Technical Report #78

# *Town of Dunbar*

## *Lake Planning Assessment*
## *December, 2001*

*Photo of Lily Lake, July, 2001; BLRPC*

Prepared By:
Bay-Lake Regional Planning Commission

# Town of Dunbar
# Lakes Planning Assessment

## Marinette County, Wisconsin

*December 2001*

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*Technical Report No. 79*

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# Bay-Lake Regional Planning Commission

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*The regional planning commission for Northeastern Wisconsin serving communities within the counties of:*
FLORENCE · MARINETTE · OCONTO · BROWN · DOOR · KEWAUNEE · MANITOWOC · SHEBOYGAN


December 31, 2001

Mr. Norman Wesolowski
Town of Dunbar Chairman
N18965 CCC Camp Road
Dunbar, WI 54119

Re: Town of Dunbar: Lake Management Planning Project LPL-726-01, Contract 56069

Mr. Wesolowski:

The Bay-Lake Regional Planning Commission is pleased to present this study entitled *Town of Dunbar Lakes Planning Assessment.*

In addition to describing the existing conditions of the lakes and surrounding land within the town, this plan includes planning and data collection recommendations that the town may use in addressing water quality issues.

The delivery of this report constitutes the completion of Bay-Lake Regional Planning Commission's obligation to the Town of Dunbar and the Wisconsin Department of Natural Resources regarding this lakes planning assessment.

The Commission looks forward to a continuing cooperative relationship with both the town and the Department of Natural Resources, and we trust that the information contained in this document will be a useful tool in guiding future growth and development in the Town of Dunbar.

Sincerely,

Martin W. Holden.

Martin W. Holden
Executive Director

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# CHAPTER 1 - INTRODUCTION

## CONTRACT WITH BLRPC

The town of Dunbar Board entered into a contract with the Bay-Lake Regional Planning Commission to prepare an assessment of the town and in particular the lakes within the town, including Johnson, Kidd, Town Corner, Lindquist, Lily and Mud lakes.

The Town Board worked jointly with the UW-Extension Agent, Marinette County Solid Waste and Zoning Administrator, and the Bay-Lake Regional Planning Commission to prepare the document. The Town Board provided important comment on the needs of the town and lakes as well as reviewing the information which was developed as a result of the Lake Planning Grant. Utilizing the information obtained from a nominal group survey process, the UW-Extension Agent identified important issues and concerns regarding the future development of the town of Dunbar. The issues and concerns were used to develop the goals, objectives, and policies of the plan.

This project is a first step in the development of a comprehensive land use plan for the town of Dunbar. This is the third town in the county to do this type of project that has a low rate of second home development and that are located in areas that are very rural in nature. The towns of Goodman and Wausaukee did similar plans in 1999. This project will collect and assess the types of social, physical and regulatory data that are available for the lakes and their watersheds. The project will identify deficiencies in data and make recommendations for additional data collection that will be the subject of future grant applications.

## Plan Contents

This planning assessment contains five chapters: **Chapter 1**: Introduction, contains the goals and objectives of the report; **Chapter 2**: General Physical Setting, provides a description of the natural features, soils, climate and geology of the planning area; **Chapter 3**: Population, presents information on the population and housing characteristics of the town; **Chapter 4**: Land Use, contains a land use inventory for the town, inventory of existing land use controls in the town and county and develops a density of development for the five lakes pertinent to the assessment; **Chapter 5**: presents the findings of the planning assessment as well as recommendations based off of the findings.

## State Planning Enabling Legislation

Under §66.945(12) of the Wisconsin Statutes regional planning commissions are able to enter into a contract with any local unit of government in the region under s.66.30 (Intergovernmental Cooperation) to make studies and offer: 1) advice on land use, thoroughfares, community facilities and public improvements; and 2) encouragement of economic and other developments. Recent examples of plans and studies completed by the Commission include: the *Green Bay East Shore Cumulative and Secondary Impacts Study (Part 1 & 2), Town of Goodman Lake Planning Assessment, Town of Wausaukee Lake Planning Assessment, Green Bay West Shore-Cumulative & Secondary Impacts Study, Assessment of the Resources of the Niagara Escarpment;* as well as numerous community comprehensive and smart growth plans.

## PAST PLANNING EFFORTS

The town of Dunbar has not had many planning efforts in the past, but Marinette County has been involved in a number of planning efforts and studies over the years. Listed below are past and current plans and studies that contain information and recommendations for Marinette County, including the town of Dunbar. It is important to note that these plans, if available, should be revisited from time to time in order to check on their implementation progress, or to review their goals to see if they have been achieved.

**Table 1. 1: Past Planning Efforts, Marinette County**

| YEAR | TITLE | AUTHOR |
|---|---|---|
| 1990 | Marinette County Community Development Plan | Bay-Lake RPC |
| 1979 | Marinette County Snowmobile Facility Plan 1979-1984 | UW-Extension |
| 1979 | Marinette County Farmland Preservation Plan | Community Research & Management, Inc. |
| 1977 | Marinette County Resources Conservation Program | Marinette Co Soil & Water Conservation District |
| 1971 | Marinette County Outdoor Recreation Plan | Northeastern Wisconsin RPC |
| 1970 | Marinette County Sewer and Water Plan | Max Anderson Associates |

SOURCE: BAY-LAKE REGIONAL PLANNING COMMISSION, 2001.

## COMMUNITY COMPREHENSIVE PLANNING PROCESS

The typical planning process is essentially completed in four stages. ***Initially,*** the town needs to gather public input on the concerns and issues within the community. This can be done a couple of ways. A nominal group process can be done letting the citizens of the town come together, and express their concerns about the town. These issues are then ranked by the citizens in order of importance. Another way is to mail out a survey to all land owners in the town. This approach allows seasonal residents as well as other citizens to voice their concerns.

The ***second stage,*** inventory and interpretation, begins with the collection of data on existing conditions within the community. The data is then analyzed to identify existing and potential problem areas. Using results from the public participation, as well as background data compiled during the inventory stage, the Comprehensive Plan Committee develops goals, objectives, policies and programs for each of the nine elements required in the comprehensive plan.

The ***third stage,*** is the development of the General Plan Design. The first two stages are combined to create a recommended land use plan to guide future conservation, growth and development within the town over the next twenty years. The preliminary General Plan Design is presented to the citizens of the community for their review and comment. The comments are considered and included in the final General Plan Design map and document.

The ***fourth stage,*** establishes the tools necessary for implementation of the plan. Recommendations for regulatory techniques including zoning, and an action plan were established to ensure that the intent of the plan will be achieved.

This lake planning assessment encompasses the second stage of the planning process. Much of the data gathered in this plan can be used in the future when the town decides to go on to the next step in comprehensive planning. This assessment will also aid in evaluating what resources the town has, as well as what the town needs.

# CHAPTER 2 - GENERAL PHYSICAL SETTING

## INTRODUCTION

### Statement of Purpose

This section is intended to provide an inventory of the existing physical and environmental features within the planning area. Builders, elected officials and property owners need to consider how these resources are affected by development in order to eliminate costly mistakes and a variety of construction or environmental problems. Some of the factors which need to be considered include: wetlands, floodways and floodplains, bedrock geology, scientific and natural areas, woodlands, unique wildlife habitats, areas of steep slope, and historic and archeological sites. Many of these features are found in corridors that are located along rivers, streams, shorelines and natural drainageways and are essential to the maintenance of an ecological balance and diversity, as well as for the preservation of the natural beauty of the area. This section will also inventory and assess the water quality data available for the lakes in the town.

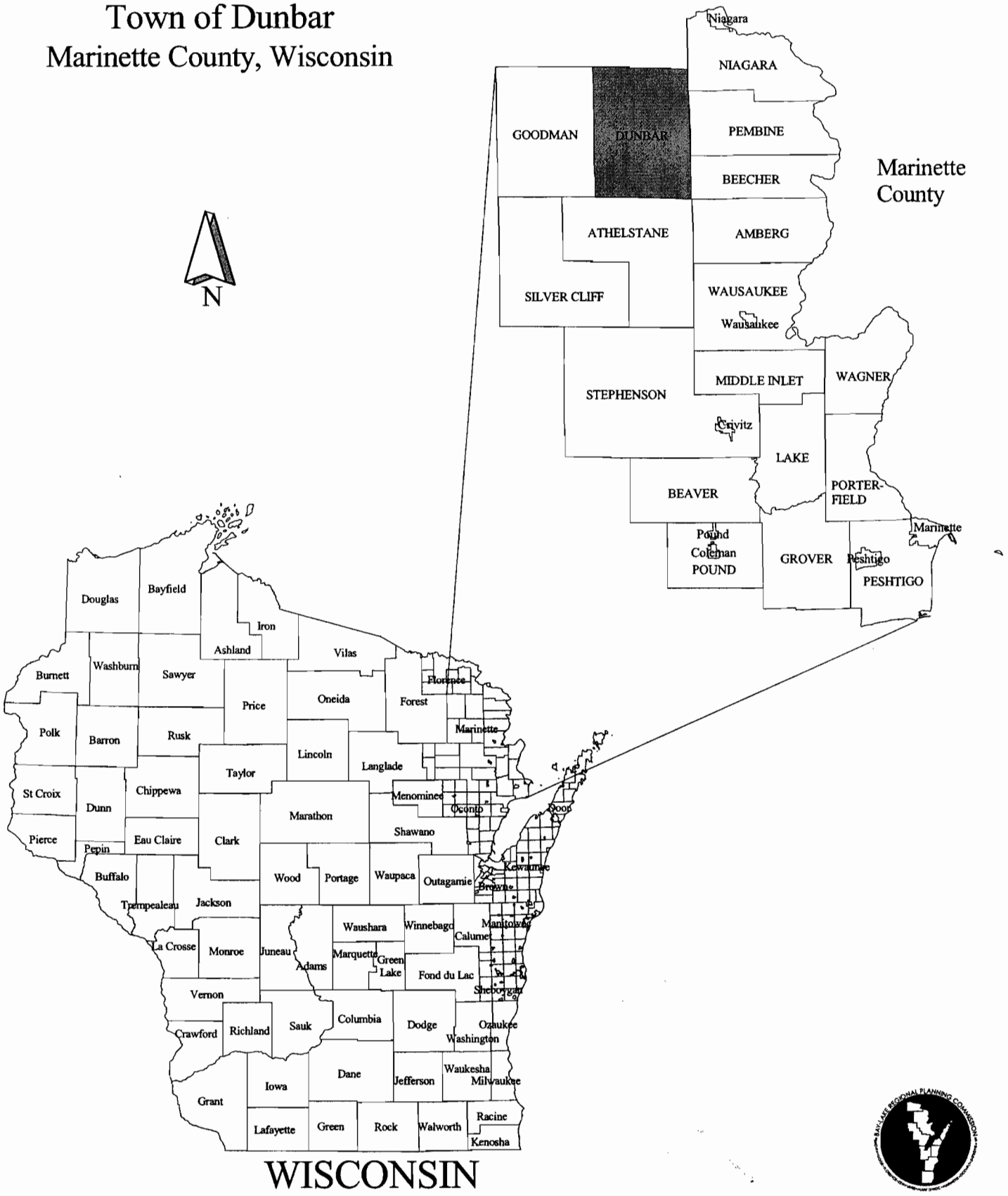
### Description of the Town of Dunbar Planning Area

