for these purposes. The project area contains no municipal wells, but municipal wells serve the following nearby communities: Baldwin, Hammond, New Richmond, Roberts, and Somerset. These wells range in depth from approximately 230 to 800 feet, drawing from sandstone, limestone, and dolomite formations of the sandstone aquifer (DNR, 1985).

Potential Groundwater Quality Problems

Previously identified potential groundwater quality problems in the St. Croix County Lakes Watershed include only one spill site located in Deer Park. According to the Spills Summary Report published in December of 1992,13 pints of Dual were spilled. No action was taken at the spill site. A waste disposal site, the Amani Sanitary District Wastewater Treatment Plant, is located near the north end of the Squaw Lake watershed, although it is not currently considered to be affecting groundwater. No other potential sources of groundwater contamination are listed (DNR, Oct. 1995a, DNR, Oct. 1995b, DNR, July 1994, and DNR, June 1993).

Water Quality Goals and Project Objectives

Goals

This priority watershed project is lake oriented in its goals. Bass and Perch Lakes have relatively good water quality overall, and the goals of the project should be focused on providing *protection* to these lakes, in order to prevent existing and future land uses from causing further degradation. Lake water quality, once degraded, is often difficult or impossible to fully restore. A reasonable approach to managing these watersheds is to hold steady, or decrease nonpoint pollution loads to these lakes as land use and development increase.

Squaw and Baldwin-Pine Lakes have poor water quality conditions that should be addressed with goals that will aim at water quality *improvement*. In order to reach these goals, land management practices will need to change to reduce the amount of nonpoint pollution reaching these lakes.

In addition, this project is intended to consider water quality in a broad ecosystem view by considering fish and wildlife habitats, natural beauty and critical aquatic habitat needs. Both protection and improvement goals should include protecting, maintaining and enhancing the aquatic ecosystems of the watersheds. The following goals address needs for both in-lake water quality and aquatic ecosystem protection and improvement.

Goals for Bass and Perch Lake watersheds are protection oriented, for both water quality and other components of the lake ecosystem:

- Maintain and enhance current good water quality conditions
- Protect and improve shallow water and terrestrial habitat along the shoreline
- Protect and enhance existing aquatic plant beds
- Protect and restore wetland habitat
- Maintain or moderately improve the fishery

Goals for Squaw and Baldwin-Pine Lake watersheds are improvement oriented and include:

- Moderately improve current poor to very poor water quality conditions
- Substantially improve shallow water and terrestrial habitat along the shoreline
- Improve and expand existing aquatic plant beds
- Protect and restore wetland habitat
- Maintain or moderately improve the fishery

For all lakes, another goal is to protect and enhance the groundwater resource from nonpoint source pollutants, including through sinkholes or other internally drained areas.

The following actions will need to be taken to meet these goals:

- **Nutrient reduction:** Sources of nutrients that are targets for reduction include agriculture, runoff from existing and future residential development in the watersheds and lakeshore development.

- **Sediment and erosion reduction:** Sediment sources include agricultural land, residential development areas and eroding shorelines.

- **Hydrologic runoff reduction:** Areas targeted for reduction in runoff rates and volumes include agricultural land and residential development. A hydrologic study being conducted by the Department in the Squaw Lake watershed will further define actions that can be taken to reduce runoff.

- **Protect and restore aquatic and riparian habitat:** Target areas include existing aquatic plant beds, wetlands and terrestrial shoreland vegetation.

- **Manage in-lake nutrients:** Recycling of nutrients in Squaw Lake contributes to the eutrophic state of the lake. Evaluation of the feasibility of in-lake techniques to address this nutrient load is a project goal.

- **Groundwater protection:** Target areas include nutrient and pest management on agricultural and residential lands.

Pollutant Reduction Objectives

The pollutant load reduction objectives for the lake watersheds are summarized in this section. These pollutant load reductions reflect the relative amount that current nutrient or sediment loads from the identified sources must be reduced in order to reach the water quality goals that have been described for each lake. These reduction objectives were arrived at by using water quality monitoring data to determine current lake water quality conditions, and then using lake models to determine the amount that pollutants would need to be reduced to achieve the water quality goals identified above. More detailed numeric reduction objectives are found later in each lake subwatershed discussion.

Phosphorus Objective

Phosphorus is the pollutant of greatest concern for the lakes in this project. Its presence in excess amounts in the lakes is the primary cause of poor water quality conditions. To reduce overall phosphorus delivered to the lakes by 30% for Bass and Baldwin-Pine, 47% for Squaw and 75% for Perch Lake, the following will need to be achieved:

* Eliminate winterspread manure in areas of channelized or concentrated flow, for a reduction of 594 pounds of phosphorus.

* Reduce winterspread manure on cropland not suited for winterspreading by 25% in Squaw and Baldwin-Pine Lake watersheds, for a reduction of 225 pounds of phosphorus.

* Reduce phosphorus runoff from residential areas by 50% for Bass and Perch Lakes, for a reduction of at least 82 pounds of phosphorus.

* Reduce phosphorus runoff from barnyards in the watershed by 80% for Bass and 50% for Squaw and Baldwin-Pine Lakes, for a reduction of at least 92 pounds of phosphorus.

* Reduce the phosphorus delivered to lakes in the watershed from soil erosion in agricultural uplands by at least 25% for Bass, Squaw and Baldwin-Pine Lakes. This would result in a phosphorus load reduction of 952 pounds.

* Reduce the phosphorus delivered to lakes in the watershed from shoreline erosion by at least 50% for Bass and Squaw, 75% for Perch and 80% for Baldwin-Pine Lakes. This can be achieved by reaching the sediment reduction objective, and would result in a phosphorus load reduction of 331 pounds.

* An additional 25% reduction in phosphorus loading to Squaw and Baldwin-Pine Lakes may be achievable through creation of detention and infiltration areas, dependent upon the results of a hydrologic engineering feasibility study, as described in the *Hydrology Restoration Objective,* below.

Sediment Objective

Shoreline erosion is the predominant source of sediments to Bass and Perch Lakes, while upland erosion is the predominant source for Squaw and Baldwin-Pine Lakes. Erosion control is needed to reduce the amount phosphorus transported to the lakes with sediment, and to protect shoreline and shallow water habitat. To reduce overall sediment delivered to the lakes by 50% for Bass, 25% for Squaw and Pine Lakes and by 75% for Perch lake, the following will need to be achieved:

* Reduce sediment delivered to the lakes from agricultural uplands by at least 25% for Bass, Squaw and Baldwin-Pine Lakes. To achieve this, the load will need to be reduced by 214 tons.

* Reduce shoreline erosion by a minimum of 50% for Bass and Squaw, 75% for Perch and 80% for Baldwin-Pine Lakes. Sediment from shorelines will need to be reduced by at least 412 tons.

* In addition to correcting eroding shoreline sites, preferably with the use of bioengineering where feasible, shoreline habitat protection or restoration will be necessary. Maintaining or developing lake woodland and grassland buffers will provide wildlife habitat, canopy, bank stabilization and sediment reduction.

Groundwater Objective

To protect and enhance the groundwater resource in the St. Croix County Lakes watershed, the following objectives will need to be achieved:

* Implement Best Management Practices as appropriate to protect and enhance groundwater quality.

* Proper abandonment of unused wells as per NR 120 and NR 812.

* Reduce over-application of pesticides.

* Reduce the over-application of commercial and organic fertilizers and the application of winterspread manure on unsuitable cropland.

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

Hydrology Restoration Objective

To reduce excessive nutrient loading to Squaw and Baldwin-Pine Lakes in high spring runoff years and during other high rainfall events, the following will need to be achieved:

* The Department will undertake an engineering and feasibility study of the Squaw Lake watershed to determine whether diversion, detention or infiltration structures can be designed, constructed and maintained to temporarily detain, infiltrate and trap nutrients from an estimated 50% of spring runoff volumes. Hydraulic modeling will be necessary to determine the feasibly of this approach, and where best management practices may be located within the watershed. The need for additional hydraulic engineering study in the Baldwin-Pine watershed will be assessed at the completion of the Squaw Lake study.

* Maintain existing (640 acres) and restore prior converted or farmed (95 acres) wetlands to slow the release of water to the lakes.

* Create and maintain woodland and grassland corridors through buffers, wildlife habitat plantings and conservation easements, all of which will help decrease peak flooding and increase infiltration of precipitation into the soil.

* Increase cropland best management practices which will increase infiltration and promote incorporation into the soil, and reduce winterspreading of manure.

Community Education and Action Objective

To develop community action to foster change that promotes sustained long-term improvement and protection of the St. Croix County Lakes watershed resources.

* Watershed staff should continue to pursue increased awareness and understanding about the watershed pollution reduction process by working with the lake districts, lake associations and individual landowners.

* Foster understanding by lake users and property owners of shoreland zoning and shoreland land uses compatible with a healthy lake ecosystem.

* Foster understanding at the county and township levels regarding the effects of new development on sediment delivery and the tools available to deal with it.

* Facilitate the continued presence and enthusiasm of the Citizens Advisory Committee to provide another vehicle of awareness and stewardship of the watershed over time.

Subwatershed Discussions

This section describes the physical and water quality conditions for each of the four lake subwatersheds in the St. Croix County Lakes Priority Project. Discussions include a general description of the subwatershed and its water quality conditions. A more detailed description of each watershed can be found in the water quality appraisal reports written by Wisconsin Department of Natural Resources and available through DNR's Western District Office.

Bass Lake Subwatershed (BL)

Description
Bass Lake is a long, narrow 416 acre lake that lies in a 4.3 square mile watershed. It has a maximum depth of about 45 feet. The relatively large (1:6) ratio of lake surface area to watershed drainage area is one of the factors contributing to the generally good water quality found in Bass Lake.

In the last three decades, Bass Lake water levels have fluctuated over 10 feet. In the late 1970's and mid 1980's, homes and roads were flooded. In 1995, lake elevation exceeded all previous recorded levels. Adverse impacts have included damaged and unusable roads, impaired use of the boat landing, property loss and damage, and shoreline erosion. In the spring of 1995, the Lake District enacted an emergency slow, no-wake ordinance for the entire lake. This ordinance will sunset in the spring of 1997 unless further action is taken.

Water Quality Conditions
Water quality in Bass Lake is generally good, falling in the mesotrophic category, better than most other lakes within this region. Bass Lake supports a quality, self sustaining sunfish community composed of largemouth bass, bluegill, black crappie and pumpkinseed. Bluegill provide the bulk of fishing opportunity on the lake. Yellow perch and a stocked walleye population are also present. Carp and sucker populations appear to co-exist with game and panfish populations without any adverse affect to the fishery or water quality.

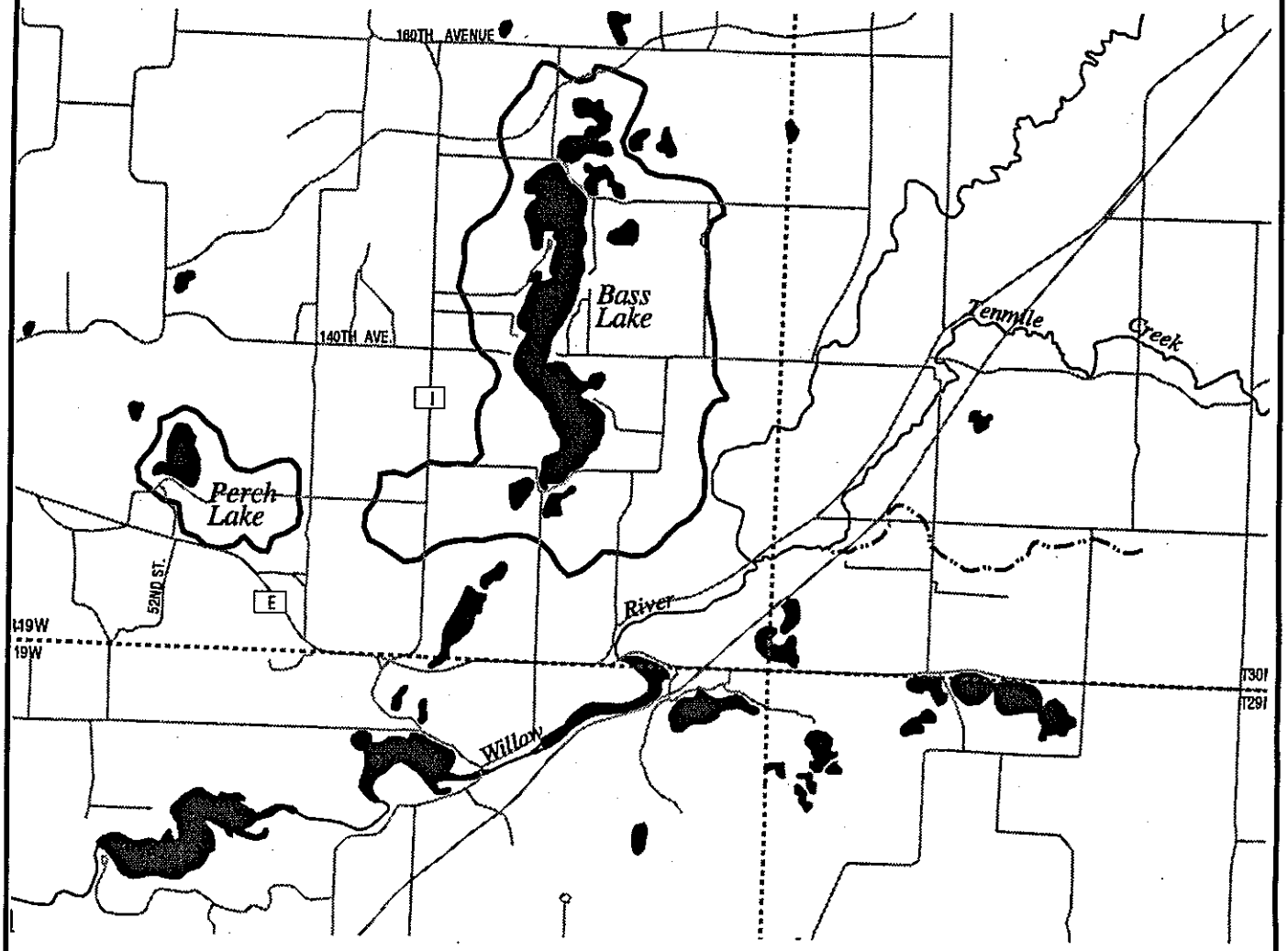
Bass Lake has been experiencing changes in it's watershed and riparian areas. Natural water level fluctuations are common and fisheries change accordingly, however, destruction of shore and near shore habitat, as often occurs with shoreline (riparian) development, can have long term negative impacts on fish communities.

Aquatic Vegetation
There were a total of 44 species found during the plant surveys. The macrophyte community is characterized by very high diversity and adequate, but declining frequencies and densities of plant growth. Plants are distributed throughout the lake and the community is not overly-dominated by any one species. However, there has been a shift between 1993 and 1996 from a community with four co-dominant species to a community with only two co-dominants. An increase in filamentous algae may be another early warning of disturbances in the community.

The plant community in Bass Lake offers valuable fish and wildlife habitat throughout the littoral (shallow) zone, particularly in the northern and southeastern bays where there are extensive and highly diverse plant beds.

The weakest component of Bass Lake's plant community is the emergents - plants that are rooted in water and extend their growth above the water surface. Rising water levels and extensive shoreline alterations have limited opportunities for emergents to become established. An aquatic plant management plan for Bass Lake should focus on ways to enhance existing stands of emergents and establish new ones.

Map 2-1. Bass and Perch Lakes Subwatersheds



LEGEND

- Local Roads
- Township/Range
- Intermittent streams
- Perennial Stream
- Bass and Perch Lake Subwatersheds
- Open Water
- Municipalities

N

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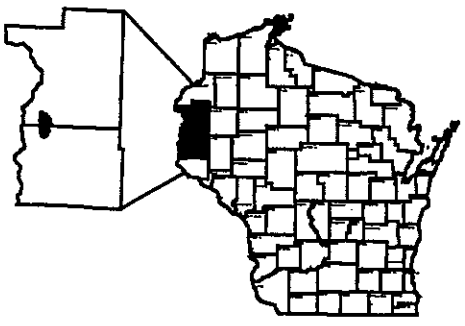
PROJECT AREA



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Perch Lake Subwatershed (PL)

Description

Perch Lake is a 63 foot deep, 43 acre lake that lies in a 0.6 square mile watershed. Its relatively large (1:9) ratio of lake surface area to watershed drainage area is one of the factors contributing to the very good water quality found in Perch Lake (Map 2-1).

Perch Lake's history is similar to Bass Lake's but on a much smaller scale. Record high water levels are flooding timber and roads. The lake is surrounded by woodlands, a privately operated beach which has recently been purchased as a county day-use park, and town and private roads. Home sites are limited by natural features and the park land fronting a large portion of the lake. However, residential development pressure is heavy in the surrounding area, and the potential for subdivision and development in the watershed could adversely affect water quality.

Water Quality Conditions

Water quality in Perch Lake is generally good to very good, within the mesotrophic to oligotrophic category. Perch Lake is a two-story fishery with the coldwater portion managed for stocked rainbow trout and the warm water portion managed for largemouth bass and panfish. Preservation of shoreline buffers and woody debris will be important to Perch Lake's limited sunfish community. Carp populations have no adverse impacts on water quality. Because Perch Lake is clean, deep and has an oxygenated hypolimnion, it can support trout year round.

Aquatic Vegetation

There were a total of 25 species found during the plant survey. Perch Lake has a diverse aquatic plant population including species sensitive to environmental change. Perch Lake's aquatic plant community plays a pivotal role in water quality and provides needed habitat for fish, waterfowl and wildlife. Protection of the extensive aquatic plant beds in the shallower bays of Perch Lake should be a high priority. These beds represent a very important habitat for warm water fish, as the steep slopes of much of the Perch Lake shore line limit littoral zone habitat to a relatively narrow band around much of the lake.

Squaw Lake Subwatershed (SQ)

Description
Squaw Lake is a 129 acre lake with an intermittent inlet and no outlet. It lies in a 9 square mile watershed that extends approximately 4 miles to the north, and drains relatively flat agricultural lands intermixed with wetlands. It has a maximum depth of about 32 feet, an average depth of 13 feet and a ratio of lake surface area to watershed drainage area of 1:32. Lake levels have fluctuated as much as 8 feet since 1951, with surface areas fluctuating between 97 and 144 acres.

Water Quality Conditions
Water quality in Squaw Lake is generally poor to very poor, falling in the eutrophic to hypereutrophic category. Analysis of a sediment core collected from Squaw Lake in 1985 provided historical information about water quality changes (Sorge, 1991). This revealed that water quality remained relatively good until about 1940, when algal levels increased significantly. This time period corresponds to increases in agriculture in the watershed, causing increased nutrients loads carried to the lake by runoff water. During the 1970's and 1980's, water quality severely deteriorated. Algal levels more than doubled compared to any other time period in the sediment core. Sediment core analysis reveals that Squaw Lake has not always had poor water quality and the most significant deterioration has occurred in relatively recent times.

Squaw Lake supports a sunfish dominated community with largemouth bass and bluegill populations abundant, and pumpkinseed and black crappies common. A small, natural reproducing population of northern pike are present along with a small population of stocked walleye.

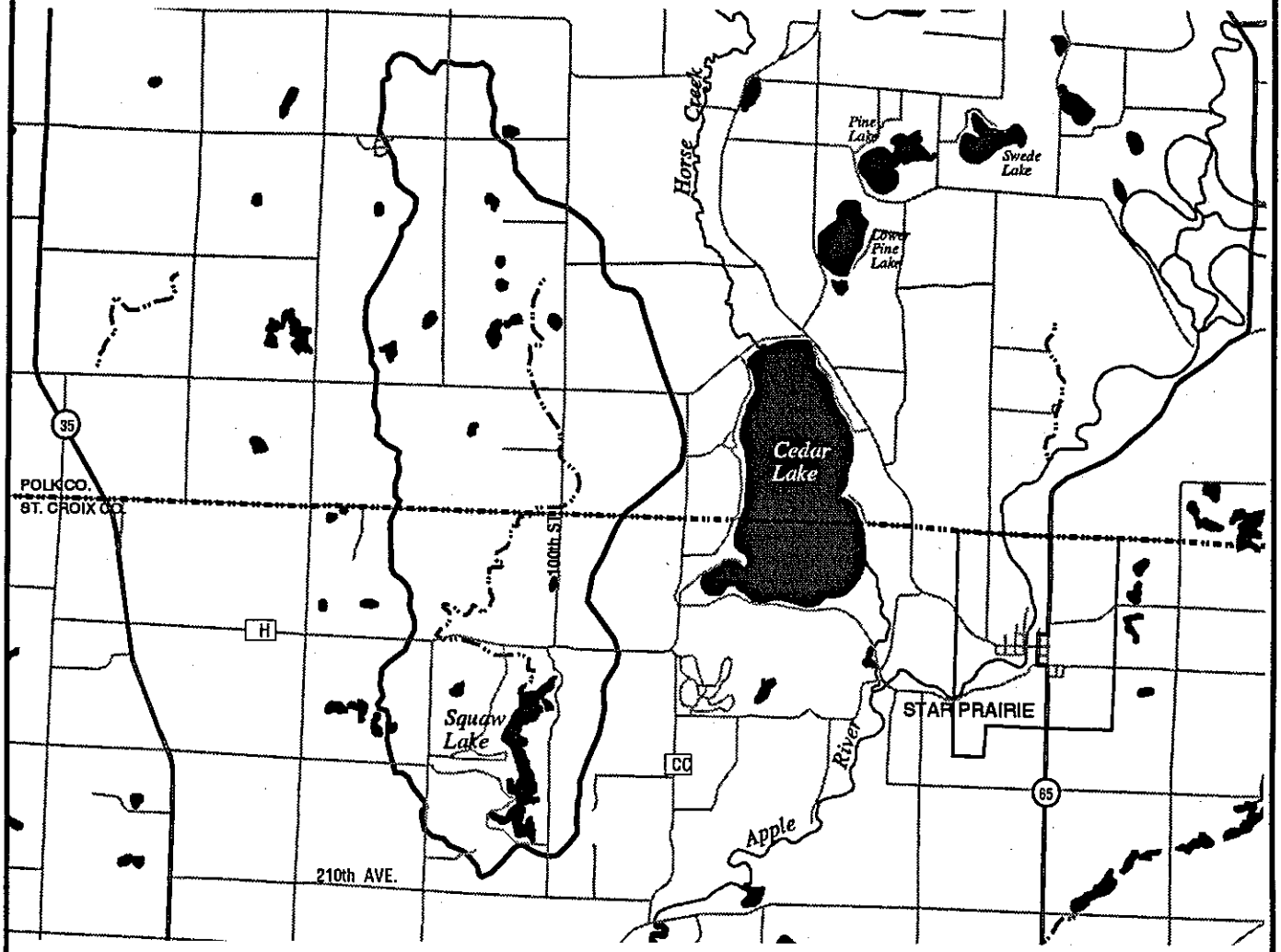
Before installation of an aeration system in 1989, winterkill occurred on an average of every 7 to 8 years. Long term and annual fluctuations of water levels are another major factor affecting Squaw Lake, and in conjunction with severe algal blooms, limit plant communities and fish habitat. With increased residential development, shorelines have been cleared of vegetation and woody debris, causing additional loss of fishery habitat. Aeration can be considered a "band aid" solution to Squaw Lake's problems, and further declines in water quality will only make aeration more difficult.

