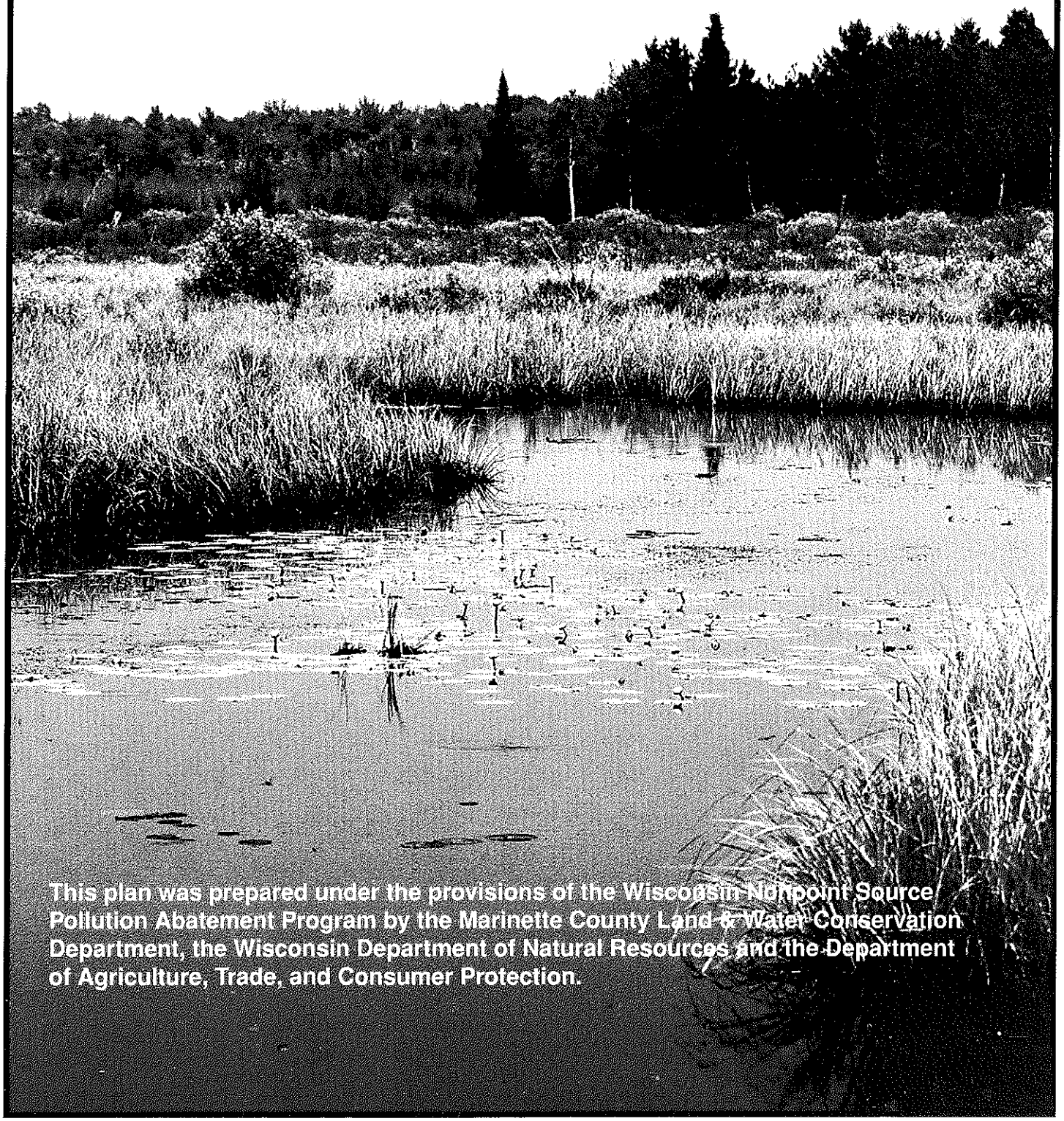
Nonpoint Source Control Plan for the Lake Noquebay Priority Watershed Project



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

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Nonpoint Source Pollution Control Plan for the Lake Noquebay Priority Watershed Project

Wisconsin Nonpoint Source Water Pollution Abatement Program

Plan Approved
February, 1995

This Plan Was Cooperatively Prepared By:

Marinette County Land & Water Conservation Department
Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection

Publication WR-425-95

For copies of this document please contact:

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The Cooperating Agencies acknowledge the Environmental Protection Agency's Region V Office for their involvement in the partial funding of this activity through Section 319 of the Water Quality Act.

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Special Recognition

The Marinette County LWCD and Land Conservation Committee acknowledges the many contributions of Mr. Harold Kinziger, former LCC member. His support for LWCD water quality programs and environmental education efforts was instrumental in the acquisition of the Lake Noquebay Priority Watershed Project.

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April 14, 1995

Mr. William Setunsky, County Board Chair
Marinette County
1926 Hall Avenue
P.O. Box 320
Marinette, WI 54143-0320

Bill

Dear ~~Mr.~~ Setunsky:

I am pleased to approve the Lake Noquebay Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Pollution Abatement Program. This plan meets the intent and conditions of S. 144.25, Wisconsin Statutes, and Chapter NR120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection and was unanimously approved by the Land and Water Conservation Board on April 4, 1995. I am also approving this plan as an amendment to the Upper Green Bay Basin Areawide Water Quality Management Plan.

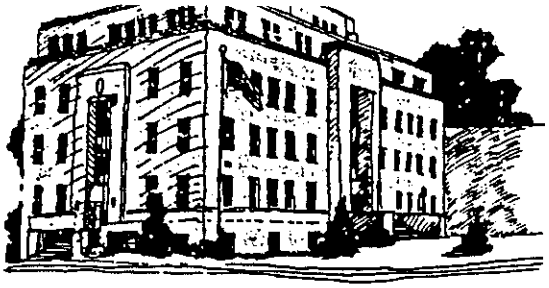
I would like to express the Department's appreciation to the Marinette County Land and Water Conservation Staff that participated in preparing this plan. The implementation of the Lake Noquebay Project will greatly enhance the regional water quality and set a standard for future lakes selected as part of the Departments Northern Lakes Initiative.

We look forward to assisting Marinette County and other units of government participating in the implementation of the Lake Noquebay Priority Watershed Plan.

Sincerely,

George

George E. Meyer
Secretary



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October 28, 1992

Ms. Rebecca Wallace, Chief
Nonpoint Source and Land Management Section
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707

RE: LAKE NOQUEBAY PRIORITY WATERSHED PROJECT
WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT PROGRAM

Dear Ms. Wallace:

I am pleased to inform you that Marinette County accepts the Wisconsin Department of Natural Resource's offer to fund a Lake Noquebay Priority Watershed Project. The project received overwhelming support from the full County Board on October 27, 1992.

We are looking forward to the successful implementation of this project and the long-term protection of Lake Noquebay and its watershed. Thank you for making this opportunity available.

Sincerely,

Claryce M. Maedke

Claryce M. Maedke
Marinette County Board
Chairperson

cc: Stephen Fredericks, County Administrator
Adolph Staidl, LCC Chairperson
William Kowalski, County Conservationist

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RESOLUTION NO. 94-95-56

ADOPTING THE NONPOINT SOURCE POLLUTION CONTROL PLAN FOR THE LAKE NOQUEBAY PRIORITY WATERSHED PROJECT

WHEREAS, the Lake Noquebay watershed was designated a "Priority Watershed" in 1992 under the Wisconsin Nonpoint Source Water Pollution Abatement Program and accepted by the Marinette County Board of Supervisors; and

WHEREAS, a detailed inventory of the land uses and nonpoint sources of pollution within the watershed was conducted in 1993 and 1994; and

WHEREAS, the Marinette County Land & Water Conservation Department has used this inventory to develop a comprehensive plan to protect and improve Lake Noquebay and the surrounding lakes and streams; and

WHEREAS, the Lake Noquebay Priority Watershed Project Citizens Advisory Committee has assisted in the development and review of the watershed plan; and

WHEREAS, public information meetings have been held and an official public hearing was conducted on February 16, 1995; and

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

WHEREAS, participation in any aspect of the priority watershed project is strictly voluntary; and

WHEREAS, the Wisconsin Nonpoint Source Pollution Abatement Program provides 100% funding for project staff and many support costs, 70% funding for office supplies and equipment, and generous cost-sharing for landowners and municipalities to reduce nonpoint sources of pollution; and

WHEREAS, Marinette County must first adopt the Lake Noquebay Priority Watershed Plan before cost-share grants are available to watershed landowners.

NOW, THEREFORE, BE IT RESOLVED THAT the Marinette County Board of Supervisors approves and adopts the Nonpoint Source Pollution Control Plan for the Lake Noquebay Priority Watershed Project.

Respectfully submitted this 21st day of February, 1995

LAND CONSERVATION COMMITTEE

Adolph Staidl, Chairman

Frederick Forst, Vice-Chairman

David Setunsky, Secretary

Mark Anderson, Member

James White, Member

Calvin Phillips, ex-officio Member

FISCAL NOTE: No fiscal impact in 1995.

State of Wisconsin)
County of Marinette) ss.

I, Don E. Phillips, County Clerk in and for the County of Marinette, do hereby certify that the foregoing is a true and correct copy of a resolution adopted by the County Board of Supervisors in said County on 2-21 1995

County Clerk
Marinette Wisconsin

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CHAPTER ONE
Introduction, Purpose and Legal Status

Wisconsin Nonpoint Source Water Pollution Abatement Program

The Wisconsin State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program (NPS) in 1978. The goal of the NPS Program is to improve and protect the water quality of streams, lakes, wetlands and groundwater by reducing pollutants from urban and rural nonpoint sources. The 153-square mile Lake Noquebay watershed, located in Marinette County, was designated a "Priority Watershed" in 1992. The primary objectives of this project are to reduce nonpoint source pollution loads to Lake Noquebay and the surrounding lakes and streams to enhance and protect water quality.

Agricultural sources of nonpoint pollution include eroding agricultural lands and streambanks, field application of manure, fertilizers and pesticides and runoff from livestock wastes. Urban sources of pollution include storm sewers, roads and road ditches and riparian development. Pollutants from nonpoint sources are carried to the surface water or groundwater through the action of rainfall runoff, snowmelt and infiltration.

The following is an overview of the NPS Program:

- The Department of Natural Resources (DNR) and the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) administer the program which focuses on critical hydrologic units called priority watersheds. The program is implemented through priority watershed projects for which a detailed plan of action is prepared.

- Local units of government implement the watershed project. Water quality improvement is achieved through voluntary implementation of nonpoint source controls (best management practices, or BMPs) and adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, metropolitan Sewerage Districts, sanitary districts, lake districts and regional planning commissions are eligible to participate.

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

- Informational and educational activities are employed to encourage participation.

- The DNR and DATCP reviews the progress of the county and other implementing units of government and provides assistance throughout the ten-year project. The DNR monitors improvements in water quality resulting from control of nonpoint sources of pollution in the watershed.

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the Lake Noquebay Priority Watershed Project began in 1993 and included the following information-gathering and evaluation steps:

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

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

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

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

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

Implementation Phase

The implementation phase begins following review of the priority watershed plan by the Lake Noquebay Citizens Advisory Committee, the project team, a public hearing and approval by the Marinette County Board of Supervisors, the DNR, DATCP and the Land and Water Conservation Board. This phase is characterized below:

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

- In the rural portions of the watershed, the Marinette County Land & Water Conservation Department (LWCD) contacts eligible landowners to determine their interest in voluntarily installing BMPs identified in the plan.

- For rural practices, the landowner and Marinette County sign cost-share agreements outlining the practices, costs, cost-share amounts and a schedule for installation of BMPs. All practices are scheduled for installation before the end of the grant period. The DNR and local units of government sign similar agreements for urban practices.

Legal Status of the Nonpoint Source Control Plan

The Lake Noquebay Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared under the cooperative efforts of the DNR, DATCP, the Marinette County LWCD and the Lake Noquebay Citizens Advisory Committee.

This plan provides the basis for the DNR to enter into cost-share and local assistance grants and is used as a guide to implement measures to achieve desired water quality conditions. In the event that a discrepancy occurs between this plan and the statutes or the administrative rules, or if the statutes or rules change during implementation, the statutes and rules will supersede the plan. Similarly, this plan is subject to the amendment process under NR 120.08(4) for substantive changes. The DNR will make determination if a proposed change will require a plan amendment. 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 147 and 144 of the state statutes to regulate significant nonpoint pollution sources in the project area.

Plan Organization

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

Chapter One. "Introduction, Purpose and Legal Status" is an overview of the purpose of the Priority Watershed Program, and the legal requirements of the agencies involved in its implementation.

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

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

Chapter Four. "Management Actions: Control Needs and Eligibility for Cost-Share Funding" identifies the level of rural and urban nonpoint source control needed to meet the water resource objectives and identifies the decision criteria and the nonpoint sources eligible for funding under the priority watershed project.

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

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

Chapter Seven. "Integrated Resource Management Program" identifies existing state, federal and local resource management programs which have the potential to benefit water quality and fish and wildlife habitat in the Lake Noquebay watershed. Coordination of these programs and recommended management actions are outlined.

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

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

CHAPTER TWO
General Watershed Characteristics

Location

The Lake Noquebay Priority Watershed Project area is located in central Marinette County in the Upper Green Bay Basin (map 2-1). The project area includes the 134-square mile Lake Noquebay drainage basin and the 19 square miles south of Lake Noquebay which drains to The Outlet and Peterman Brook (map 2-2). The entire project area drains to the Peshtigo River which in turn drains to the bay of Green Bay. This entire project area is referred to as the "watershed" throughout the remaining sections of this plan.