The town of Dunbar is located in the north western portion of Marinette County and lies partially within the boundaries of the Marinette County Forest (Map 2.1). The town, comprised of 108 square miles, has a 2000 population of 1,303 persons. It is bounded by the towns of Aurora and Homestead in Florence County to the north, the towns of Niagara, Pembine and Beecher to the east, the town of Athelstane to the south, and the town of Goodman to the west. The town of Dunbar encompasses approximately 67,270 acres (108 square miles) of which the vast majority is within woodlands. The town is located approximately 25 miles southwest of the City of Niagara, 50 miles northwest of Marinette and 100 miles northwest of Green Bay, Wisconsin.

# Location Map

## Town of Dunbar

## Marinette County, Wisconsin




Source: Bay-Lake Regional Planning Commission, 2001.

## PRINCIPAL PHYSICAL ELEMENTS

### Geology

#### Bedrock Geology

The bedrock in Dunbar is a continuation of the Canadian Shield and consists of Lower Precambrian and Cambrian rock types. Crystalline and undifferentiated Precambrian rock of metamorphic and igneous types are found in the planning area throughout the whole town. These include gneiss and granite types of rock. There is also a small section of sedimentary (dolomite and shale) rock in the southern part of town. (Map 2.2).

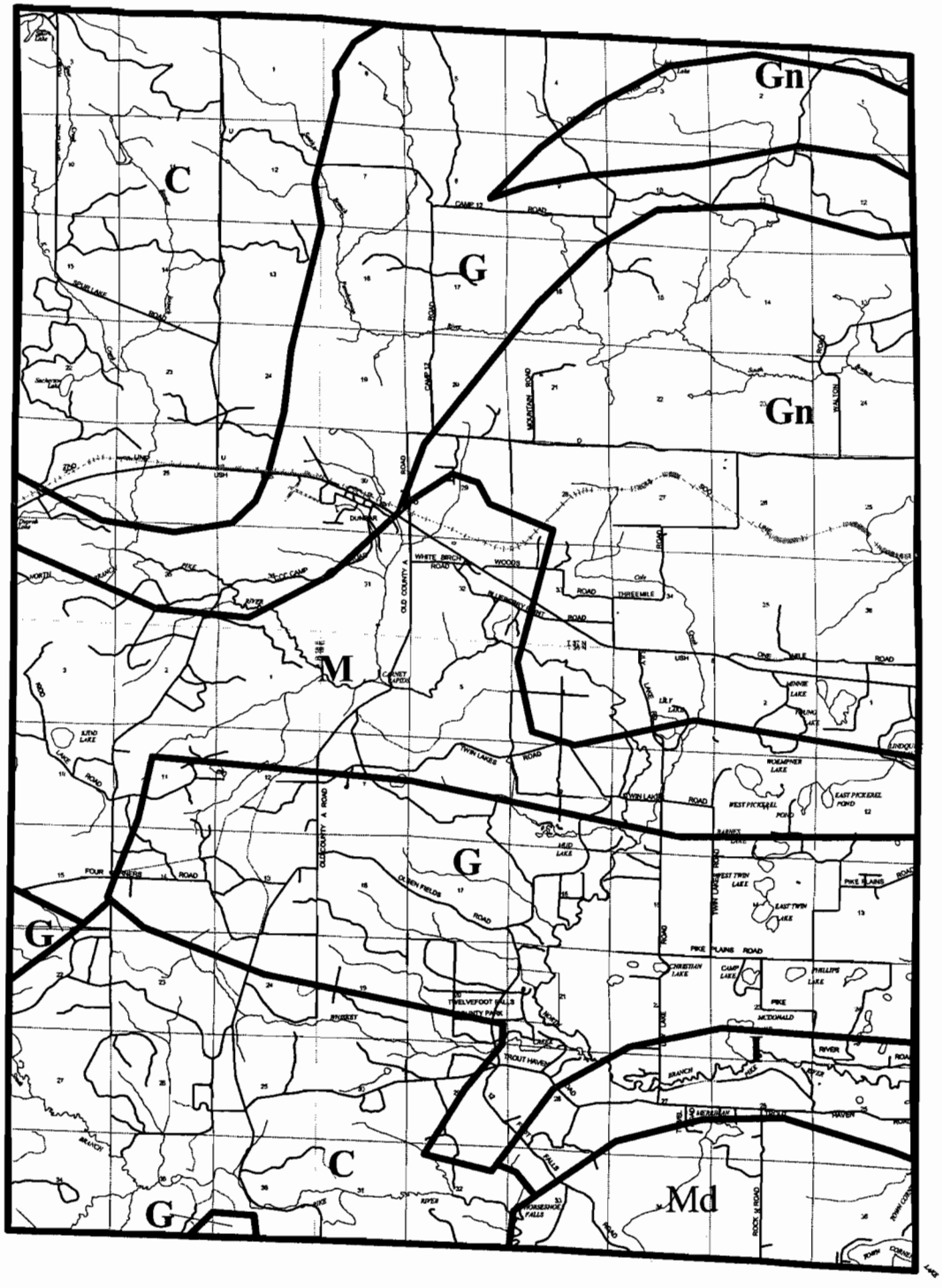
#### Pleistocene Geology

The town of Dunbar falls within the Northern Highlands geomorphic region. This region is comprised of a complex of igneous and metamorphic rocks dating more than 600 million years old. Continental glaciers moved across the planning area in a southwesterly direction forming drumlins, eskers, and other glacial features. Dunbar has a variety of deposits including stratified drift of outwash and ice-contact deposits and unstratified drift of clay, silt, pebbles and boulders (Map 2.3). Stratified drift is sandy outwash ice-contact deposits that were laid down by melt water during glaciation and are good sources of ground water because of high permeability. Unstratified drift contains unsorted sandy, clay till laid down directly by thin ice sheets and are usually poor sources of ground water because of their low permeability (Oakes and L.J. Hamilton).

Across the hills and valleys created by the glacial action, mostly in the northern and western portions of the town, winds deposited silty material which covered the glacial deposits and formed a basis for the original hardwood-conifer forests.