Aquatic Vegetation
The plant community in Squaw Lake is limited by the prolonged algal blooms that shade submersed plants, limiting plant beds to a depth of 6 to 7.5 feet. Another limitation to rooted plant growth is the extensive mats of filamentous algae that carpet the sediment in the littoral zone. Filamentous algae was found on the sediment at over 90% of the sampling sites.

The only plants that are doing well in Squaw Lake are emergents in less than a foot of water and two plants with special adaptations for eutrophic (poor water quality) waters: elodea and duckweed. The emergent aquatic plants that are present in the shallow water offer important shoreline stabilization and help buffer both wave action and upland runoff. These emergent beds are also important fish spawning sites for northern pike, and are the primary habitat for many waterfowl and shorebirds. Reducing the areas of cultivated lawn running down to the shoreline, and creating more native plant buffer zones, would be beneficial for water quality and fish and wildlife. Seven of the sample sites had cultivated lawn along more than 20% of the shoreline.

A better diversity and distribution of aquatic plants would be very beneficial for both the fishery and wildlife dependent on this lake. Better water clarity would also allow plants to grow in deeper water where they could help to stabilize sediment and extend fish habitat.

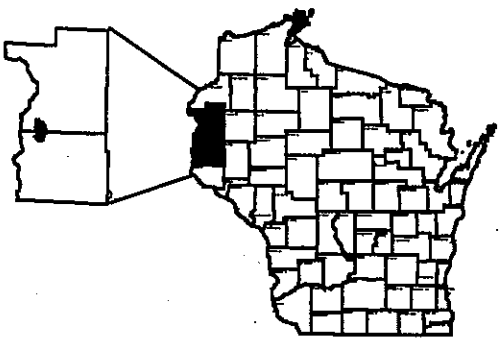
Map 2-2. Squaw Lake Subwatershed



LEGEND

- Local Roads
- County Boundary
- Highway
- Intermittent streams
- Perennial Stream
- Squaw Lake Watershed
- Open Water
- Municipalities

PROJECT AREA



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Baldwin-Pine Lake Subwatershed (BP)

Description

Baldwin-Pine Lake is a 107 acre seepage lake with several intermittent stream inlets and one intermittent outlet. The lake has a 5 square mile watershed. It has a maximum depth of about 21 feet, an average depth of 8 feet, and a ratio of lake surface area to watershed drainage area of 1:30. Much of the watershed is gently rolling agricultural land. Intermittent streams draining the watershed carry a significant sediment load to the lake. Almost all of the lake's water supply comes from surface water runoff.

Water Quality Conditions

Water quality in Baldwin-Pine Lake is generally poor to very poor, falling in the eutrophic to hypereutrophic category. Baldwin-Pine Lake has a long history of sinkholes, fluctuating water levels, winterkills, algal blooms and excess nutrient enrichment. On an average of once in 30 years Pine Lake has experienced near complete dewatering from a major sinkhole developing in the bottom of the lake. Periodically, minor sinkholes have developed. In each case sinkholes have been repaired by local citizens, or organizations acting alone or in conjunction with Department personnel.

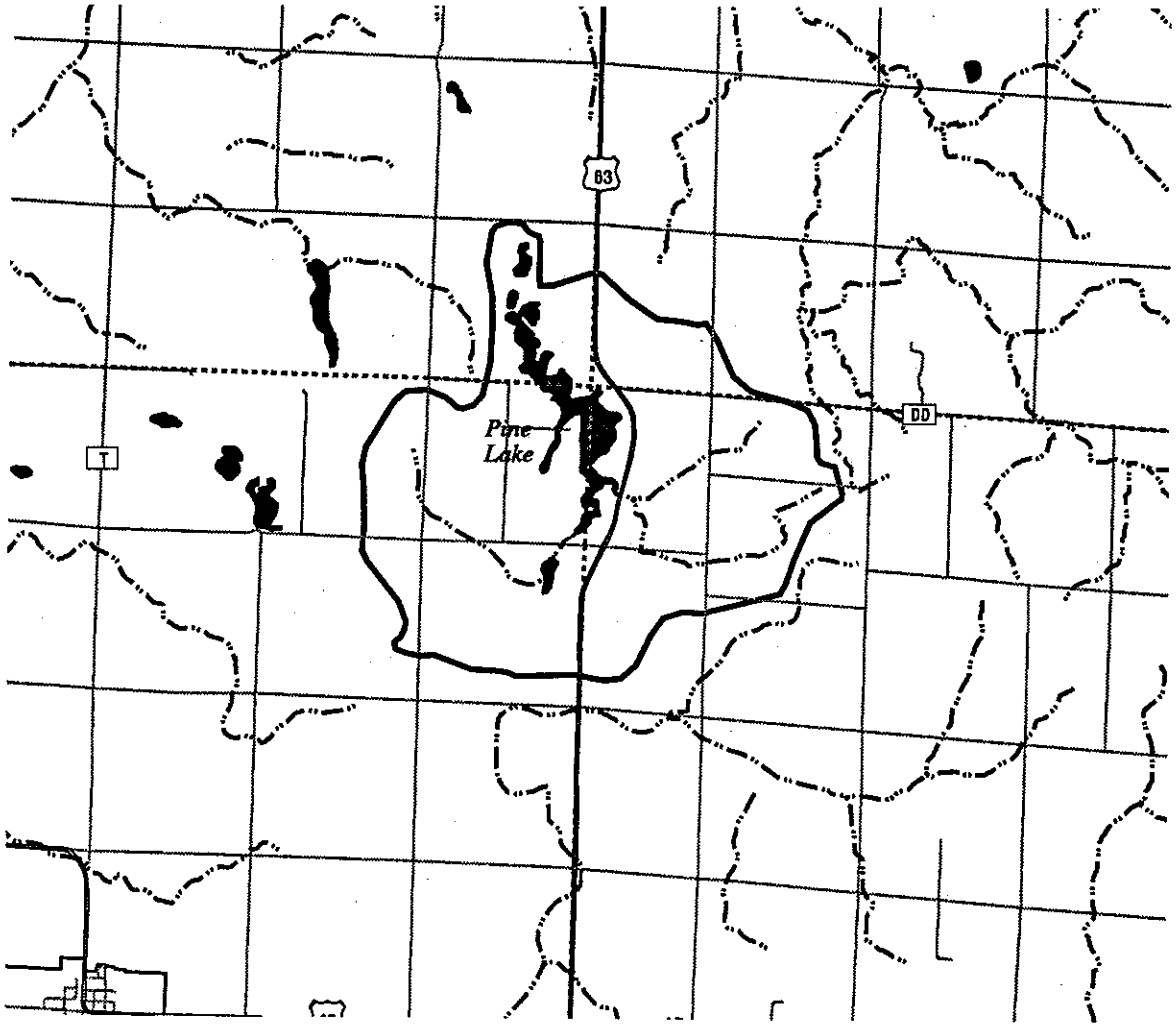
At the present, Pine Lake's fishery is in transition from a stunted bullhead to a sunfish dominated community. This process began during 1994 with the installation of two aeration systems, removal of 13 ton (about 273,000) of bullhead and the stocking of largemouth bass, northern pike, walleye and bluegill. Rehabilitation of the sport fishery is anticipated to take 3 to 5 years to complete.

Although aerated and on its way to recovery, Pine Lake still has many threats. Both annual and long term fluctuations in water levels can result in loss of habitat, or the lake may become too shallow to support fish life. Drought or sinkholes present problems that may be beyond our control. Until the fall of 1996, cattle grazed the banks, causing serious bank erosion. These banks are currently slowly healing, though some slumping does occur on the east shoreline. Upland runoff carries heavy silt loads and nutrients to the lake. Increased nutrient enrichment and algal blooms may make aeration more difficult.

Aquatic Vegetation

The water quality problems in Pine Lake are evident in the plant population. Only disturbance tolerant species are present, and even these have low frequencies and densities. The hard sediments and sloped littoral zone create some limitations, but improved water clarity would open a window of opportunity for new species. Even the addition of a few species that do well in firm sediments, such as wild celery and slender naiad, would vastly improve both the fish and wildlife habitat of Pine Lake.

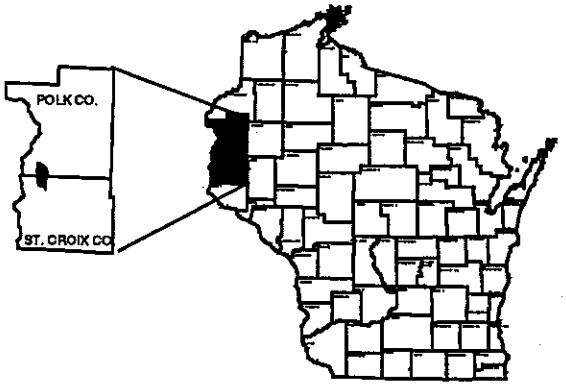
Map 2-3. Baldwin-Pine Lake Subwatershed



LEGEND

- Local Roads
- Highway
- Township/Range
- Intermittent streams
- Perennial Stream
- Baldwin-Pine Lake Subwatershed
- Open Water
- Municipalities

PROJECT AREA



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Rural Inventory Results, Nonpoint Source Pollutants, Objectives, and Cost-Share Eligibility Criteria

This section describes the results of the rural nonpoint source inventories, objectives and cost-share eligibility criteria for each pollutant source. These sources include barnyard runoff, agricultural nutrients, sediments from upland areas, gully erosion and shoreline erosion. Because this project consists of four separate lakes and their watersheds, the inventory results, objectives and cost share eligibility criteria will be discussed separately for each lake.

Management Categories

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

Management category eligibility criteria are expressed in terms of tons of sediment delivered to surface waters from eroding uplands and streambanks and pounds of phosphorus delivered to surface water from barnyards. Any newly created sources requiring controls after the signing of a cost-share agreement must be controlled at the landowners expense .

The Land Conservation Departments (LCDs) will assist landowners in applying Best Management Practices (BMPs). Practices range from alterations in farm management (such as changes in manure-spreading and crop rotations) to engineered structures (such as diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations. See Chapter 3 for a complete list of BMPs.

Critical Management Category
Nonpoint sources included in this category contribute a significant amount of the pollutants impacting surface waters. Critical sites are those sites where BMPs must be applied to have a reasonable likelihood of achieving water quality objectives. These sites may be designated by both numeric and descriptive criteria.

Nonpoint sources designated as critical are eligible for funding and/or technical assistance through the priority watershed project. The most severe critical sites will receive notification to correct the practices soon after designation. The remaining critical sites will receive notification if voluntary participation fails to meet expectations.

Eligible Management Category
Nonpoint sources of pollution in this category contribute less significantly to water quality degradation. These sites are eligible for technical and cost-share assistance but are not as critical to reaching water quality objectives.

Ineligible Management Category
Sites which do not contribute significant amounts of pollutants are not eligible for funding or technical assistance through the priority watershed project. Other DNR programs, such as wildlife and fisheries management, may assist county project staff to control these sources as part of the implementation of the integrated resource management plan for this watershed. Other local, state, or federal programs may also be applicable to these lands.

Summary of Eligibility and Critical Site Criteria

This section summarizes the criteria established for identifying critical sources of pollution and for determining landowner eligibility for cost sharing for the identified sources of pollution. Because the individual lake watersheds differ in their conditions, goals and objectives, a more detailed discussion for each lake follows this summary.

Cropland Erosion
In appraising the condition of the lakes in the St. Croix Lakes project, sediment and phosphorus loading from eroding fields was found to be a major pollutant inhibiting the quality of the watershed ecosystem for Squaw and particularly Baldwin-Pine lakes. However, through conducting an inventory of the existing field erosion situation, nearly all fields are shown to be farmed at very low sediment delivery rates to the lake. For these reasons, critical acres were designated as those with sediment delivery rates of 0.3 ton/acre/year or more for Bass and Perch subwatersheds and 1 ton/acre/year or more for Squaw and Baldwin-Pine subwatersheds. Only 45 critical acres were identified, in the Bass subwatershed.

Landowners will be considered "eligible" to receive cost sharing for cropping practices if they own fields with sediment delivery rates down to .01 ton/acre/year to encourage widespread adoption of pollution control management practices and because the sediment delivery sources are very widespread even at these low delivery rates.

Table 2-3 . Cropland Sediment

Management Category	Sediment Delivery (tons/acre/yr.)	Acres
Critical	$\geq .3$ (Bass,Perch) ≥ 1 (Squaw, Pine)	45 (Bass) (5 landowners)
Eligible	> 0.01	7200

Barnyard Runoff
To maintain cost effectiveness, only those landowners with barnyard sites delivering more than 50 pounds (Squaw and Baldwin-Pine) or 10 pounds (Bass and Perch) of phosphorus to surface water on an annual basis will be eligible for a complete barnyard runoff management system. No barnyards have been identified that meet these criteria. Landowners with barnyards delivering less than these

amounts annually will be eligible to receive lower cost clean water diversions and roof gutters (17 barnyards).

Table 2-4 . Barnyard Runoff

Management Category	Phosphorus (lbs./year)	Number of Barnyards
Critical	> 50 (Squaw, Pine) >10 (Bass, Perch)	0
Eligible:	All (Clean water diversions)	17

Nutrient and Pest Management

Nutrient loading from cropped fields in the St. Croix County Lakes watersheds was found to be a major source of phosphorus, especially inhibiting the quality of Squaw and Baldwin-Pine Lakes. Some of the phosphorus load reaches the lakes in conjunction with phosphorus-rich runoff and sediments delivered from uplands. This accounts for 82% of the phosphorus load in Baldwin-Pine, 29% in Squaw and 12% in Bass Lake watersheds. All cropped lands will be "eligible" for nutrient and pest management planning, to encourage adoption of practices to reduce phosphorus delivery.

Spring runoff from acres winterspread with manure were found to be another major source of phosphorus, especially to Squaw Lake (42% of annual phosphorus load) and Baldwin-Pine Lake (8% of annual phosphorus load). A variety of approaches will be needed to address this nutrient source, including promotion of alternative manure management strategies including manure storage and manure brokering, and temporary detention and infiltration of spring runoff, and grassed waterways, filter strips or easements to provide buffers for areas of concentrated flow.

Intermittent waterways or areas of concentrated flow have been designated "critical" for winterspreading of manure. Inventories have identified 17 acres (6 landowners) in the Squaw Lake watershed, though it is expected that the number of acres will increase with further inventory work.

Table 2-5. Nutrient Management

Management Category	Description	Acres
Critical	Winterspread acres in areas of concentrated flow	at least 17 (6 landowners)
Eligible	All cropped acres	7200, including 800 winterspread

Shoreline Erosion

Nutrient and sediment loading from eroding shorelines in the St. Croix County Lakes watersheds was found to be a major source of pollutants, especially threatening the quality of Bass and Perch Lakes. Exceedingly high water levels in the last several years have aggravated this problem, and to some extent, when water levels recede, eroding sites may correct themselves. Therefore, the emphasis will be on lower cost practices such as bioengineering and establishment of vegetation to establish

shorelines resilient to fluctuating water levels. Eroding sites that are delivering 10 tons of sediment or more annually, or receding laterally at 1 foot or more per year have been designated "critical". Of the 72 inventoried eroding sites, 21 are critical. However, some of these sites may not be considered critical, if it is determined that there is no human use impact that is contributing to the erosion, or if there is no cost effective means of correcting the erosion. Sites eroding at 1 to 10 tons per year are designated as "eligible" (27 sites).

Table 2- 6. Shoreline Erosion

Management Category	Description	Number of sites
Critical	>10 T/yr eroding, or >1 ft/yr lateral recession	21
Eligible	1-10 T/yr eroding	27

Streambank and Gully Erosion

Gully erosion has been determined to not be a significant nonpoint source in the St. Croix County Lakes watersheds. A gully may be designated "critical" if it delivers 10 tons or more of sediment directly to a lake, and can be cost effectively corrected. Active gullies eroding more than 1 ton/year will be eligible to receive cost-share.

Table 2-7. Gully Erosion

Management Category	Description	Number of Sites
Critical	>10 T/yr, delivered to lake	None identified
Eligible	Active gullies eroding >1 T/yr	N/A

Bass Lake Inventory Results and Objectives

Nonpoint Source Pollutants

Bass Lake receives just over 700 pounds of phosphorus annually. Shoreline erosion contributes an estimated 242 pounds, or 34% of this load. Current very high water levels are a major contributing factor, and this source is expected to diminish when water levels fall. Residential development in the watershed is the second largest source, contributing an estimated 149 pounds, or 21% of the phosphorus load. An estimated 274 tons of sediment reach Bass Lake, with 242 tons, or 88% coming from shoreline erosion. Tables 2-8 and 2-9 summarize the inventoried sediment and nutrient loads and pollutant load reduction objectives.

Table 2-8. Bass Lake Sediment Reduction Objectives

Source	Inventoried Sediment Load (tons)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (tons)
Uplands	18	7	25	14
Gullies	5	2	100	0
Shoreline	242	88	50	121
Rural Residential	9	3		9
Total	**274**	**100**	**48**	**144**

Table 2-9. Bass Lake Phosphorus Reduction Objectives

Nonpoint Source	Inventoried Phosphorus Load (lbs)	Percent of Total	Planned Percent Reduction	Planned Phosphorus Load (lbs)
Uplands	83	12	25	62
Gullies	5	<1	100	0
Shoreline	242	34	50	121
Barnyards	14	2	80	3
Residential Development	149	21	50	75
Precipitation	102	14	0	102
Groundwater	118	17	0	118
Total	**713**	**100**	**32**	**480**

Current in lake summer phosphorus concentration is estimated to be 18 ug/l, and would be reduced to about 12 ug/l with a 32% reduction in phosphorus load. A detailed description of modeling methods and in lake phosphorus concentration as a measure of water quality can be found in the Appraisal Report for this watershed project (DNR, 1996).

Bass Lake Rural Nonpoint Pollution Sources and Eligibility Criteria

Upland Sediment and Phosphorus
Agricultural practices are a fairly small source of sediments and nutrients to Bass Lake. Upland sediment sources were evaluated using the WINHUSLE model on the direct drainage areas to the lake. (The WINHUSLE model is a sediment transfer model based on the Universal Soil Loss Equation). An estimated 13 tons of soil per year are delivered to the lake from croplands. An additional 10 tons/year are delivered from farmsteads, pastures and gullies. These sources account for 9 percent of the sediment delivered to surface waters.

A 25 percent reduction in sediment from eroding fields is targeted for agricultural lands. The erosion rate and sediment delivery rate in the watershed is quite low, with nearly all fields already meeting the tolerable (T) soil loss objective. The average sediment delivery rate for the watershed is less than 0.1 ton/acre/year. *All uplands delivering greater than .01 ton/acres/year are eligible.*

To be classified as critical, fields must be in the direct drainage area of Bass Lake, and be contributing greater than 0.3 ton/acre/year of sediment. There are 6 fields, including approximately 45 acres identified as critical at this time. Critical sites will be required to reduce their annual load below the critical level. Landowners wishing to voluntarily participate in the Priority Watershed Project may sign a cost share agreement to apply practices to reduce the sediment loss to the target amount.

Barnyard Runoff
Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is overall a small source of pollutants in Bass Lake. However, where barnyards or confined livestock areas drain directly to the lake, they may have locally significant impacts. Three barnyards are a source of 14 pounds of phosphorus per year. *Barnyards contributing more than 10 pounds of phosphorus annually and with direct drainage to surface water will be designated critical.* There are currently no critical site barnyards. If a barnyard is determined to be critical, animal lot relocation may be an eligible practice.

All barnyard sites are eligible for low cost practices to control runoff. These practices include clean water diversions and roof gutters. The objective for barnyard runoff control is to reduce phosphorus loading to the lake by 80 percent, and should be achievable with installation of these low-cost practices.

Keeping horses is often a popular activity in areas of low density residential development. Although this is not very common yet in the Bass Lake watershed, it is a often a high intensity land use with potential adverse impacts to the lake, and should be monitored as future development occurs.

Nutrient and Pest Management
All cropland in the Bass Lake Watershed will be eligible for cost sharing for development of a nutrient and pest management plan. Approximately 5 farms (912 acres) are eligible. Manure spreading runoff and management of nutrients are addressed through Natural Resource Conservation Service (NRCS) Nutrient Management Standard 590. Pest management is addressed through NRCS Pest Management Standard 595. Nutrient and pest management plans will be developed by private consultants. Landowners will be eligible to participate for up to three years and will be responsible for paying 50 percent of the consulting fees. A soil conservation plan is necessary for development of a nutrient

management plan. LCD staff will prepare soil conservation plans and materials for the nutrient and pest management plan. LCD staff will also review the nutrient and pest management plans.

Nutrient and pest management activities will result in pollutant load reductions. For this reason, fertilizer application rates must be tracked and reported. Professional services contracts developed for nutrient and pest management consulting must include a provision for reporting the required information to the LCD. Records should be kept showing progress towards reducing the use of fertilizer and pesticides.