Cultural Features

Civil Divisions

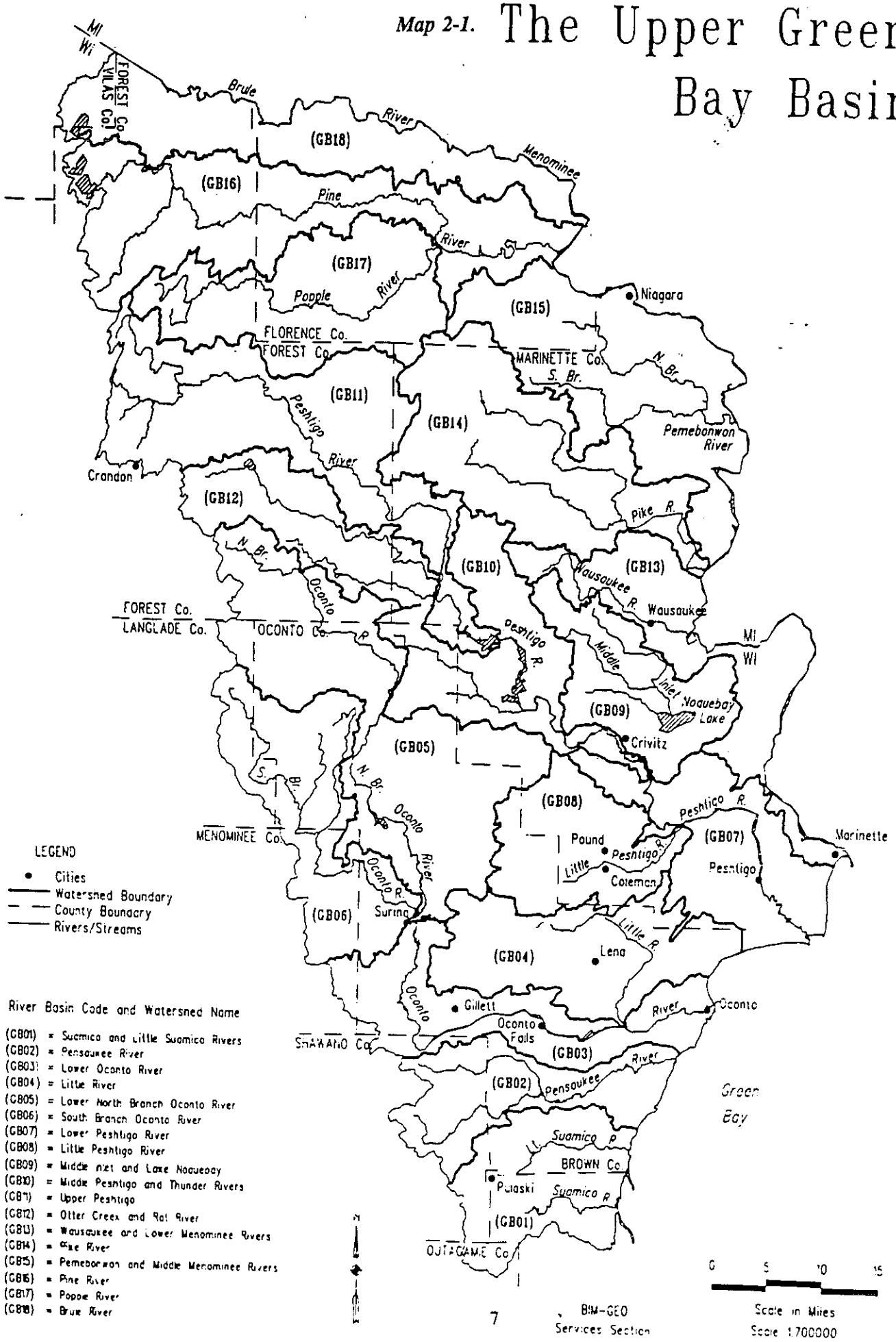
The Lake Noquebay watershed is located entirely within Marinette County. The majority of the watershed lies in the rural townships of Lake, Middle Inlet and Stephenson. Smaller areas of the watershed can be found in the townships of Wagner, Wausaukee, Athelstane and Porterfield. Approximately one-half of the village of Crivitz lies within the watershed boundary.

There are approximately 13,000 acres of public land within the Lake Noquebay watershed. On the east, Lake Noquebay is bordered by the 1300-acre Noquebay Wildlife Area and more than 9,000 acres of Marinette County forest lands. More than 2,600 acres of county forest lands are also located in the northern reaches of the watershed.

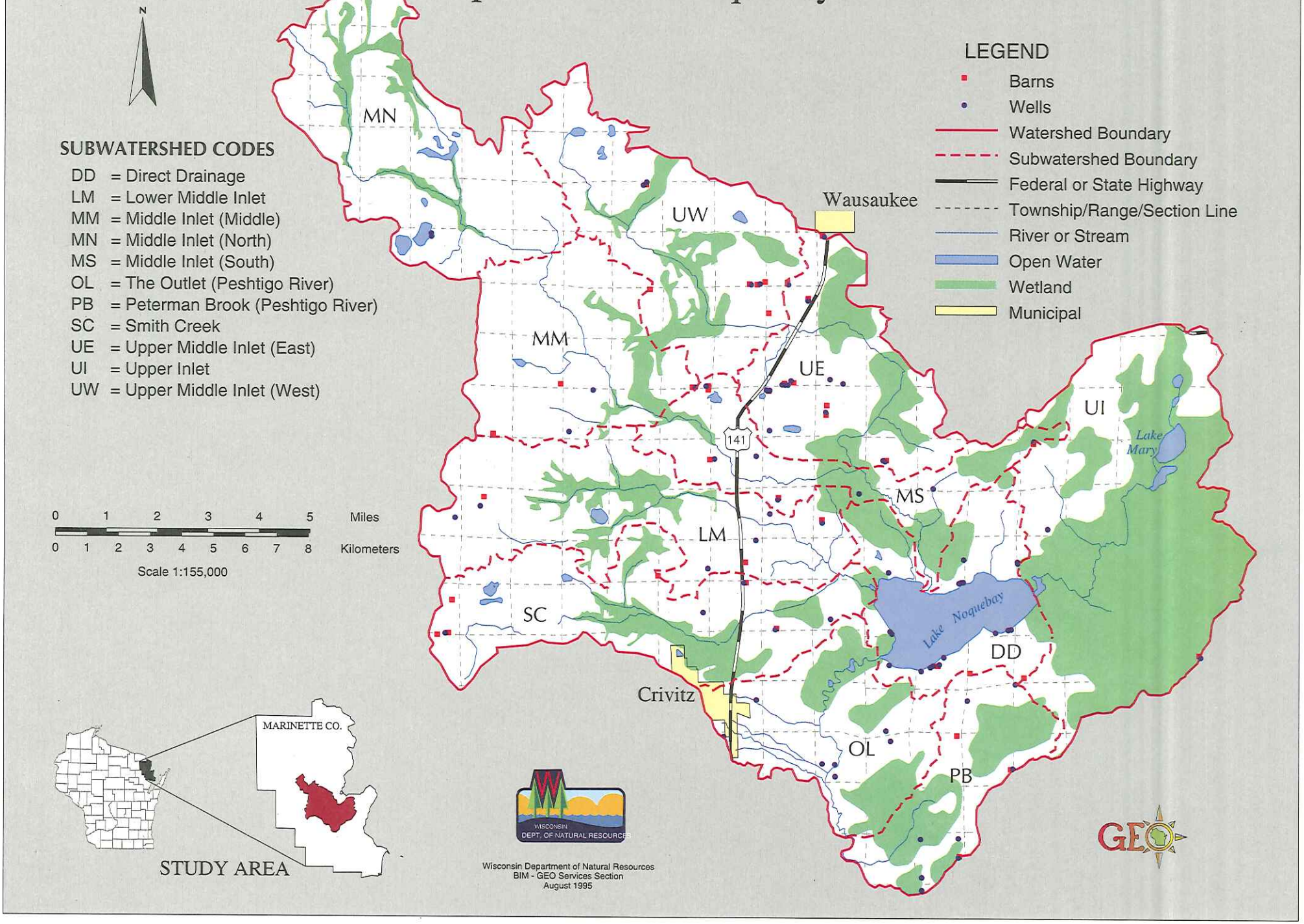
Population Size and Distribution

The population of the Lake Noquebay watershed is estimated at 2,500 people. Approximately 80% of the watershed population lives in rural unincorporated areas. The balance of the population (513 people) lives in the village of Crivitz, part of which lies within the watershed boundary. The village of Crivitz has a total population of 1026 people, approximately the same number as in 1980, however the growth rate in Crivitz is predicted to increase in the future. The watersheds rural population has increased by approximately

Map 2-1. The Upper Green Bay Basin



Map 2- 2. Lake Noquebay Watershed



10.5% since 1980, and more than 50% since 1970. This growth rate is 2.3 times higher than the average for Marinette County. Regional trends suggest that the watersheds rural population will continue to expand in the future.

Much of the population growth in the rural watershed areas is due to increasing recreational development in riparian areas. Lake Noquebay has experienced a rapid expansion of second tier and back-lot development in the past 20 years. This trend is likely to continue as population centers in the Fox Valley expand and their residents look to Marinette County for recreational opportunities. Riparian and second tier development is also severe in the Newton Lakes area. Several small lakes in the watershed have escaped riparian development because the entire shoreline is owned by one or two landowners. These lakes could experience rapid development if subdivided in the future.

Seasonal residents and weekend vacationers make up a large portion of the rural population which is not accounted for in regional population figures. Around Lake Noquebay 19% of the lakefront property owners are seasonal residents, and 33% are weekend residents. Riparian development pressures have been compounded by the fact that many of these seasonal homes and vacation retreats are being converted to permanent residences. This trend is expected to continue or increase as absentee owners age and retire to their lake homes.

Land Uses

Rural land use predominates in the watershed. Forest is the predominant land cover, comprising 78% of the watershed. Agriculture makes up 20% of the land use. Dairy farming is the principal agricultural land use. Developed land occupies less than 3% of the watershed, however 50% of this is located in riparian areas (table 2-1).

Table 2-1. Summary of Land Uses: Lake Noquebay Watershed

Land Uses	Acres	Percent
Cropland	14,945	17.0
Pasture	367	0.4
Grassland	3,997	4.6
Farmstead	666	0.8
Woodland	39,614	46.0
Developed	841	1.0
Riparian Developed	371	0.4
Wetland[1]	25,771	30.0
TOTAL	86,572	100.0

[1] Wetland acres were estimated using DNR Wisconsin Wetlands Inventory maps. Estimates are of actual wetland acres, not cropped wet fields.

Natural Resource Features

Climate and Precipitation

The frequency, duration and amount of precipitation influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics and the physical condition of waterways. The Lake Noquebay watershed lies in the Continental Zone which is characterized by long, relatively cold and snowy winters. In winter, the average mean temperature is 16 degrees Fahrenheit (F), with an average minimum of 5 degrees F. Summers are mostly warm with periods of hot humid conditions. In summer, the average mean temperature is 66 degrees F, with an average maximum of 79 degrees F. Total annual precipitation averages about 30 inches in the watershed area. The majority of this falls as rain during April through September. The highest levels of surface runoff occur in March and April when land surfaces are frozen and soil moisture is highest.

Geology and Physiography

The physical geographic characteristics of the Lake Noquebay watershed are primarily the result of glaciation. Within the watershed there are three major physiographic regions. The northern and western sections are in the Northern Highlands region and are underlain by Precambrian igneous and metamorphic rocks, a southern extension of the "Canadian Shield." The central section of the watershed is part of the Wisconsin Central Plain and is underlain by a narrow area of Upper Cambrian sandstones that contain some dolomite and shale. The southeast part of the watershed is in the Eastern Ridges and Lowlands physiographic region and is underlain by Ordovician dolomite that formed from marine sediments.

The bedrock in the Lake Noquebay watershed is overlain by glacial deposits consisting of till and outwash sand and gravel. Depth of these materials ranges from zero to over one-hundred feet. The irregular Precambrian rock surface is mostly covered by glacial deposits, however, outcrops are common in the far northwestern part of the watershed. The Ordovician dolomite has a fairly well defined topographic escarpment and occasionally outcrops to the southeast of Lake Noquebay.

Relief and Drainage

Elevations range from about 1,020 feet above sea level in the northwestern part of the watershed to less than 650 feet above sea level in the southeastern part. Perennial streams flow dominantly to the southeast. Secondary drainage systems are poorly developed throughout much of the watershed. Much of the surface runoff flows into basins and depressions where it tends to accumulate and is released slowly to streams. Many basins or depressions are closed, including several inland lakes, and do not have surface outlets.

Soils

Soils in the Lake Noquebay watershed can be divided into three large groups. These groups are: 1) areas dominated by soils that formed in glacial till; 2) areas dominated by soils that formed in glacial outwash and till; and 3) areas dominated by organic soils. These major areas are further divided into soil associations that have a distinctive pattern of soils, relief and drainage (map 2-3). Each has a unique natural landscape.

Areas Dominated by Soils that Formed in Glacial Till

Two soil associations formed primarily in glacial till occur along the south shore of Lake Noquebay and the southeast section of the watershed.

- Cunard-Emmet association - Moderately deep and deep, nearly level to steep, well drained loamy soils on moraines and drumlins.

- Menominee-Emmet association - Deep, nearly level to steep, well drained, sandy and loamy soils on outwash plains, moraines and drumlins.

The major soils in these associations are used for crops, pasture or woodland. The main concerns in managing Cunard, Emmet and Menominee soils for crops and pasture are controlling water erosion and maintaining fertility. Soil blowing is also a management concern for Menominee soils. The less sloping areas of Emmet and Menominee soils are usually suited to septic tank absorption fields. Cunard soils are poorly suited to septic tank absorption fields because of the underlying dolomite.

Areas Dominated by Soils that Formed in Glacial Outwash and Till

Two soil associations that have formed in mixed areas of glacial outwash and till occur in the central, northern and western sections of the watershed.

- Mancelona-Emmet-Menahga association - Deep, nearly level to steep, well drained to excessively drained, sandy and loamy soils primarily on end moraines.

- Menahga association - Deep, nearly level to steep, excessively drained, sandy soils on moraines, outwash plains and stream terraces.

Many of the lakes in the watershed are found in areas of pitted outwash within these soil associations. Most land areas within these associations are used as woodland. Some areas are used for crops or pasture.

Controlling water erosion and maintaining fertility are main concerns in managing these soils, especially on sloping crop fields and areas of concentrated runoff. Droughtiness and wind erosion are also concerns for managing Mancelona and Menahga soils. The less sloping areas of Emmet soils are usually suited to septic tank absorption fields. Mancelona and Menahga soils are poorly suited to septic tank absorption fields because of poor filtering

SOIL LEGEND*

AREAS DOMINATED BY SOILS THAT FORMED IN GLACIAL TILL

Cunard-Emmet association: Moderately deep and deep, nearly level to steep, well drained, loamy soils on moraines and drumlins

Menominee-Emmet association: Deep, nearly level to steep, well drained, sandy and loamy soils on outwash plains, moraines, and drumlins

AREAS DOMINATED BY SOILS THAT FORMED IN GLACIAL OUTWASH AND TILL

Mancelona-Emmet-Menahga association: Deep, nearly level to steep, well drained to excessively drained, sandy and loamy soils primarily on end moraines

Menahga association: Deep, nearly level to steep, excessively drained, sandy soils on moraines, outwash plains, and stream terraces