Map 2.2

# Bedrock Geology
## Town of Dunbar
### Marinette County Wisconsin




N

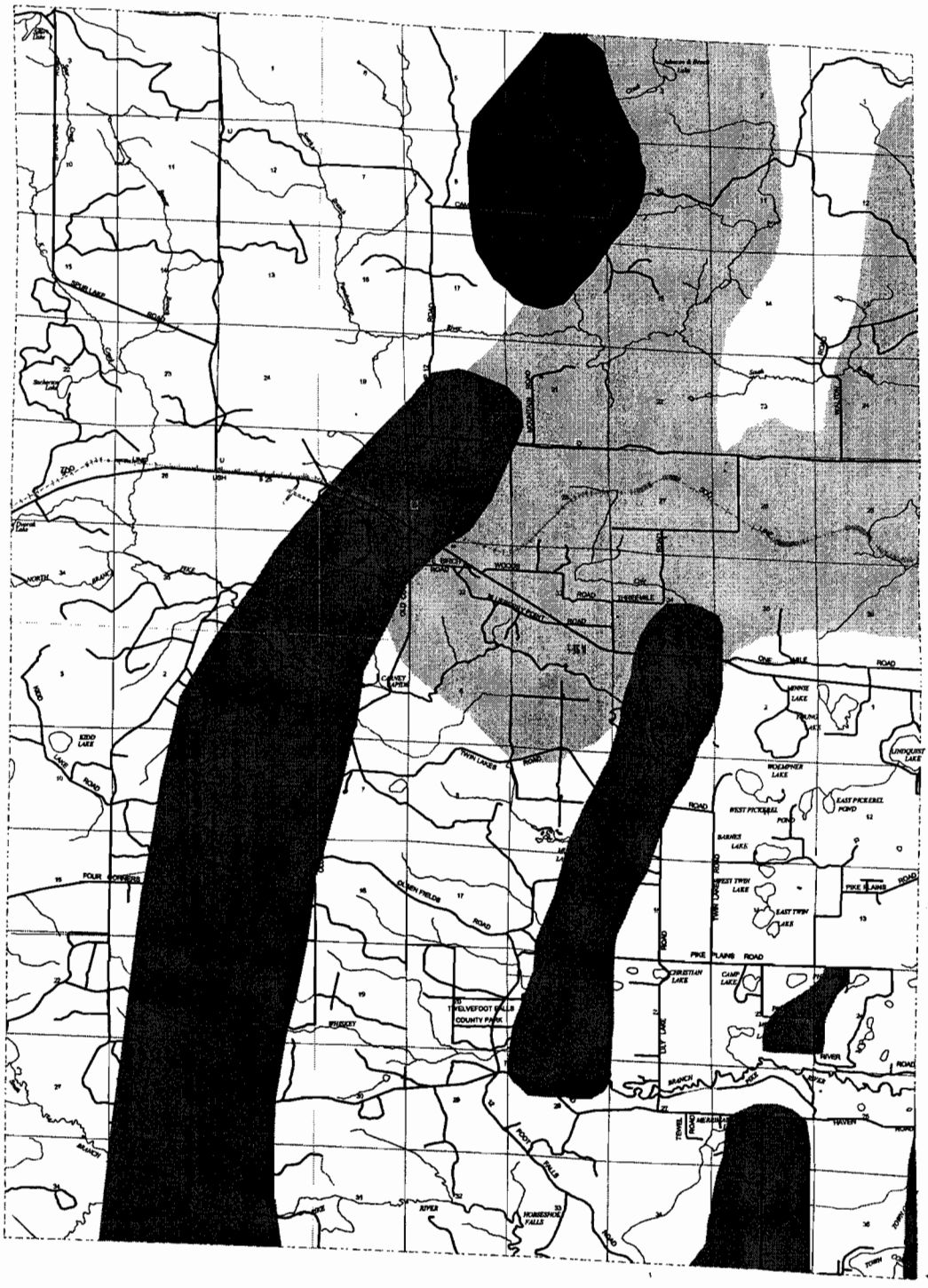
4000 0 4000

Feet

C - Carbonate
Gn - Gneiss
I - Intermediate
M - Metavolcanic
G - Granitoid
Md - Mudstone

Source: FEMA FIRM, 1982: Bay Lake Regional Planning Commission, 2001.

# Pleistocene Geology
## Town of Dunbar
### Marinette County Wisconsin




N

4000 0 4000

Feet

- Lake Deposits
- End Moraine
- Ground Moraine
- Outwash & Ice-Contact Deposits

Source: NRCS, 1978: Bay Lake Regional Planning Commission, 2001.

## General Soils

The soils within the planning area are made up of the sandy/loam Ishpeming, Pence-Padus loam, and the sandy Sayner association. (Map 2.4).

### Ishpeming-Michigamme-Menahga Association:

The soils in this association are found on moraines, outwash plains and rock outcrop. They are moderately deep, gently sloping to moderately steep, excessively drained to well drained, sandy, loam soils. Permeability is rapid. Most areas in the county of this soil type is used as woodlands. Equipment use is limited in Michigamme soils during wet periods due to low soil strength, and numerous bedrock outcrops. These soils are poorly suited to dwellings with basements and septic tank absorption fields mainly because of the shallowness to bedrock.

### Pence-Padus-Greenwood Association:

These loamy soils are found on outwash plain, stream terraces, moraines, kames, and eskers. The landform ranges from broad, convex plains to irregularly shaped ridges, and slopes from 1 to 35 percent. Pence soils are found on flats, broad ridgetops, and side slopes of ridges. They are characterized by being well drained, varied slope (1 to 35 percent), and low water capacity. The upper, loamy layer has moderately rapid permeability, whereas in the substratum it is rapid or very rapid. Padus soils are also found on flats, ridgetops, and side slopes of ridges. They are well drained and a little less steep compared to the Pence soils (1 to 25 percent). These soils have a moderate to moderately rapid permeability in the loamy upper profile, and rapid to very rapid in the sandy and gravelly substratum. Water capacity is moderate. Areas within the Pence-Padus association are mainly used for woodlands. Managing concerns are equipment limitations; Pence soils for steep slope, and Padus for low soil strength during wet periods and slope. Less sloping areas are suited to dwellings, but all areas are poorly suited for septic due to the danger of ground water pollution from their poor filtering capabilities.

### Sayner-Rubicon-Omega:

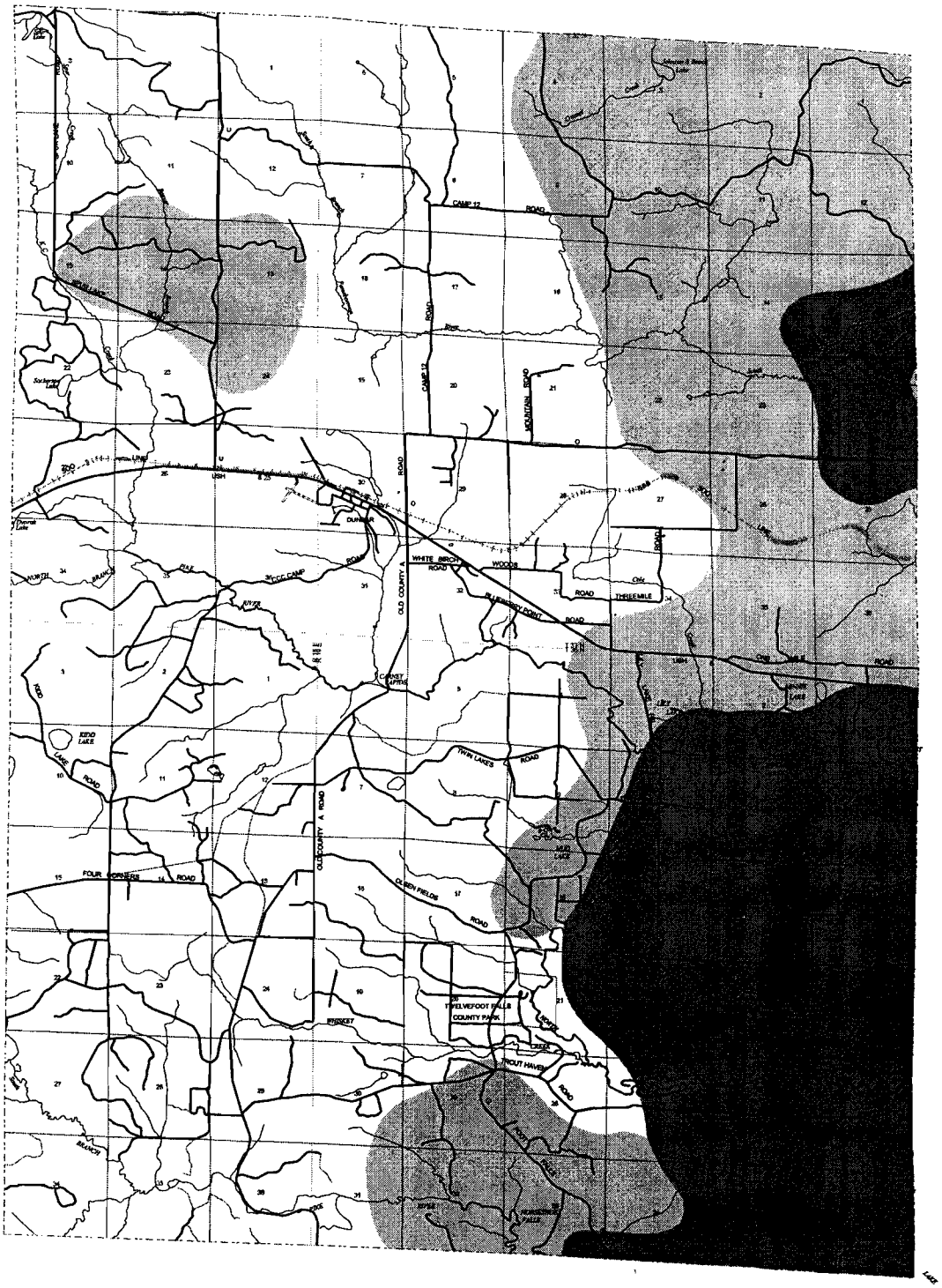
The soils in this association are found on moraines, outwash plains and stream terraces. These soils are excessively drained, and the slope ranges widely from 0 to 25 percent. Most of the area in the county of this type is in woodlands. Problems for managing for woodlands are equipment limitations because of the sandy soils, the steep slope in certain areas, and water erosion in areas of steep slope. Some areas in less sloping terrain may be used for certain crops, but need to be managed for droughts and soil blowing. These soils are not suited well for septic tanks because the poor filtering capacity creates a danger for ground water pollution. Less sloping areas are suited for dwellings.

Map 2.4

# General Soil Associations

## Town of Dunbar

### Marinette County Wisconsin




N

4000 0 4000

Feet

- Sayner-Rubicon-Omega
- Padus-Pence-Greenwood
- Ishpeming-Michigamme-Menahga

Source: WDNR: Bay Lake Regional Planning Commission, 2000.

## Steep Slope

In order to determine where areas of steep slope (greater than 12 percent slope) exist within the town of Dunbar, the Commission used the Soil Survey of Marinette County, Wisconsin as produced by the Natural Resource Conservation Service. The town has approximately 3,770 acres of steep slope, primarily located in the central and east central part of the town. The areas of steep slope reflect the different geologic and physiographic regions of the county (Map 2.5).

## Water Resources

### Watershed and Sub-watersheds

Lakes, rivers, and streams comprise the surface water resources within the town of Dunbar and make up the Menominee drainage basin. There are two main watersheds within this basin. The Pike River watershed makes up 65 percent of the town and is found in the western and southern part of town. The Pemebonwon River watershed is found on the northeast Within these watersheds, there are 12 sub-watersheds (Map 2.6). Drainage of the town's surface waters is typically west to east and flows into the Menominee River and eventually to the Bay of Green Bay.

### Surface Water Features - Lakes and Ponds

The following information for the lakes within the town has been taken from the Wisconsin Department of Natural Resources *Surface Water Features of Marinette County, 1975*. Lakes are defined as all waters navigable, meandered or public that hold water nine out of ten years. Map 2.7 shows the location of these lakes.