In addition to eligibility and promotion of nutrient management planning on all cropland, the plans will encourage limiting the application of manure to meet plant needs for phosphorus wherever possible. Manure stacks or leaking manure storage structures will be targeted for abandonment or relocation to a suitable site.

In order to reduce spring runoff to the lake, no manure will be spread in channels or places of concentrated flow. These places are designated critical sites for manure spreading. Channels and places of concentrated flow will be identified by reviewing sites for evidence or history of crops impacted by inundation, crop flattening by water flow, and indication of intermittent waterways in the USDA/NRCS Soil Survey of St. Croix County. There are no identified critical sites at this time.

Manure Storage

Eligibility for a grant for manure storage practices will be based on the development of a preliminary Nutrient Management Plan, developed in accordance with NRCS standard 590. This means that the storage facility is needed to manage manure during periods of snow-covered, frozen and saturated conditions in order to protect water quality. The nutrient management plan must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice.

Options for manure storage may include, but are not limited to: properly sited, unconfined manure stacks (in accordance with Std. 312); the construction of a short term storage facility (capacity for 30 to 100 days manure production in accordance with Std. 313); the construction of a long term storage facility (capacity for up to 210 days production in accordance with Std. 313 or 425); a reduction in the number of animals; the rental of additional lands; or haul or broker manure to a neighboring farm that can use the manure in accordance with a nutrient management plan.

The eligibility for storage facilities will be based on the least cost system that can 1) meet the requirements of the nutrient management plan and 2) allow the watershed to meet its goals of overall reduction of nutrients reaching the lake from winterspread manure. Cost share funding of manure storage through the federal Environmental Quality Incentive Program (EQIP) may be an option that should be investigated to enhance incentives for installation of storage facilities. More detailed discussion of the EQIP program can be found in the Integrated Resources Management Chapter.

The impact of winterspreading of manure are substantial for Squaw and Baldwin Pine Lakes, and will be discussed in more detail in the Squaw Lake rural nonpoint source discussion.

Shoreline Erosion

Shoreline erosion on Bass Lake is a major source of sediments and nutrients. Extremely high water levels have contributed to this problem. A shoreline erosion inventory was done during the summer of

1996. The inventory showed 242 tons of sediment from shoreline erosion. Of the 37 contributing sites, five sites lost more than 10 tons annually to the lake.

Critical area sites for shoreline erosion are those with severe erosion, defined as having greater than 10 tons/year eroding or a lateral recession rate of 1 foot per year or more. Sites are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem. Eligible sites are those with mild and moderate erosion. *Eligible sites are defined as having 1 to 10 tons/year eroding.* Currently 13 sites are identified as critical. Fluctuating water levels may change the status of these and other sites. Exceedingly high water levels in the last several years have aggravated shoreline erosion, and to some extent, when water levels recede, eroding sites may correct themselves. Therefore, the emphasis will be on lower cost practices such as bioengineering and establishment of vegetation to establish shorelines resilient to fluctuating water levels.

Gully Erosion

Gully erosion has been determined to not be a significant problem throughout this watershed, therefore, a complete field inventory of gully erosion has not been done. One severely eroding gully was identified during inventory. Gullies identified during implementation will be evaluated to determine if they are significant sediment sources and eligible for cost sharing. *Actively eroding gullies eroding 1 ton or more per year are eligible. A gully that delivers 10 ton or more of sediment directly to surface water may be designated as critical.* Gullies are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem.

Rural Residential Nonpoint Sources

Bass Lake currently has approximately 370 acres of low to medium density residential development on land that drains directly or indirectly via swales or ditches to the lake. Inventory and modeling using the Source Loading and Management Model (SLAMM) estimated a loading rate of 0.4 lbs/acre/year. Residential development is estimated to contribute 149 lbs of phosphorus to the lake annually.

The Bass Lake watershed, like much of western St. Croix County, is experiencing rapid rural residential growth. The West Central Wisconsin Regional Planning Commission population projections show an anticipated 18 to 20% per decade growth rate over the next two decades.

There are an estimated additional 250 acres of land that could be converted to residential development in areas that drain directly or indirectly via swales to the lake. The potential future phosphorus load to the lake from all residential development if these lands are developed is 250 lbs, or a 68 % increase over the existing residential load of 149 lbs. With low cost best management practices applied to existing, and potential new development, the total phosphorus load from maximum residential development could be kept at about 125 lbs.

Practices to accomplish this include diversion of clean runoff from rooftops and other hard surfaces to grass swales and other infiltration areas, low herbicide and low phosphorus fertilizer yard care practices, and other low cost yard care practices. Most of this will be accomplished by information and education efforts. Other low cost efforts such as down spout extenders and landscaping for infiltration may be cost sharable as residential retrofits, or structural urban BMPs, to solve runoff problems from existing development. *Eligibility will be determined on an individual basis by project staff.*

For riparian property owners, Shoreline Habitat Restoration for Developed Areas will be available as an interim BMP. *Landowners with existing shoreline vegetation that can be improved to provide better habitat diversity will be eligible, as described in the guidelines for this BMP (see Appendix B).*

Perch Lake Inventory Results and Objectives

Nonpoint Source Pollutants

Perch Lake receives an estimated 200 pounds of phosphorus annually. Shoreline erosion contributes an estimated 83 pounds, or 41% of this load. Current very high water levels are a major contributing factor, and this source is expected to diminish when water levels fall. Groundwater recharging the lake is the second largest source, contributing an estimated 78 pounds, or 39% of the phosphorus load. An estimated 284 tons of sediment reach Perch Lake, with 278 tons, or 98% coming from shoreline erosion. Several badly eroding sites are major contributors. Tables 2-10 and 2-11 summarize the inventoried sediment and nutrient loads and pollutant load reduction objectives.

Table 2-10. Perch Lake Sediment Reduction Objectives

Source	Inventoried Sediment Load (tons)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (tons)
Uplands	1	<1	0	1
Gullies	5	2	50	2
Shoreline	278	98	75	69
Rural Residential	1	<1	50	<1
Total	**285**	**100**	**74**	**73**

Table 2-11. Perch Lake Phosphorus Reduction Objectives

Nonpoint Source	Inventoried Phosphorus Load (lbs)	Percent of Total	Planned Percent Reduction	Planned Phosphorus Load (lbs)
Uplands	8	4	0	8
Gullies	6	3	50	3
Shoreline	83	41	75	21
Residential Development	15	7	50	7
Precipitation	11	6	0	11
Groundwater	78	39	0	78
Total	**201**	**100**	**36**	**128**

Current in lake summer phosphorus concentration is estimated to be 12 ug/l, and would be reduced to about 8 ug/l with a 36% reduction in phosphorus load. A detailed description of modeling methods and in lake phosphorus concentration as a measure of water quality can be found in the Appraisal Report for this watershed project (DNR, 1996).

Perch Lake Rural Nonpoint Pollution Sources and Eligibility Criteria

Upland Sediment and Phosphorus

Agricultural practices are a very small source of sediments and nutrients to Perch Lake. Upland sediment sources were evaluated using the WINHUSLE model on the direct drainage area to the lake. Approximately two tons of soil per year are delivered to the lake from croplands, pastures, forest and rural residential uses. An additional 5 tons per year are delivered from gullies. These sources account for 2 percent of the sediment delivered to Perch Lake.

No sediment reduction is planned for agricultural lands because there are no identified contributing fields in the direct drainage area. The erosion rate and sediment delivery rate in the watershed is very low, with all fields already meeting the tolerable (T) soil loss objective. *All uplands delivering greater than 0 .01 ton/acres/year are eligible.* There are no eligible acres identified with the WINHUSLE inventory at this time, though roughly 100 acres may be identified by project staff after further evaluation.

To be classified as critical, fields must be in the direct drainage area of Perch Lake, and be contributing greater than 0.3 ton/acre/year of sediment. The average sediment delivery rate for the watershed is less than 0.01 tons/acre/year. There are no critical sites at this time.

Barnyard Runoff

There are three horse barnyards with several horses each, but no other confined livestock areas in the Perch Lake watershed. *Barnyards contributing more than 10 pounds of phosphorus per year will be designated critical.* There are currently no critical site barnyards. All barnyard sites are eligible for low cost practices to control runoff, as described for the Bass Lake watershed.

Keeping horses is often a popular activity in areas of low density residential development. Although this is not very common yet in the Perch Lake watershed, it is a land use with potential adverse impacts to the lake, and should be monitored as future development occurs.

Nutrient and Pest Management

All cropland in the Perch Lake Watershed will be eligible for cost sharing for development of a nutrient and pest management plan, as described for the Bass Lake watershed. Approximately 30 acres are eligible.

As described for Bass Lake, no manure will be spread in channels or places of concentrated flow. *These places are designated critical sites for manure spreading,* however, there are no identified critical sites.

Manure Storage
Eligibility for a grant for manure storage practices will be based on the development of a preliminary Nutrient Management Plan, as described for Bass Lake. With current land uses in the watershed, this practice is not needed.

Shoreline Erosion
Shoreline erosion on Perch Lake is a major source of sediments and nutrients. Extremely high water levels have contributed to this problem. A shoreline erosion inventory was done during the summer of 1996. The inventory showed 278 tons of sediment from shoreline erosion. Of the 8 contributing sites, four sites lost more than 10 tons annually to the lake.

Critical area sites for shoreline erosion are those with severe erosion, defined as having greater than 10 tons/year eroding or a lateral recession rate of 1 foot per year or more. Sites are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem. *Eligible sites are those with mild and moderate erosion, and are defined as having 1 to 10 tons/year eroding.* Currently five sites are critical. Exceedingly high water levels in the last several years have aggravated shoreline erosion, and to some extent, when water levels recede, eroding sites may correct themselves. Therefore, the emphasis will be on lower cost practices such as bioengineering and establishment of vegetation to establish shorelines resilient to fluctuating water levels.

Gully Erosion
Gully erosion has been determined not to be a significant problem throughout this watershed, therefore, a complete field inventory of gully erosion has not been done. One severely eroding gully was identified during inventory. Gullies identified during implementation will be evaluated to determine if they are significant sediment sources and eligible for cost sharing. *A gully that delivers 10 ton or more of sediment directly to surface water may be designated as critical.* Gullies are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem. *Actively eroding gullies eroding 1 ton or more per year are eligible.*

Rural Residential Nonpoint Sources
Perch Lake currently has approximately 37 acres of low density residential development on land that drains directly or indirectly via swales or ditches to the lake. Inventory and modeling using the SLAMM model estimated a loading rate of 0.4 lbs/acre/year. Residential development is estimated to contribute 15 pounds of phosphorus to the lake annually.

The Perch Lake watershed, like much of western St. Croix County, is experiencing rapid rural residential growth. The West Central Wisconsin Regional Planning Commission population projections show an anticipated 18 to 20% per decade growth rate over the next two decades.

There are an estimated additional 152 acres of land that could be converted to residential development in areas that drain directly or indirectly via swales to the lake. The potential future phosphorus load to the lake from all residential development if these lands are developed is 76 lbs, or a 5-fold increase over the existing residential load of 15 lbs. With low cost best management practices applied to existing, and potential new development, the total phosphorus load from maximum residential development could be kept at about 37 lbs.

Practices to accomplish this include diversion of clean runoff from rooftops and other hard surfaces to grass swales and other infiltration areas, low herbicide and low phosphorus fertilizer yard care practices, and other low cost yard care practices. Most of this will be accomplished by information and education efforts. Other low cost efforts such as down spout extenders and landscaping for infiltration may be cost sharable as residential retrofits, or structural urban BMPs to solve runoff problems from existing development. *Eligibility will be determined on an individual basis by project staff.*

For riparian property owners, Shoreline Habitat Restoration for Developed Areas will be available as an interim BMP. *Landowners with existing shoreline vegetation that can be improved to provide better habitat diversity will be eligible, as described in the guidelines for this BMP (see Appendix B).*

Squaw Lake Inventory Results and Objectives

Nonpoint Source Pollutants

Squaw Lake receives an estimated 2949 lbs of phosphorus annually. Winterspread manure contributes an estimated 1244 lbs, or 42% of this load. Most of this load is carried to the lake in spring runoff. Uplands deliver an additional 1224 lbs or 42% and internal loading contributes 330 lbs or 11% of the phosphorus load. An estimated 261 tons of sediment reach Squaw Lake, with 256 tons, or 98% coming from uplands. Tables 2-12 and 2-13 summarize the inventoried sediment and nutrient loads and pollutant load reduction objectives.

Table 2-12. Squaw Lake Sediment Reduction Objectives

Source	Inventoried Sediment Load (tons)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (tons)
Uplands	256	98	25	192
Shoreline	4	1	50	2
Rural Residential	1	<1	50	<1
Total	**261**	**100**	**25**	**195**

Table 2-13. Squaw Lake Phosphorus Reduction Objectives

Nonpoint Source	Inventoried Phosphorus Load (lbs)	Percent of Total	Planned Percent Reduction	Planned Phosphorus Load (lbs)
Uplands	1224	42	25	918
Winterspread Manure *Uplands*	650	22	25	488
Winterspread Manure *Dry Run*	594	20	100	0
Shoreline	7	<1	50	4
Barnyards	82	3	50	41
Residential Development	18	<1	50	9
Internal Loading	330	11	80	66
Precipitation	34	1	0	34
Groundwater	10	<1	0	10
Total	**2949**	**100**	**47**	**1569**

Current in lake summer phosphorus concentration is estimated to be 270 ug/l, and would be reduced to about 130 ug/l with a 78% reduction in phosphorus load. A detailed description of modeling methods and in lake phosphorus concentration as a measure of water quality can be found in the Appraisal Report for this watershed project (DNR, 1996).

Squaw Lake Rural Nonpoint Pollution Sources and Eligibility Criteria

Upland Sediment and Phosphorus

Upland sediment sources were evaluated using the WINHUSLE model on the St. Croix County portion of the drainage area to the lake. An estimated 256 tons of soil per year are delivered to the lake from uplands, nearly all of it coming from croplands. An additional 5 tons/year are delivered from shorelands and rural residential areas. Uplands are the source of 98 percent of the sediment delivered to surface waters. Erosion control is needed to reduce the amount of phosphorus transported to the lakes with sediment and to protect shoreline habitat.

A 25 percent reduction in sediment from eroding fields is targeted for agricultural lands. The erosion rate and sediment delivery rate in the watershed are very low, with nearly all fields already meeting the tolerable (T) soil loss objective. Bringing half the lands that are contributing sediment at a rate greater than .1 tons/acre/year down to .1 tons/acre/year would reduce sediment and P by 20 percent. Infiltration practices will be installed in order to reduce the sediment delivery by 25 percent. These practices include sediment control basins, wetland restoration, and buffer strips. *All uplands delivering greater than .01 ton/acres/year are eligible.*

To be classified as critical, fields must be contributing greater than 1 ton/acre/year of sediment. The average sediment delivery rate for the watershed is about 0.1 tons/acre/year. There are no critical sites at this time.

Barnyard Runoff

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a source of pollutants in Squaw Lake. Five barnyards are a source of 82 pounds of phosphorus per year, with the largest one contributing 28 pounds per year. *Barnyards contributing more than 50 pounds of phosphorus annually will be designated critical.*

All barnyard sites are eligible for low cost practices to control runoff. These practices include clean water diversions and roof gutters. The objective for barnyard runoff control is to reduce phosphorus loading to streams by 50 percent, and should be achievable by installing these low cost practices.

Spring Runoff with Frozen Ground Conditions

In years when heavy snow cover combines with a sudden spring thaw, a large volume of nutrient laden runoff is carried to Squaw Lake. Once the ground thaws, infiltration occurs quickly, but in years when snow melt precedes ground thaw, an estimated 20% of the phosphorus load, approximately 600 pounds, comes from this source. This load was calculated based on the number of winterspread acres in the watershed, with a phosphorus delivery coefficient of 33 pounds/acre for areas of concentrated flow, and 1.25 pounds/acre for winterspread uplands. An approach to reducing heavy spring runoff will include an investigation options for creating temporary detention throughout the watershed, where runoff water can be stored for a few days or weeks, until the ground thaws and

infiltration can occur. Preliminary field investigations indicate this may be a feasible approach, and may be able to achieve approximately a 30 to 50% reduction in runoff volume.

In order to design structures and identify locations for infiltration, it will be necessary to do hydraulic modeling of the watershed for spring runoff conditions. The Department will undertake an engineering and feasibility study in the Squaw Lake watershed to determine whether diversion, detention or infiltration structures can be designed, constructed and maintained to temporarily detain, infiltrate and trap nutrients from runoff. Hydraulic modeling will be necessary to determine the feasibility of this approach, and where best management practices may be located within the watershed.
Existing BMP's that may apply include, but are not limited to terraces and diversions. Interim BMP's that may be needed could include detention structures designed to provide storage with infiltration.

All areas of concentrated or channelized flow are designated as critical for winter spreading of manure. Approximately 17 acres are identified as critical, though the number of acres may increase with additional inventory efforts. Channels and places of concentrated flow will be identified by reviewing sites for evidence or history of crops impacted by inundation, crop flattening by water flow, and indication of intermittent waterways in the USDA/NRCS Soil Survey of St. Croix County. Areas of concentrated or channelized flow are eligible for easements or fee purchase, for the establishment of permanently vegetated waterways.

Nutrient and Pest Management
All cropland in the Squaw Lake Watershed will be eligible for cost sharing for development of a nutrient and pest management plan, as described for the Bass Lake watershed. Approximately 6 farms (1500 acres) are eligible.

In addition to eligibility and promotion of nutrient management planning on all cropland, the plans will encourage limiting the application of manure to meet plant needs for phosphorus wherever possible. Manure stacks or leaking manure storage structures will be targeted for abandonment or relocation to a suitable site.

In order to reduce nutrients in spring runoff to the lake, no manure will be winter spread in channels or places of concentrated flow. These places are designated critical sites for winter manure spreading, as discussed above.

Manure Storage
Eligibility for a grant for manure storage practices will be based on the development of a preliminary Nutrient Management Plan, as described for the Bass Lake watershed. The manure storage facility that will be approved for cost sharing will be based on the least cost system that can 1) meet the requirements of the nutrient management plan and 2) allow the watershed to meet its goals of overall reduction of nutrients reaching the lake from winterspread manure. In many cases, this will mean that the landowner will be eligible for maximum storage.

About 40% of the phosphorus load to Squaw Lake is estimated to be coming from winterspread manure. In order to meet nutrient load reduction objectives for the lake, an effective combination of approaches will be needed. Key components of management may include:

- Reduction of winterspread acres through manure storage

- Reduction of manure in the watershed through manure brokering
- Reduction of spring runoff of nutrient laden waters through created temporary storage and infiltration.
- Removal of areas of concentrated flow from cropping through easements or acquisitions.

With approximately six farm operators in the watershed, nutrient loading reduction strategies can be tailored to each situation. Ultimately the nutrient load reduction strategy must have a reasonable chance of achieving the watershed goals. Alternatives that can be considered include, but are not limited to 1) across the board nutrient reductions for all operators or 2) greater reductions for larger contributors.

Shoreline Erosion

While shoreline erosion on Squaw Lake is essentially a natural process caused by wind and wave action, it may be affected by water level fluctuations, human trampling, and shoreline land use practices. A shoreline erosion inventory done during the summer of 1996 showed very little shoreline erosion. Two eroding sites had a total soil loss of less than 4 tons annually to the lake.

While the inventory does not identify shoreline erosion as a major sediment problem, there may be areas where shoreline habitat is being affected. *Critical area sites for shoreline erosion are those with severe erosion, defined as having greater than 10 tons/year eroding, or a lateral recession rate of 1 foot per year or more.* Sites are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem. There are no critical sites identified. *Eligible sites are those with mild and moderate erosion, defined as having 1 to 10 tons/year eroding.*

Gully Erosion

Gully erosion has been determined to not be a significant problem throughout this watershed, therefore, a complete field inventory of gully erosion has not been done. Gullies identified during implementation will be evaluated to determine if they are significant sediment sources and eligible for cost sharing. *Actively eroding gullies eroding 1 ton or more per year are eligible. A gully that delivers 10 ton or more of sediment directly to surface water may be designated as critical.* Gullies are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem.

Rural Residential Nonpoint Sources

Squaw Lake currently has approximately 45 acres of low density residential development on land that drains directly or indirectly via swales or ditches to the lake. Inventory and modeling using the SLAMM model estimated a loading rate of 0.4 lbs/acre/year. Residential development is estimated to contribute 18 lbs of phosphorus to the lake annually.

Much of western St. Croix County is experiencing rapid rural residential growth, with West Central Wisconsin Regional Planning Commission population projections showing an anticipated 18 to 20% per decade growth rate over the next two decades. There are an estimated additional 325 acres of land that could be converted to residential development in areas that drain directly or indirectly via swales to the lake. The potential future phosphorus load to the lake from all residential development if these lands are developed is 150 lbs. With low cost best management practices applied to existing, and potential new development, the total phosphorus load from maximum residential development could be kept at about 75 lbs.

Practices to accomplish this will be promoted by information and education efforts, and as described for Bass and Perch lakes. *Eligibility will be determined on an individual basis by project staff.* For riparian property owners, Shoreline Habitat Restoration for Developed Areas will be available as an interim BMP. *Landowners with existing shoreline vegetation that can be improved to provide better habitat diversity will be eligible, as described in the guidelines for this BMP (see Appendix B).*

Baldwin-Pine Lake Inventory Results, Objectives and Eligibility Criteria

Nonpoint Source Pollutants

Baldwin-Pine Lake receives an estimated 3,042 lbs of phosphorus annually. Uplands contribute an estimated 2,501 lbs, or 82% of this load. An estimated 686 tons of sediment reach Baldwin-Pine Lake, with 585 tons or 85% coming from uplands. Tables 2-14 and 2-15 summarize the inventoried sediment and nutrient loads and pollutant load reduction objectives.