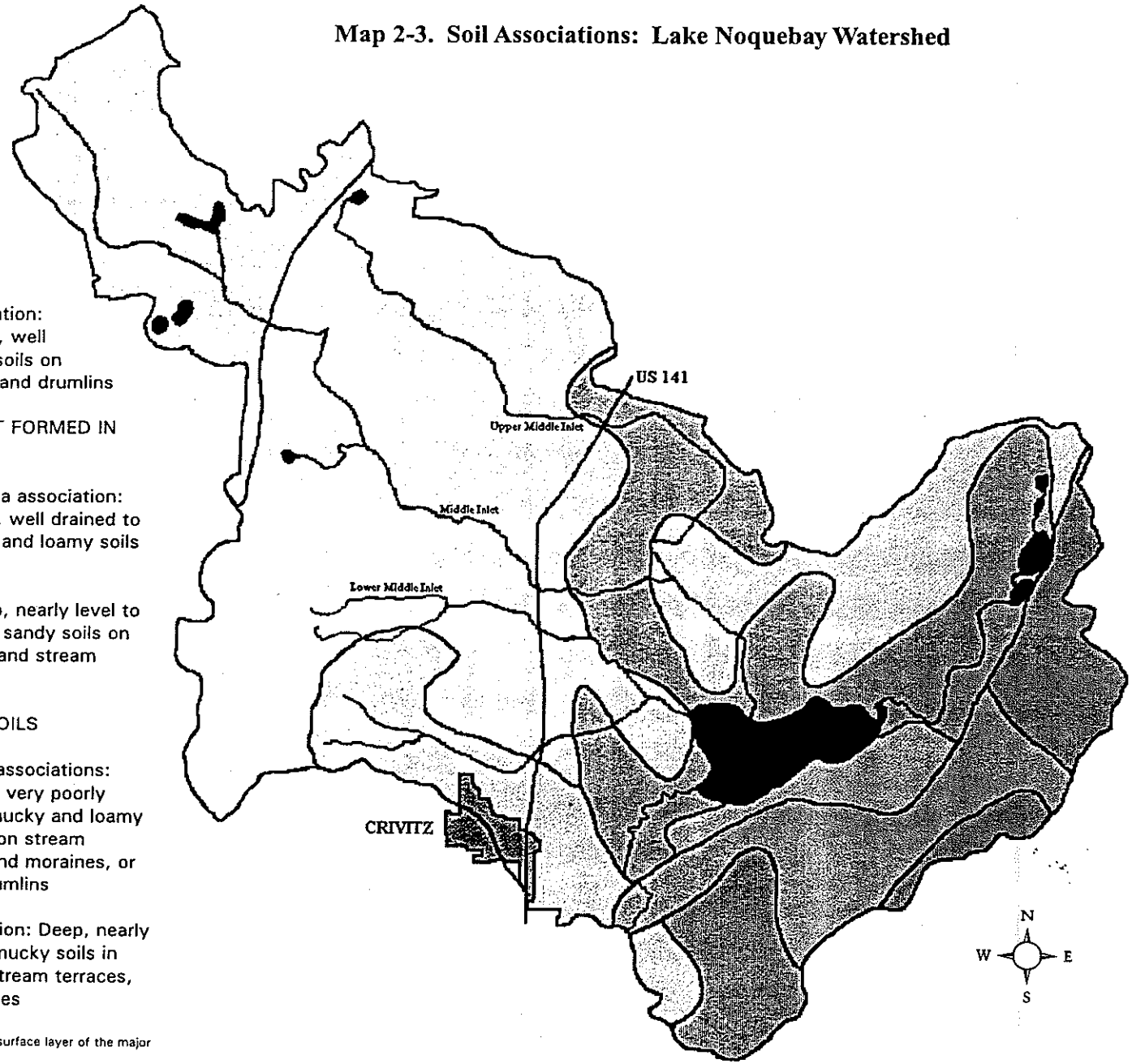
AREAS DOMINATED BY ORGANIC SOILS

Seelyeville-Markey-Emmet associations: Deep, nearly level to steep, very poorly drained and well drained, mucky and loamy soils in glacial lake basins, on stream terraces, outwash plains, and moraines, or on upland moraines and drumlins

Seelyeville-Markey association: Deep, nearly level, very poorly drained, mucky soils in glacial lake basins and on stream terraces, outwash plains, and moraines

* Texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

Map 2-3. Soil Associations: Lake Noquebay Watershed



capacity and the danger of groundwater pollution. These limitations have become more apparent with riparian development along inland lakes and the installation of septic tank absorption fields in these coarse textured soils.

Areas Dominated by Organic Soils

Two soil associations that have formed in areas dominated by organic soils occur around much of Lake Noquebay, in the eastern and southeast portion of the watershed, and in the north and central portion of the watershed.

- Seelyeville-Markey-Emmet association - Deep, nearly level to steep, very poorly drained and well drained, mucky and loamy soils in glacial lake basins, on stream terraces, outwash plains, and moraines, or on uplands moraines and drumlins.

- Seelyeville-Markey association - Deep, nearly level, very poorly drained, mucky soils in glacial lake basins and on stream terraces, outwash plains and moraines.

The major soils in these associations are dominantly used as woodland. Some areas, including the Lake Noquebay Wildlife Area located east of the lake, are used as wildlife habitat. Some areas of the Emmet soils are used for crops or pasture.

The main management concerns in Emmet soils are controlling water erosion and maintaining fertility. The less sloping areas of Emmet soils are usually suited to septic tank absorption fields. The Seelyeville and Markey soils are unsuited to septic tank absorption fields because of the high water table and ponding. Many of these organic soil areas bordering Lake Noquebay were filled in past years and have undergone riparian development. Non-conforming and potentially failing septic tank absorption fields are a concern in these areas.

Surface Water Resources

Land drainage patterns in the Lake Noquebay watershed have been delineated into 11 major subwatersheds. Nine of these subwatersheds, encompassing over 74,000 acres, drain to Lake Noquebay. Two subwatersheds, with a combined 12,350 acres, drain to the Peshtigo River (map 2-4). There are also numerous closed depressions and pothole lakes throughout the watershed. See table 2-2 for a listing of major water resources in the Lake Noquebay watershed.

Map 2- 4. Lake Noquebay Watershed and Subwatersheds

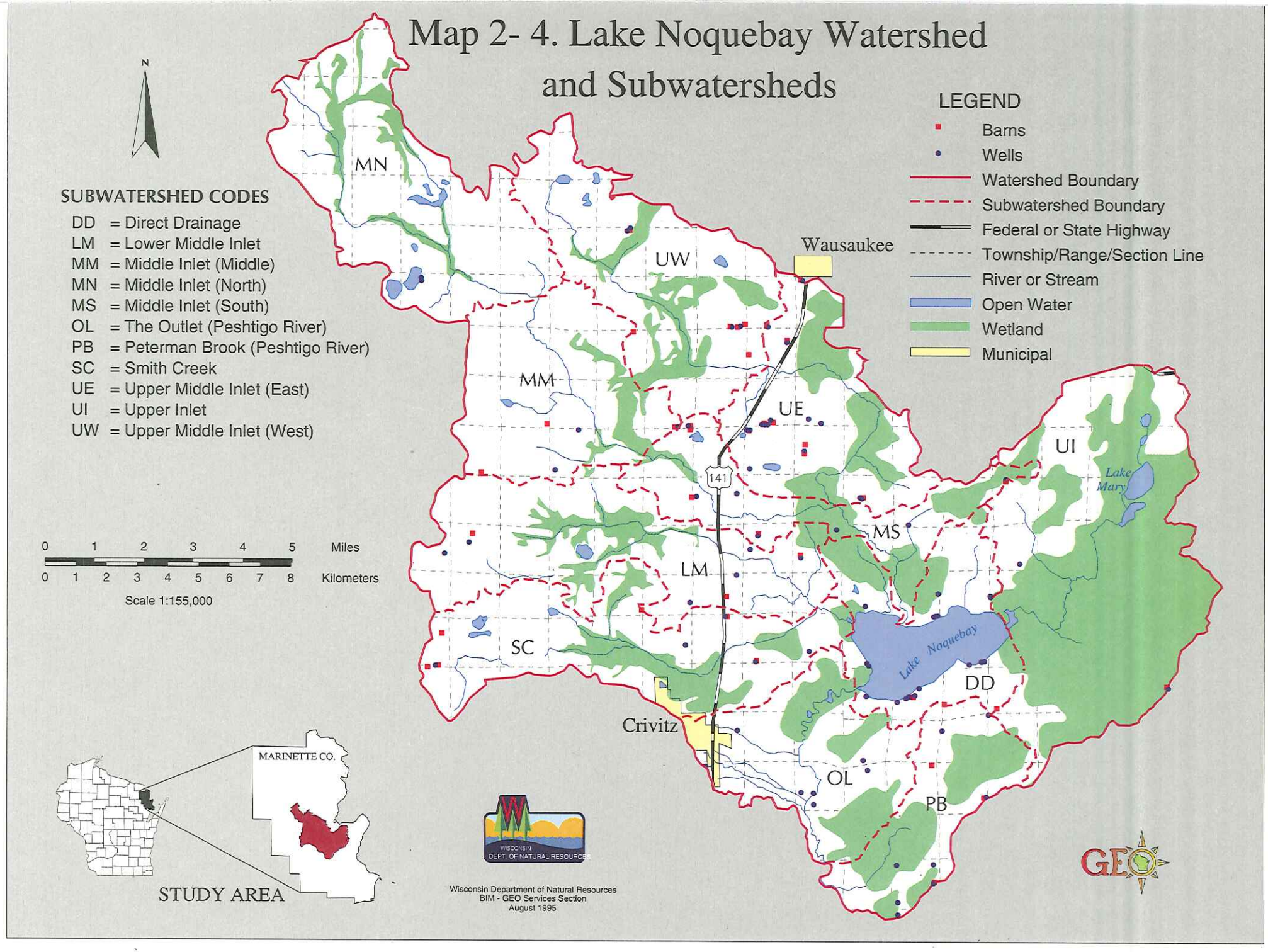


Table 2-2. Water Resources: Lake Noquebay Watershed

Rivers and Streams	Length (miles)	Drainage Area (square miles)
Elbow Creek	0.7	4.39
Lower Middle Inlet	8.3	28.43
Meadow Brook	6.4	7.76
Middle Inlet	14.9	38.18
Peterman Brook	3.4	10.33
Plumadore Creek	1.8	3.40
Smith Creek	6.1	12.50
The Outlet	4.3	105.53
Upper Inlet	5.9	15.08
Upper Middle Inlet	10.1	27.89
Unnamed S8 T32N R20E	1.5	3.04
Unnamed S24 T32N R20E	0.4	1.92
Unnamed S18 T33N R20E	0.3	0.59
Unnamed S34 T33N R20E	1.1	1.42

Table 2-2. Continued

Lake	Size (acres)	Max. Depth (feet)	Drainage (sq. miles)	Shoreline (miles)
Butterfly Lake	6	15	0.09	0.60
Campbell Lake	24	8	0.12	1.21
Charles Lake	27	--	0.17	--
Chrizel Lake	1	7	0.01	0.10
Elbow Lake	62	60	1.19	2.31
Engleman Lake	13	4	0.17	0.55
Finnegan Lake	6	3	0.30	0.35
Jug Lake	15	--	0.12	--
Lake Julia	47	20	1.65	1.17
Lily Lake	10	10	0.54	0.80
Little Newton Lake	27	37	0.44	1.19
Lake Mary	167	20	1.27	2.28
Mud Lake	8	19	0.93	0.47
Newton Lake	68	40	0.44	1.30
Lake Noquebay	**2,409**	**51**	**45.00**	**9.40**
Perch Lake	27	15	0.09	0.82
Retcof lake	47	14	0.16	1.07
Rollins Lake	9	4	0.06	0.47
Roosevelt Lake	1	3	0.20	0.10
Round Lake	3	3	0.30	0.25
Rush Lake	17	31	0.14	0.66
Silver Lake	8	19	0.04	0.44
Simpson Lake	13	24	0.08	0.74
Spencer Lake	3	4	0.04	0.26
Spies Lake	27	5	1.16	0.80
Springer Lake	2	18	0.08	0.25
Stephenson Lake	19	24	0.78	0.69
Wolf Lake	22	7	0.22	0.82

Source: Surface Water Resources of Marinette County

Subwatersheds in the Lake Noquebay Watershed

Smith Creek	(SC)
Lower Middle Inlet	(LM)
Middle Inlet (north)	(MN)
Middle Inlet (middle)	(MM)
Middle Inlet (south)	(MS)
Upper Middle Inlet (west)	(UW)
Upper Middle Inlet (east)	(UE)
Upper Inlet	(UI)
Direct Drainage Area	(DD)
The Outlet	(OL)
Peterman Brook	(PB)

Streams

The Lake Noquebay watershed is drained by a network of more than 60 miles of perennial streams which discharge to Lake Noquebay via three major inlets. The major watershed streams include Smith Creek and the Lower Middle Inlet which enter the lake from the west, the Middle Inlet and the Upper Middle Inlet which drain to the lake from the north and the Upper Inlet which enters the lake from the east. The Upper Inlet supports a warmwater sport fish community, while the rest of the major streams support valuable coldwater sport fish communities. Eroding cropland and excessive nutrient runoff are the major sources of nonpoint pollution to watershed streams.

Lake Noquebay drains to the Peshtigo River through The Outlet which exits the lake from the southwest. A dam located on The Outlet, which controls the water level in Lake Noquebay is responsible for varying stream flows. The Outlet supports a warmwater sport fish community. Peterman Brook, which drains over 5,000 acres south of Lake Noquebay, also flows to the Peshtigo River.

The abundant wetlands and forest lands in the Lake Noquebay watershed tend to absorb rainfall and slowly release the runoff to streams. Watershed streams are characterized by relatively stable stream flows and minimal streambank erosion.

Intermittent streams drain much of the agricultural land in the Lake Noquebay watershed. These streams flow only when there are high runoff events or when groundwater discharge is high. Intermittent waterways form the headwaters of many of the larger perennial streams in the watershed. The proximity of intermittent streams to cultivated agricultural lands make them particularly susceptible to nonpoint source pollution.

Lakes

There are a total of 28 named lakes within the Lake Noquebay watershed. Lake Noquebay, Lake Mary, Lake Julia, Big and Little Newton Lakes and Spies Lake are all heavily developed. The remaining watershed lakes are only sparsely developed and most have no public access.

Lake Noquebay, with 2,409 acres and 9.4 miles of shoreline, is the largest lake in Marinette County. The lake offers a wide variety of recreational opportunities for the public and over 200 riparian property owners. Lake Noquebay's water quality has been degraded by nonpoint source pollution, primarily by excessive nutrient runoff. These nutrients are believed to be playing a role in the recent expansion of nuisance aquatic vegetation in the lake.

Big Newton and Little Newton Lakes are also very important to the local tourist industry. There are two resorts on the lakes and a public swimming beach on Little Newton Lake. Shoreline development on both lakes is very heavy and all dwellings are served by on-site sewage disposal systems. Most of these systems are located in sandy soils which may not be effectively removing pollutants. Although these lakes have excellent water clarity, phosphorus concentrations show there is a cause for concern.

Wetlands

Wetlands are valuable natural resources. They provide wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff, flood control and removal of pollutants. Floodplain wetlands support fur bearing animals, waterfowl and provide seasonal habitat for sport fish.

The Lake Noquebay watershed contains an estimated 25,700 acres of wetlands, or approximately 30% of the land area. Many of the watershed streams flow through wetland corridors as they approach Lake Noquebay. The Upper Inlet drains over 7,000 acres of forested wetlands.

Groundwater Resources

Groundwater is the sole source of drinking water within the Lake Noquebay watershed. Rural residents obtain their water primarily from privately owned drilled or driven wells. Residents of the village of Crivitz are served by a municipal well.

Since 1936, the State of Wisconsin has required well drillers to document well construction and rock and soil layers encountered during well installation. Driller construction reports for wells located in the Lake Noquebay watershed indicate that private wells draw groundwater

from four aquifers: 1) the Pleistocene sand and gravel aquifer; 2) the Ordovician age sandstone and dolomite aquifer; 3) the Cambrian sandstone and dolomite aquifer; and 4) the Precambrian granite aquifer.

Groundwater Quality

As part of the water quality appraisal process, private well samples were collected and analyzed for nitrate + nitrite and triazine, two of the most widespread groundwater contaminants in rural areas. Sources of nitrate and nitrite contamination include animal waste, the over application of commercial fertilizer and improperly functioning septic systems. Triazine contamination is most often caused by the over application of pesticides containing atrazine on sandy soils or pesticide spills.

Groundwater test results for nitrate + nitrite greater than 10 mg/l exceed the state enforcement standard (ES). Results between 2 and 10 mg/l exceed the state's preventative action limit (PAL). The current ES for triazine is 3 μg/l. The PAL for triazine is 0.3 μg/l.