#### *Barnes Lake*

Barnes lake has approximately 27.3 surface acres and a maximum depth of 19 feet with a secchi disk depth of 13 feet. It is a medium hard water seepage with neutral, clear water of high transparency. The littoral zone consists of gravel (35%), sand (35%) and muck (30%). The entire shoreline is upland with a mixture of hardwoods, softwoods, and pasture. This lake is home to such fish as largemouth bass, bluegill, and perch. However, waterfowl are limited here. Floating vegetation makes up 40% of the lake basin while submergent vegetation covers 30%. There is no public access to the lake.

#### *Camp Lake*

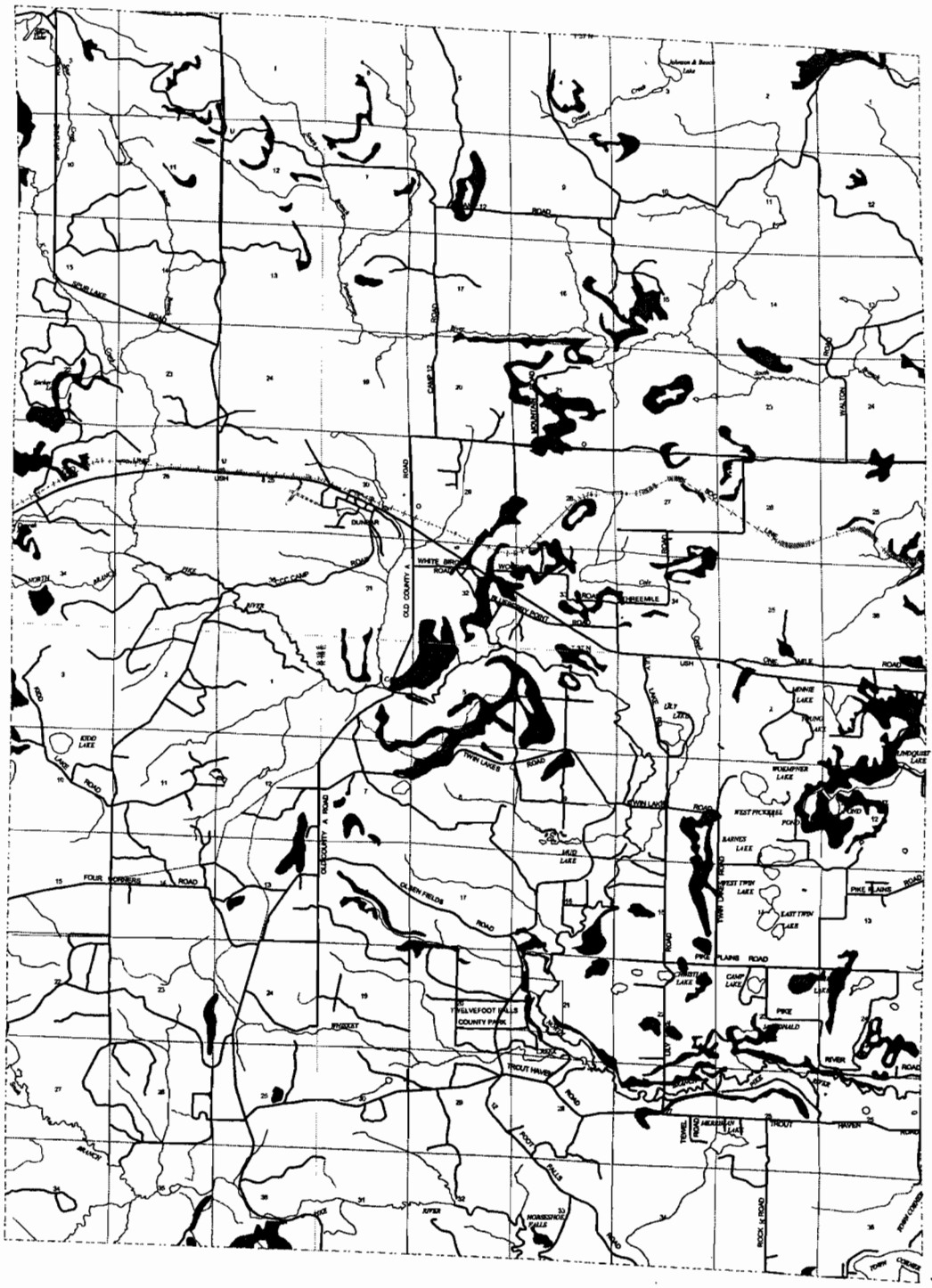
Camp Lake has approximately 7.3 surface acres and a maximum depth of 14 feet. It is a medium hard water seepage lake consisting of neutral, clear water of moderate transparency (secchi disk depth of nine feet). The littoral zone is composed primarily of muck and gravel. The entire shoreline is upland, consisting of hardwoods, conifers and cleared land. The fish population consists of small perch and bluegill with winterkill being an occasional problem. Waterfowl make limited use of the lake. There is no public access.

#### *Christian Lake*

Christian Lake is a 5 acre lake with a maximum depth of 19 feet. It is a soft water seepage lake with clear, highly transparent, and slightly acidic water. The secchi disk depth is 19 feet. Sand (20%) and muck (80%) make up this lake's littoral zone. The shoreline is 100% upland and is comprised of hardwoods and scattered conifers. There is limited use of the lake by waterfowl. Largemouth bass and panfish have solid populations here.

Map 2.5

# Steep Slope
## Town of Dunbar
### Marinette County Wisconsin



N

4000 0 4000

Feet

Slope Greater than 12 Percent

Source: NRCS, 1982: Bay Lake Regional Planning Commission, 2001.

### *East Pickerel Pond*

Pickerel Pond has approximately 9.1 acres of surface and a maximum depth of 35 feet, however nearly fifty percent of the lake is in excess of twenty feet in depth. The water is clear and highly transparent (secchi disk depth of 17 feet), and slightly alkaline. The littoral zone is made up of muck (95%) and sand (5%). The shoreline is 95% upland and consists of hardwoods, while the wetland area is meadow. The inlet originates in West Pickeral Pond and the outlet flows to the South Branch of the Pemebonwon River. Northern Pike, Largemouth Bass and Panfish are reported to inhabit this lake. There is limited use of the lake by waterfowl. There is no public access.

### *East Twin Lake*

This 6.9 acre seepage lake has a maximum depth of 21 feet with a secchi disk depth of only 4 feet. The water is stained of low transparency and acidic. Muck makes up the littoral zone. The shoreline is primarily upland (90%) consisting of mixed hardwoods and conifers, with a limited area of open bog wetland on the south end. The known fish population consists of largemouth bass, bluegill and perch. Waterfowl make limited use of the lake. There is no public access.

### *Johnson and Beach Lake*

Johnson and Beach Lake is a 14 acre drainage lake with a maximum depth of 7 feet, however seventy percent of the lake is less than 3 feet in depth. The water is alkaline, slightly stained and of moderate transparency (secchi disk depth of 7 feet). Muck makes up the littoral zone. The shoreline is wetland (100%), consisting of shrub bog. Information of fish species is lacking, but forage fish are probably present. There is wilderness public access from county land surrounding the entire lake. Both the inlet and outlet are part of Crossett Creek.

### *Kidd Lake*

This 21 acre seepage lake has a maximum depth of 5 feet and alkaline, slightly stained water of moderate transparency (secchi disk depth of 5 feet). The littoral zone is made up of silt (50%),sand (30%) and muck (20%). The shoreline is made up of wetland (60%) and upland hardwoods (40%). Information is lacking on fish species present in the lake, but due to its shallow depth and susceptibility to winterkill, minnows are most likely all that is present. Waterfowl make limited use of the lake. Unimproved and difficult public access can be found on the south side of the lake.

### *Lily Lake*

Lily Lake is a 24 acre hard water drainage lake with a maximum depth of 19 feet and a secchi disk depth of 11 feet. The water is acidic, slightly stained and of moderate transparency. The littoral zone is composed of sand (50%), muck (40%) and gravel (10%). The shoreline is composed of upland (85%) and wetland (15%). Fish species include largemouth bass, black crappie, perch and bluegill. Waterfowl make limited use of the lake. Some development inhabits the shoreline. Unimproved or difficult public access and swimming facilities are provided at the west end of the lake.

### *Lindquist Lake*

This hard water drainage lake has slightly alkaline, clear water of high transparency. The secchi disk depth is 15 feet and a maximum depth of 58 feet with 75% of the lake in excess of 20 feet. The littoral zone is composed of sand (60%), muck (40%), gravel (8%) and rubble. The shoreline

is composed of upland of mixed hardwoods and conifers (85%) and wetland of bog and shrub (15%). Fish species present include northern pike, largemouth bass, bluegill, pumpkinseed, black crappie, perch, and white sucker. Waterfowl make limited use of the lake. The outlet flows to the South Branch of the Pemebonwon River. There is some development present on the shoreline. The town of Dunbar landing with parking provides public access on the southwest side of the lake. The town of Pembine picnic site and swimming beach on the east side of the lake.

***McDonald Lake***

McDonald Lake is an 11 acre spring lake with a maximum depth of 8 feet. The water is alkaline, clear and highly transparent (secchi disk depth greater than 8 feet). The littoral zone is made up of silt (50%), marl (25%), sand (20%), and gravel (5%). The shoreland is entirely upland consisting of hardwoods and conifers. The outlet flows to the North Branch of the Pike River. Fish species present are largemouth bass, bluegill and white sucker. Waterfowl make limited use of this lake. There is no public access.