Table 2-14. Baldwin-Pine Lake Sediment Reduction Objective

Source	Inventoried Sediment Load (tons)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (tons)
Uplands	585	85	25	439
Shoreline	100	15	50	50
Gullies	1	<1	50	<1
Total	**686**	**100**	**29**	**489**

Table 2-15. Baldwin-Pine Lake Phosphorus Reduction Objectives

Nonpoint Source	Inventoried Phosphorus Load (lbs)	Percent of Total	Planned Percent Reduction	Planned Phosphorus Load (lbs)
Uplands	2501	82	25	1876
Winterspread Manure *Uplands*	250	8	25	188
Shoreline	181	6	80	36
Barnyards	80	3	50	40
Precipitation	29	1	0	29
Groundwater	<1	<1	0	<1
Total	**3042**	**100**	**29**	**2169**

Current in lake summer phosphorus concentration is estimated to be 170 ug/l, and would be reduced to about 120 ug/l with a 29% reduction in phosphorus load. A detailed description of modeling methods

and in lake phosphorus concentration as a measure of water quality can be found in the Appraisal Report for this watershed project (DNR, 1996).

Baldwin-Pine Lake Rural Nonpoint Pollution Sources and Eligibility Criteria

Upland Sediment and Phosphorus

Agricultural practices have caused considerable amounts of eroded soil to reach Baldwin-Pine Lake. Upland sediment sources were evaluated using the WINHUSLE model on the entire drainage area to the lake. An estimated 530 tons of soil per year are delivered to the lake from croplands. An additional 56 tons/year are delivered from farmsteads, pastures and rural residential areas. Uplands are the source of 85 percent of the sediment delivered to surface waters. Erosion control is needed to reduce the amount of phosphorus transported to the lakes with sediment and to protect shoreline habitat.

A 25 percent reduction in sediment from eroding fields is targeted for agricultural lands. The erosion rate and sediment delivery rate in the watershed is very low. The average sediment delivery rate for the watershed is about 0.2 tons/acre/year. Virtually all fields are already meeting the tolerable (T) soil loss objective. Bringing half of all lands that are contributing sediment at a rate greater than .2 tons/acre/year down to 0.2 tons/acre/year would reduce sediment and P by 20 percent. Infiltration practices will be installed in order to reduce the sediment delivery by 25 percent. These practices include sediment control basins, wetland restoration, and buffer strips. *All uplands delivering greater than .01 ton/acre/year are eligible.*

To be classified as critical, fields must be contributing greater than 1 ton/acre/year of sediment. There are no critical sites at this time.

The Department will undertake an engineering and feasibility study in the Squaw Lake watershed to determine whether diversion, detention or infiltration structures can be designed, constructed and maintained to temporarily detain, infiltrate and trap nutrients from runoff during spring runoff and other high rainfall events. Hydraulic modeling will be necessary to determine the feasibility of this approach, and where best management practices may be located within the watershed. The need for additional hydraulic engineering study in the Baldwin-Pine watershed will be assessed at the completion of the Squaw Lake study.

Barnyard Runoff

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a source of pollutants in Baldwin-Pine Lake. Five barnyards are a source of 80 pounds of phosphorus per year, with the largest one contributing 26 pounds per year. *Barnyards contributing more than 50 pounds of phosphorus annually will be designated critical.* There are no critical site barnyards identified at this time.

All barnyard sites are eligible for low cost practices to control runoff. These practices include clean water diversions and roof gutters. The objective for barnyard runoff control is to reduce phosphorus loading to streams by 50 percent, and should be achievable by installing these low cost practices.

Nutrient and Pest Management
All cropland in the Baldwin-Pine Lake watershed will be eligible for cost sharing for development of a nutrient and pest management plan, as described for the Bass Lake watershed. Approximately 7 farms (2,142 acres) are eligible.

In addition to eligibility and promotion of nutrient management planning on all cropland, the plans will encourage limiting the application of manure to meet plant needs for phosphorus wherever possible. Manure stacks or leaking manure storage structures will be targeted for abandonment or relocation to a suitable site.

In order to reduce nutrient loads from spring runoff to the lake, no manure will be winter spread in channels or places of concentrated flow. These places are designated critical sites for winter manure spreading, as described for Squaw Lake. There are no identified critical acres at this time. Areas of concentrated or channelized flow are eligible for easements or fee purchase, for the establishment of permanently vegetated waterways.

Manure Storage
Eligibility for a grant for manure storage practices will be based on the development of a preliminary Nutrient Management Plan, as described for the Bass Lake watershed. The impacts of winterspreading of manure are substantial for Baldwin-Pine Lake and are discussed in detail in the previous Squaw Lake rural nonpoint discussion section.

Shoreline Erosion
Shoreline erosion on Baldwin-Pine Lake is the second largest source of sediment to the lake. Causes include wind and wave action, water level fluctuations, past cattle access, and shoreline land use practices. A shoreline erosion inventory was done during the summer of 1996, and showed 100 tons of soil loss. Of the 25 sites with soil loss inventoried, 17 sites were eroding more than 1 ton/year, with three sites exceeding 10 tons/year.

Critical area sites for shorelines are those with severe erosion, defined as having greater than 10 tons/year eroding, or a lateral recession rate of 1 foot per year or more. Sites are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem. Three sites are identified as critical. *Eligible sites are those with mild and moderate erosion, defined as having 1 to 10 tons/year eroding.* As described for Bass and Perch Lakes, the emphasis will be on lower cost practices such as bioengineering and establishment of vegetation to establish shorelines resilient to fluctuating water levels.

Gully Erosion
Gully erosion has been determined to not be a significant problem throughout this watershed, therefore, a complete field inventory of gully erosion has not been done. Gullies identified during implementation will be evaluated to determine if they are significant sediment sources and eligible for cost sharing. *Actively eroding gullies eroding 1 ton or more per year are eligible.*

A gully that delivers 10 ton or more sediment directly to surface water may be designated as critical. Gullies are not considered critical if there is no human use impact causing the erosion, and/or there is no cost effective means of correcting the problem.

Rural Residential Nonpoint Sources
Baldwin-Pine Lake has very little residential development at this time. As future development occurs, information and education efforts will focus on promoting good yard care practices and development that minimizes runoff and maximizes infiltration.

Rural Residential/Urban Nonpoint Source Pollutants and Ordinance Development Goals

The watershed has no areas that would be classified as urban, yet rural residential development brings stormwater and construction site erosion control concerns that are often associated with urban areas. This section describes these sources of pollutants and their control.

Urban and Residential Runoff Impacts

Residential runoff can deliver a variety of pollutants depending on the land uses, the types of storm water conveyance systems, and pollution prevention practices, such as street sweeping, yard waste collection and low phosphorus fertilizer usage. Residential areas can generate metals, sediment and phosphorus and may include large impervious areas. Lawn areas contribute fertilizers and pesticides. Rooftop areas are sources of zinc and atmospheric pollutants. Their connection to the storm drainage system may be direct or indirect, depending on the use of downspouts, grassed areas, drain tiles, etcetera. Sediment, particularly from construction sites, can be a major component of residential runoff.

Stormwater Conveyance
Storm water is most commonly conveyed to surface water through a combination of storm sewers, roadside ditches, grassed swales, and ponds. Storm sewers (currently not present in the watersheds) 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 it flows into streams and storm sewer systems.

Reducing pollutant transport involves reducing the amount of storm water reaching surface waters, primarily from impervious surfaces such as rooftops, driveways and roads. This is accomplished by increasing the infiltration of storm water into the soil. Storm water infiltration on a suitable site can effectively reduce nonpoint pollution. In addition, infiltration can help stabilize the hydrology by replenishing groundwater, much of which is ultimately discharged to surface water. Infiltration can reduce bank erosion and the need for expensive, highly engineered drainage structures.

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

Construction Site Erosion

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

Construction site erosion is a major water quality concern in the watershed. Uncontrolled construction site erosion can devastate aquatic communities in lakes receiving sediment-laden runoff. Importantly, water quality improvements occurring through implementation of nonpoint source control practices for existing residential areas can be negated by construction site erosion pollution sources. Predicting rates of construction site erosion is difficult. However, erosion rates exceeding 75 tons/acre/year can occur. This rate of erosion can be two to ten times greater than what occurs on the most severely eroding croplands. Often the proximity of construction sites to drainage ways or water bodies results in nearly all of the sediment being delivered to surface water.

Existing Regulatory Controls for Stormwater and Construction Site Erosion

Developers are governed by state regulations (Ch. 281 Wis. Stats.) set forth by the Department of Commerce (COM), (formerly the Department of Industry, Labor and Human Relations or DILHR) for erosion control on sites with one and two family dwellings. Erosion control provisions of the Uniform Dwelling Code (UDC) are required to be enforced in municipalities with populations exceeding 2,500, although counties and other municipalities have the option of adopting these provisions elsewhere. Table 2-16 summarizes the existing regulatory requirements for stormwater and construction site erosion control for various types of development, and identifies the agencies with jurisdiction.

In the St. Croix County Lakes Project watersheds, only the town of St. Joseph (Bass and Perch Lake watersheds) has a population exceeding 2,500, and is therefore required to enforce erosion control on one and two family dwelling building sites. The Town building inspector is responsible for inspections and enforcement.

St. Croix County's subdivision ordinance requires stormwater and erosion control plans for any subdivisions of less than 35 acres. Control measures apply to the whole subdivision, but not to individual home site development. The county LCD reviews subdivision plans for compliance.

St. Croix County's shoreland zoning ordinance also places restrictions on the extent of filling and grading activities on lands within 300 feet of the high water mark of a water body, depending upon the degree of slope of the land. The ordinance also requires erosion control practices (as described in Wisconsin Construction Site Handbook), as needed to prevent excessive runoff, sedimentation or pollution.

Management Needs and Goals

Construction site erosion and stormwater runoff control, especially in areas that drain toward the lakes, is critical to protecting the lakes from excess sediment and nutrient loads. It is expected that the rate of construction activity will remain steady or increase in the future. Without a high level of control, sediment from construction site erosion can impair water quality and aquatic life in the watershed project area.

In order to ensure that the water quality and resource protection goals of this project are met, the following two areas need to be assessed:

- effectiveness of existing regulations and their associated inspection and enforcement procedures, and
- areas and types of development where ordinance development is needed to provide adequate construction site or erosion control.

Goals for areas of residential development include:

- Develop and implement pollution prevention practices. This could include roadside ditch and swale maintenance, promoting use of low phosphorus fertilizers and other good yard care practices.
- Implement an information and education program that could be targeted at both current residents, new home owners, and developers in the watersheds. Lake Districts or organizations and Citizen Advisory Committee should be involved in this effort.
- Effectively enforce the construction site erosion control and stormwater management provisions in local ordinances
- Revise or develop ordinances to meet needs not addressed by existing ordinances.

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.

Management Actions

In order to meet the goals identified above, the following actions should be taken:

- During the first year of implementation, the project manager should work with the towns and county to identify all existing ordinances that provide stormwater or construction site erosion controls, and evaluate current inspection and enforcement procedures. In order to accomplish this, a work group consisting of representatives from towns, the county, lake management districts or organizations and developers should be formed early in the first year of implementation.
- By the end of the first year of implementation, the work group should develop a plan for implementing revisions to ordinances or inspection and enforcement procedures as determined necessary by the group.
- The construction site erosion control provisions of the Uniform Dwelling Code will be developed as an overlay to the St. Croix County Lakes Cluster Priority Watershed Project as a *requirement* of implementation of this plan.

- Following completion and adoption of the Wisconsin Stormwater Manual, Part II (in preparation), a model stormwater control ordinance will be available and it is *recommended* that it be used in developing a stormwater management ordinance.

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

Specific Needs of Local Government and Developers: The following is a list of specific needs that local government and developers should address in developing and maintaining an effective construction site erosion and stormwater runoff control program:

- The towns or county need to review (and modify where needed) their ordinances to assure effective penalties for non-compliance and responses to concerns of citizens, inspection staff and developers.

- The towns or county need to identify and fill staffing and training needs for effective ordinance administration and enforcement.

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

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

Table 2-16. Construction Site Erosion Control Jurisdiction

TYPE OF PROJECT	PRIMARY RESPONSIBILITY	SECONDARY RESPONSIBILITY	COMMENTS & EXCEPTIONS
No Building			
<5 acres	Municipalities may adopt local ordinances		Any municipality may voluntarily adopt a local ordinance. However, the Storm Water Discharge Permit program requires Green Bay, Allouez, Ashwaubenon, DePere, Marinette, Sheboygan, Superior, Eau Claire, Racine, West Allis, and Waukesha to adopt local erosion control ordinances.
≥5 acres	DNR *NR216 Storm Water Discharge Permit Code*	Municipalities may adopt local ordinances	Municipalities may enforce local ordinances that are more restrictive than DNR regulations. If the local ordinance was adopted prior to 1/1/94, the owner may not have to pay the DNR fee. However, the owner must still file a "notice of intent" with DNR to obtain a Storm Water Discharge Permit.
1 or 2 Family Home			
	Municipality *ILHR 20-25 Uniform Dwelling Code*	COM *ILHR 20-25*	Municipalities[2] ≤ 2500 population are not required to enforce the Uniform Dwelling Code (UDC). In this case, the county may adopt and enforce the erosion control provisions of the UDC or COM will enforce the erosion control provisions. Of about 1500 municipalities with populations≤ 2500, 178 enforce the UDC. In addition, 3 counties enforce the full UDC (Adams, Chippewa, and Eau Claire) and 2 enforce the erosion control provisions of the UDC (Dane and Walworth).
Commercial Building			
<5 acres	COM *ILHR 50-64*[1] *Commercial Building Code*		With COM approval, municipalities may enforce the commercial building code for new buildings <50,000 cu. ft. or for remodeling <100,000 cu. ft. They may also do inspections for larger projects still under COM jurisdiction. About 80 municipalities and one county have delegated authority to enforce the commercial code. Also, municipalities with erosion control ordinances adopted prior to 1/1/94 that are more restrictive than the commercial code may continue to enforce the local ordinance on commercial projects.
≥5 acres	COM *ILHR 50-64*[1]	DNR *NR216*	See comment above. COM or the delegated municipality forward notice of all commercial projects involving ≥5 acres of land disturbance to DNR. The owner does not have to directly notify DNR or pay the DNR fee.
Road Project (state/federal funds)			
<5 acres	DOT	DNR	See comment below.
≥5 acres	DOT *TRANS 401*	DNR *NR216*	DNR and DOT have a memorandum of understanding on erosion control that is part of a broader memorandum of agreement related to environmental impacts of road projects under DOT's jurisdiction. DNR has the opportunity to review and comment on the plans for road projects and participate in the preconstruction conference with the contractor.

[1] As of October 1995, the Commercial Building Code (ILHR 50-64) has not been amended to include erosion control regulatins. However, COM has adopted a rule (ILHR 50.115) that requires landowners to file a Notice of Intent with COM or delegated municipalities for commercial buildingprojects disturbing 5 or more acres of land. The

landowner is exempt from the DNR fee of $200, but must prepare an erosion control plan in accordance with the DNR Construction Site Best Management Practices Handbook and meet the substantive requirements of NR 216.

[2] Municipality means any city, village, town or county.

<5 acres means less than 5 acres of land disturbed throughout all phases of the project.
≥5 acres means 5 acres or more of land disturbed throughout all phases of the project.
COM - Wisconsin Department of Commerce (formerly Wisconsin Department of Industry, Labor and Human Relations)
DNR - Wisconsin Department of Natural Resources
DOT - Wisconsin Department of Transportation
EPA - U.S. Environmental Protection Agency
UDC - Wisconsin Uniform Dwelling Code which applies to all 1 and 2 family homes, manufactured buildings for dwellings or newlyconstructed community-based residential facilities providing care, treatment and services for 3-8 unrelated adults constructed after June 1, 1980.

Adapted from a table prepared by Carolyn Johnson, University of Wisconsin-Extension, Southeast Area Urban Water QualityEducator, Rev. 10/95.

Manure Storage Ordinance

Surface water and groundwater resources are at risk when animal waste storage facilities are improperly located, designed, or constructed. Manure overflows and storage facility failures are a serious threat to aquatic life. Counties adopt animal waste storage ordinances to prevent ground and surface water pollution by assuring the proper design, construction, location, and management of permitted facilities. An ordinance must meet the guidelines adopted by DATCP and cite the applicable NRCS construction and management standards. Ordinances require permits for the installation, modification and major repair of animal waste storage facilities.

Polk County enacted an animal waste storage ordinance in 1985. However, this ordinance applied only to earthen pits. The ordinance has been revised to encompass all pits, earthen and concrete.. The new ordinance went into effect in late 1996.

St. Croix County enacted an animal waste storage ordinance in 1985.

Eligibility for Wetland Restoration and Easements

Wetland Restoration

Wetland restoration is an eligible best management practice for the purpose of controlling nonpoint sources of pollution and enhancing fish and wildlife habitat. Wetlands act to filter nutrients, settle sediments and trap organic wastes from surface runoff.

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

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

- *Cultivated hydric soils with tile or open channel drainage systems discharging to a stream or tributary.* Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource either by establishing permanent vegetation or altering the drainage system.

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

- *Prior converted wetlands downslope or upslope from fields identified as Critical Management Area upland sediment sources through the WIN model.* Restoration of wetlands in these situations will do one of these things: 1) create a wetland filter which reduces the pollutants from an upslope field(s) to a water resource; or 2) reduce the volume and/or velocity of water flowing from an up-slope wetland to a down-slope critical field; or 3) recreate a wetland in wet,

marginal cropland to reduce pollutants from that field. Two eligibility conditions must be met to use wetland restoration in this situation:

- All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to the soils "T" value.
- Wetland restoration or creation will be used in conjunction with cropping practices and structures to meet sediment reduction goals.

Easements will be used to encourage wetland restoration in the watershed.

Prevention of Wetland Degradation
All landowners in the St. Croix Lakes watersheds will also be eligible for cost share practices to protect existing wetlands from degradation from upland erosion and sediment delivery and livestock access.

Easements will also be used for protection of existing valuable wetlands where wetlands are threatened by development, and regulatory programs do not appear to offer adequate protection.

Regulatory programs that can provide protection against degradation of wetlands include county shoreland zoning, DNR Chapter 30 and 31 protection of navigable waters, Section 404 permits required by the Army Corps of Engineers, and administrative requirements under federal farm bills.

Land Easements

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

- Areas of channelized or concentrated flow: vegetative areas which can act to convey, infiltrate and trap sediments carried by spring runoff water;
- Shoreline Buffers: vegetative areas which minimize nonpoint source impacts and other direct impacts to streams;
- Critical Area Stabilization: stabilization efforts needed on sites that either erode at an excessive rate, or have high sediment delivery rates to surface water;
- Wetland Restoration: areas where wetlands are intentionally restored or enhanced in order to improve their ecological values, such as natural filters of surface water.

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

Although easements are not considered a best management practice, they can help achieve desired levels of nonpoint source pollution control in specific conditions. Easements are used to support best management practices, enhance landowner cooperation and more accurately compensate landowners for loss or altered usage of property. The benefits of using easements in conjunction with a management practice are: 1) riparian easements can provide fish and wildlife habitat along with the

pollutant reduction function; 2) easements are generally perpetual, so the protection is longer term than a management practice by itself; and 3) an easement may allow for limited public access (depending on the situation). However, the primary justification of an easement must be for water quality improvement.

Easements should be considered in the following situations:

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

    - There is any grazing of wetlands.
    - Livestock density is so great that areas of unvegetated soil are within 60 feet of intermittent streams or lakes.
    - More than 200 feet of lake or streambank are severely trampled and eroding.
    - Channel erosion is exacerbated by livestock grazing such that unvegetated lake or streambanks are two feet or more in height.

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

    - Row cropping is occurring within 60 feet or less of streams, intermittent streams or areas of concentrated spring runoff flow.
    - Row cropping is being practiced on slopes greater than 6 percent.

3. To support eligible wetland restorations and protection. Easements are strongly recommended whenever:

    - The eligible wetland restoration is greater than 1 acre in size.
    - Existing wetlands are critical to maintaining water quality, are threatened by development, and regulatory programs do not appear to offer adequate protection.

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

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

Easements may be held either by the Department, or by another governmental unit or non-profit organization designated, in writing, by the Department. In the St. Croix County Lakes Project, the county or lake districts may wish to consider obtaining easement acquisition authority.

Land Acquisition

Units of government in the St. Croix County Lakes watershed area are eligible for nonpoint source grants to supplement the purchase of land (in fee) that is contributing or will contribute nonpoint

source pollution. Any land acquisition proposal must meet the applicable goals of the St. Croix County Lakes watershed project to be eligible for acquisition.

In-Lake Nonpoint Source Control

Nutrient inactivation is an eligible treatment to reduce internal cycling of phosphorus from bottom sediments, thereby improving water quality conditions in a lake. Alum treatments are one treatment method that may be used to meet water quality goals particularly in Squaw Lake. Nutrient inactivation practices should be conducted only after significant reduction in nonpoint sources is achieved. Eligibility and adequacy of progress in controlling other nonpoint sources will be evaluated by the DNR West Central Region Nonpoint Source Coordinator and Lakes Management Coordinator. Progress toward controlling nonpoint sources in the Squaw Lake watershed will be assessed annually, with the goal of reaching control levels sufficient for alum treatment by the end of the fourth year of implementation.

Other Pollution Sources

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

Industrial Point Sources of Pollution

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface water resources. Chapter 283, Wis. Stats., requires any person discharging pollutants into the waters of the state to obtain a Wisconsin Discharge Elimination System (WPDES) Permit issued by the DNR.

Sewage Treatment Systems

Sanitary sewer service availability is minimal throughout the St. Croix County Lakes Cluster Watershed. The Amani Sanitary District owns and operates a wastewater treatment plant at the former Osceola Air Force Station, located on the far northwest edge of the Squaw Lake watershed. The plant is designed to treat 32,000 gallons per day (gpd), but actual average monthly flows ranged from 4,200 to 9,900 gpd. The treatment system serves 27 homes and several dormitories at a retreat center. The system discharges to an unnamed ditch leading to a wetland tributary leading to an intermittent waterway that drains to Squaw Lake. The plant is about four miles from Squaw Lake. Discharge from the ponds occurs about two times per year, and at a maximum rate of 36,000 gpd (roughly equivalent to the flow from three garden hoses). For these reasons, this treatment plant is not considered to be a concern for Squaw Lake.