Well sample analysis shows that triazine contamination does not appear to be widespread in the Lake Noquebay watershed. However, analysis for nitrate + nitrite indicates that more than 41% of the sampled wells were contaminated (table 2-3). The village of Crivitz has also recently closed one of its municipal wells due to nitrate contamination.
The location of nitrate contaminated wells does not indicate a pattern of groundwater contamination that can be linked to specific sources of nitrate at this time. Similarly, no specific source of triazine contamination is indicated by sample results.

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

Table 2-3. Well Sampling Results: Lake Noquebay Watershed

Sample Result	Nitrate + Nitrite		Triazine	
	Number	%	Number	%
Exceeds ES	13	13	1	2
Exceeds PAL	27	28	4	10
Less Than PAL	58	59	37	88
TOTAL	98	100	42	100

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

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

Any existing archaeological sites within the Lake Noquebay watershed will need special consideration when structural best management practices are being considered. Settling basins, manure storage structures, and streambank or shoreline shaping and riprapping are likely practices that may impact archaeological sites. As discussed above, state and federal laws require preservation of archaeological resources within the framework of the NPS Program.

The Lake Noquebay Priority Watershed Project will address these concerns with the following procedures:

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

2. Landowners' questionnaires will then be sent to the State Historical Society for determination of archaeological significance. In addition, landowners will have their

lands evaluated by county staff for the need to conduct an archaeological survey (essentially compare property with known archaeological site locations). The historical society will determine the need for additional, extensive surveys. The county and the DNR District NPS Program coordinator will also be involved in these determinations.

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

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

Endangered and Threatened Resources

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

It should be noted that comprehensive endangered resource surveys have not been completed for the entire Lake Noquebay watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed.

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

Rare Species

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

Wisconsin Endangered Species

Any species whose continued existence as a viable component of this state's wild animals or wild plants, as determined by the DNR on the basis of scientific evidence, is considered to be in jeopardy. No Wisconsin endangered species are known to exist in the Lake Noquebay watershed.

Wisconsin Threatened Species

Any species which, on the basis of scientific evidence, appears likely to become endangered within the foreseeable future. There are three Wisconsin threatened species in the watershed, the Bald Eagle (*Haliaeetus leucocephalus*), Blandings turtle (*Emydoidea blandingii*) and Prairie thistle (*Cirisium hillii*). The Blandings turtle and Prairie thistle are both under review by the US Fish and Wildlife Service for federal listing.

Wisconsin Special Concern Species

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

Least darter (*Etheostema microptera)*
Black tern (*Chlidonias niger*)
Bird's-eye primrose (*Primula mistassinica)*
Showy lady's slipper (*Cypripedium reginae)*
Farwell's water-milfoil (*Myriophyllum farewellii)*
Green-faced clubtail (*Hylogomphus viridifrons)*
Dragon's mouth (*Arethusa bulbosa)*

A nesting colony of Black terns (*Hydrochellidon nigra surinamensis*) is located on the northwest shore of Lake Noquebay near the mouth of Smith Creek. The Aquatic Plant Management Plan for Lake Noquebay currently restricts harvesting in this area to minimize disturbance to the colony.

Wild rice (*Zizania aquatica*) beds are also found on Lake Noquebay. Although wild rice is not a special concern species, it is given special protection and a limited harvesting season by the State of Wisconsin. The Aquatic Plant Management Plan for Lake Noquebay does not allow the cutting of wild rice.

Natural Areas

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

Noquebay area (northern sedge meadow; shrub-carr)
Wolf Lake and Middle Inlet Swamp natural area (lake-shallow, soft, seepage; northern-wet mesic forest; northern sedge meadow)
Wallace Swamp natural area (northern wet forest)
Old Athelstane Sharptail natural area (pine barrens)
New Athelstane Barrens natural area (alder thicket; pine barrens; stream-fast, cold, hard)

Spies, Butterfly and Jug Lakes natural area (lake-shallow, hard, drainage; lake-shallow, soft, seepage; northern sedge meadow)
Perch Lake and Woods natural area (spring pond; northern wet-mesic forest; northern wet forest; stream-fast, hard, cold; northern dry-mesic forest; northern mesic forest)

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

CHAPTER THREE
Water Quality Conditions, Nonpoint Sources and Resource Objectives

Introduction

Topics covered in this chapter include:

- Major nonpoint source pollutants.
- Establishment of water quality objectives.
- Results of nonpoint source inventories.
- Individual subwatershed general characteristics.
- Amount of pollutant control necessary to achieve desired water resource conditions.
- Other potential pollutant sources.

Major Nonpoint Source Pollutants

Nonpoint source pollutants are responsible for the degraded condition of Lake Noquebay and continue to threaten other water resources in this watershed. Excessive amounts of sediment and nutrients degrade the water quality causing excessive aquatic macrophyte growth which negatively impacts the biotic community in Lake Noquebay and reduces the recreational potential of the lake.

Manure

Manure contains several components that adversely affect water quality and aquatic life. Manure entering a stream breaks down, resulting in depletion of the oxygen in the water that fish and other aquatic life require to survive. Also, manure contains nitrogen which can form ammonia in the streams and lakes. In high concentrations, the ammonia is toxic to fish and other aquatic life. Ammonia toxicity is temperature and pH dependent. The nutrients in manure (including nitrogen and phosphorus) also promote nuisance algae and weed growth in streams and lakes. Bacteria found in livestock manure can be harmful to humans and livestock when found in drinking water. The major sources of manure in this watershed are

runoff from barnyards and runoff from improperly field-spread manure. Steep slopes and drainageways can present special manure management problems.

Sediment

Sediment adversely impacts the water resources in many ways. It degrades habitat for fish and aquatic insects which support fish and other forms of aquatic life. High sediment concentrations abrade fish gills making the fish more susceptible to disease, fills in pools and degrades fish spawning habitat. Suspended sediment also warms the water in the summer, and warm water cannot hold as much oxygen as cold water. The major sources of sediment in this watershed are upland erosion from croplands and shoreline erosion.

Nitrates

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

It has also been postulated that nitrogen in lake sediments may be closely tied to the production of aquatic macrophytes. Sources of sediment nitrogen include groundwater and surface runoff.

Water Quality Conditions

Lakes

Lake Noquebay exhibits variable water quality with seasonally heavy aquatic weed growth. The lake supports a valuable sport fishery and provides recreational enjoyment for thousands of people annually. However, the fishery and recreational potential of the lake are only maintained at this high level due to the efforts of the Lake Noquebay Rehabilitation District (LNRD). The LNRD harvests in excess of 3,400 tons of aquatic plants annually, preventing more than 360 acres of the lake from becoming weed choked and unusable.

Nonpoint sources to Lake Noquebay include agricultural runoff, urban runoff, and riparian runoff. Elevated levels of nitrogen and phosphorus have been documented from streams draining to Lake Noquebay. Poorly sited and maintained septic systems are also potential sources of pollutants.

A sediment core was collected from Lake Noquebay during the winter of 1993 and analyzed by the DNR Bureau of Research. Segments of the core were dated and analyzed for nutrients, metals, algal concentration, zooplankton species composition, and sediment and organic matter accumulation rates. Analysis of the core gives valuable insight into watershed land use and eutrophication during the last 200 years.

Sediment core results indicate that watershed erosion rates began to increase around 1900. This was likely the result of deforestation when old growth forests were logged off throughout the watershed. Sedimentation rates continued to increase into the 1980s when the amount of land in agricultural production was highest. Since the 1980s, the rate of sedimentation and metals accumulation has decreased. Phosphorus and nitrogen accumulation rates increased dramatically around 1940 when many of the forests were being converted to agricultural production (figure 3-1). Although nitrogen inputs appear to be declining, the rate of phosphorus accumulation remains high, possibly due to inputs from riparian areas.

The rate of organic matter accumulation in Lake Noquebay (figure 3-2) is a good indicator of the lake's productivity. Organic matter accumulation rates began increasing around 1900 and continued to increase until about 1980, indicating accelerated eutrophication. Since 1980, the rate of organic matter accumulation in the lake has been greatly reduced. This decrease is likely due to the LNRD weed harvesting operation, which has removed over 3,000 tons of aquatic plants annually from Lake Noquebay since 1979.

Big Newton Lake and Little Newton Lake are heavily developed and are popular tourist destinations. Both lakes exhibit excellent water clarity, however phosphorus levels in the mesotrophic range give cause for concern. The major source of nutrients to the Newton Lakes is runoff from riparian development and leachate from septic systems installed in course sands which can be poor filters of septic effluent.

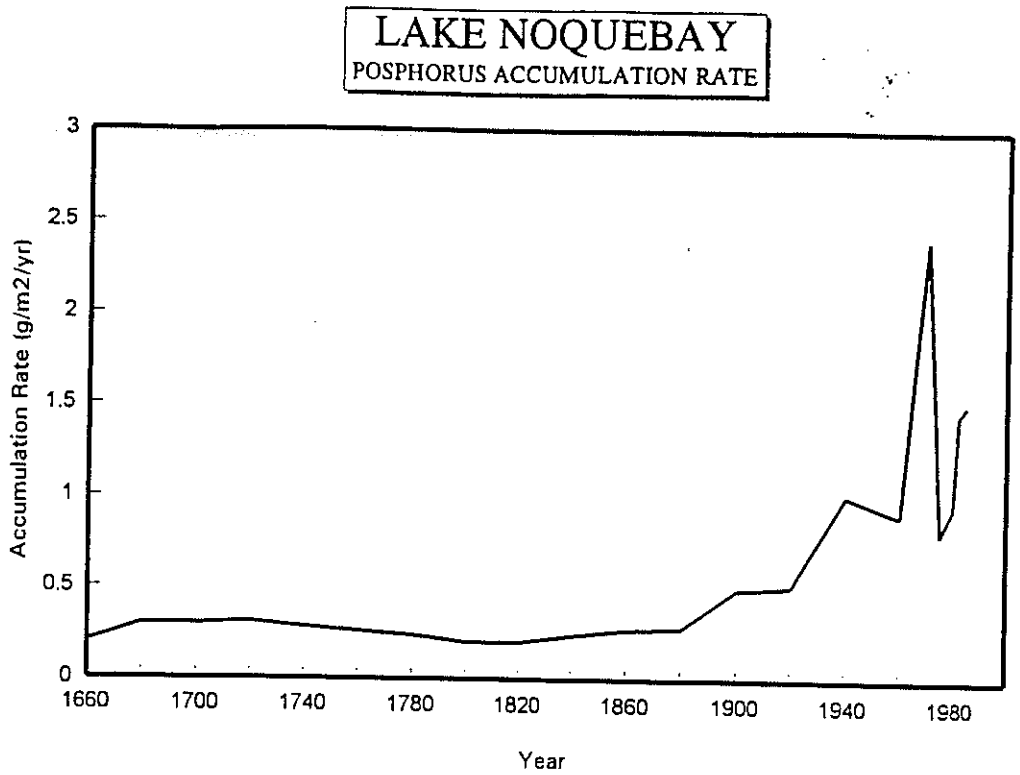
Lake Julia and Lake Mary are less heavily developed drainage lakes which are tributary to Lake Noquebay. Both are mesotrophic lakes with good water quality. Poorly drained soils around both lakes may not adequately filter septic effluent and are not suited to development.

There are 23 other named lakes within the Lake Noquebay watershed. The majority of these lakes have no public access and remain sparsely developed. These lakes will be described in more detail in the subwatershed descriptions later in this chapter.

Streams

Although nutrient loading from watershed streams has negatively impacted the water quality and ecology of Lake Noquebay, the current level of nutrient loading has had less visible effects on in-stream habitat conditions and ecology. Of the five major streams in the Lake Noquebay watershed, all have good to excellent water quality and are currently meeting their potential uses. These streams will be described in more detail in the subwatershed descriptions later in this chapter.

Figure 3-1. Nutrient and Metals Accumulation Rates: Lake Noquebay



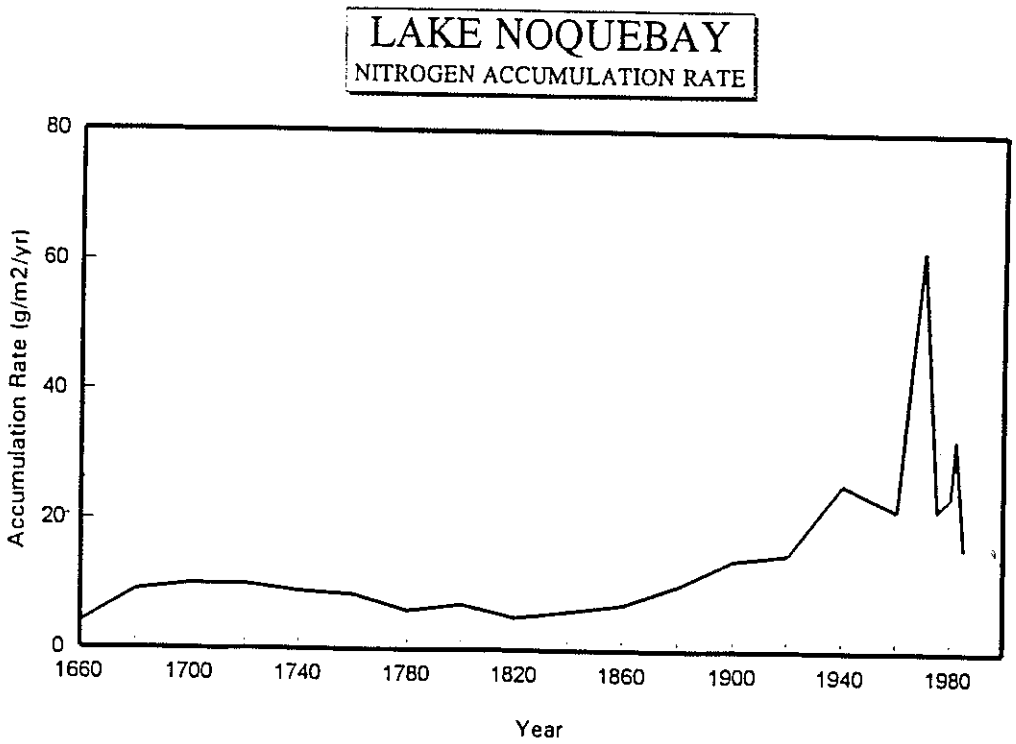
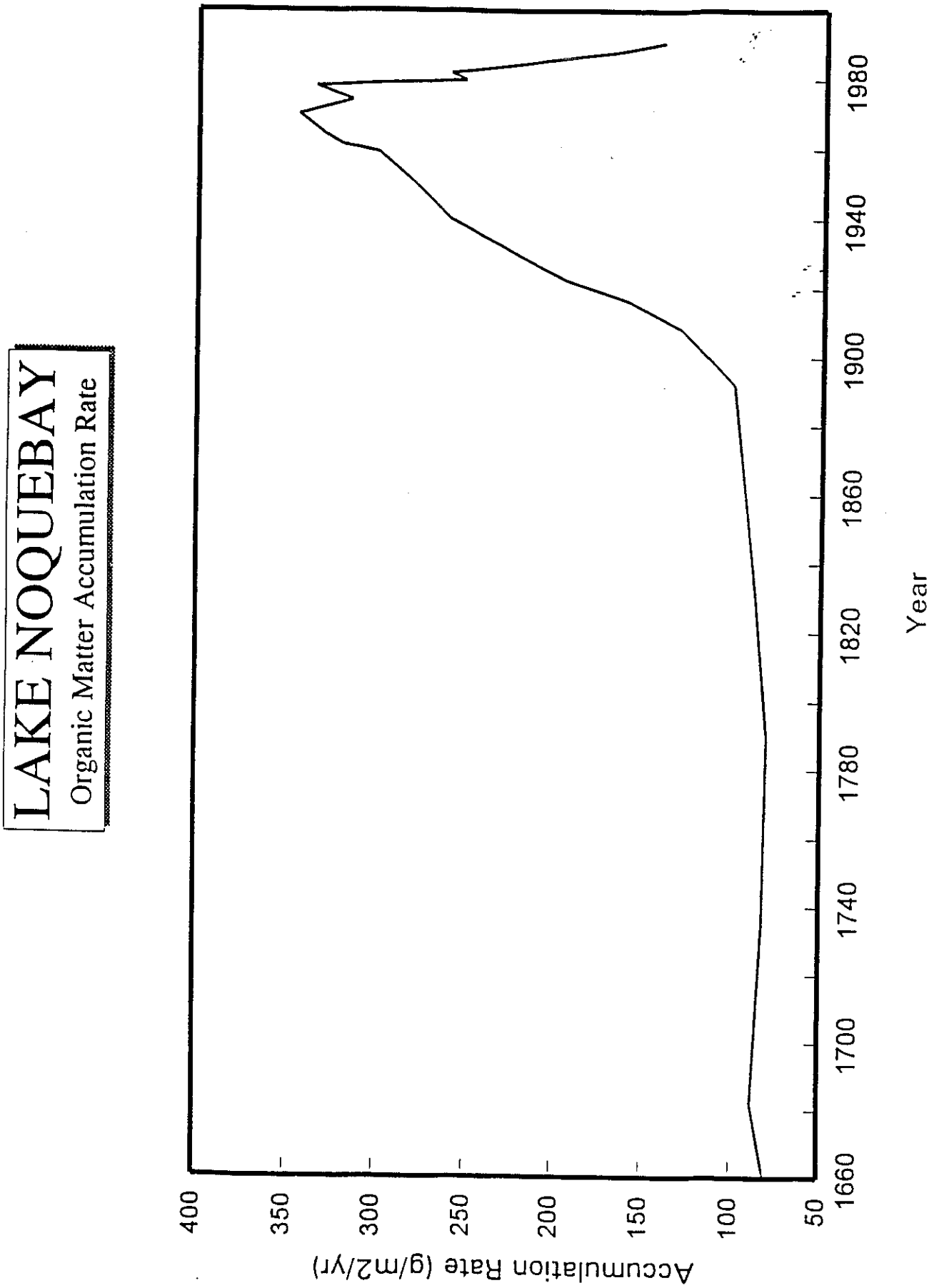