***Merriman***

Merriman Lake is a hard water seepage lake with slightly alkaline, medium brown water of maoderate transparency. The 19 acre lake has a maximum depth of 12 feet and a secchi disk depth of eight feet. The littoral zone is made up of sand (90%), detritus (5%) and silt (5%). The shoreline is entirely upland consisting of conifers and hardwoods. Fish species that inhabit the lake are largemouth bass and bluegills. Winterkill has occurred in the past when water levels are low. Waterfowl make limited use of this lake. There is no public access.

***Minnie Lake***

This seepage lake has a maximum depth of 7 feet and has hard brown water of maoderate transparency (secchi disk depth of 7 feet) The littoral zone of this 9 acre lake is entirely composed of muck. The shoreline is entirely wetland, consisting primarily of open bog. The fish species probably consists of forage species. Winterkill most likely occurs. Waterfowl make limited use of this lake. There is no public access.

***Mud Lake***

Mud Lake is a 6 acre, medium hard drainage lake (impoundment). The maximum depth is five feet and water is slightly acidic, light brown and of moderate transparency (secchi disk of five feet). The littoral zone is made up of muck (99%) and sand (1%). The shoreline is open bog (95%) and upland (5%), consisting of mixed hardwoods and conifers. The outlet flows to the North Branch of the Pike River. Panfish are the only fish species known to inhabit the lake. Waterfowl make limited use of this lake. There is unimproved or difficult public access from a town road.

***Phillips Lake***

Phillips Lake is a 9.4 acre, hard water seepage lake with a maximum depth of 18 feet. The water is acidic, clear and of high transparency (secchi disk depth of 18 feet). The littoral zone is composed of sand (50%), muck (40%) and gravel (10%). The shoreline is entirely made up of upland consisting of hardwoods and conifers. Fish species present are largemouth bass and bluegills. Waterfowl make limited use of this lake. There is no public access.

*Sackerson Lake*

This hard water spring lake has a surface area of 13 acres and a maximum depth of 23 feet. The water is alkaline, clear and of high transparency (secchi disk depth of 19 feet). The littoral zone is composed of sand (50%), muck (20%), gravel (15%), rubble (10%) and boulders. The entire shoreline is upland consisting of mostly hardwoods and some conifers. The outlet flows to K.C. Creek. Fish species known to inhabit this lake are perch and brown trout. Waterfowl make limited use of this lake. There is no public access.

*Spur Lake*

Spur Lake is a hard water spring lake with slightly alkaline, clear water of high transparency (secchi disk depth of 17 feet). The 11 acre lake has a maximum depth of 24 feet. The littoral zone is composed of marl (40%), muck (20%), sand (15%), silt (14%) and with the remainder consisting of gravel, rubble and boulders. The shoreline is upland (95%) and wetland (5%). The outlet Spur Creek flows to K.C. Creek. Fish species present are brook trout and panfish. Waterfowl make limited use of the lake. An unimproved or difficult public access is available on the northeast shore of the lake.

*Town Corner Lake*

This 175 acre hard water lake is the biggest in the town and has a maximum depth of 12 feet. The water is acidic, slightly stained and of moderate transparency (secchi disk depth of 11 feet). The littoral zone is made up of muck (90%) and sand (10%). The shoreline consists of upland (70%) and wetland (30%). The outlet stream, Town Corner Creek, flows to the North Branch of the Pike River. Northern Pike and perch inhabit this lake but are subject to occasional winterkills. Puddle ducks and diving ducks make moderate use of the lake. The lake is divided among three townships however, with town of Beecher providing public access with parking.

*West Pickerel Pond*

West Pickerel Pond is a hard water spring lake with a surface area of 12 acres and a maximum depth of 39 feet. The water is very clear and highly transparent with a secchi disk depth of 21 feet. The littoral zone consists of muck (40%), sand (40%) and gravel (20%). The shoreline is upland (95%) composed of hardwoods and scattered conifers and shrub meadow wetland (5%). The outlet stream flows to the South Branch of the Pemebonwon River. Fish Species inhabiting the lake include northern pike, largemouth bass, perch and bluegill. Waterfowl make limited use of this lake. There is no public access.

*West Twin Lake*

This soft water seepage lake is a surface area of 16 acres and a maximum depth of 15 feet. The water is acidic, slightly stained and of moderate transparency with a secchi disk depth of 15 feet. The littoral zone is composed of sand (60%), muck (35%) and gravel (5%). The shoreline is primarily upland (90%) consisting of hardwoods, conifers, cultivated land and cleared area. The remaining shoreline is open bog wetland (10%). Fish populations consist of largemouth bass, perch and bluegill. There is no public access.

*Woempner Lake*

Woempner Lake is a 24.6 acre hard water seepage lake with a maximum depth of eight feet and a secchi disk depth of eight feet. Over a quarter of the lake is three feet or less. The water is

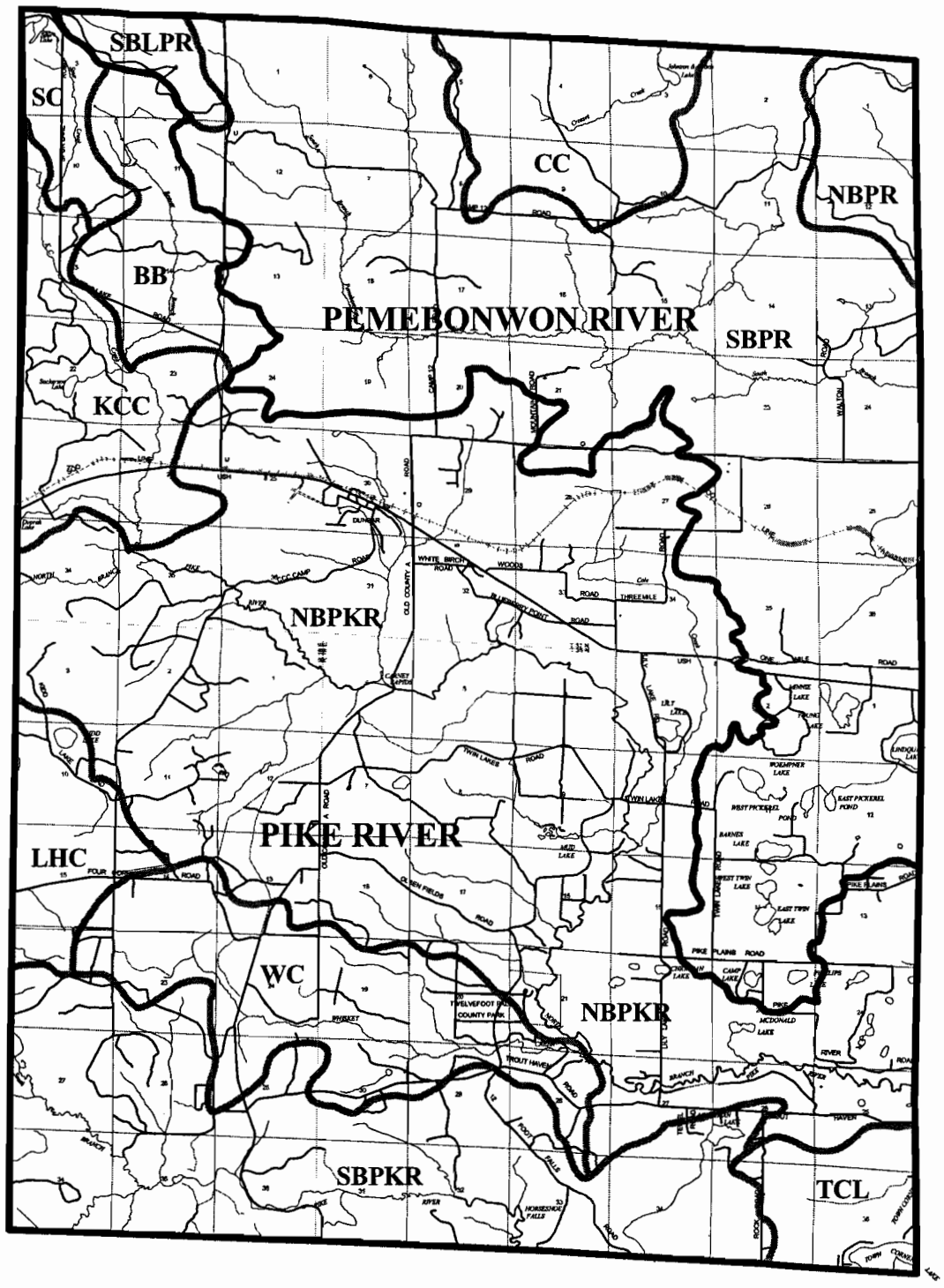
mildly acidic, slightly stained and of moderate transparency. The littoral zone is compose of silt (50%), muck (40%), sand (9%) and gravel. The shoreline is upland (70%) consisting of hardwoods and scattered conifers, wetlands make up the other (30%) and consist of coniferous swamp. Northern pike, largemouth bass, and perch are the fish species found in the lake. Waterfowl make limited use of the lake. There is no public access.

***Young Lake***

Young Lake is a medium hard seepage lake with a maximum depth of 13 feet. The water is acidic, slightly stained and of low transparency (secchi disk depth of five feet). The littoral zone of this 22.5 acre lake is made up of sand (70%) and muck (30%). The shoreline is upland (80%) consisting of hardwoods and conifers, wetlands make up the other (20%) which consist of bog and meadow. Fish species inhabiting the lake are northern pike, bluegill and black crappie. The lake is however subject to occasional winterkills. Waterfowl make limited use of this lake. There is no public access.