Wastewater generated by the remainder of the watershed residents is disposed of through private on-site 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 such as tanks which go unemptied. Pollutants from septic system discharges are nitrates, bacteria, viruses and hazardous materials from household products. Generally, in the St. Croix County Lakes Cluster Watershed, the majority of soils are suitable for conventional septic tank soil absorption systems. *Areas of concern include riparian homes where high water levels may have impaired proper drain field functioning. Systems in these areas should be checked for proper functioning, and brought into compliance if necessary.*

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 St. Croix County 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 zoning department for more information.

Leaking Underground Storage Tank (LUST) Sites

The Wisconsin Remedial Response Site Evaluation Report (DNR publication number SW-144-91) lists the petroleum storage sites identified through the LUST program. There are no sites listed within the watershed.

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. There are no identified sites.

CHAPTER THREE
Implementation

Introduction

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

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

Best Management Practices

BMPs Eligible For Cost-Sharing And Their Rates

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

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

The practices eligible for cost-sharing and the cost share rates for each BMP are listed in tables 3-1 and 3-2 below; the BMPs listed in table 3-1 can either be cost-shared at 50% or at the flat rates listed.

Table 3-1. Practices with Flat Rates for State Cost-Share Funding

BEST MANAGEMENT PRACTICE	MAXIMUM FLAT RATE
Contour Farming	$ 9.00/ac[1]
Contour Stripcropping	$ 13.50/ac[1]
Field Stripcropping	$ 7.50/ac[1]
High Residue Management	$ 18.50/ac[2]
Riparian Buffer Strip	$125.00/ac[3]
Cropland Protection Cover	$25.00/ac[4]

[1] **Wildlife habitat restoration components of this practice are cost-shared at 70 percent.**
[2] **Cost-shared up to six years.**
[3] **Cost-shared up to five years.**
[4] **Cost-shared up to three years.**

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

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

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

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

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

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

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

Nutrient Management. The management and crediting of nutrients from all sources, including legumes, manure, and soil reserves for the application of manure and commercial fertilizers. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface and groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

Pesticide Management. The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning.

Table 3-2. State Cost-Share Rates for Best Management Practices

BEST MANAGEMENT PRACTICE	STATE COST-SHARE RATE
Nutrient and Pesticide Management	50%
Pesticide Handling Spill Control Basins	70%
Livestock Exclusion from Woodlots	50%
Intensive Grazing Management	50% [1]
Manure Storage Facilities	70% and 50% [2]
Manure Storage Facility Abandonment	70%
Field Diversions and Terraces	70%
Grassed Waterways	70%
Critical Area Stabilization	70% [3]
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70% [3]
Shoreline Buffers	70% [3]
Wetland Restoration	70% [3]
Barnyard Runoff Management	70%
Barnyard Abandonment or Relocation	70%
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Milking Center Waste Control	70%
Cattle Mounds	70%
Structural Urban Practices	70%
Shoreline Habitat Restoration	70%
Well Abandonment	70%
Lake Sediment Treatment	70%

[1] **To a maximum of $2,000 per watering system**

[2] **Manure storage is cost-shared at 70% for the first $20,000 of cost and at 50% for the remaining cost, not to exceed $35,000.**

[3] **Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter Two for an explanation of where easements may apply.**

[4] **The maximum cost-share rate for land acquisition, storm sewer rerouting, and removal of structures necessary to install structural urban BMPs is 50%.**

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

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

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

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

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

Shoreline and Streambank Stabilization. The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access.

Shoreline Buffers. A permanently vegetated area immediately adjacent to lakes, streams, channels and wetlands designed and constructed to manage critical nonpoint sources or to filter pollutants from nonpoint sources.

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

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

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

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

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

Manure Storage Facility Abandonment. Manure storage system abandonment is the proper abandonment of leaking and improperly sited manure storage systems, including: a system with bottom at or below groundwater level; a system whose pit fills with groundwater; a system whose pit leads into the bedrock; a system which has documented reports of discharging manure into surface or groundwater due to structural failure; and a system where there is evidence of structural failure. The

practice includes proper removal and disposal of wastes, liner materials, and saturated soil as well as shaping, filling, and seeding of the area.

Milking Center Waste Control Systems. A milking center waste control system is a piece of equipment, practice or combination of practices installed in a milking center for purposes of reducing the quantity or pollution potential of the wastes.

Roofs for Barnyard Runoff Management and Manure Storage Facilities. Roofs for barnyard runoff management and manure storage facilities are a roof and supporting structure constructed specifically to prevent rain and snow from contacting manure.

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

Cattle Mounds. Cattle mounds are earthen mounds used in conjunction with feeding and dry lot operations and are intended to provide a dry and stable surface area for cattle.

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

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

Interim Best Management Practices

Under some circumstances, practices may be recommended that are not included on the BMP list. Administrative Rule NR 120.15 provides for alternative practices where necessary to meet the water resource objectives identified in the watershed plan. The Department may identify in the nonpoint source grant agreement the design criteria and standards and specifications where appropriate, cost share conditions, and cost share rates for each alternative best management practice. Alternative BMPs identified for this project include Shoreline Habitat Restoration and Manure Hauling and Brokering (Appendix B).

Shoreline Habitat Restoration. This is an interim Best Management Practice for the St. Croix County Lakes Watershed (Appendix B). Shoreline Habitat Restoration is the establishment of vegetation consisting of a mixture of native trees, shrubs, grasses or wetland species on a strip or areas of land along the shoreline of a lake, and can be used when existing habitat lacks the structure or complexity to support habitat functions described for this practice.

Manure Hauling and Brokering. This is an Interim Best Management Practice for the Branch River Priority Watershed Project, and will be considered an eligible practice when it has been approved for use in other projects. Manure hauling is the transport of manure from a storage facility to agricultural lands for the purpose of meeting crop nutrient needs. This practice is described in Appendix B of the *Nonpoint Source Control Plan for the Branch River Priority Watershed Project.*

Practices Not Cost-Shared

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

- That portion of a practice to be funded through other programs.
- Practices previously installed and necessary to support cost-shared practices.
- Changes in crop rotations.
- Changes in location of unconfined manure stacks involving no capital cost.
- Non-stationary manure spreading equipment.
- Practices needed for land use changes during the cost-share agreement period.
- Other practices necessary to achieve the objectives of the watershed project.
- Minimum levels of street sweeping and leaf collecting.
- Operation and maintenance of cost-shared BMPs.
- Practices already installed,with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner.
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed, but which are producing an increased amount of pollutant loading to the surface or groundwater, counter to the water resource objectives of the watershed plan, due to the landowner's change in land management.
- Practices whose purpose is to accelerate or increase drainage of land or wetlands, except where drainage is required as a component of a BMP.
- Practices normally and routinely used in growing crops and required for growing crops or feeding livestock.
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 283 of Wis. Statutes, except urban nonpoint sources that must be controlled to obtain a WPDES permit if control of the sources is identified in the priority watershed plan and the sources are not required to obtain coverage under a WPDES stormwater permit for discharges associated with an industrial activity, as defined under ch. NR 216.
- Livestock operations which: have applied for and are eligible for WPDES permits, have been issued WPDES permits, have greater than 1,000 animal units, or are greater than 1,000 animal units and have been issued a notice of discharge.
- Septic system controls or maintenance.

- Dredging activities.
- Silviculture activities except as necessary for site stabilization.
- Practices to control spills from commercial bulk storage of pesticides, fertilizers, petroleum and similar materials.
- Activities and structures intended solely for flood control.
- Activities required as part of a license for a solid waste management site.
- Activities funded through state or federal grants for wastewater treatment plants.
- Active mining activities.
- Pollution control measures needed during building and utility construction and stormwater management practices for new developments.
- Pollution control measures needed during construction of highways and bridges.
- Other practices or activities determined by DNR not to meet the objectives of the program.

Cost Containment

Cost Containment Procedures

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

Bids: Competitive bids will be required for all structural BMPs with estimated total costs, as determined by the project technician, exceeding $5,000. The bidding process requires a minimum of two bids from qualified contractors in itemized bid format. In cases where bids were requested from a minimum of three qualified contractors, but only one bid was received, the county will determine if the bid constitutes a n appropriate cost for the project. If no bids are received, the county will determine if the bid constitutes an appropriate dost for the project. If no bids are received or if the lone bid is not deemed appropriate, counties will limit cost sharing based on average costs.

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

Flat Rates: BMP's using flat rates are shown in Table 3-1. The rates shown are the state's share of the practice installation costs.

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

The Wisconsin Conservation Corps may be used to install BMPs for cost share recipients.

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

Implementation Schedule

Cost-Share Agreement Administration

Money for cost-share agreements is distributed to landowners by the LCD from a Nonpoint Source grant provided by the DNR. The LCD receives additional grant money to support its staff and other administrative responsibilities. Cost-share agreements are binding contracts between landowners and the LCD. To qualify for cost-sharing funds, landowners must meet eligibility criteria defined in the previous chapter.

Landowner Contact Schedule

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

- County LCD staff will continue to make contacts with eligible landowners until the landowners have made a definite decision regarding participation in the program.

- County staff will contact all eligible landowners not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up period to encourage participation.

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Critical Site Notification Process

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

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

information will be maintained at the appropriate LCD offices and will be available for inspection upon request.

The NRCS staff 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 NR 120.13(4)(d). A site is no longer considered a critical site if the site no longer meets the criteria for critical sites or the site has had BMPs implemented in accordance with a cost-share agreement.

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

- The county LCD staff will complete the verification of critical sites at the rate of 50 percent per year according to the following schedule for 1998 and 1999. Notification will proceed at a faster pace if county staff time allows.

    - April-November: Conduct site visits and verification work.
    - December-January: Prepare report.
    - February 1: Send report to DNR implementation coordinator.
    - April 1: DNR sends notification to the critical site landowners.

- The notification schedule may be modified and revised at the annual watershed review meeting when progress on critical sites is discussed.

- In the Squaw Lake watershed, all areas of concentrated or channelized flow are designated as critical for winter spreading of manure. Approximately 17 acres are identified as critical, though the number of acres may increase with additional inventory efforts. Channels and places of concentrated flow will be identified by reviewing sites for evidence or history of crops impacted by inundation, crop flattening by water flow, and indication of intermittent waterways in the USDA/NRCS Soil Survey of St. Croix County. Areas of concentrated or channelized flow are eligible for easements or fee purchase, for the establishment of permanently vegetated waterways.

Critical Site Appeals Process

The owner or operator of a site designated as a critical site may appeal the critical site designation to the St. Croix County Land Conservation Committee. The site owner or operator, now called the appellant, must write to the LCC and ask for an informal hearing. The appeal request must be received by the LCC within 60 days of the day that the notification letter was received by the owner or operator.

The Land Conservation Committee shall:

- provide the appellant with a hearing and give reasonable notice of the hearing to the appellant, the DNR and the DATCP.
- conduct the hearing as an informal hearing. Chapter 68.11(2), Wis. stats., does not apply to this hearing. This language describes the conduct of the hearing.
- hold the hearing in a place that is convenient for the appellant. The appellant and project staff will present information about the site so that LCC members may make a decision. Representatives of DNR and DATCP may attend the hearing. DNR is required to submit a

report and recommendation to the LCC within 60 days after the hearing. DATCP has the option to submit a report and recommendation within 60 days.

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

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

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

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

Cost-Share Budget

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

The capital cost of installing the Best Management Practices is approximately $1.3 million, assuming 100 percent participation. At 75 percent participation the capitol cost is $1 million.

- State funds necessary to cost-share this level of control would be approximately $699,000.

- The local share provided by landowners and other cost-share recipients would be approximately $305,000.

Chapter Two identifies where nonpoint source program funds can be used to purchase easements. The estimated cost of purchasing easements on eligible lands is shown in Table 3-3. At 75 percent participation, the estimated purchase price of easements on eligible lands would be $180,000. Easements are funded at the 100 percent and will be purchased by either the state or by the St. Croix County LCD.

Table 3-3 Rural BMP Cost-Share Budget Required to Meet Watershed Goals in St. Croix County Lakes Watershed

BMP	Perch	Bass	Squaw	Pine	Cost/	Total	75% Participation	
							State Share	Local Share
Upland Control								
Change in Crop Rotation	0	300	2000	500 ac	NA	0	0	(1)
Contour Cropping	30	100	800	500 ac	9	12,870	9,653	(1)
Contour Strip Cropping	0	0	0	40 ac	13.5	540	405	(1)
High Residue Management (2)	180	1800	3000	900 ac	18.5	108,780	81,585	(1)
Cropland Protection Cover (Green Manure) (3)	0	400	400	200 ac	25	25,000	18,750	(1)
Intensive Grazing Management (Rotational Grazing)	0	0	1	1 ea	4,000	8,000	3,000	3,000
Critical Area Stabilization	10	20	75	50 ac	800	124,000	65,100	27,900
Grass Waterways	1	1	20	8 ac	3,000	90,000	47,250	20,250
Field Diversions and Terraces	0	0	1000	500 ft	3	4,500	2,363	1,013
Grade Stabilization	2	2	2	2 ea	4,000	32,000	16,800	7,200
Agricultural Sediment Basin	0	1	7	3 ea	10,000	110,000	57,750	24,750
Shoreline Buffers	1	5	10	1 ac	400	6,800	3,570	1,530
Riparian Buffers	5	25	50	5 ac	125	10,625	3,984	3,984
Nutrient Management (3)	0	0	1500	1500 ac	6	18,000	6,750	6,750
Nutrient and Pest Management (3)	0	0	750	750 ac	10	15,000	5,625	5,625
Manure Brokering	0	0	3	1 ea	3,000	12,000	6,300	2,700

Spill Control Basin	0	0	1	0 ea	10,000	10,000	5,250	2,250
Wetland Restoration	2	3	10	6 ea	2,000	42,000	22,050	9,450
Livestock Exclusion, Woods	50	500	1000	500 ft	1	2,050	769	769
Upland subtotal						**632,165**	**356,954**	**114,171**
Barnyard Runoff Control and Manure Storage								
Complete System	0	0	1	0 ea	25,000	25,000	13,125	5,625
Roof Gutters	0	0	5	5 ea	1,500	15,000	7,875	3,375
Clean Water Diversion	1	3	7	6 ea	2,500	42,500	22,313	9,563
Roofs	0	0	0	0 ea	25,000	0	0	0
Cattle Mounds	0	0	1	2 ea	3,000	9,000	4,725	2,025
Barnyard Abandonment or Relocation	0	0	1	0 ea	16,500	16,500	8,663	3,713
Manure Storage Facility (3)	0	0	3	2 ea	40,000	200,000	90,000	60,000
Milkhouse Waste	0	0	2	2 ea	7,000	28,000	14,700	6,300
Manure Storage Abandonment	0	0	0	2 ea	10,000	20,000	10,500	4,500
Barnyard subtotal						**347,000**	**167,176**	**93,076**
Shoreline Erosion Control								
Shape and Seeding	505	1955	45	1548 ft	10	40,530	21,278	9,119
Fencing	500	1500	1000	1000 ft	1	4,000	2,100	900
Rock Riprap	150	500	0	200 ft	30	25,500	13,388	5,738
Bio-Bank Stabilization	350	1200	45	1000 ft	25	64,875	34,059	14,597
Crossing	0	1	1	1 ea	2,000	6,000	3,150	1,350
Remote Watering Systems	0	1	1	1 ea	2,000	6,000	3,150	1,350
Shoreline subtotal						**146,905**	**77,125**	**33,054**
Miscellaneous								

Shoreline Habitat Restoration (6)	3	25	20	6 ea	750	40,500	21,263	9,113
Riparian Residential Retrofits (7)	3	22	16	2 ea	750	32,250	16,931	7,256
Lake Sediment Treatment	0	0	1	0 ea	80000	80,000	56,000	24,000
Well Abandonment	2	3	5	5 ea	500	7,500	3,938	1,688
Subtotal						**1,286,320**	**699,387**	**282,358**
Easements	20	20	150	50 ac	1,000	240,000	180,000	0
Total						**1,526,320**	**879,387**	**282,358**

(1) Local share consists of labor and equipment costs. Also see flat rates in table 3-1.
(2) High Residue Management is cost-shared for six years. Number of acres shown represents six times the eligible acres.
(3) Cropland Protection Cover and Nutrient and Pest Management is cost-shared per acre over a three year period. Number of acres shown represents three times the eligible acres.
(4) Riparian Buffers are cost-shared for five years. Number of acres shown represents five times the eligible acres.
(5) Manure storage is cost-shared at 70% for the first $20,000 of cost and at 50% for the remaining cost, not to exceed $35,000.
(6) See Appendix B for this interim BMP.
(7) Riparian Residential Retrofits are composed of Urban Structural Practices.

Source: Wisconsin DNR, DATCP, and St. Croix County

Budget and Staffing Needs

This section estimates the funding and staffing required to provide technical assistance for the rural portion of this project.

Staff Needs and Costs

Table 3-4 lists the total estimated staff needed to implement the project assuming a 75 percent level of participation by eligible landowners. Approximately 21,680 staff hours are required to implement this plan. Currently, 1.3 positions are being funded on the St. Croix County Lakes Project. The LCD and agencies will determine the need for additional staff based on an annual workload analysis.

The estimated cost for staff is $513,000, and these costs will be paid by the state through the Local Assistance Grant Agreement.

Project Cost

The total state funding required to meet the rural nonpoint source pollution control needs at 75 percent level of landowner participation is presented table 3-5. The estimated cost to the state is $1.4 million. The estimated cost to landowners and others is $311,000 for a total project cost of $1.7 million. This figure includes the capital cost of practices, staff support, and easement costs as presented above.

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

Table 3-4. Estimated Staff Hours Needed to Meet the Water Quality Goals in St. Croix County for 9 Years of Project Implementation

Activity	Staff Hours
Project and Financial Management	5,400
Information and Education Program	2,700
Inventory and Planning*	1,810
Practice Design and Installation	
Upland Sediment Control	3750
Animal Waste Management	650
Shoreline Erosion Control	1660
Miscellaneous	1,300
Easements	1400
Monitoring	950
Training	2,070
Total Hours:	**21,690**
Estimated Staff Required per year	1.3
Hours per year	2,699

Source:
DNR, DATCP, and the St. Croix County LCD

* Inventory and Planning includes: Inventory, Landowner Contacts, Conservation Planning and Plan Revisions, Cost-Share Agreement Development and Amendment, Progress Tracking, Storm Water Planning, Construction Site Erosion Control Ordinance Development and Implementation.

Table 3-5. Cost Estimates for the St. Croix County Lakes Priority Watershed Project

Item	State Share	Local Share
Cost Share Funds: Practices	699,390	282,360
Cost Share Funds: Easements	180,000	0
Local Assistance Staff Funding	513,000	0
Information and Education Direct	21,000	0
Other Direct (travel, supplies, etc.)	13,800	6,000
Professional Services	4,000	0
Total	**1,431,190**	**288,360**

Source: DNR, DATCP, and the St. Croix County Land Conservation Department

Grant Disbursement and Project Management Schedule

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

The project implementation period is nine years. During the first five years of implementation, cost-share agreements with eligible landowners may be signed. Practices listed on any cost-sharing agreement must be installed before the end of the implementation phase. The implementation phase of this project is scheduled to conclude in 2006.

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

Local Assistance grants will be disbursed annually to St. Croix County to cover the costs of personnel, operating expenses, and equipment. The DNR will evaluate an annual workload analysis and grant application submitted by St. Croix County.

CHAPTER FOUR
Integrated Resource Management Program

Introduction

Integrated resource management is the coordination of many programs and their benefits to provide the best possible management of land and water resources. Watershed staff will work to become aware of and make use of the many programs, agencies and organizations that can contribute to best meeting the goals of the St. Croix County Lakes Priority Watershed Project.

While the primary purpose of the priority watershed project is to improve and protect water quality, wildlife and fishery management and protection of aquatic and riparian habitat are also important goals. In many cases, other programs can provide additional opportunities and funding to protect and improve these resources.

The purpose of this chapter is to identify existing state, federal and local resource management programs and management approaches which can be utilized cooperatively to meet project goals.

Fisheries and Wildlife Management

Watershed BMPs, such as shoreline protection, shoreline habitat restoration, critical area stabilization, intensive grazing management, wetland restoration, and easements, should be implemented in a manner that enhances fish and wildlife habitat.

DNR Fish Management and Wildlife Management personnel, U.S. Fish and Wildlife Service personnel or private consultants will be consulted for input in the design of shoreline, wetland and grassland BMPs to maximize benefits to the fish and wildlife communities. In cooperation with counties, DNR staff will also review placement of agricultural detention or infiltration basins They will also provide technical assistance when the installation of BMPs may adversely impact wildlife habitat by proposing measures to minimize the impact, or seeking alternatives that enhance wildlife habitat. In addition, there are state and federal fish and wildlife habitat programs that can complement or provide water quality protection by reducing run-off, increasing infiltration and protecting wetlands and shorelines. Opportunities for coordinating activities that will meet both water quality and habitat objectives will be explored and promoted.

Shoreline Protection
Shoreline erosion control should be accomplished using bioengineering wherever feasible. Native plantings of terrestrial shoreline and emergent aquatic vegetation for habitat enhancement should be used and promoted.

Wetland Restoration and Enhancement
Less than 100 acres of restorable wetlands have been identified in the St. Croix County Lakes watershed, and DNR Wildlife Management personnel should be consulted for guidance in wetland restoration. The greatest need in these watersheds is for protection and enhancement of existing wetlands, through easement acquisition and development of vegetative buffers. These buffers are needed to protect wetland functions and, if wide enough, can provide important nesting and breeding habitat for waterfowl, reptiles and others. Wetlands that are important wildlife habitats will be identified in consultation with DNR Wildlife Management and Water Management personnel. Shoreline buffer easements may be acquired adjacent to these wetlands to offer better protection from sedimentation and other nonpoint source pollution. There may be options for utilizing federal funding sources through the Farm Bill's Wildlife Habitat Incentive Program (WHIP), or other programs, and these options should be investigated with DNR, NRCS or U.S. Fish and Wildlife Service (USFWS) staff as opportunities for restoration and enhancement arise.