Figure 3-2. Organic Matter Accumulation Rate: Lake Noquebay



Recreational Uses

Lake Noquebay is the largest lake in Marinette County and one of the county's most popular tourist destinations, drawing sportsmen and boaters from the Fox River Valley and much of northeast Wisconsin. Recreational facilities include three public boat landings and Lake Noquebay County Park which is one of the most heavily used parks in Marinette County. There are five resorts located on the shores of Lake Noquebay and over 200 seasonal and permanent homes. Many businesses in the nearby village of Crivitz depend on the tourist dollars attracted by Lake Noquebay, which is a cornerstone of Marinette County's 43 million dollar tourist industry.

The watershed's 28 named lakes and the 64 miles of trout streams provide a wide variety of high quality fishing opportunities. The 1,300-acre Lake Noquebay Wildlife Area located on the east end of the lake is popular with waterfowl hunters and cross country skiers. Forests and wetlands throughout the watershed offer diverse recreational opportunities including wildlife observation, hiking, snowmobiling, hunting and trapping.

Water Quality Objectives

DNR staff, with assistance from the Marinette County Land & Water Conservation Department staff and DATCP, developed water quality objectives for lakes and streams throughout the watershed. Objectives were identified for each subwatershed and are listed in the following subwatershed descriptions. Details of objective development can be found in the *Lake Noquebay Water Resource Appraisal Report* (Rasman, 1994).

The following are general objectives for streams and lakes:

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

- **Enhancement**: Enhancement refers to a change in the overall condition of a stream or lake within its given biological and recreational use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the objective focuses on changing those water quality conditions which keep it from achieving its full biological potential.

- **Restoration**: Restoration refers to upgrading the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warmwater game fish,

but no longer does. This objective seeks to improve conditions allowing viable populations of forage and warmwater game fish species to become reestablished.

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

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

COLD = Coldwater Communities include surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for coldwater fish species.
WWSF = Warmwater Sport Fish Communities include surface waters capable of supporting a community of warmwater sport fish and/or serving as a spawning area for warmwater sport fish.
WWFF = Warmwater Forage Fish Communities include surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF = Limited Forage Fish Communities

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

Class I trout streams are high quality, and populations are sustained by natural reproduction.
Class II trout streams have some natural reproduction but may need stocking to maintain a desirable fishery.
Class III trout streams have no natural reproduction and require annual stocking of legal-size fish to provide sport fishing.

See table 3-1 for a summary of water resource conditions and objectives for streams in the Lake Noquebay watershed.

Table 3-1. Water Resource Conditions and Objectives for Major Streams: Lake Noquebay Watershed

Subwatershed	Stream Name	Length (Miles)	Biological Use[1] Current Use/Miles	Potential Use/Miles	Supporting Potential Use Fully-Part-Not (Miles)	Limiting Factors[2]	Observed or Potential Sources[3]	Water Resource Goals
Smith Creek	Smith Creek	10	COLD Class I / 10	Same	10	BDAM, HAB NUT	NPS	Maintain biological and recreational use Reduce nutrient loading to Lake Noquebay
Lower Middle Inlet	Lower Middle Inlet	10	COLD Class I / 10	Same	10	BDAM, HAB NUT	NPS	Maintain biological and recreational use Reduce nutrient loading to Lake Noquebay
Middle Inlet	Middle Inlet	22	COLD Class I / 13 COLD Class I / 3	Same	22	BDAM, HAB NUT	NPS	Maintain biological and recreational use Reduce nutrient loading to Lake Noquebay
	Plumadore Creek	2	COLD Class I / 2	Same	2	BDAM, HAB		Maintain biological and recreational use
	Elbow Creek	2	COLD Class I / 2	Same	2	BDAM, HAB		Maintain biological and recreational use
	Meadow Brook	7	COLD Class I / 7	Same	7	BDAM, HAB		Maintain biological and recreational use
	Springer Creek	1	WWFF / 1	Same	1	BDAM, HAB		Maintain biological and recreational use
	Pine Creek	1	COLD Class I / 1	Same	1	BDAM, HAB		Maintain biological and recreational use

Table 3-1. Continued

Subwatershed	Stream Name	Length (Miles)	Biological Use[1] Current Use/Miles	Potential Use/Miles	Supporting Potential Use Fully-Part-Not (Miles)	Limiting Factors[2]	Observed or Potential Sources[3]	Water Resource Goals
Upper Middle Inlet	Upper Middle Inlet	15	COLD Class I / 10 COLD Class II / 3	Same	15	BDAM, HAB NUT, BAC, SED	NPS	Maintain biological and recreational use Reduce nutrient and sediment loading to Lake Noquebay
	Finnegan Creek	2	WWFF / 2	Same	2	BDAM, HAB NUT	NPS	Reduce nutrient loading to Lake Noquebay
	Roosevelt Creek	<1	COLD Class I / 1	Same	1	BDAM,HAB		Maintain biological and recreational use
	Perch Creek	2	COLD / 2	Same	2	BDAM,HAB		Maintain biological and recreational use
Upper Inlet	Upper Inlet	10	COLD Class I / 10	Same	10	HAB	NPS	Maintain biological and recreational use
Peterman Brook	Peterman Brook	3.4	COLD Class I / 0.6 COLD / 2.8	Same	3.4	HAB	NPS	Reduce nutrient and sediment loading
The Outlet	Middle Inlet	22	COLD Class I / 13 COLD Class I / 3	Same	22	HAB	NPS	Maintain biological and recreational use

Table 3-1. Continued

LEGEND:

[a] The current use classification listed in NR 104.
[b] Trout stream identified in the "blue" Trout Stream Book (DNR,1980).
[c] A formal classification or classification review has been completed and approved. (These are classifications that have been completed but for one reason or another will not appear in NR 104).
[d] A formal classification or classification review has been completed. Based on this analysis the current NR 104 is incorrect and should be changed the next time NR 104 is revised.
[e] Recent studies or the professional judgement of a fish manager or aquatic biologist familiar with the water indicates this is the biological use the stream is currently meeting or has the potential to meet.
[f] Other information used

[1] Biological Use, Existing - this column indicates the existing biological use supported by the stream as defined in NR 102 (04)(3) under fish and aquatic life uses.
COLD - coldwater communities
WWSF - warmwater sport fish communities
WWFF - warmwater forage fish communities
LFF - limited forage fishery (intermediate surface waters)

Biological Use, Potential: This column indicates the biological use a stream or stream segment could meet if it was well managed and pollution sources controlled. In many cases the potential use is the same as the existing use. In other streams potential use may be higher than the existing use. Abbreviations are the same as those used in the existing use columns. The sources of information are indicated by footnotes on each table. The classifications for trout streams came from "Wisconsin Trout Streams" (DNR Publ. 6-3600[80]).

Supporting Potential Use: This column indicates whether a stream is fully, partially, or not meeting its potential biological use. An entry in any of the columns indicates the relationship between actual stream use and potential use. For example, if the entire length of a stream is listed under the "Fully" column, the stream has no problems which can be controlled. When a portion or all of a stream length is listed under another heading the stream is affected by some manageable factor, and the biological use of the stream can probably be improved.

[2]**Limiting Factors**
HAB- Habitat (lack of cover, sedimentation scouring etc.)
BDAM- Beaver Dam
SED- Sedimentation (filling in of pools)
TEMP- Temperature (extreme high for trout)
DO- Dissolved Oxygen (to low)
FLOW- Flooding or fluctuating water levels
ALG- Algae (abundant)
NUT- Nutrient enrichment
TURB- Turbidity
BAC- Bacteria (MMFCC/100 ml)

[3]**Observed or Potential Sources**
NPS- Unspecified nonpoint sources
CL- Cropland erosion
SL- Shoreline erosion
SB- Streambank erosion
PSB- Streambank pasturing
BY- Barnyard or exercise lot runoff
PSM- Point source, municipal treatment plant discharge
PSI- Point source, industrial discharge (rotten granite pit dewatering)
NMM- Non-metallic mining (rotten granite/gravel)

Subwatershed Discussions

Smith Creek Subwatershed (SC)

Subwatershed Description

The riverine portion of Smith Creek begins at the SW¼ of the SW¼ section 14, T32N, R19E and ends at Lake Noquebay. The Smith Creek (SC) subwatershed drains 9,521 acres, or 11% of the total watershed area (map 3-1). Agricultural land use accounts for 27% of the subwatershed land area. There are three lakes in the SC subwatershed; Campbell Lake, Charles Lake and Rush Lake.

Water Quality Conditions

Smith Creek has a cold water Class I sport fish community consisting of brook trout and forage species. Nutrient loads calculated from historical data show that phosphorus and nitrogen levels are elevated in Smith Creek. Water resource studies have shown that areal nitrogen loading from Smith Creek is 252% higher than the non-agricultural Upper Inlet subwatershed, while areal phosphorus loading is 168% higher.

Habitat ratings for Smith Creek at St. Paul Road were fair to good while biotic index ratings ranged from good to excellent. Smith Creek is designated as an Outstanding Resource Water. Dissolved oxygen measurements taken in June 1993 indicated 5.7 mg/l of dissolved oxygen which is below the acceptable dissolved oxygen standard of 6.0 mg/l established by the Wisconsin DNR.

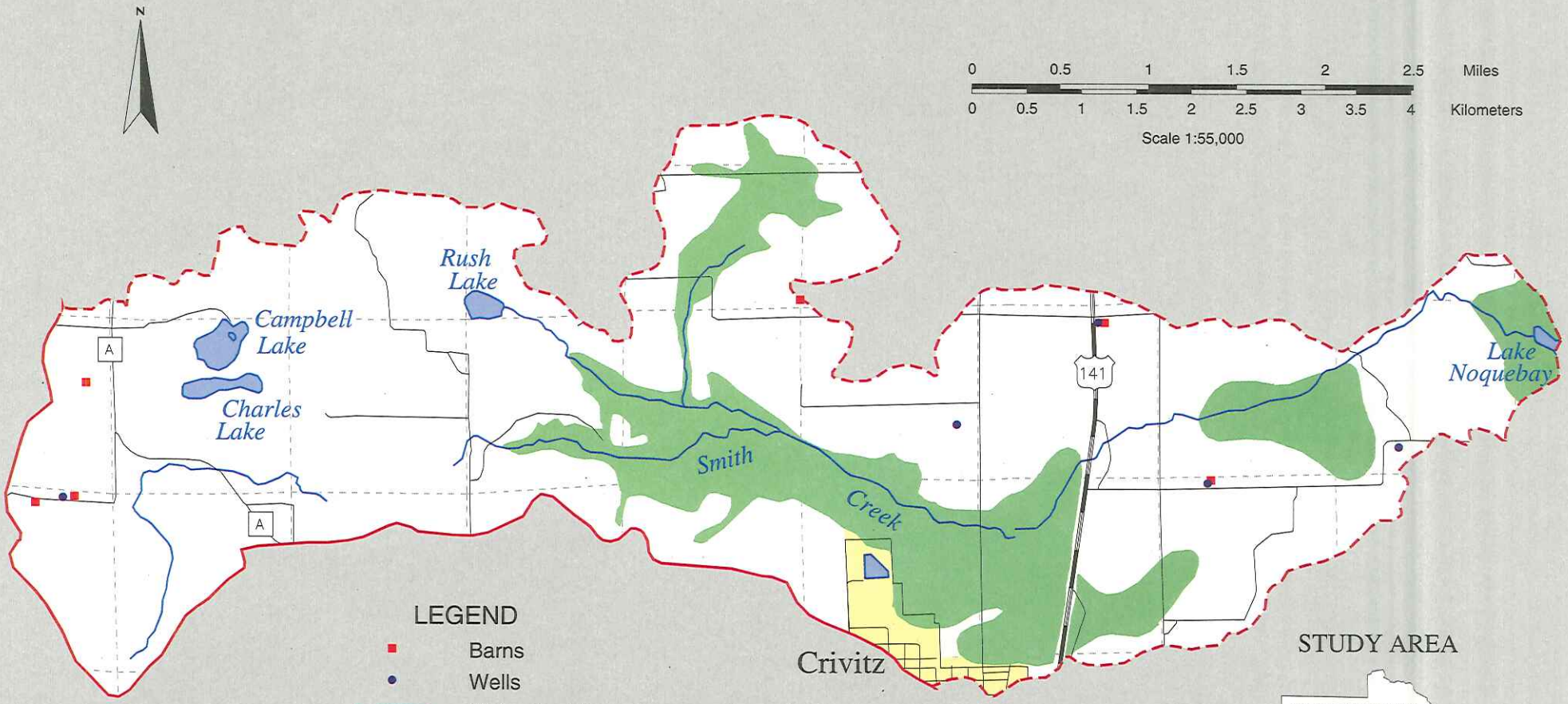
Nonpoint Source Pollutants

- The SC subwatershed contains six animal lots which contribute 263 pounds of phosphorus annually. This represents 21% of the phosphorus from barnyards for the entire watershed.