Map 2.6

# Watersheds
## Town of Dunbar
Marinette County Wisconsin




N

4000 0 4000
Feet

Watersheds
Sub-Watersheds

BB- Beaver Branch
CC- Crosset Creek
KCC- KC Creek
LHC- Little Harvey Creek
NBPR- N. Branch Pemebonwon River
NBPKR- N. Branch Pike River
SBLPR- S. Branch Little Popple River
SBPR- S. Branch Pemebonwon River
SBPKR- S. Branch Pike River
SC- Spur Creek
TCL- Town Corner Lake
WC- Whiskey Creek

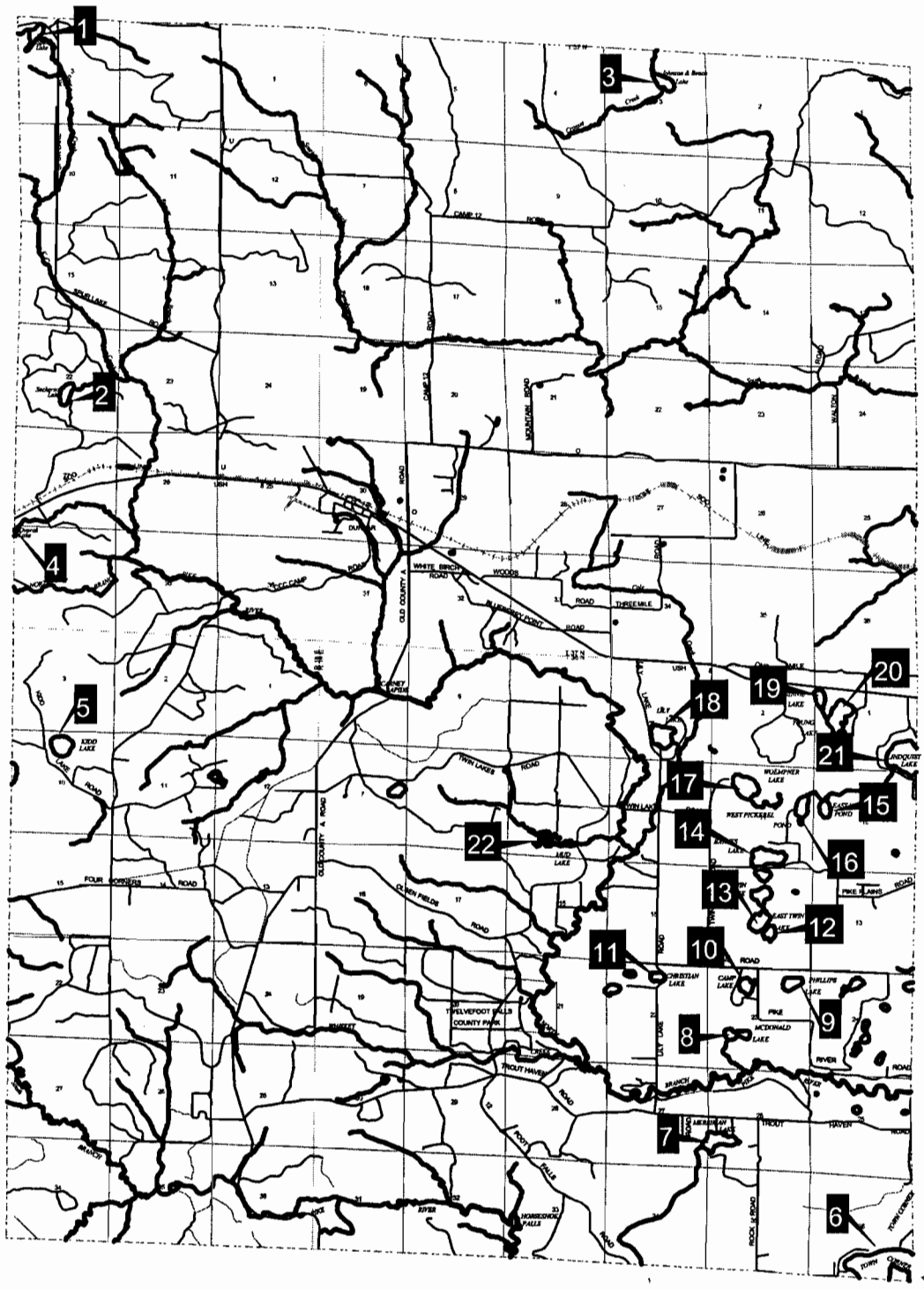
Source: WDNR; Bay-Lake Regional Planning Commission, 2001.

# Surface Water Features - Lakes & Ponds

## Town of Dunbar

Marinette County Wisconsin

Map 2.7




N

4000 0 4000

Feet

1 - Spur Lake
2 - Sackerson Lake
3 - Johnson & Beach Lake
4 - Dvorak Lake
5 - Kidd Lake
6 - Town Corner Lake
7 - Merriman Lake
8 - McDonald Lake
9 - Phillips Lake
10 - Camp Lake
11 - Christian Lake
12 - East Twin Lake
13 - West Twin Lake
14 - Barnes Lake
15 - East Pickerel Pond
16 - West Pickerel Pond
17 - Woempner Lake
18 - Lily Lake
19 - Minnie Lake
20 - Young Lake
21 - Lindquist Lake
22 - Mud Lake

Source: WDNR, 1975: Bay Lake Regional Planning Commission, 2001.

**Surface Water Features – Rivers and Streams**

The following information for the rivers and streams within the town has also been taken from the Wisconsin Department of Natural Resources *Surface Water Features of Marinette County, 1975*. Streams are defined in this study as those which have a permanent flow or any streams of intermittent (seasonal) flow which have significance for recreational purposes. The following is a brief description of the four named streams in the town. Map 2.8 shows the location of these streams.

***Beaver Branch***

Beaver Branch is medium hard water stream having slightly acidic, light brown water. It is 3.2 miles long and has an average width of 5 feet. Beaver Branch is a tributary to K.C. creek. Fish species are primarily forage species. Wildlife and waterfowl values are limited due to its small size. Public access is available at one road and on 5.6 miles of public frontage. The entire watershed is wooded.

***Cole Creek***

Cole Creek is a hard water stream having slightly acidic, clear water. It is 4.9 miles in length and is 5 feet wide on average. Cole Creek is a tributary to the North Branch of the Pike River. A native brook trout population inhabits this stream. Wildlife values are limited due to its small size. Public access is available at four road crossings. The watershed is primarily forested with few areas of agriculture.

***K.C. Creek***

K.C. Creek is a hard water stream having neutral, clear water. It is a 6.7 mile long and on average 12 foot wide creek. K.C. Creek is a tributary to the North Branch of the Pike River. The lower 6.0 miles of the stream provides an excellent native brook trout fishery with a few brown trout. Some furbearers do use the stream, but wildlife values are limited. The watershed is forested and public access is available at two road crossings and on 11.6 miles of public frontage.

***North Branch Pike River***

North Branch Pike River is a hard water stream having neutral, light brown water. The North Branch is 30.0 miles long and on average 38 feet wide, it joins the South Branch in Amberg to form the Pike River. The stream is included in the states Wild River Program along with other streams in the Pike River System. A native brook and brown trout population provide good sport fishery. Muskrat, mink and beaver make use of this stream, although only small numbers of these are present. Waterfowl do make some use of the stream at certain times of year. Public access is available at nine road crossings and from 20.6 miles of public frontage. The watershed is primarily forested with scattered areas of agriculture.

***South Branch Pemebonwon River***

The South Branch of the Pemebonwon River is a medium hard water stream having slightly acidic, light brown water. It is 26.5 miles long and has an average width of 18 feet. This stream joins the North Branch of the Pemebonwon River. A native brook trout population inhabits the stream. Furbearers make moderate use of the stream, but waterfowl use is very limited. Ten road crossings and 31.0 miles of public frontage provide public access. The watershed is primarily forested.

### *South Branch Pike River*

South Branch Pike River is a hard water stream having neutral, light brown water. It is 18.9 miles in length and on average 41 feet wide. It joins the North Branch of the Pike River near Amberg to form the Pike River and is part of the Wild Rivers System. A population of brook and brown trout provide a good sport fishery. Furbearers make moderate use of the stream, but waterfowl use is limited. Four road crossings and 20.0 miles of public frontage provide public access. The watershed is primarily forested with few areas of agriculture.

### *Spur Creek*

Spur Creek is a hard water stream having slightly acidic, light brown water. It has a length of 1.9 miles and an average width of 5 feet. Spur Creek is a tributary to K.C. Creek. The known fish population consists of forage species. Wildlife values are limited due to its small size. Public access is available on 3.3 miles of public frontage. The entire watershed is forested.