Grassland restoration
Because the majority of St. Croix County was grassland habitat prior to European settlement, the DNR and FWS are very involved in upland grass restoration, focusing on native prairie restoration. These grassland plantings are generally conversions of farmed fields or enhancements of pastures, and as such, can benefit watersheds by trapping nutrients and sediments and enhancing infiltration. Modified grazing systems can also have beneficial wildlife impacts by allowing more bird nests to hatch successfully. Where possible, upland grassland management plans will be coordinated to meet both habitat and water quality goals.

Land Acquisition
Both the DNR and FWS have land acquisition (fee and easement) authority which may be used for wetland and upland grassland protection and may be used within the Cluster Lakes watersheds. If important sites and interested landowners are identified, and if the sites meet the acquisition criteria of the agencies, they may be referred to the DNR or FWS for possible acquisition.

Western Prairie Habitat Restoration Area (HRA)
An HRA has been proposed for portions of St. Croix and Polk Counties which may include all or parts of the Cluster Lakes watershed. This HRA, if approved, will have a goal of restoring and protecting wetland and grassland habitat as described above, and will increase the DNR's land acquisition authority.

Endangered and Threatened Resources

Information on threatened and endangered resources is 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 St. Croix County Lakes Cluster Priority Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and so are not listed in this document.

Wisconsin Endangered Species
An endangered species is one whose continued existence as a viable component of this state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. Our files do not contain records of any Wisconsin Endangered species in this watershed.

Wisconsin Threatened Species
A threatened species is one which, if not protected, has a strong probability or becoming endangered. Our files do not contain records of any Wisconsin Threatened species in this watershed.

Wisconsin Special Concern Species
A special concern species is one fort 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:
Lanius ludovicianus, loggerhead shrike
Fundulus diaphanus, banded killifish
Panicum wilcoxianum, Wilcox panic grass
Crotalaria sagittalis, arrow-headed rattle-box

Natural Areas
Natural areas are sites that contain high quality examples of natural communities.
The following natural areas have been identified in the St. Croix County Lakes Cluster Priority Watershed. The natural communities found at each area are also listed.

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.

Groundwater Management

Wells provide a direct conduit for pollutants to reach groundwater resources. Preventing well contamination and sealing abandoned wells are important steps for protecting these resources. If not properly sealed, abandoned wells can directly channel contaminated surface water or shallow groundwater into deeper drinking water aquifers, bypassing the normal purifying action that takes place as surface water slowly percolates downward.

Project staff will encourage all landowners to properly seal abandoned wells. Information on the proper abandonment procedures will be provided to landowners when abandoned wells are located.

Well Abandonment
The Agricultural Conservation Program (ACP), which is administered by the Consolidated Farm Services Agency (CFSA), provides cost-share assistance to farm operators to properly seal abandoned wells to protect groundwater resources. Well abandonment is not an eligible cost-share practice under NR 120.

Wisconsin Well Compensation Grants
Wisconsin's Well Compensation grant program provides financial assistance to replace or treat private wells contaminated with heavy metals, pesticides, solvents or gasoline. Wells must exceed state or

federal drinking water standards. Replacement of wells contaminated with bacteria or nitrate are not eligible for cost-sharing, with the exception of livestock wells contaminated with more than 40 ppm of nitrate. DNR district water supply personnel should be consulted for more information concerning income limits and other eligibility requirements.

Private Sewage System Maintenance and Rehabilitation

Poorly sited or improperly functioning private sewage systems have the potential to contaminate groundwater and surface waters in the St. Croix County Lakes watersheds, especially in riparian areas where groundwater flow is toward a lake. Pollutants from sewage system discharge includes bacteria, viruses, household chemicals, nitrates and phosphorus. Many sewage systems located in riparian areas are out-dated and may be installed in soils which do not adequately filter pollutants due to the poor filtering ability of the soil and/or a high water table. Failing sewage systems in riparian areas are a special concern since pollutants can enter the surface waters with minimal filtering. Sewage system failure is often due to poor maintenance, primarily a failure to pump septic tanks on a regular basis.

St. Croix County staff will distribute educational materials to promote the proper maintenance of private sewage systems. Sewage system maintenance and household tips to reduce groundwater contamination will also be stressed during field visits and "home environmental audits".

It is also recommended that St. Croix County adopt an "update at date of sale" policy to require the proper inspection, update and/or replacement of septic systems when homes are sold in the county.

Wisconsin Fund

The Private Sewage System Replacement & Rehabilitation Grant Program (Wisconsin Fund) provides financial incentives to protect and improve groundwater quality in Wisconsin. The Wisconsin Fund provides funds to update private sewage systems installed before 1978. To be eligible the septic system must have been inspected by the County Sanitarian and determined to be failing by discharging waste to the groundwater or surface water. Only permanent residences qualify, and there are income restrictions. Applications for Wisconsin Fund assistance are made through the County Zoning and Planning Department.

St.Croix County staff will inform watershed residents about the benefits of the Wisconsin Fund grant program and encourage eligible landowners to apply.

Forestry Programs

Private forest lands account for over 2,000 acres within the St.Croix County Lakes watersheds and contribute to the quality of water resources and fish and wildlife resources in the watershed. Financial assistance is available for forest management and soil and water resource protection through the Stewardship Incentive Program (SIP), the Managed Forest Law Program (MFL) and other forest stewardship programs. Additional information can be found in DNR publication FR-093-95, Wisconsin Forestry Best Management Practices For Water Quality, developed by DNR Bureau of Forestry.

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

Managed Forest Law
The goal of the Managed Forest Law (MFL) program is to encourage long-term sound forest management. MFL is a tax incentive program for industrial and nonindustrial private woodland owners who manage their woodlands for forest products while also managing for water quality protection, wildlife habitat and public recreation. In return for following an approved management plan, property taxes are set at a lower rate than normal. At a later time when the landowner receives an income from a timber harvest, some of the deferred tax is collected in the form of a yield tax. Management plans are based on the landowners' objectives. These plans may address harvesting, planting, thinning, release and soil erosion on a mandatory basis while addressing other practices such as wildlife and aesthetic activities on a voluntary basis. Additional information about financial assistance for forest management can be obtained by contacting the local DNR forester.

Coordination with Bass Lake and Squaw Lake Rehabilitation Districts

Lake Management Districts are local units of government established for the purpose of protecting and rehabilitating lakes. St. Croix County Lakes project staff will continue to cooperate with and assist the two lake districts on watershed project activities, attending board meetings and public meetings as requested. Representatives of both Lake Districts are Citizen Advisory Committee members for the St. Croix County Lakes Project. Active involvement of the Lake Districts will continue to be vital to the success of the project. As a local unit of government, the Lake Districts may apply for local assistance grants. They may also provide funds to offset the local share of some BMP installations.

Coordination with Lake Associations

Lake associations are voluntary organizations. They can raise money for special projects, cosponsor lake fairs and other events that educate and inform the public about lake issues, and participate in local actions to protect and improve lakes. Currently Perch and Baldwin-Pine Lakes have interested citizen groups, but have not become formally organized. As lake associations, they would be eligible for nonpoint source program local assistance grant funds if they meet the following criteria:

- They must be incorporated under Chapter 181 Wisconsin Statutes.
- They must specify in the articles of incorporation or by-laws that they support the protection or improvement of inland lakes for the benefit of the general public and demonstrate this by their past actions.

- They must allow membership in the association to any individual living on or within one mile of the lake for at least one month of each year or individuals who own real estate on or within one mile on that lake.

- They do not limit or deny the right of any member or class of members to vote as provided under Chapter 181.16(1), Wisconsin Statutes.

- They have been in existence for at least one year, have at least 25 members and require annual membership fees of not less than $10 nor more than $25.

State Lake Planning and Lake Protection Grant Programs

Local units of government and qualified lake associations in the watershed are eligible to receive Lake Planning Grants and/or Lake Protection Grants to do the following:

- Gather lake and watershed information and prepare lake management plans.

- Develop environmental ordinances to improve and protect lake water quality and lake ecosystems.

- Purchase property such as wetlands or shoreline buffers which will significantly contribute to lake water quality or lake ecosystems.

- Restore wetlands.

Lake Planning Grant funds are available at a 75% cost share rate for up to $10,000 per two-year period and $30,000 for the life of the program. Lake Protection Grant funds are limited to $100,000 for property purchased, wetland restorations and regulation development, and program funds must be matched with an equal share by the local government.

Coordinating Regulations, Permits, and Zoning

Best management practices that address shoreline erosion such as riprap or vegetative shoreline stabilization will require permits from the DNR. Any BMP which effects wetland form or function may require permits form the DNR, the St. Croix or Polk County Zoning office and the US Army Corps of Engineers.

St.Croix County Lake Project staff will work closely with the DNR Water Team staff, the St. Croix County Zoning Department and the US Army Corps of Engineers to assure that necessary permits are received prior to the installation of shoreline stabilization practices or other BMPs.

In an attempt to protect the use, enjoyment and water quality of our lakes and streams the state, federal and local government regulates some activities on riparian properties. Activities that disturb or remove the natural vegetation surrounding our lakes and streams reduces the buffering capacity of the area and often drastically increases erosion, sedimentation and nutrient runoff. Many lake front

property owners, particularly those who are purchasing waterfront property for the first time, are not aware of these regulations or the need for them.

St. Croix County Lake Project staff will work in cooperation with the Property Listing Department, Zoning Department and the DNR to provide information packets to new waterfront property owners within the Project boundaries to educate residents about the existence of zoning regulations and the proper contacts to make within each agency. The guides will also educate lake front residents about the steps they can take to become responsible lake stewards.

Coordination With State and Federal Agricultural Conservation Programs

The St. Croix County Lakes Cluster Watershed Project will be coordinated with the conservation features of the Wisconsin Farmland Preservation Program (FPP) administered by DATCP, and the Federal Food Security Act (FSA) administered by the Farm Service Agency and the Natural Resource Conservation Service. Federal programs available which may have water quality implications include the Conservation Reserve Program (CRP), the Wetland Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP) and the Environmental Quality Incentive Program (EQIP). These programs generally involve cost-sharing to landowners for beneficial land management practices. Project staff should seek to utilize these or similar funding sources to accomplish project goals, as they become available.

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners who volunteer to participate in the program. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.44, 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.

There are two known archaeological sites within or near the St. Croix County Lakes Cluster Watershed. The sites are in agricultural areas of the watersheds. These areas will need special consideration if structural best management practices are being considered, in order to assure that archaeological resources are preserved.

Before finalizing the cost-share agreement with the landowner, project staff should review the maps showing known archaeological and historic sites. If a known site occurs in the vicinity of a proposed BMP, this does not necessarily mean the BMP needs to be moved or altered. In some cases, the specific location of the BMP will not actually be near enough to the location of the known site to warrant further review. Project staff should visit the area and conduct a "pre-review" to ensure that the *specific* location of the proposed BMP will not disturb the known archaeologic or historic site.

If it is too difficult to determine through a pre-review, or if it appears that the known site would indeed be disturbed, a formal Archaeological or Historic Site Review of the area may be necessary. The survey will assess the potential of the practice to significantly impact the site. 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. Any costs incurred as part of a site review will not be passed on to the landowner.

CHAPTER FIVE
Information and Education Strategy

Information and Education Strategy Goals

Goals of the Information and Education Strategy are the same as the project's overall water resource goals:

1. Reduce nutrient runoff from agricultural lands, existing and future residential development, and shoreland development.
2. Reduce erosion and sediment delivery from agricultural lands, existing and future residential development, shoreland development, and eroding shorelines.
3. Reduce hydrological runoff from agricultural land and residential developments.
4. Protect and restore aquatic and riparian habitats.
5. Manage in-lake nutrients in Squaw Lake.
6. Protect groundwater quality.

In addition to these water resource goals, the Information and Education Strategy has the additional goal of:

7. Maximize the effectiveness of the St. Croix Lakes Project as a way to assist those who live, work, own land, and recreate in the project area to improve and protect water resources.

The Information and Education Strategy will reach these goals by increasing **awareness** of issues, providing an **understanding** of problems and solutions, and transferring **knowledge and skills** needed to successfully implement Best Management Practices.

Based on these goals, the Citizen Advisory Committee and project staff developed the following Information and Education Strategy that identifies **Target Audiences, Key Messages,** and **Message Delivery Methods**.

Target Audiences and Key Messages for Individual Water Quality and Project Goals

1. **Reduce nutrient runoff from agricultural lands, existing and future residential development, and shoreland development.**

   Target audiences: Farmers, residential property owners, ag businesses, lawn care businesses, builders/developers, county and town boards, county planning staff, county planning committee, county land conservation committee, and youth.

   Key messages:
   1. Management of farm manure and commercial fertilizer has direct impacts on water quality.

2. Management of residential yard waste and commercial fertilizer has direct impacts on water quality.
3. There are practices that farmers can implement to reduce nutrient enrichment of lakes, including soil testing, crop nutrient balancing, and manure runoff control.
4. There are practices that residential property owners can implement to reduce nutrient enrichment of lakes, including use of low impact lawn care methods, reducing impervious surfaces, and increasing areas of natural vegetation.
5. There are positive things that already are being done in the project area to reduce nutrient runoff to lakes.
6. Nutrient management practices can also have economic benefits.

2. **Reduce erosion and sediment delivery from agricultural lands, existing and future residential development, shoreland development, and eroding shorelines.**

Target audiences: Farmers, residential property owners, individuals having homes built, builders/developers, excavators, paving contractors, county planning staff, county planning committees, board of adjustment, county land conservation committee, county and town boards, building inspectors, lake districts/ associations, and youth.

Key messages:

1. Soil erosion has direct impacts on water quality. Small sources of pollution in a watershed add up to be big problems in a lake.
2. Sources of eroded soil include farm fields, construction sites, road sides, streambanks, and shoreland.
3. There are practices that farmers can implement to reduce soil erosion and sediment delivery to lakes, including conservation tillage, hay in rotation, and buffer strips.
4. There are practices that builder/developers can implement to reduce soil erosion and sediment delivery to lakes, including phasing construction, sediment trapping, and site re-vegetating.
5. There are erosion control programs communities can implement that will ensure better use of erosion control practices.
6. Positive things are already being done in the project area to reduce soil erosion and sediment delivery.
7. Soil erosion control practices can also have economic benefits.

3. **Reduce hydrological runoff from agricultural land and residential developments.**

Target audiences: Farmers, residential property owners, builders/developers, paving contractors, county planning staff, county planning committee, board of adjustment, county land conservation committee, and, county and town boards, lake district/ associations.

Key messages:

1. Reducing the amount of water running off a watershed reduces the amount of pollution carried into a lake.

2. Reducing the amount of water running off a watershed increases groundwater recharge and base stream flow.
3. There are practices that can be implemented to reduce the amount of runoff leaving a watershed, including conservation tillage, buffer strips, upland dams, and wetland restoration.
4. Communities can adopt stormwater management programs that will reduce the impact of development on lake water quality.

4. **Protect and restore aquatic and riparian habitats.**

Target audiences: Residential property owners, farmers, lake associations/districts, county planning staff, county planning committee, board of adjustment, county land conservation committee, county and town boards, park managers (state, county, town), highway crews, real estate agents, builders/developers, excavators, dock installers, outdoor shops, outdoor/environmental groups, and youth.

Key messages:

1. Aquatic plants are beneficial to many types of wildlife and are an indicators of lake health.
2. There is a balance between too few and too many aquatic plants.
3. Exotic plants are often harmful to lake ecosystems.
4. Natural shorelines provide important wildlife habitats.
5. Both permanent and seasonal wetlands provide important habitat, flood control, and water quality protection.
6. There are ways to protect desired aquatic plants and safely control undesired aquatic plants.
7. There are ways to restore damaged aquatic and riparian habitats.
8. There are regulations that govern plant removal, aquatic pesticide use, and shoreland and wetland modification.

5. **Manage in-lake nutrients in Squaw Lake.**

Target audience: Squaw Lake property owners, Squaw Lake users, watershed residents, town and county boards, and outdoor/environmental organizations.

Key messages:

1. Much of Squaw Lake's current enrichment problem is the result of past inputs of phosphorous that keep recycling in the lake.

2. Once current phosphorous inputs are under control, steps can be taken to "cap" in-lake phosphorous so that it does not continue to cause problems.

6. **Protect groundwater quality.**

Target audience: Project area property owners with private water supplies, county planning staff, county health staff, county planning committee, land conservation committee, county and town boards.

Key messages:

1. Our drinking water comes from groundwater, and groundwater comes from precipitation that soaks into the ground.
2. The quality of groundwater is dependant on land use. Contaminated soil results in contaminated groundwater.
3. Private water supplies should be tested annually for bacteria and nitrates. Additional testing can be done if the need is indicated.
4. There are practices that landowners can implement to protect groundwater quality, including cropland nutrient and pesticide management, animal lot management, and "Farm-A-Syst" and "Home-A-Syst" programs.

7. **Maximize the effectiveness of the St. Croix Lakes Project as a way to improve and protect lake water quality and aquatic and riparian habitats.**

Target audience: Those who live, work, own land, and recreate in the project area.

Key messages:

1. Protection of our lakes and aquatic and riparian habitats requires that we change the way we manage our soil and water resources.
2. Change often comes hard, but the project can help with educational, technical, and financial support.
3. All who live, work, or recreate in a lake's watershed influence lake water quality by how they manage the land. We all need to work together and do our part if lakes are to be protected.
4. The project is a local effort. Funding comes from the state, but program direction comes from a citizen advisory committee and the County Board.

Methods for Key Message Delivery

One-on-one contacts: Contacts to potential participants by staff and advisory committee members.
Provide individual consultation on farm best management practices.
Provide individual consultation on lakeshore best management practices.
Provide individual consultation on construction site best management practices.
Up-dates to ag business, yard care, construction, and financial communities.
Up-dates to county board and town board members.
Up-dates to county land conservation and extension committees.
Up-dates to county planning and zoning staff and board of adjustment members.
Job shadowing experiences for high school juniors and seniors.

Demonstrations: Lakeshore property best management practice demonstration.

	Farm demonstrations of erosion control and nutrient management practices. Construction site demonstration of erosion control practices.
Presentations:	Present at County and Town Board meetings. Present at Planning and Zoning Committee and Board of Adjustment meetings. Present at Lake District/Association meetings. Present at farm business and association meetings. Present at St. Croix Valley Home Builder meetings. Present at outdoor/sports/environmental group meetings. Present to students in classroom and at field days.
Events:	Local official workshops on land use planning and water resource protection. Organize annual Lake Fair. Organize "neighborhood" project property owner meetings. Display at County Fair. Display at annual Sportsmen Expo. Annual sale of plant materials used in establishing natural areas. Project WET training for project area teachers.
Youth involvement:	Field demonstrations conducted by youth, e.g, FFA, Vo-Ag, or 4-H groups Adopt-A-Lake projects
Targeted media:	Direct mail and watershed project newsletter. Distribution of lakeshore best management practice information packets. Include articles in lake district newsletters.
Mass media:	Use of local and regional press and radio Use of agricultural press

Information and Education Activity Planning and Implementation

Annually, project staff and Citizen Advisory Committee members will review last year's information and education activities, re-evaluate information and educational needs, and prepare an Annual Information and Education Activity Plan for the coming year. Annual Information and Education Activity Plans will indicate the "what, when, who, and how much" for planned activities.

Activity implementation will be supervised by the Project Manager. The manager will assure that activities listed in the annual plan are carried out by those who they are assigned to.

Information and Education Strategy Evaluation

Evaluation of Information and Educational Strategy will be done in the following manners:

1. Assessment of awareness and understanding of the key messages being delivered will be made. Assessments will be done at the beginning of year 1, at the end of year 3, and at the end of year 8. Telephone survey will be the assessment method used.

2. Reasons for project interest and best management practice implementation will be tracked. Project participants will be asked what factors made them decide to investigate the project, or to implement a given best management practice. Simple tracking sheets kept in participant files will used to collect this information.

3. Follow-up evaluations will be made of information and education activities. The most common form of this will be evaluation sheets distributed to participants at the end of information and education events.

TWO YEAR ANNUAL INFORMATION AND EDUCATION ACTIVITY PLAN - January 1, 1997 - December 31, 1998
St. Croix Lakes Project

Information and Education (I&E) activities are designed around the following information and educational goals:

1. Reduce nutrient runoff from agricultural lands, existing and future residential development, and shoreland development.
2. Reduce erosion and sediment delivery from ag. lands, existing and future residential development, shoreland development, and eroding shorelines.
3. Reduce hydrological runoff from agricultural land and residential developments.
4. Protect and restore aquatic and riparian habitats.
5. Manage in-lake nutrients in Squaw Lake.
6. Protect groundwater quality.
7. Maximize the effectiveness of the St. Croix Lakes Project as a way to assist those who live, work, own land, and recreate in the project area to improve and protect water resources.