- Urban runoff from the village of Crivitz contributes 32 tons of sediment and 107 pounds of phosphorus annually.

- Upland sediment delivery in the SC subwatershed is 1,775 tons annually or 17% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 69% of the load.

Map 3- 1. Smith Creek Subwatershed



LEGEND

- Barns
- Wells
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Roads
- Township/Range/Section Line
- River or Stream
- Open Water
- Wetlands
- Municipal Area

STUDY AREA

Lake Noquebay Watershed

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Water Resource Objectives

Improve water quality and reduce nuisance macrophyte growth in Lake Noquebay by:

- Reducing phosphorus and sediment delivery to streams in the SC subwatershed by 30%.

- Reducing sediment from ephemeral gully erosion by 50%.

Lower Middle Inlet Subwatershed (LM)

Subwatershed Description

The Lower Middle Inlet originates in the NE1/4 of the NE1/4 section 35, T33N, R19E and joins Smith Creek approximately one mile from Lake Noquebay. The Lower Middle Inlet (LM) subwatershed drains 9,578 acres, or 11% of the total watershed area (map 3-2). Agricultural land use makes up 21% of the subwatershed area.

There are two lakes within the LM subwatershed. Chrizel Lake is a one-acre undeveloped spring lake which forms the headwaters of the Lower Middle Inlet. Retcof Lake is a 47-acre seepage lake with two dwellings and no public access.

Water Quality Conditions

The Lower Middle Inlet has a cold water Class I sport fish community consisting of brook trout and forage species. The stream is classified as only partially meeting its potential use. Nutrient loads calculated for the Lower Middle Inlet have shown that phosphorus and nitrogen levels are elevated. Samples collected during spring runoff contained elevated levels of BOD, ammonia, phosphorus and suspended solids. The Lower Middle Inlet and Smith Creek, which account for 22% of the land draining to Lake Noquebay, are responsible for half of the phosphorus and nitrogen delivered to the lake annually.

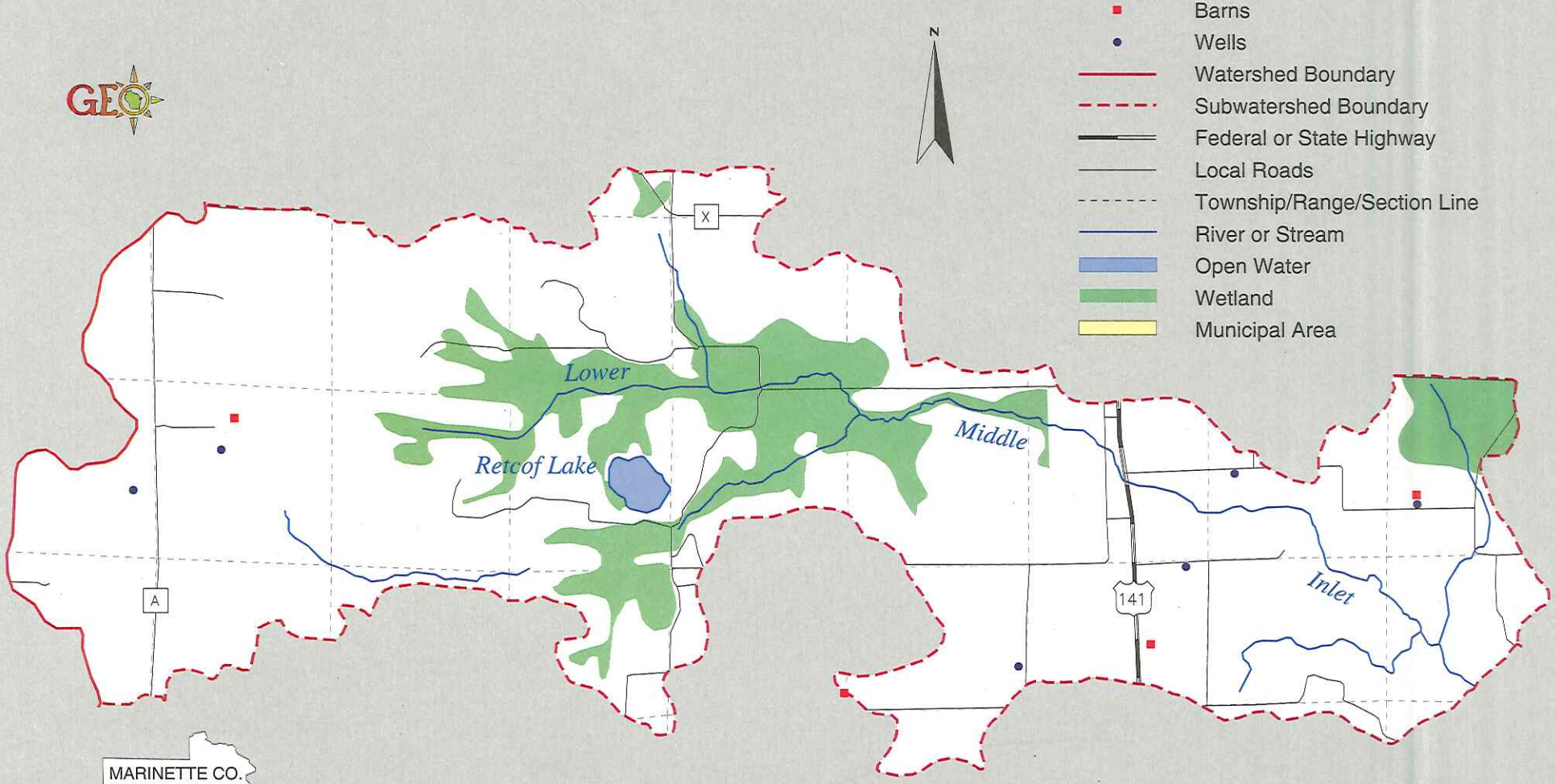
Habitat ratings for the Lower Middle Inlet were good at the Quarry Road and Cemetery Road crossings. The stream has been designated an Exceptional Resource Water by the Wisconsin DNR.

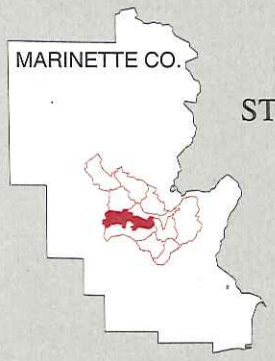
Nonpoint Source Pollutants

- The LM subwatershed contains three animal lots which contribute 238 pounds of phosphorus annually. This represents 19% of the phosphorus from barnyards for the entire watershed.

- Upland sediment delivery in the LM subwatershed is 1,503 tons annually, or 14% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 57% of the load.

Map 3- 2. Lower Middle Inlet Subwatershed





STUDY AREA

Lake Noquebay Watershed

0 0.5 1 1.5 2 2.5 Miles

0 0.5 1 1.5 2 2.5 3 3.5 4 Kilometers

Scale 1:55,000

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- Gullies in the LM subwatershed contribute 72 tons of sediment annually, this represents 100% of the known active gully erosion in the watershed.

Water Resource Objectives

Improve water quality and reduce nuisance macrophyte growth in Lake Noquebay by:

- Reducing phosphorus and sediment delivery to streams in the LM subwatershed by 22%.

- Reducing sediment from gully erosion by 50%.

Middle Inlet North, Middle and South Subwatersheds (MN, MM, MS)

Subwatershed Descriptions

The riverine portion of the Middle Inlet originates in the SW1/4 of the SW1/4 section 8, T34N, R19E and drains to Lake Noquebay. There are in excess of 24 miles of streams in the three subwatersheds which make up the Middle Inlet drainage area.

The Middle Inlet north (MN) subwatershed drains 7,026 acres of land, or 8% of the total watershed area. The primary land use in the MN subwatershed is forests, which accounts for 84% of the subwatershed land area. There are no active farms in this subwatershed (map 3-3).

There are seven lakes located in the MN subwatershed. Big Newton Lake and Little Newton Lake both have public access and are heavily developed. Rollins, Elbow, Silver, Lily and Springer Lakes are all lightly developed with no public access.

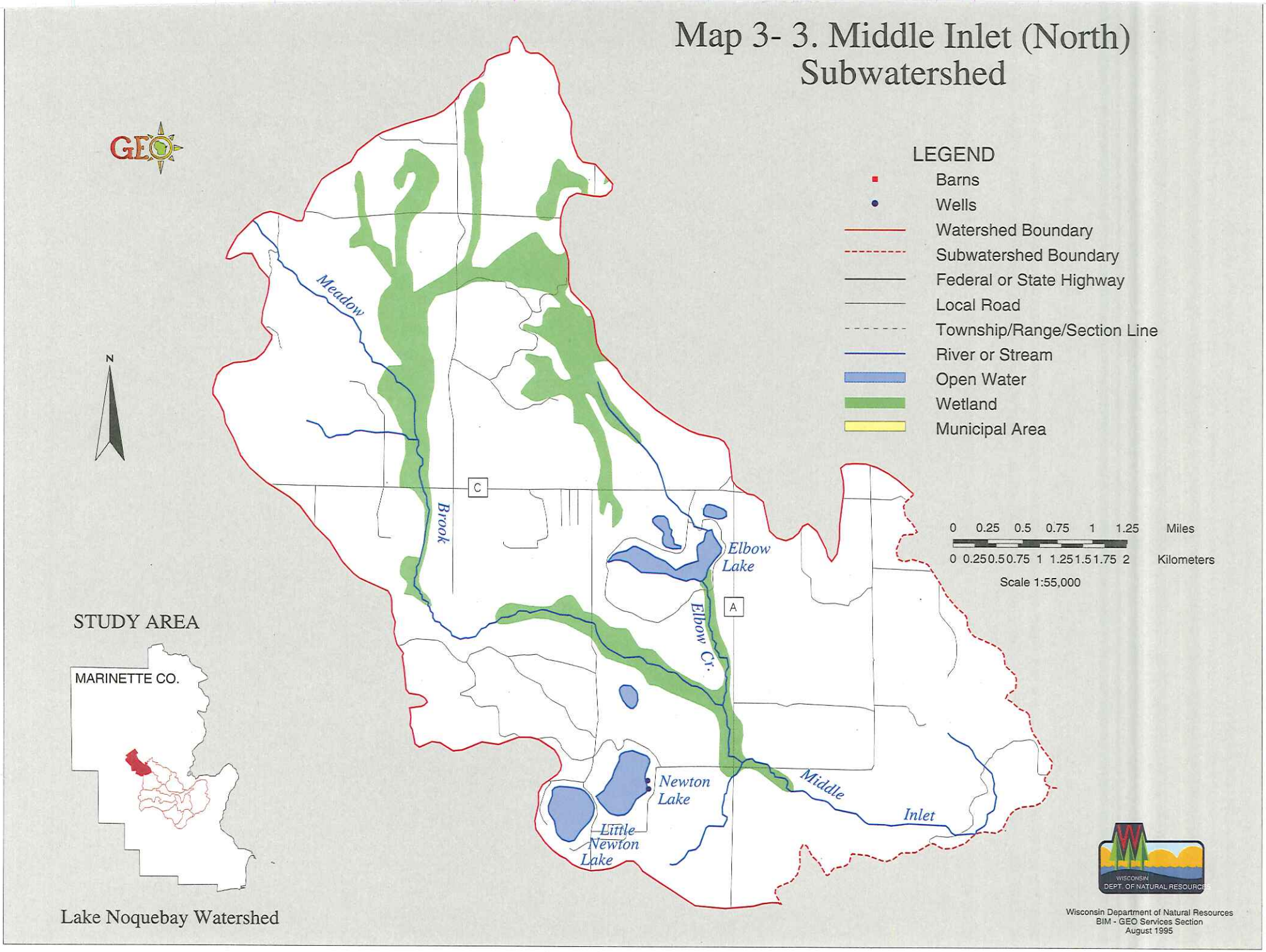
The Middle Inlet middle (MM) subwatershed encompasses 5,704 acres, or 7% of the total watershed area (map 3-4). The riverine portion of this subwatershed originates at the junction of the Middle Inlet and an unnamed stream in the SW1/4 of the NE1/4 section 1, T33N, R19E and ends in the NE1/4 of the SE1/4 section 20, T33N, R20E. Agricultural land use accounts for 20% of the subwatershed area.

Simpson Lake, a hard water spring lake, is located at the headwaters of Plumadore Creek which drains to the Middle Inlet. There are two private dwellings located on Simpson Lake and no public access.

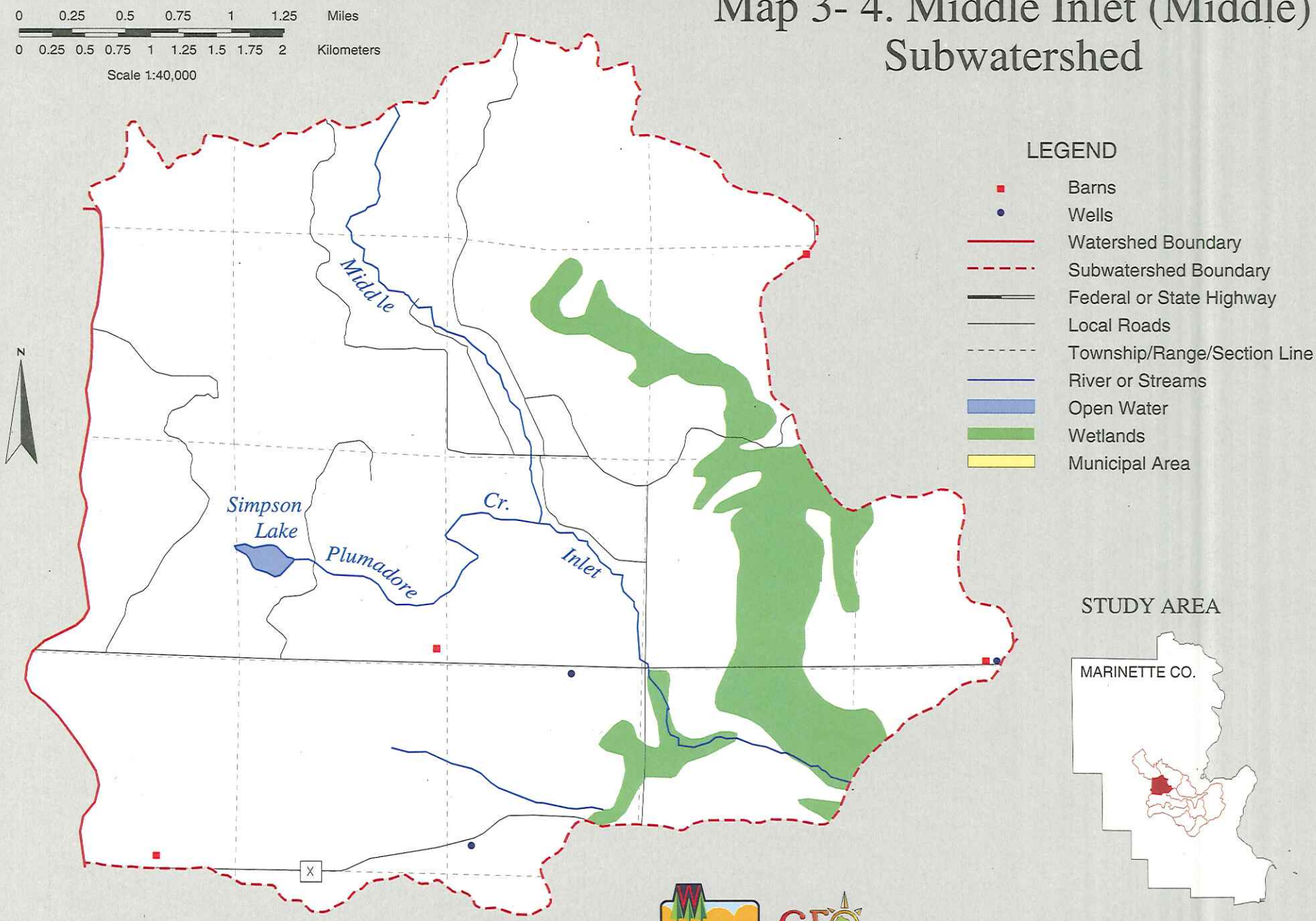
The Middle Inlet south (MS) subwatershed originates at the downstream end of the MM subwatershed and empties into Lake Noquebay on the north shore. Agricultural land use accounts for 21% of the subwatershed area (map 3-5).