### *Whiskey Creek*

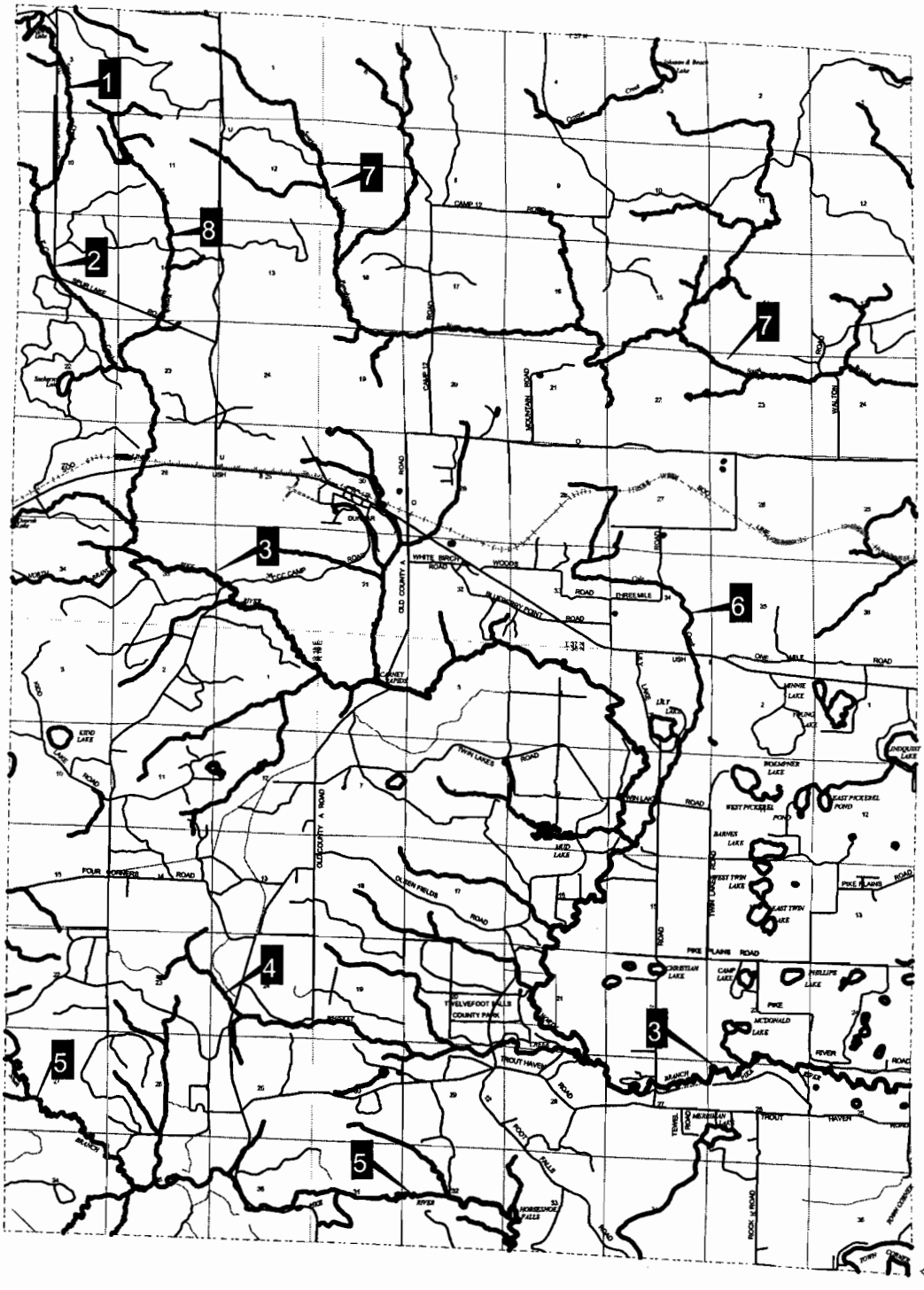
Whiskey Creek is a hard water stream having slightly acidic, clear water. It is 5.1 miles long and has an average width of 4 feet. it is a tributary to the north branch of the Pike River. A good native brook trout population inhabits this stream. Wildlife values are limited due to its small size. Public access is available at two road crossings and from 5.1 miles of public frontage. The entire watershed is forested.

# Surface Water Features - Rivers & Streams

## Town of Dunbar

Marinette County Wisconsin

Map 2.8




N

4000 0 4000

Feet

1 - Spur Creek
2 - KC Creek
3 - North Branch Pike River
4 - Whiskey Creek
5 - South Branch Pike River
6 - Cole Creek
7 - South Branch Pemembonwon River
8 - Beaver Branch

Source: WDNR, 1975: Bay Lake Regional Planning Commission, 2001.

**Floodplains**

Floodplains are often viewed as valuable recreational and environmental resources. These areas provide for storm water retention, ground water recharge, and habitat for various kinds of wildlife unique to the water.

Development permitted to take place in these areas is susceptible to storm damage and can have an adverse effect on water quality and wildlife habitat. In addition, it can also result in increased development and maintenance costs such as: providing floodproofing, repairing damage associated with flooding and high water, increased flood insurance premiums, extensive site preparation, and repairing water related damage to roads, sewers, and water mains.

As a result, the state of Wisconsin requires that counties, cities and villages adopt shoreland/floodplain zoning ordinances to address the problems associated with development in floodplain areas. Development in shoreland areas is generally permitted, but specific design techniques must be considered. Development in floodplain areas is strictly regulated and in some instances is not permitted. For planning and regulatory purposes, the floodplain is normally defined as those areas, excluding the stream channel, that are subject to inundation by the 100-year recurrence interval flood event. This event has a one percent chance of occurring in any given year. Because of this chance of flooding, development in the floodplain should be discouraged and the development of park and open space in these areas encouraged.

The authority to enact and enforce these types of zoning provisions in counties is set forth in Chapter 59.97 of the Wisconsin Statutes and Wisconsin Administrative Code NR 116. This same authority is also vested to cities and villages in Chapter 62.23 of the Wisconsin Statutes.

Within the town of Dunbar, there are approximately 7,866 acres of floodplains (Map 2.9). The floodplains are located along the major waterways in the town.

**Wetlands**

According to the Wisconsin Department of Natural Resources, wetlands are areas where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophilic vegetation. Other common names for wetlands are swamps, bogs, or marshes. Wetlands serve as a valuable natural resource. They provide scenic open spaces in both urban and rural areas. Wetlands act as natural pollution filters, makings many lakes and streams cleaner and drinking water safer. They act as groundwater discharge areas, and retain floodwaters. Finally they provide valuable and irreplaceable habitat for many plants and animals. Because of their importance, there are strict state and federal regulations regarding wetlands.

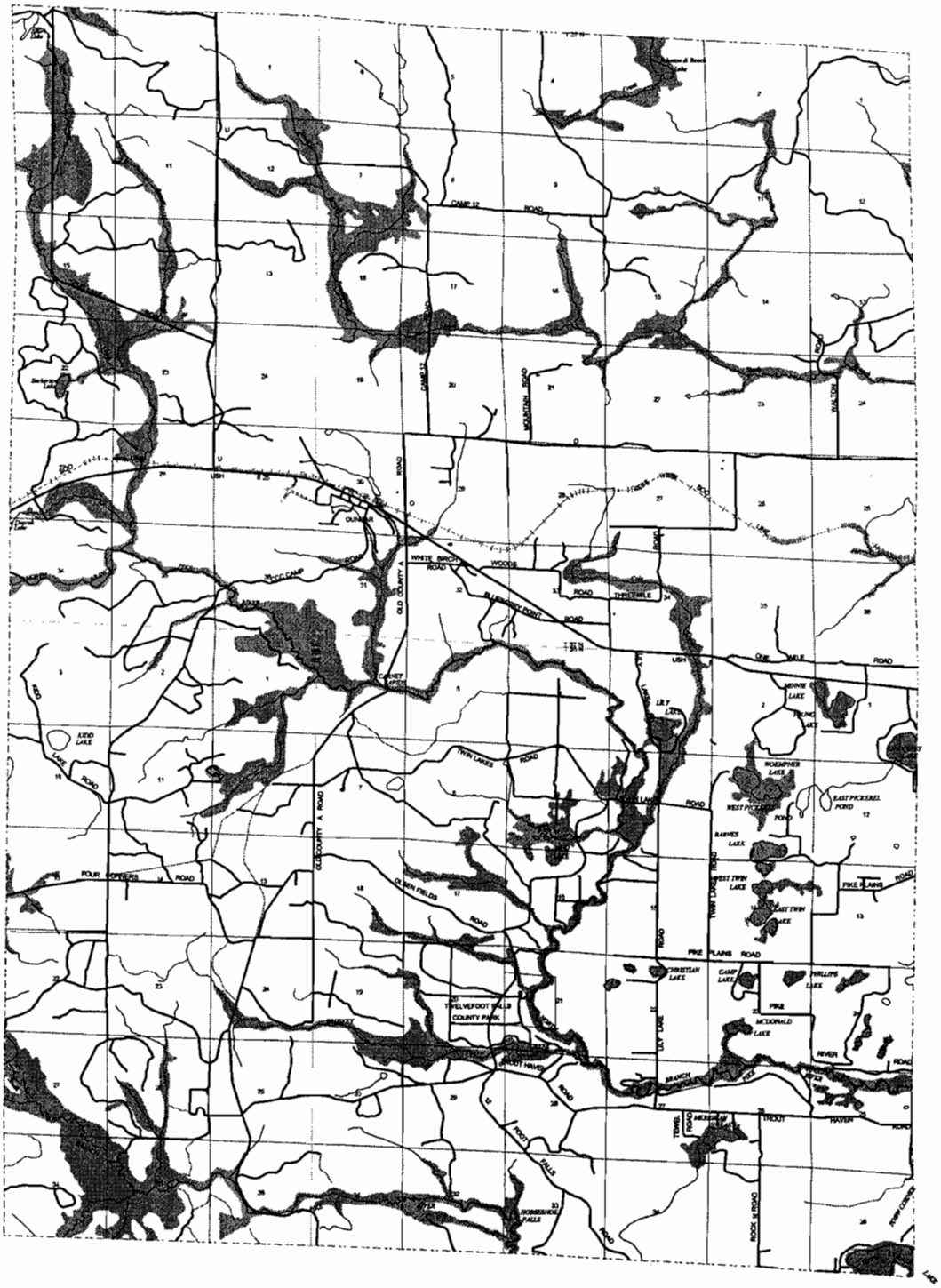
Wetlands are scattered throughout the town of Dunbar with large complexes in the northwest and southeast parts of the town. The wetlands are more prominent in the northwest and western part of town, primarily adjacent to the surface waters in the town (Map 2.10). There are 14,790 acres of wetlands within the town of Dunbar. (Table 2.1).

Map 2.9

# Floodplains

## Town of Dunbar

Marinette County Wisconsin





4000 0 4000

Feet

100 - Year Floodplain

Source: FEMA FIRM, 1982: Bay Lake Regional Planning Commission, 2001.