Table 5-1. 1997 Information and Education Activity Plan

Activity	Schedule	Educational Goals	Assignments	Materials & Costs
One-on-one project area contacts	On-going	All	Pete Kling Assistance - CAC LCD UWEX	Handout packet - $ 50
Presentations to interest groups	On-going	All	Pete Kling	Handouts - $ 50 Film costs - $ 200 Slide show dev. - $ 100 Display board - $ 800
Lake Fair Annual event to highlight lake issues and enjoy natural resources.	July 1997	All except 5	Planning - Pete Kling Assistance - CAC DNR LCD UWEX WAV	Handouts - $ 50 Publicity - $ 50 Displays - $ 400

Activity	Schedule	Educational Goals	Assignments	Materials & Costs
Sportsmen Show Display project information at this annual event.	March 1997	All except 5 and 6	Planning - Pete Kling Assistance - DNR UWEX	Handouts - $ 50
County Fair Display project information at this annual event	July 1997	All except 5	Planning - Pete Kling Assistance - CAC DNR UWEX	Handouts - $ 50
Shoreland Habitat Restoration Demo Bass and Squaw lakes	Install spring 97 Showcase fall 97	1,2,4, and 7	Planning - Pete Kling Assistance - CAC DNR UWEX	Food - $ 50 Publicity - $ 50 Bus transport - $ 100
Gully Erosion Control Demo Perch Lake	Install in 1997	2	Oversight - Pete Kling	Signs - $ 200
Grassed Waterway Demo	Pine Lake Install in 1997	2	Oversight - Pete Kling	Signs - $200
Shoreline Erosion Control Demo Bass and Squaw Lakes	Install in 1996 and 1997	2	Oversight - Pete Kling	Signs - $ 200
Upland Dam Demo Squaw Lake	Install 1997	1,2, and 3	Oversight - Pete Kling	Signs - $200
Newsletter	Feb. 1997 June 1997	All	Planning - Pete Kling Assistance - UWEX	Postage - $ 120
Project WET Training For project area teachers	Oct. 1997	All	Planning - Pete Kling Instruction - Ron Struss	Lunch - $ 300
St. Croix Co. Farm-City Day For non-farm families	August, 1997	All except 5	Planning - Pete Kling Assistance - CAC DNR UWEX	Handouts - $ 50

Activity	Schedule	Educational Goals	Assignments	Materials & Costs
Outdoor Skills Day Outdoor education for young adults	Fall, 1997	All except 5	Planning - Pete Kling Assistance - CAC, DNR	Handouts - $ 50
"Watershed Steward" dock signs Design, print, and distribution	April 1997	7	Planning - Pete Kling Assistance - DNR UWEX	$ 200
TOTALS				**$ 3,520**

Table 5-2. 1998 Information and Education Activity Plan

Activity	Schedule	Educational Goals	Assignments	Materials & Costs
One-on-one project area contacts	On-going	All	Pete Kling Assistance - CAC LCD UWEX	Handout packet - $ 50
Presentations to interest groups	On-going	All	Pete Kling	Handouts - $ 50 Film costs - $ 200 Slide show dev. - $ 100
Lake Fair Annual event to highlight lake issues and enjoy natural resources.	July 1998	All except 5	Planning - Pete Kling Assistance - CAC DNR LCD UWEX WAV	Handouts - $ 50 Publicity - $ 50 Displays - $ 400
Sportsmen Show Display project information at this annual event.	March 1998	All except 5 and 6	Planning - Pete Kling Assistance - DNR UWEX	Handouts - $ 50
County Fair Display project information at this annual event	July 1998	All except 5	Planning - Pete Kling Assistance - CAC DNR, UWEX	Handouts - $ 50
Spring Demonstration Field Day Showcase the demonstration projects installed in 1997	May. 1998	1,2,3,4, and 7	Planning - Pete Kling Assistance - CAC, DNR UWEX	Food - $ 50 Publicity - $ 50 Bus transport - $ 100
Fall Demonstration Field Day Showcase the demonstration projects installed in 1997	Sept. 1998	1,2,3,4, and 7	Planning - Pete Kling Assistance - CAC DNR, UWEX	Food - $ 50 Publicity - $ 50 Bus transport - $ 100
Newsletter	Feb. 1998 June 1998	All	Planning - Pete Kling Assistance - UWEX	Postage - $ 120

Activity	Schedule	Educational Goals	Assignments	Materials & Costs
"Watershed Steward" dock signs Continue distribution	On-going	7	Planning - Pete Kling Assistance - DNR, UWEX	No direct costs
School environmental field day New Richmond Schools	Sept. 1998	All	Planning - Pete Kling Assistance - AAL DNR, UWEX, WAV	Bus transport - $ 300
St. Croix Co. Farm-City Day For non-farm families	August, 1998	All except 5	Planning - Pete Kling Assistance - CAC DNR, UWEX	Handouts - $ 50
Outdoor Skills Day Outdoor education for young adults	Fall, 1998	All except 5	Planning - Pete Kling Assistance - CAC, DNR	Handouts - $ 50
Manure Pit Demonstration For non-farm and farm adults	Fall, 1998	All	Planning - Pete Kling Assistance - CAC	Bus transport - $ 300 Food - $ 100 Handouts - $ 50
Career development field experience High school juniors and seniors are given field experience in soil and water conservation careers	Spring 1998	7	Coordination - Pete Kling Assistance - DATCP, DNR, LCD, UWEX	Housing costs - $ 400
TOTALS				**$ 2,670**

Agency / Program: /AAL = Adopt-A-Lake, /CAC = Citizen Advisory Committee, /DATCP = Dept. of Ag, Trade and Consumer Protection, /DNR = Department of Natural Resources, /LCD = Land Conservation Department, /UWEX = U of Wisconsin Extension, /WAV = Water Action Volunteers Program

CHAPTER SIX
Project Evaluation

This chapter briefly summarizes the plan for monitoring the progress and evaluating the effectiveness of the St. Croix County Lakes Cluster Priority Watershed Project. The evaluation strategy includes these components:

- Administrative review
- Pollution reduction evaluation
- Watershed Resource Evaluation Monitoring

Information on the first two components will be collected by the St. Croix County LCD and reported on a regular basis to the DNR and the DATCP. The project team will meet early in the year throughout the implementation phase to review and evaluate the accomplishments of the preceding year. Additional information on the numbers and types of practices on cost-share agreements, funds encumbered on cost-share agreements, and funds expended will be provided by the DNR's Bureau of Community Finance. The Watershed Resource Evaluation Monitoring follows guidance established by DNR's Bureau of Watershed Management to select and monitor specific sites in the watershed to monitor resource quality changes.

A final report will be prepared for the St. Croix County Lakes Cluster Priority Watershed Project within 18 months of the end of the Nonpoint Source grant period. This report will include information on landowner participation, project management, grant management, technical assistance, and any Signs of Success sites completed within the watershed among other topics. It is developed to evaluate progress, provide documentation on attainment of water quality and pollutant load reduction objectives, evaluate BMP effectiveness, and provide recommendations on which target key areas needing improvement in the NPS program. DNR, DATCP and the County will prepare the final report.

Administrative Review

The first component, the administrative review, will focus on the progress of the county and other units of government in implementing the project. The project will be evaluated with respect to accomplishments, financial expenditures, and staff time spent on project activities.

Accomplishment Reporting

The County will provide the following data to the DNR and the DATCP annually:

- Planned and completed BMPs
- Planned and completed conservation systems

- Major information and education activities undertaken

Accomplishment data are summarized in the Annual accomplishment Report prepared by the county, and are also discussed at watershed review meetings held annually for projects in implementation. Additional evaluation data provided by the county for the annual watershed review include:

- Pollutant load reductions (described below)
- Status of grants and related financial activities
- Evaluation of landowner participation
- Status of project administration including data management, staff training and BMP monitoring
- Status of nutrient management planning, and easement acquisition and development
- Effectiveness of construction site erosion control activities
- Status of stormwater management activities for new development overseen by the local units of government.

Likewise, participating local units of government implementing the urban nonpoint source management program meet periodically with DNR staff to review progress. The DNR and local units of government will jointly evaluate the urban implementation program. For the St. Croix County Lakes Cluster Project, "urban" implementation is primarily ordinance review, development and implementation. Requested information related to urban activities will include:

- Information and education activities
- Implementation of urban "housekeeping" program activities
- Construction site erosion control ordinances adopted or implemented
- Storm water management ordinance provisions adopted or implemented
- Stormwater management and construction site erosion control planning activities

Details of the reporting requirements are contained in DNR Publication WR-223-94, which is reviewed every two years by DATCP and DNR and revised as necessary.

The Field Offices Computing System (FOCS) is a computer data management system that has been developed by the U.S. Natural Resources Conservation Service (NRCS). The NRCS, the DNR and the DATCP use FOCS to meet the accomplishment reporting requirements of all three agencies. The county can use FOCS to collect data for administrative accomplishments, and can provide the information to the DNR and the DATCP for program evaluation.

Financial Expenditures

The county and other participating units of government will provide the following financial data to the DNR and the DATCP on an annual basis or a more frequent basis depending on the needs of DNR grant managers:

- 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 County staff
- Amount of money paid for installation of BMPs, and money encumbered in cost-share agreements

The county and other participating units of government will also provide the DNR with the following financial data on or before April 15 of each year:

- Staff training expenditures
- Interest money earned and expended
- Total budget and expenditures on the project

Time Spent On Project Activities

The county and other participating governmental units with local assistance grants will provide time summaries to both departments for the following activities on an annual 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

Annual evaluation activities will be used to make decisions about projects with regard to funding and time periods of grants. NR 120.28 includes the various actions available to DNR for making project adjustments that are needed to correct deficiencies.

Pollutant Load Reduction Evaluation

The purpose of the second evaluation component, pollutant load reduction, is to estimate reductions in nonpoint source pollutants as a result of installing BMPs. Key sources were identified for estimating changes in pollutant loads that reach surface waters in the St. Croix County Lakes Cluster Watershed. Data collected for evaluation include sediment load reduction from uplands, shorelines and gullies; reduced winter spreading of manure; nutrient load reduction from barnyard practices and shoreline habitat restoration. Chapter Two of this plan describes target pollutant reductions for each of the subwatersheds.

Cropland Sources

The county can use the WINHUSLE (Wisconsin Nonpoint Source) model to estimate sediment reductions due to changes in cropping practices. The county will use FOCS to provide data for the WINHUSLE model on an annual basis, as described above. These reports can also be developed for each cost share agreement and used to document eligibility and changes to sediment delivery.

Alternative systems used to document eligibility and pollutant load reductions must be approved by DNR.

Shoreline Sources

County staff will report reductions in shoreline sediment erosion from planned BMPs. The FOCs system is capable of tracking these reductions and would provide the advantage of tracking the reductions on a continuous basis.

Barnyard Runoff

The county LCD will use the BARNY model to estimate phosphorus reductions due to the installation of barnyard control practices. The LCD can report the information to the DNR through FOCS. In the event that FOCS is not used, a replacement system will be used for project tracking.

Winter Manure Spreading on Unsuitable Acres

The county LCD will report reductions in acres of unsuitable lands that are winter spread with manure. This information can be reported using nutrient management planning or other methods determined by the county to track reductions in winter spread unsuitable acres.

Urban/Rural Residential Areas

The LCD project staff, with assistance from other appropriate county, or town staff or lake districts will report annually to the DNR on the number of construction sites, the number of construction sites receiving appropriate permits, and the number of sites not adequately meeting permit requirements. Any amendments to construction site erosion control plans, ordinances or enforcement procedures that affect sediment loads associated with these sources will also be reported.

Units of government (the county, towns or lake districts) in the project that receive grants will be required to report annual progress on the activities funded under the grant. These reports can be written narratives or summaries of activities.

Water Resource Evaluation Monitoring

Limited funds and the intensive staffing needed to properly evaluate water quality changes prohibits monitoring each watershed individually. Instead, two types of evaluation monitoring are being conducted on a state-wide basis: Whole Stream Monitoring and Signs of Success.
The goal of the evaluation monitoring activities is to determine the progress the Nonpoint Source Program is making towards improving the quality of Wisconsin's water resources.
Evaluation monitoring activities were developed to answer five questions about the water resource objectives and the pollution reduction goals:

1) Do the levels and types of best management practices recommended in the watershed plans achieve the water resource objectives?

2) Do the types and levels of best management practices recommended in the watershed plans achieve the pollutant reduction goals?

3) Does any level of practice installation below 100 percent achieve the water resource objectives or the pollutant reduction goals?

4) Do we need to adjust the pollutant load reduction goals to achieve the water resource objectives?

5) Can we use simple environmental indicators in many of the watershed projects to provide some early evidence that the practices might achieve the water resource objectives and pollutant reduction goals?

A team of experts from state and federal agencies, and the University of Wisconsin was formed to develop and direct the evaluation monitoring activities at the Whole Stream Monitoring and Signs of Success sites.

Whole Stream Monitoring Sites

Criteria were developed to select and monitor twelve streams around the state. The stream sites represent the five major types of fishery found in agricultural and urban parts of priority watersheds, and they also represent three of the five ecoregions in the state. The five fishery types are: high gradient cold water sport fishery, high gradient warm water sport fishery, high gradient warm water forage fishery, low gradient warm water forage fishery, and low gradient cold water sport fishery. A storm sewer outfall is also being monitored. The three ecoregion types represented are the Southeastern Wisconsin till plains, the Driftless area, and the North Central Hardwood Forest.

All but one of the stream sites drains a small area (about ten square miles or less). The schedule involves two years of monitoring before any best management practices are installed, five years of monitoring during the practice installation phase, 2 years of monitoring during the response period, and two years of monitoring during the post-practice installation phase, for a total of eleven years of monitoring.

State-of-the-art chemical and physical monitoring is being done at all the stream sites. State-of-the-art biological monitoring will be done at eight of the twelve streams. Results of the monitoring will be used to determine how well the best management practices achieve the pollution reduction goals and objectives. Improving the fish community is the most important water resource objective for all the streams.

Signs of Success

Signs of Success (SOS) is short-term monitoring designed to provide some early evidence that better land management does make a difference. One site is being sought for each watershed project. Signs of Success will focus on one practice such as barnyard runoff controls, manure storage, or streambank fencing that is expected to have an early effect on the adjacent stream.

Monitoring will take place over a two-year period--the year before and the year after a practice is installed. Positive improvements are expected at those sites where implementation has occurred.

Habitat sampling and photographs will be used to indicate the benefit of the practice. Limited chemical monitoring, macroinvertebrate, and fish sampling will be done at some sites.

SOS sites for the St. Croix County Lakes Cluster Priority Watershed Project are still being identified and will be established shortly after the implementation stage begins. County staff will be asked to help identify potential SOS sites during implementation of the project.

The cost of water resources monitoring programs will be borne by the state. The results will be documented and featured in educational materials such as local newsletters, newspapers and the statewide newsletter "Fields and Streets."

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APPENDIX A
List of Acronyms

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

APPENDIX B
Interim Best Management Practices

Name of Interim Best Management Practice:
Shoreline Habitat Restoration for Developed Areas

Description
Shoreline habitat restoration is the establishment of vegetation consisting of a mixture of native trees, shrubs, grasses or wetland species on a strip or area of land along the shoreline of a lake or stream.

Purpose
Shoreline habitat restoration will:

-reduce the intensity and impact of human activities in the near shore area,
-enhance littoral zone (shallow water) habitat function for a broad range of vertebrate and invertebrate species, including fish, amphibians, reptiles and aquatic insects by providing shade and cover with overhanging vegetation, and woody and vegetative debris contributions to the littoral zone structure,
-provide habitat and over wintering cover for aquatic fauna dependent upon nearshore terrestrial habitat for a portion of their life cycle.

Additional benefits include reduced shoreline erosion, decreased use of fertilizers and pesticides, increased runoff infiltration, and attenuation of some sediments and nutrients carried in runoff. Along streams, additional benefits may also include dissipation of stream flow energy under high flow conditions, and improvement in stream channel contours.

Conditions Where Practice Applies
Cost-sharing for shoreline habitat restoration will be approved when:

-This practice is consistent with the watershed plan.
-Existing shoreline vegetation lacks the structure or complexity to support the habitat functions described above for littoral and riparian areas.
-Landowner will maintain the practice with zero phosphorus and minimum herbicide applications. Phosphorus fertilizer may be applied only where soil tests indicate it is needed, and herbicides may be applied only where this is the best available method of controlling invasive undesirable species.

Planning Considerations
The following factors should be considered when planning shoreline habitat restoration for developed areas.

-Erosion control measures must be in place.
-Runoff from lands that drain to this practice should be maintained in sheet flow to the greatest extent possible.
-Runoff from impervious areas and roof gutter downspouts should be directed to maximize infiltration.
-Land uses within the shoreland zone should be in compliance with county shoreland zoning regulations.
-Vegetation may be planted to enhance shoreline stability, but rip rap or bioengineering will be used only where the need to control shoreline erosion has been identified. Where feasible,

bioengineering will be the first choice for controlling shoreline erosion because of the vegetative support this measure can provide.
-Native plant species appropriate for conditions should be used where ever possible, and all species should be selected to minimize the need for fertilizer, pesticides, water and maintenance.
-Landowner goals for habitat restoration design may include providing access to the water body, enhancing desirable views, screening of unwanted views and enhancing privacy. These goals may be incorporated into the design as long as they do not conflict with the purpose and design criteria for this practice.
-Contiguous stretches of uninterrupted vegetative habitat should be encouraged.
-Where stairways are needed for access, they should be located and constructed to minimize erosion. Stairs constructed on elevated posts are recommended, rather than those excavated into steep slopes, to minimize erosion. Alternate methods may be approved on a case by case basis.

Design Criteria

- Plantings shall provide a dense complete and vigorous cover of vegetation consisting of trees, shrubs, prairie grasses, forbs and/or wetland species, and shall be selected to provide adequate diversity and structural complexity along at least 70% of the shoreline. Any cleared areas shall not exceed 30 feet of lake frontage per lot.
-Vegetation should be adapted to the local soils, climate and the surrounding vegetation. Refer to UW Extension Publication GWQ014, *Shoreline Plants and Landscaping*, or similar publication for choosing plant material. Watershed staff must approve plants chosen. Native species are preferred, and certain invasive species such as reed canary grass and purple loosestrife are prohibited. For areas where prairie establishment is planned, refer to DNR Publication PUBL-WM-228, *Home on the Range - Restoring and Maintaining Grasslands for Wildlife.*
- Restoration strips shall be a minimum of 15 feet in width, with wider strips encouraged. Wider strips will provide greater habitat benefits for a wider variety of species. Wider strips may be required by project staff on an individual basis, where there are depressions, drainage ways, steeply sloping areas or other conditions making wider strips necessary to provide adequate function.
-Access openings and trails maintained through the buffer should not channel runoff to the lake, and should be located to avoid areas of high runoff or erodible soils. Grass or other cover that will hold the soil is recommended for trails.
-Disturbance of sod cover and exposure of soil should be the minimum required to shape the slope and install the practice. All exposed soil will be mulched and any other necessary measures taken to prevent erosion. Refer to Chapter 3, Wisconsin Construction Site Best Management Practice Handbook for erosion control guidelines.
-Heavy equipment use must be minimized to prevent soil compaction.
-Initial start-up fertilization of phosphorus is allowed only if a soil test indicates a deficiency of phosphorus.
-Herbicide use is allowed for establishment, but not for maintenance.
-Burning may not be used for clearing or maintaining buffers unless approved by staff. Burning releases nutrients that could be washed to the lake or stream.

Operation and Maintenance

- Vehicles or all terrain vehicles are to be excluded from the buffer to prevent disturbance and ground compaction.
- Herbicides and fertilizers are not allowed for maintaining buffers except as noted earlier under "Conditions Where Practice Applies".

-Development of multi-story canopy layers created by a mixture of tree and shrub species is desirable, and maintenance activities should be done in a manner that promotes this development.
-Cutting of trees or shrubs may be done only to prevent safety hazards. Where possible dead or windblown trees should be left in place, as they provide an important habitat component. Removal of undesirable competitive species is allowed if it does not compromise the function of the buffer.
-The forest floor duff layer and leaf litter must remain intact to provide a continuous ground cover and meet habitat functions of this practice.
-In established prairie buffer areas, mowing is allowed to a minimum height of ten inches, and only as needed to reduce competition from weeds and woody vegetation. Mowing should be done between August 1 and September 1 to avoid disturbance of nesting birds and allow regrowth before winter. Mowing is generally not needed more than once every several years.

Cost Share Conditions and Rates

The watershed pays 70% of the eligible costs which include:

-Plants and seed
-Labor and equipment for installation
-Necessary erosion control measures to prevent erosion during installation

Costs not covered:

-Material for stairs, walkways or other access structures
-Rip rap or bioengineering unless the area has been identified as having an erosion problem that is eligible for shoreline protection measures
-Plants not approved by the watershed staff

APPENDIX C
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 ASCS through county ACP 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 manures. Ammonia can be toxic to aquatic life.

ANAEROBIC:

Without oxygen.

AREA OF CONCERN:

Areas of the Great Lakes identified by the International Joint Commission (IJC) as having serious water pollution problems.

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.

ANTIDEGRADATION:

A policy stating that water quality will not be lowered below background levels unless justified by economic and social development considerations. Wisconsin's antidegradation policy is currently being revised to make it more specific and meet EPA guidelines.

AVAILABILITY:

The degree to which toxic substances or other pollutants are present in sediments or elsewhere in the ecosystem and are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by

sediment. Oxygen content, pH, temperature and other conditions in the water can affect availability.

BACTERIA:
Single-cell, microscopic organisms. Some can cause disease, but others are important in organic waste stabilization.

BARNY:
The Wisconsin Barnyard runoff model, a computer model used to assess the water quality impacts of barnyards or feedlots. It was developed by DNR with assistance from NRCS and DATCP.

BASIN PLAN:
See "Areawide Water Quality Management Plan".

BENTHIC ORGANISMS (BENTHOS):
Organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP):
The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION:
The uptake and retention of substances by an organism from its surrounding medium and food. As chemicals move through the food chain, they tend to increase in concentration in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOASSAY STUDY:
A test for pollutant toxicity. Tanks of fish or other organisms are exposed to varying doses of treatment plant effluent. Lethal doses of pollutants in the effluent are then determined.

BIOCHEMICAL OXYGEN DEMAND (BOD):
A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. 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 stream or lake.

BULKHEAD LINES:
Legally established lines that indicate how far into a stream or lake an adjacent property owner has the right to fill. Many of these lines were established many years ago and allow

substantial filling of the bed of the river and bay. Other environmental laws may limit filling to some degree.

CARCINOGENIC:
A chemical capable of causing cancer.

CATEGORICAL LIMITS:
All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/1 effluent limits for SS and BOD). For industry the level depends on the type of industry and the level of production. More stringent effluent limits are required, if necessary, to meet water quality standards.

CHLORINATION:
The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CHLORORGANIC COMPOUNDS (CHLORORGANICS):
A class of chemicals that contain chlorine, carbon and hydrocarbon. This generally refers to pesticides and herbicides that can be toxic. Examples include PCB's and pesticides such as DDT and dieldrin.

CHRONIC TOXICITY:
The effects of long-term exposure of organisms to concentrations of a toxic chemical that are not lethal, but is injurious or debilitating in one or more ways. An example of the effect of chronic toxicity is reduced reproductive success.