Engleman Lake is the only lake located in the MS subwatershed. There are no homes located on the lake and no public access.

Map 3- 3. Middle Inlet (North) Subwatershed



Map 3- 4. Middle Inlet (Middle) Subwatershed



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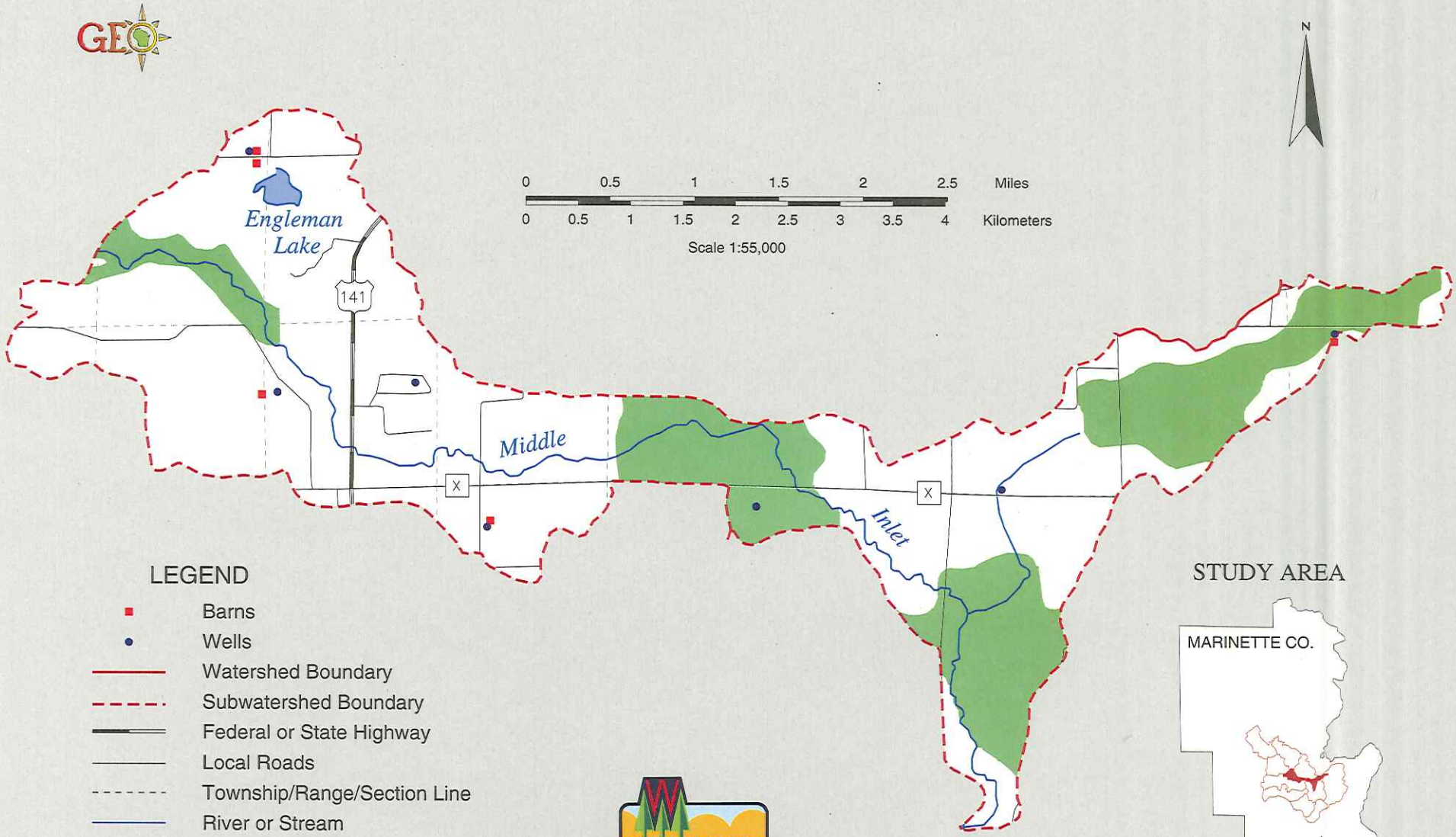
Lake Noquebay Watershed

Map 3- 5. Middle Inlet (South) Subwatershed



LEGEND

- Barns
- Wells
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Roads
- Township/Range/Section Line
- River or Stream
- Open Water
- Wetland
- Municipal Area

STUDY AREA

Lake Noquebay Watershed

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Water Quality Conditions

The Middle Inlet has a cold water Class II classification for the lower 3.3 miles of its length and cold water Class I classification for the upper 10.3 miles. The Middle Inlet was rated as having good habitat on two separate occasions. The stream has been designated an Exceptional Resource Water by the Wisconsin DNR.

Nutrient loads calculated for the Middle Inlet have shown that areal nitrogen loading is 26% higher than the primarily forested Upper Inlet subwatershed.

Big Newton Lake and Little Newton Lake both have excellent water clarity with secchi disk depth readings of four to six meters. These secchi values indicate an oligotrophic condition, however, phosphorus trophic values indicate a mesotrophic condition. Shoreline erosion, septic leachate and runoff from riparian areas all impact the water quality of the Newton Lakes.

Engleman Lake is impacted by runoff from agricultural fields which occupy more than 95% of its drainage area. Cattle access to the lake also negatively impacts water quality.

Nonpoint Source Pollutants

- There are five animal lots in the MM subwatershed which contribute 58 pounds of phosphorus annually, this represents 4.6% of the entire watershed load.

- The MS subwatershed contains four animal lots which contribute 61 pounds of phosphorus, or 4.8% of the total watershed load.

- Upland sediment delivery in the MM subwatershed is 624 tons annually, or 6% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 84% of the load.

- Upland sediment delivery in the MS subwatershed is 896 tons annually, or 9% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 62% of the load.

- Runoff from riparian areas surrounding Big Newton Lake and Little Newton Lake in the MN subwatershed delivers 52 pounds of phosphorus annually. Phosphorus and nitrogen from septic systems located in sandy soils around both lakes have the potential to negatively effect water quality.

Elevated nitrogen loading from the Middle Inlet to Lake Noquebay negatively impacts the health and ecology of the lake by stimulating excessive aquatic plant growth.

Water Resource Objectives

Improve water quality and reduce nuisance macrophyte growth in Lake Noquebay by:

- Reducing phosphorus and sediment delivery to streams in the MN, MM, and MS subwatersheds by 33%.
- Reducing sediment from ephemeral gully erosion by 50%.

Improve water quality in Engleman Lake by:

- Reducing nutrient and sediment delivery to Engleman Lake.
- Eliminating cattle access to Engleman Lake.

Improve water quality and fish and wildlife habitat in Big and Little Newton Lakes by:

- Reducing sediment loading from shoreline erosion.
- Reducing nutrient loading from riparian runoff.
- Reducing nutrient inputs by educating lakefront residents concerning the proper maintenance and use of septic systems.
- Improving fish and wildlife habitat through the use of vegetative shoreline stabilization practices using emergent wetland vegetation.

Upper Middle Inlet East and West Subwatersheds (UE, UW)

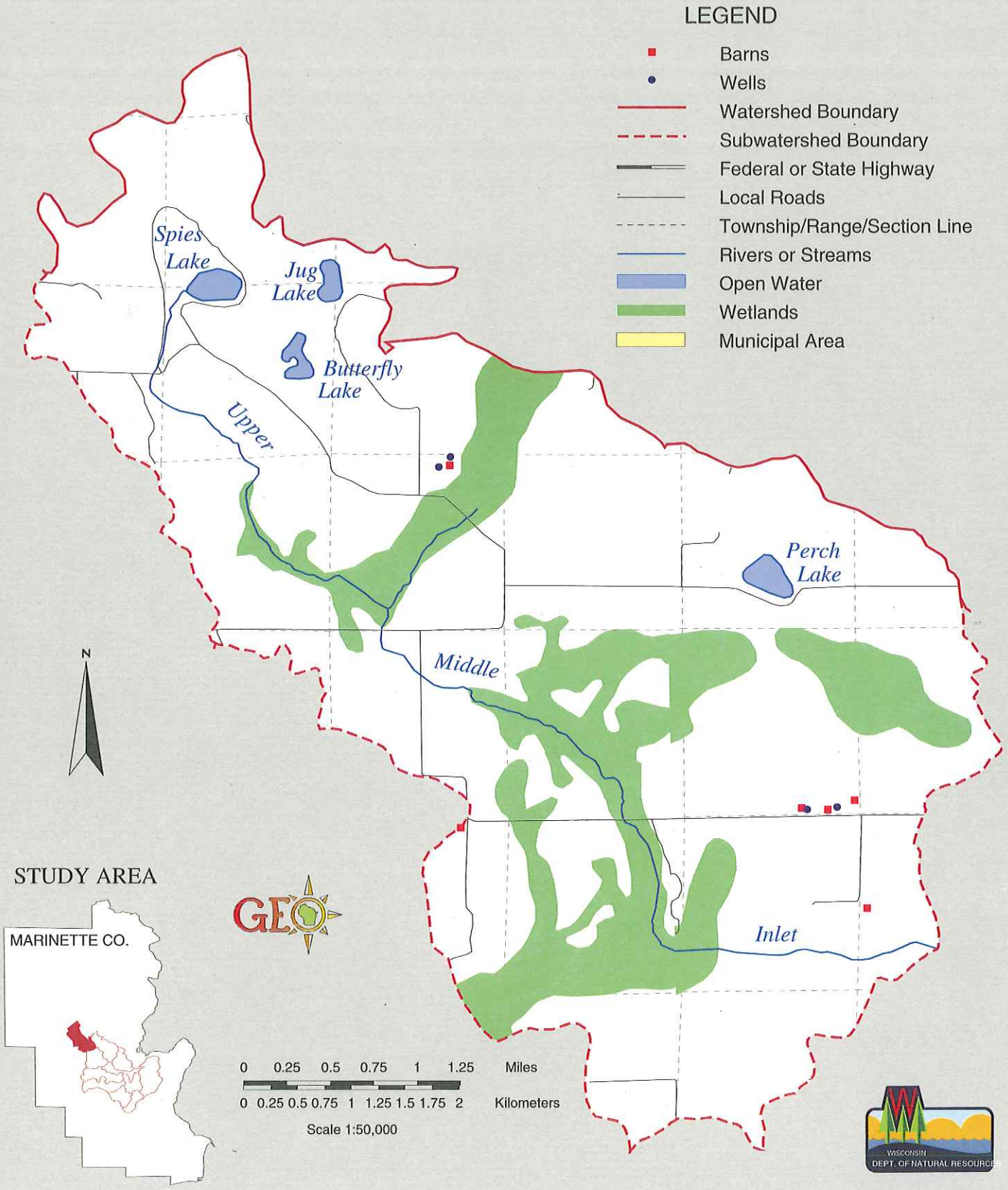
Subwatershed Descriptions

The Upper Middle Inlet originates as the outlet to Spies Lake in the NW1/4 of the NW1/4 section 30, T34N, R20E and drains to the Middle Inlet. There are 13.3 miles of streams in the two subwatersheds which make up the Upper Middle Inlet drainage area.

The Upper Middle Inlet west (UW) subwatershed drains 9,150 acres of land, or 11% of the total watershed area. Forests and wetlands in the UW subwatershed account for 74% of the subwatershed land area. Agricultural land use accounts for 22% of the subwatershed land area (map 3-6).

There are four lakes located in the UW subwatershed; Spies Lake, Jug Lake, Butterfly Lake and Perch Lake. Spies Lake is the only lake which is heavily developed. None of the lakes have public access.

Map 3- 6. Upper Middle Inlet (West) Subwatershed



Lake Noquebay Watershed

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The Upper Middle Inlet east (UE) subwatershed is 6,696 acres in size. This represents 8% of the total watershed area. The riverine portion of this subwatershed originates at the junction of the Upper Middle Inlet and Finnegan Creek and ends where the Upper Middle Inlet joins the Middle Inlet. Agricultural land use accounts for 35% of the subwatershed area (map 3-7).

There are two lakes in the UE subwatershed; Finnegan Lake and Wolf Lake. Finnegan Lake lacks public access and is undeveloped. The shores of Wolf Lake are also undeveloped due to the marshy nature of the shoreline, however, a small but densely populated subdivision called Sweetheart city is located within 1/4 mile of the lake.

Water Quality Conditions

The Upper Middle Inlet has been classified a cold water Class I trout stream for the 10.3 miles above the middle of section 18, T33N, R21E and Class II for the 3.3 miles below this point. The Upper Middle Inlet was rated as having good habitat at two sample locations. The stream has been designated an Outstanding Resource Water by the Wisconsin DNR.

Nutrient loads calculated for the Upper Middle Inlet and the Middle Inlet have shown that areal nitrogen loading is 26% higher than the primarily forested UI subwatershed. The highest concentration of farms in the watershed is located in the UM subwatershed.

Nonpoint Source Pollutants

- There are five animal lots in the UW subwatershed which contribute 150 pounds of phosphorus annually, or 12% of the entire watershed load.

- The UE subwatershed contains eight animal lots which contribute 323 pounds of phosphorus, or 26% of the total watershed load.

- Upland sediment delivery in the UW subwatershed is 1,230 tons annually, or 12% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 56% of the load.

- Upland sediment delivery in the UE subwatershed is 1,435 tons annually, or 14% of the entire watershed load. Cropland is the major source in this subwatershed, contributing 69% of the load.

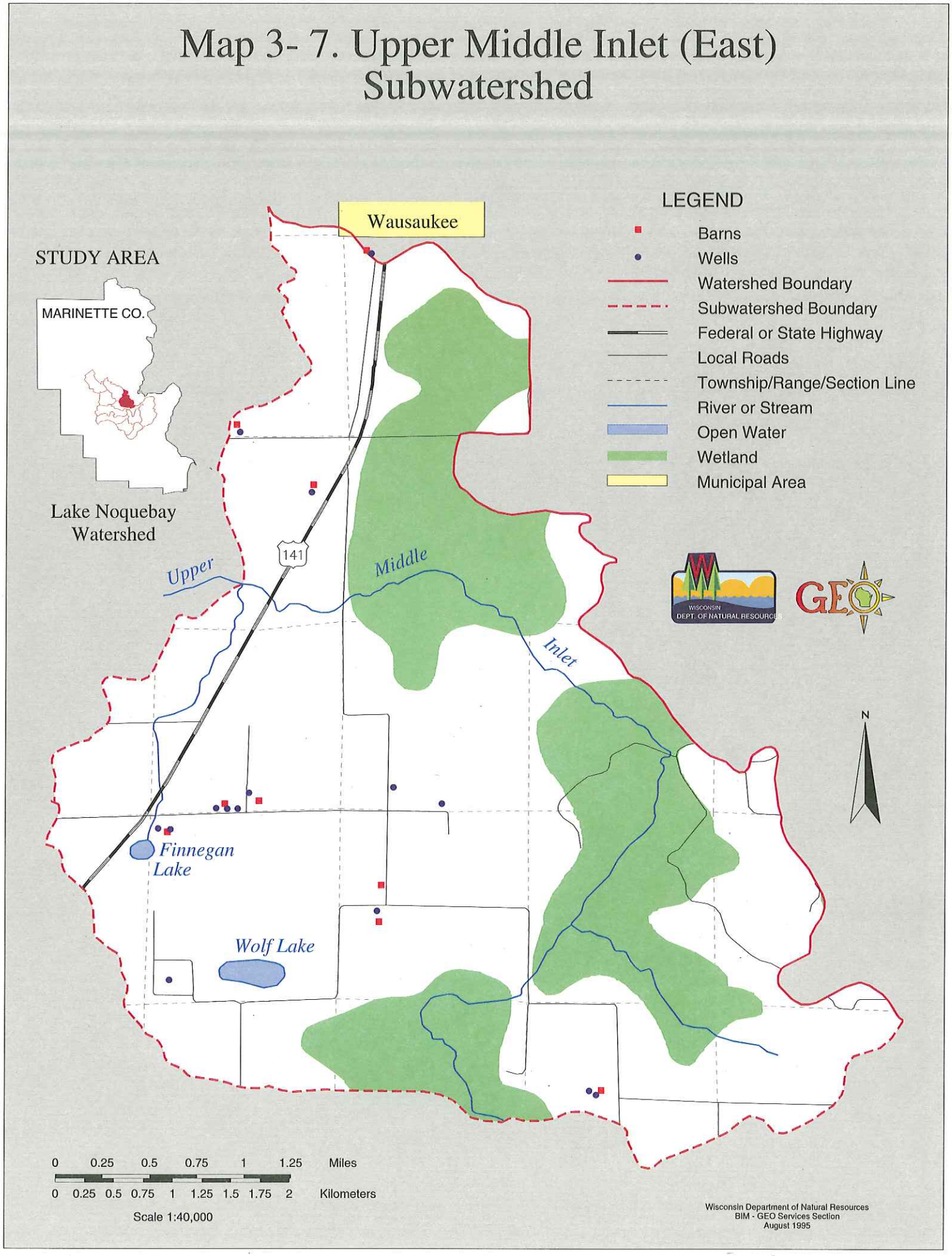
Elevated nitrogen loading from the Upper Middle Inlet to Lake Noquebay negatively impacts the health and ecology of the lake by stimulating excessive aquatic plant growth.

Water Resource Objectives

Improve water quality and reduce nuisance macrophyte growth in Lake Noquebay by:

- Reducing phosphorus delivery to streams in the UE and UW subwatersheds by 21%.

Map 3- 7. Upper Middle Inlet (East) Subwatershed



- Reducing sediment delivery from agricultural lands to streams in the UE and UW subwatersheds by 20%.

- Reducing ephemeral gully erosion by 50%.

Upper Inlet Subwatershed (UI)

Subwatershed Description

The Upper Inlet begins as the outlet to Stephenson Lake in NW1/4 of the NW1/4 section 19, T33N, R22E then flows through Mud Lake, Lake Mary and Lake Julia before emptying into Lake Noquebay. The Upper Inlet drains 16,362 acres of relatively undeveloped land, or 19% of the total watershed area (map 3-8).

Water Quality Conditions

The Upper Inlet (UI) subwatershed contains only 480 acres of active cropland, or 3% of the entire subwatershed area. Upland forests and extensive wetlands areas account for over 92% of the subwatershed. The stream has been classified as a warm water sport fish community.

Water quality studies have shown very low phosphorus and nitrogen loading from the Upper Inlet. For comparison purposes, the Upper Inlet has been used extensively in watershed planning as a benchmark stream for nutrient loading.

Water resource studies indicate that Lake Mary is a mesotrophic lake with fair water quality. Low dissolved oxygen concentrations were measured during the winter of 1994.

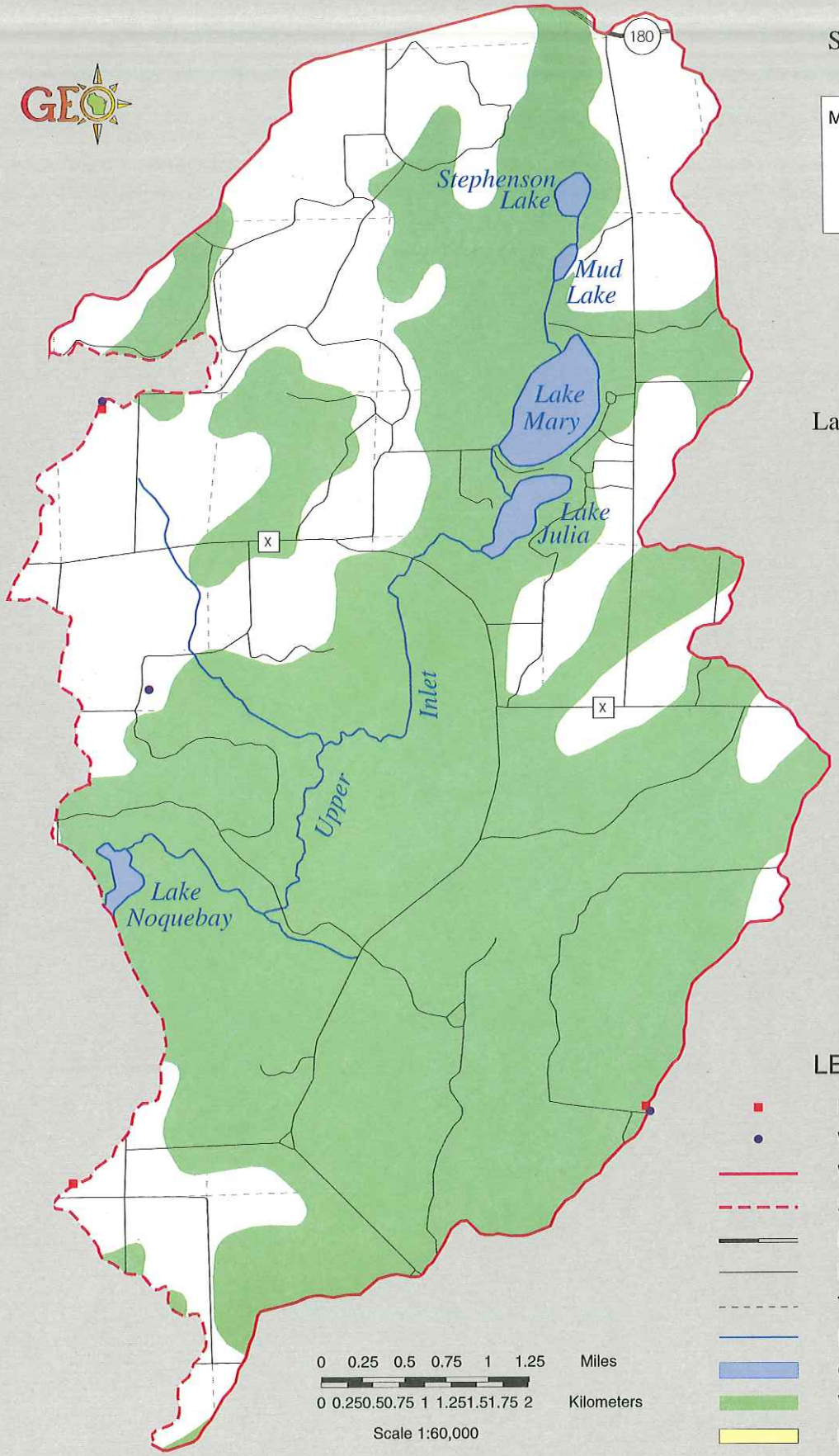
Nonpoint Source Pollutants

There is one barnyard in the UI subwatershed which delivers 5.2 pounds of phosphorus annually.

The WIN HUSLE watershed model, which was designed for agricultural watersheds, was not applied to the UI subwatershed

Much of the development surrounding Lake Mary and Lake Julia is located on poorly drained soils which are not suited to septic system placement. Septic system leachate and nutrients from riparian runoff are a source of nonpoint pollutants.

Map 3- 8. Upper Inlet Subwatershed



STUDY AREA

Lake Noquebay Watershed

N

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LEGEND

- Barns
- Wells
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Roads
- Township/Range/Section Line
- River or Stream
- Open Water
- Wetlands
- Municipal Area

Water Resource Objectives

Protect and maintain present biological and recreational uses of the Upper Inlet.

Protect and improve lake water quality in Lakes Mary and Julia by:

- Reducing nutrient input from riparian areas.
- Reducing nutrient inputs by educating lakefront residents concerning the proper maintenance and use of septic systems.

Direct Drainage Subwatershed (DD)

Subwatershed Description

The Direct Drainage (DD) subwatershed is the land surrounding Lake Noquebay which drains directly to the lake as overland flow or via secondary annual and ephemeral streams. The DD subwatershed drains 4,546 acres, or 5% of the total watershed area (map 3-9). Woodlands and wetlands make up 65%, urban riparian land use accounts for 14% and agricultural land use makes up 10% of the subwatershed area.

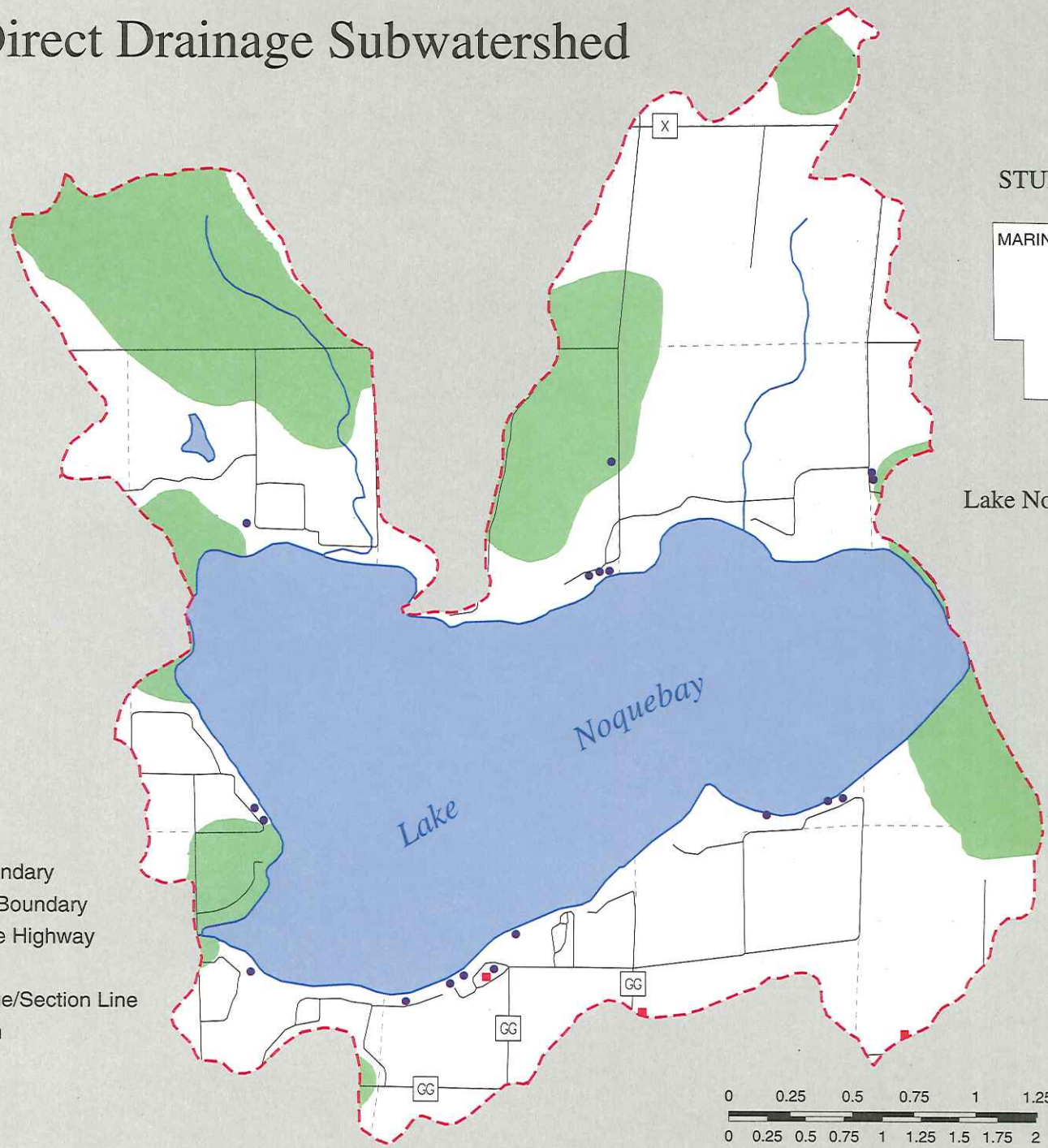
Water Quality Conditions

Lake Noquebay is characterized by variable water quality and extensive macrophyte production. Water resource investigations have shown that Lake Noquebay can be classified as a mesotrophic, or moderately nutrient rich lake. However, phosphorus and secchi trophic state values in the lower eutrophic range are common.

Nonpoint Source Pollutants

- There are three animal lots in the DD subwatershed which contribute 119 pounds of phosphorus annually, or 9% of the entire watershed load.
- The DD subwatershed contributes 736 pounds of phosphorus to Lake Noquebay annually. Runoff from the narrow band of riparian development surrounding Lake Noquebay accounts for 473 pounds, or 64% of the phosphorus delivery.
- Septic systems deliver an estimated 642 pounds of phosphorus to Lake Noquebay annually. This number may be much higher due to the location of systems in unsuitable soils, the advancing age of many septic systems and improper maintenance.

Map 3- 9. Direct Drainage Subwatershed



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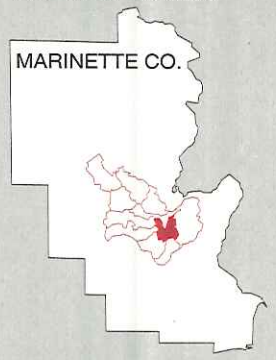
STUDY AREA



Lake Noquebay Watershed

LEGEND

- Barns
- Wells
- Watershed Boundary
- Subwatershed Boundary
- Federal or State Highway
- Local Road
- Township/Range/Section Line
- River or Stream
- Open Water
- Wetlands
- Municipal Area

0 0.25 0.5 0.75 1 1.25 Miles

0 0.25 0.5 0.75 1 1.25 1.5 1.75 2 Kilometers

Scale 1:40,000