CLEAN WATER ACT:
See "Public Law 92-500."

COMBINED SEWERS:
A wastewater collection system that carries both sanitary sewage and stormwater runoff. During dry weather, combined sewers carry only wastewater to the treatment plant. During heavy rainfall, the sewer becomes swollen with stormwater. Because the treatment plant cannot process the excess flow, untreated sewage is discharged to the plant's receiving waters, i.e., combined sewer outflow.

CONFINED DISPOSAL FACILITY (CDF):
A structure built to contain and dispose of dredged material.

CONGENERS:
Chemical compounds that have the same molecular composition, but have different molecular structures and formula. For example, the congeners of PCB have chlorine located at different spots on the molecule. These differences can cause differences in the properties and toxicity of the congeners.

CONSERVATION TILLAGE:
Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease.

CONSUMPTION ADVISORY:
A health warning issued by DNR and WDHSS that recommends people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT:
Some material that has been added to water that is not normally present. This is different from a pollutant, which suggests there is too much of the material present.

CONVENTIONAL POLLUTANT:
Refers to suspended solids, fecal coliforms, biochemical oxygen demand, and pH, as opposed to toxic pollutants

COST-EFFECTIVE:
A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA:
See water quality standard criteria.

DIOXIN (2;3,7,8-tetrachlorodibenso-p-dioxin):
A chlorinated organic chemical which is highly toxic.

DISINFECTION:
A chemical or physical process that kills organism that cause disease. Chlorine is often used to disinfect wastewater.

DISSOLVED OXYGEN (DO):
Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen often result from inadequate wastewater treatment. The DNR considers 5 ppm DO necessary for fish and aquatic life.

DREDGING:
Removal of sediment from the bottom of water bodies.

ECOSYSTEM:
The interacting system of biological community and its nonliving surrounding.

EFFLUENT:
Solid, liquid or gas wastes (byproducts) that are disposed on land, in water or in air. As used in the RAP, effluent generally means wastewater discharges.

EFFLUENT LIMITS:
The DNR issues WPDES permits establishing the maximum amount of pollutant to be discharged to a receiving stream. Limits depend on the pollutant and the water quality standards that apply for the receiving waters.

EMISSION:
A direct (smokestack particles) or indirect (busy shopping center parking lot) release of any contaminant into the air.

ENVIRONMENTAL PROTECTION AGENCY (USEPA):
The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL REPAIR FUND:
A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EPIDEMIOLOGY:

The study of diseases as they affect populations rather than individuals, including the distribution and incidence of a disease mortality and morbidity rated, and the relationship of climate, age, sex, race and other factors. EPA uses such data to establish national air quality standards.

EROSION:

The wearing away of the land surface by wind or water.

EUTROPHIC:

Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION:

The process of nutrient enrichment of a lake loading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FACILITY PLAN:

A preliminary planning and engineering document that identifies alternative solutions to a community's wastewater treatment problems.

FECAL COLIFORM:

A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

FISHABLE AND SWIMMABLE:

Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FOOD CHAIN:

A sequence of organisms where each uses the next as a food source.

GREEN STRIPS:

See buffer strip.

GROUNDWATER:

Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

HABITAT:

The place or type of site where a plant or animal naturally lives and grows.

HEAVY METALS:

Metals present in municipal and industrial wastes that pose long-tern environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE:

A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

INFLUENT:

Influent for an industry would be the river water that the plant intakes for use in its processing. Influent to a municipal treatment plant is untreated wastewater.

IN-PLACE POLLUTION:

As used in the RAP, refers to pollution from contaminated sediments. These sediments are polluted from post discharges from municipal and industrial sources.

ISOROPYLBIPHENYL:

A chemical compound used as a substitute for PCB.

LANDFILL:

A conventional sanitary landfill is "a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading solid wastes in thin layers, materials at the end of each operating day". Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization chemical fixation encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LEACHATE:

The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

LOAD:

The total amount of materials or pollutants reaching a given local.

MACROPHYTE:

A rooted aquatic plant.

MASS:

The amount of material a substance contains causing it to have weight in a gravitational field.

MASS BALANCE:

A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC:

Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrophic.")

MILLIGRAMS PER LITER (mg/1):

A measure of the concentration of substance in water. For most pollution measurement this is the equivalent of "parts per million".

MITIGATION:

The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses or replacing lost values.

MIXING ZONE:

The portion of a stream or lake where effluent is allowed to mix with the receiving water. The size of the area depends on the volume and flow of the discharge and receiving water. For streams the mixing zone it is one-third of the lowest flow that occurs once every 10 years for a seven day period.

NONPOINT SOURCE POLLUTION (NPS):

Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

OLIGOTROPHIC:

Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

OUTFALL:

The mouth of a sewer, drain, or pipe where effluent from a wastewater treatment plant is discharged.

PATHOGEN:

Any infective agent capable of producing disease. It may be a virus, bacterium, protozoan, etc.

PELAGIC:

Referring to open water portion of a lake.

PESTICIDE:

Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

PH:

A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral and 0 being most acid, and 14 being most alkaline.

PHENOLS:

Organic compounds that are byproducts of petroleum refining, textile, dye, and resin manufacture. High concentrations can cause taste and odor problems in fish. Higher concentration can be toxic to fish and aquatic life.

PHOSPHORUS:

A nutrient that, when reaching lakes in excess amounts, can lead to overfertile conditions and algae blooms.

PLANKTON:

Tiny plants and animals that live in water.

POINT SOURCES:
Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION:
The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

POLYCHLORINATED BIPHENYLS(PCBs):
A group of 209 compounds, PCBs have been manufactured since 1929 for such common uses as electrical insulation and heating/cooling equipment, because they resist wear and chemical breakdown. Although banned in 1979 because of their toxicity, they have been detected on air, land and water. Recent surveys found PCBs in every section of the country, even those remote from PCB manufacturers.

POLYCHLORINATED ORGANIC COMPOUNDS:
A group of toxic chemicals which contain several chlorine atoms.

PRETREATMENT:
A partial wastewater treatment required from some industries. Pretreatment removes some types of industrial pollutants before the wastewater is discharged to a municipal wastewater treatment plant.

PRIORITY POLLUTANT:
A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major dischargers are required to monitor all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED:
A drainage area 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 plat owned by a city, village or other unit of government.

RECYCLING:
The process that transforms waste materials into new products.

REMEDIAL ACTION PLAN:
A plan designed to restore beneficial uses to a Great Lakes Area of Concern.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS):
An investigation of problems and assessment of management options conducted as part of a superfund project.

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA):
This federal law amends the Solid Waste Disposal Act of 1965 and expands on the Resource Recovery Act of 1970 to provide a program that regulates hazardous wastes, to eliminate open dumping and to promote solid waste management programs.

RETRO-FIT:
The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN:
Belonging or relating to the bank of a lake, river or stream.

RIPRAP:
Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

RULE:
Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF:
Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS:
The indirect effects that an action can have on the health of the ecosystem or the economy.

SECONDARY TREATMENT:
Two-stage wastewater treatment that allows the coarse particles to settle out, as in primary treatment, followed by biological breakdowns of the remaining impurities. Secondary treatment commonly removes 90% of the impurities. Sometimes "secondary treatment" refers simply to the biological part of the treatment process.

SEDIMENT:
Soil particles suspended in and carried by water as a result of erosion.

SEICHES:
Changes in water levels due to the tipping of water in an elongated lake basin whereby water is raised in one end of the basin and lowered in the other.

SEPTIC SYSTEM:
Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

SLUDGE:
A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE:
Unwanted or discharged material with insufficient liquid to be free flowing.

STANDARDS:
See water quality standards.

STORM SEWERS:
A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUPERFUND:
A federal program that provides for cleanup of major hazardous landfills and land disposal areas.

SUSPENDED SOLIDS (SS):
Small particles of solid pollutants suspended in water.

SYNERGISM:
The total effect is greater than the sum of the individual effects. For example, the characteristic property of a mixture of toxicants that exhibits a greater-than-additive cumulative toxic effect.

TERTIARY TREATMENT:
See advanced wastewater treatment.

TOP-DOWN MANAGEMENT:
A management theory that uses biomanipulation, specifically the stocking of predator species of fish to improve water quality.

TOTAL MAXIMUM DAILY LOADS:
The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC:
An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE:
A chemical or mixture of chemicals which, through sufficient exposure, or ingestion, inhalation of assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TOXICANT:
See toxic substance.

TOXICITY:

The degree of danger posed by a toxic substance to animal or plant life. Also see acute toxicity, chronic toxicity and additivity.

TOXICITY REDUCTION EVALUATION:

A requirement for a discharger that the causes of toxicity in an effluent be determined and measures taken to eliminate the toxicity. The measures may be treatment, product substitution, chemical use reduction or other actions that will achieve the desired result.

TREATMENT PLANT:

See wastewater treatment plant.

TROPHIC STATUS:

The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

TURBIDITY:

Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIFORM DWELLING CODE:

A statewide building code for communities larger than 2500 residents specifying requirements for electrical, heating, ventilation, fire, structural, plumbing, construction site erosion, and other construction related practices.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX):

A special outreach, education branch of the state university system.

VARIANCE:

Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

VOLATILE:

Any substance that evaporates at a low temperature.

WASTELOAD ALLOCATION:

Division of the amount of waste a stream can assimilate among the various dischargers to the stream. This limits the amount (in pounds) of chemical or biological constituent discharged from a wastewater treatment plant to a water body.

WASTEWATER:

Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE:

Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT:

A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY AGREEMENT:

The Great Lakes Water Quality agreement was initially signed by Canada and the United States in 1972 and was subsequently revised in 1978 and 1987. It proves guidance for the management of water quality, specifically phosphorus and toxics, in the Great Lakes.

WATER QUALITY LIMITED SEGMENT:

A section of river where water quality standards will not be met if only categorical effluent standards are met.

WATER QUALITY CRITERIA:

A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY STANDARDS:

The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE:

When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

WATERSHED:

The land area that drains into a lake or river.

WETLANDS:

Areas that are inundates or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WINHUSLE:

A computer model for evaluating sediment delivery to surface waters from agricultural lands. It was developed by DNR with assistance from NRCS.

WISCONSIN ADMINISTRATIVE CODE:

The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND:

A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state's taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for treatment plant construction, but three percent of this fund is available for repair or replacement of private, on-site sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution. Nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. $500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM:
A state cost-share program established by the State Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES):
A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

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

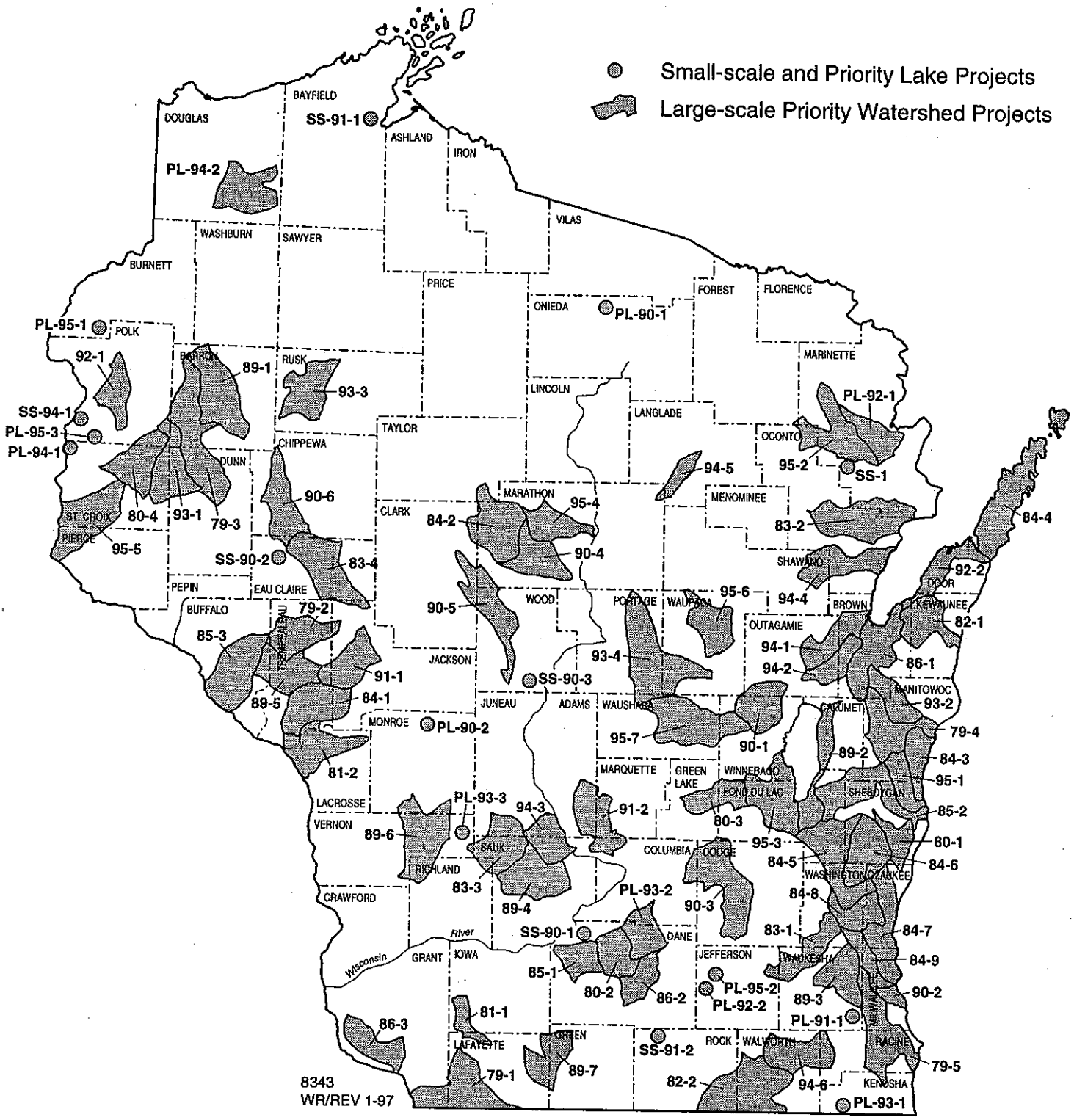
Year Selected-Map Number	Small-scale Priority Watershed Project	County(ies)
SS-1	Bass Lake ♦	Marinette
SS-90-1	Dunlap Creek	Dane
SS-90-2	Lowes Creek	Eau Claire
SS-90-3	Port Edwards - Groundwater Prototype	Wood
SS-91-1	Whittlesey Creek	Bayfield
SS-91-2	Spring Creek	Rock
SS-94-1	Osceola Creek	Polk

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



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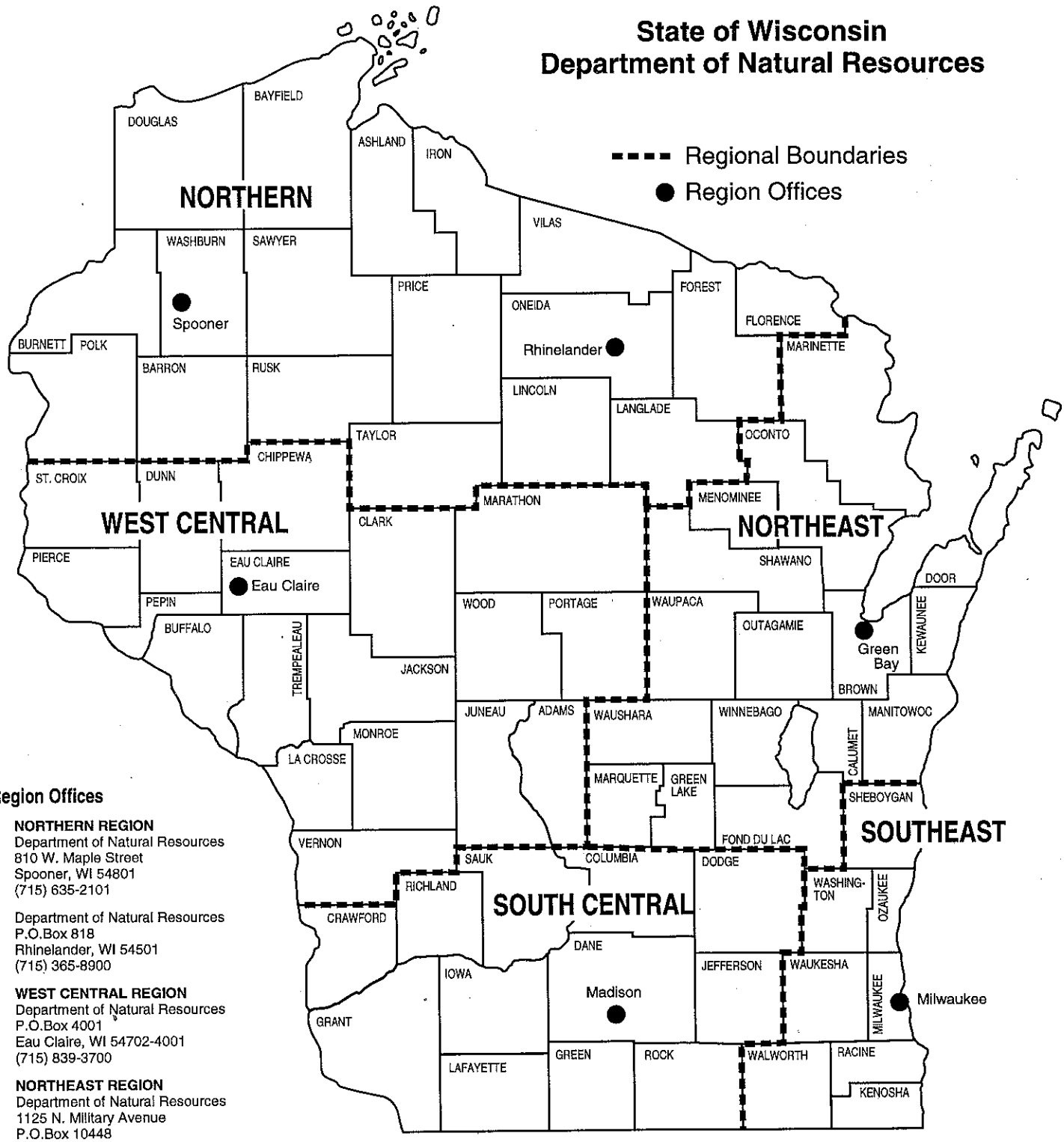

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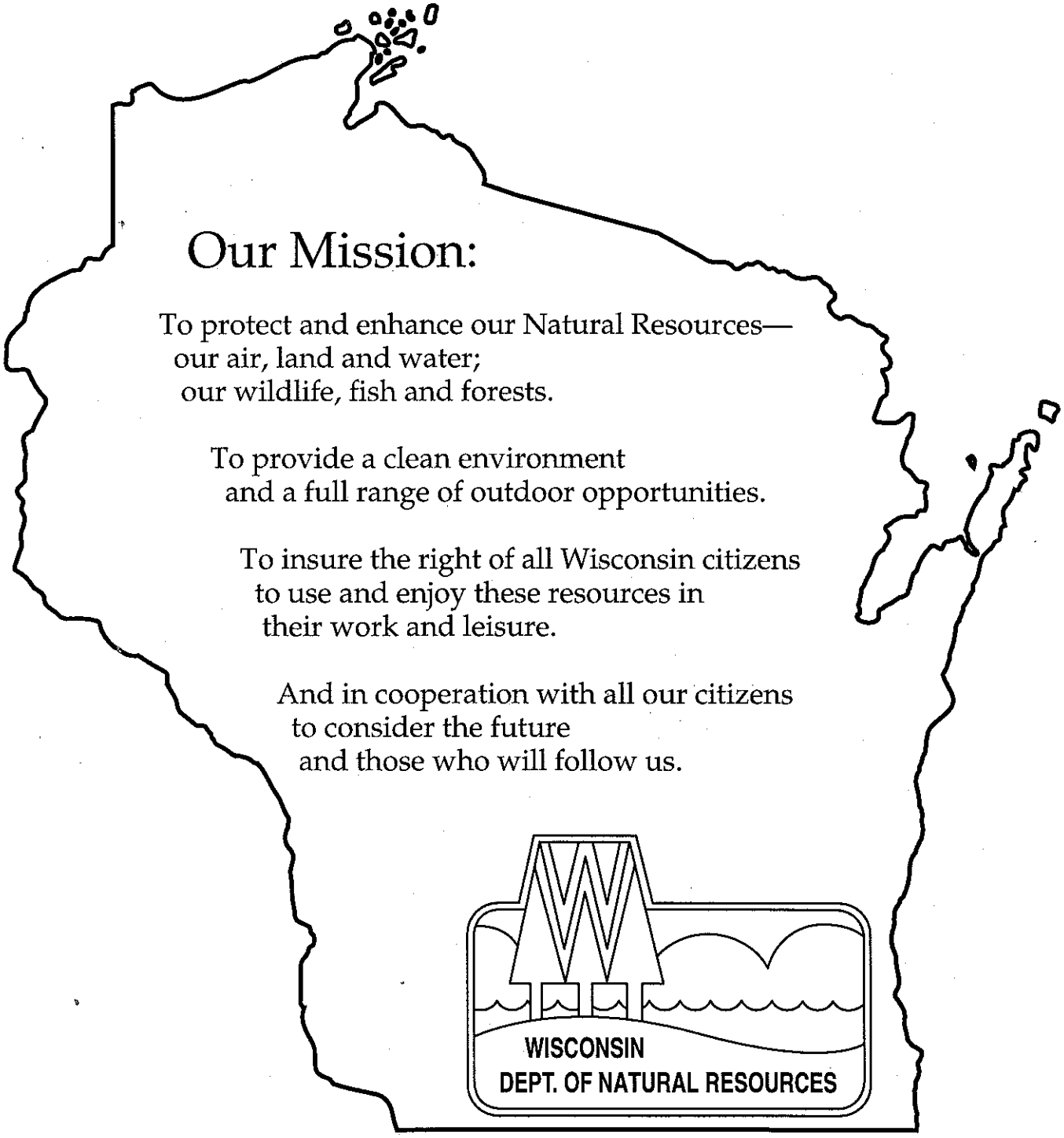

Our Mission:

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

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

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

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

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