**Table 2.1: Wetland Types - Town of Dunbar**

| Wetland Class | Acres | Percent |
|---|---|---|
| Emergents/Wet Meadow | 759.69 | 5.14 |
| Emergents/Open Water | 163.59 | 1.11 |
| Scrub/Shrub | 2,190.27 | 14.81 |
| Scrub/Emergents | 1,437.46 | 9.72 |
| Scrub/Open Water | 107.987 | 0.73 |
| Forested | 6,287.90 | 42.50 |
| Forested/Emergents | 600.95 | 4.06 |
| Forested/Scrub | 2,909.50 | 19.67 |
| Forested/Open Water | 133.23 | 0.90 |
| Open Water | 202.87 | 1.37 |
| Total Wetlands | 14793.4 | 100.00% |

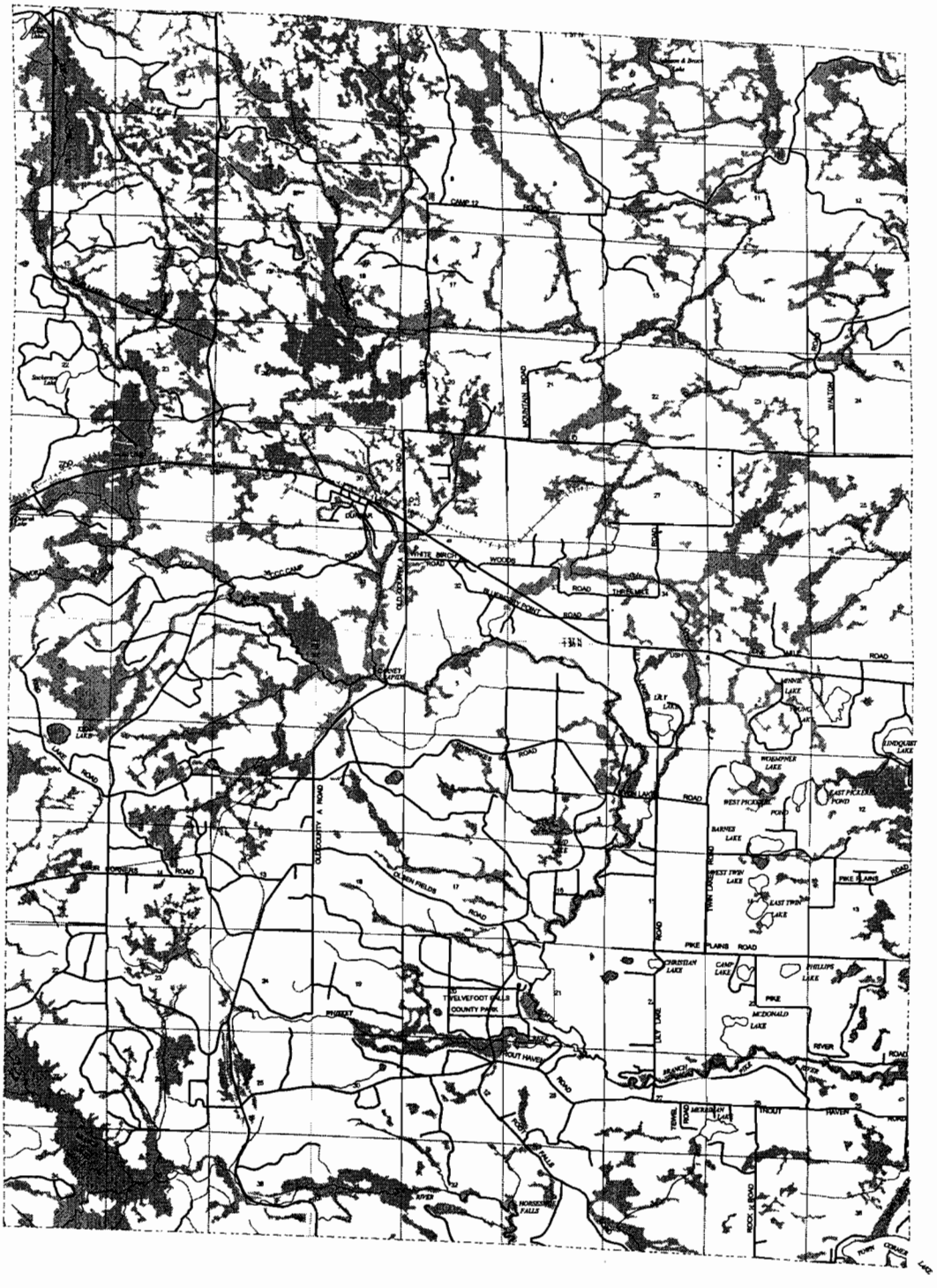
Source: WDNR, 1991; Bay-Lake Regional Planning Commission, 2001.

## Woodlands

The town is heavily forested, approximately 91 percent, with a mix of hardwoods and conifers. There are 61,370 acres of woodlands in the town of Dunbar (Map 2.11). Of these wooded areas, the vast majority are upland (77 percent) while the rest are lowland coniferous swamps. Many tree species are present including hardwoods such as sugar maple, paper and yellow birch, red maple, black cherry, northern pin oak and others. Some common coniferous species are eastern hemlock, white pine, jack pine, red pine (planted and native), balsam fir, white spruce, black spruce and white cedar.

Map 2.10

# Wetlands
## Town of Dunbar
Marinette County Wisconsin




Source: WDNR, 1991; Bay Lake Regional Planning Commission, 2001.

# Woodlands
## Town of Dunbar
Marinette County Wisconsin

Map 2.11

N

4000 0 4000

Feet

Upland Woodlands
Lowland Woodlands

Source: FEMA FIRM, 1982: Bay Lake Regional Planning Commission, 2001.

### Wildlife Habitat

The fauna that lives within the planning area is quite diverse. Many animals such as the white-tailed deer, black bear, bald eagle, grouse, coyote, gray wolf, porcupine, beaver, muskrat, gray and red squirrel, and chipmunks are some of the more well known species found in the area. The surface waters sustain a diverse community of fish providing many opportunities for sport fishing for locals and tourists alike. Migratory fowl also frequent the area during the summer months utilizing the lakes and streams to raise their young. Much of the land is undisturbed by mankind and thus very receptive to sustaining a diverse ecological system.

### National, State & County Scientific and Natural Areas

The Wisconsin State Natural Area program was established to formally designate sites in natural or near natural condition for scientific research, the teaching of conservation biology and most of all, preservation of their natural values and genetic diversity for the future. These areas are not intended for intensive recreation use, but rather to serve the mission of the Natural Areas Program, to locate and preserve a system of State Natural Areas harboring all types of biotic communities, rare species, and other significant natural features native to Wisconsin. Within the town there are no state designated natural areas, although much of the county forest land and state owned land can serve the same purpose.

### Historic and Archeological Sites

There are numerous sites within the planning area that have historical importance. They are all located within the community of Dunbar. Please note that these sites are not all eligible by the State Historical Society of Wisconsin. It is a list compiled by many individuals on the belief that these areas be considered for eligibility. There is a possibility that several structures or sites may not be listed. For further information, please contact the State Historical Society of Wisconsin, 816 State St., Madison, WI 53706. These sites include the old town hall, the library, the Girard Lumber Company Stables, the post office, the Dunbar Covenant Community Church Rectory and many other private homes. There are no listed archeological sites.

Care should be taken when excavation is done within the town of Dunbar, since there is the possibility of disturbing a historical or archeological site. The State of Wisconsin requires any findings of human bones to be reported (*Wisconsin Statute 157.70)* so an investigation can be done by the State Historical Society. Also, land developers trying to obtain state permits from the Wisconsin Department of Natural Resources or any development involving federal monies, are required to be in compliance with Section 106 of the National Historic Preservation Act and 36 CFR Part 800: Protection of Historic Properties.

**Environmental Corridors**

Many of the Commission's planning activities require delineation of environmental corridors (comprehensive plans, watershed plans, sewer service area plans, etc.). Environmental corridors protect local water quality and wildlife habitat through identification and preservation of environmentally sensitive areas. They can be used as a means of controlling, moderating, and storing floodwaters while providing nutrient and sediment filtration. Environmental corridors can provide fish and wildlife habitat, recreational opportunities, and serve as buffers between land uses while improving the aesthetics of the community. Typically, environmental corridors contain wetlands, water features, floodplains, natural and scientific areas, woodlands, parks and recreation areas, areas of steep slope, and other unique natural features which overlap or are contiguous. The concept of a corridor is based on the delineation of environmental features adjacent to waterways and water related resources.

The Commission has identified environmental corridors for the town of Dunbar planning area to help in identifying areas that have the greatest need for protection. These corridors (Map 2.13) were delineated through the use of the Commission's Geographic Information System (GIS) to overlay a variety of features. The environmental corridors total 21,700 acres of land within the planning area and include: wetlands, a 25-foot wetland buffer, floodplains, areas of steep slope (having a slope greater than 12 percent), water resources and a 75-foot setback from these water resources.

**Town of Dunbar Water Quality Data Inventory**

The Marinette County Land & Water Conservation Department (LCD)has collected data about lakes for a county wide lake classification projects. The LCD did a field inventory of about 90 lakes in the county during the summers of 1999 - 2000. Characteristics of the lakes inventoried included: total phosphorus, Secchi disk depths, developed lots, flora species present, and TSI numbers based on total phosphorus and Secchi disk. Twenty eight lakes in the town of Dunbar have been looked at. Only lakes greater than five acres were inventoried. Some lakes could not be tested for all criteria because permission was not granted by the landowners surrounding the lake. The complete results are located in Appendix B.

The Wisconsin Department of Natural Resources started a monitoring study in the 1970's to inventory all the lakes in the state. The result of this study was the Surface Water Features manuals for each county. The data from that study was previously stated in the "Water Resources" section of this chapter. The DNR also put together a report called the *Upper Green Bay Basin Water Quality Management Plan* in 1993, that inventories some of the lakes in the town. The goal of this report was to identify areas of water quality concerns and identify management objectives for the water resources of the Upper Green Bay basin. Four lakes in the town of Dunbar were looked at: Barnes, Lindquist, Town Corner and Woempner. Of these, only Town Corner Lake was classified with a trophic class. The results of this study for the town of Dunbar are also located in Appendix B.

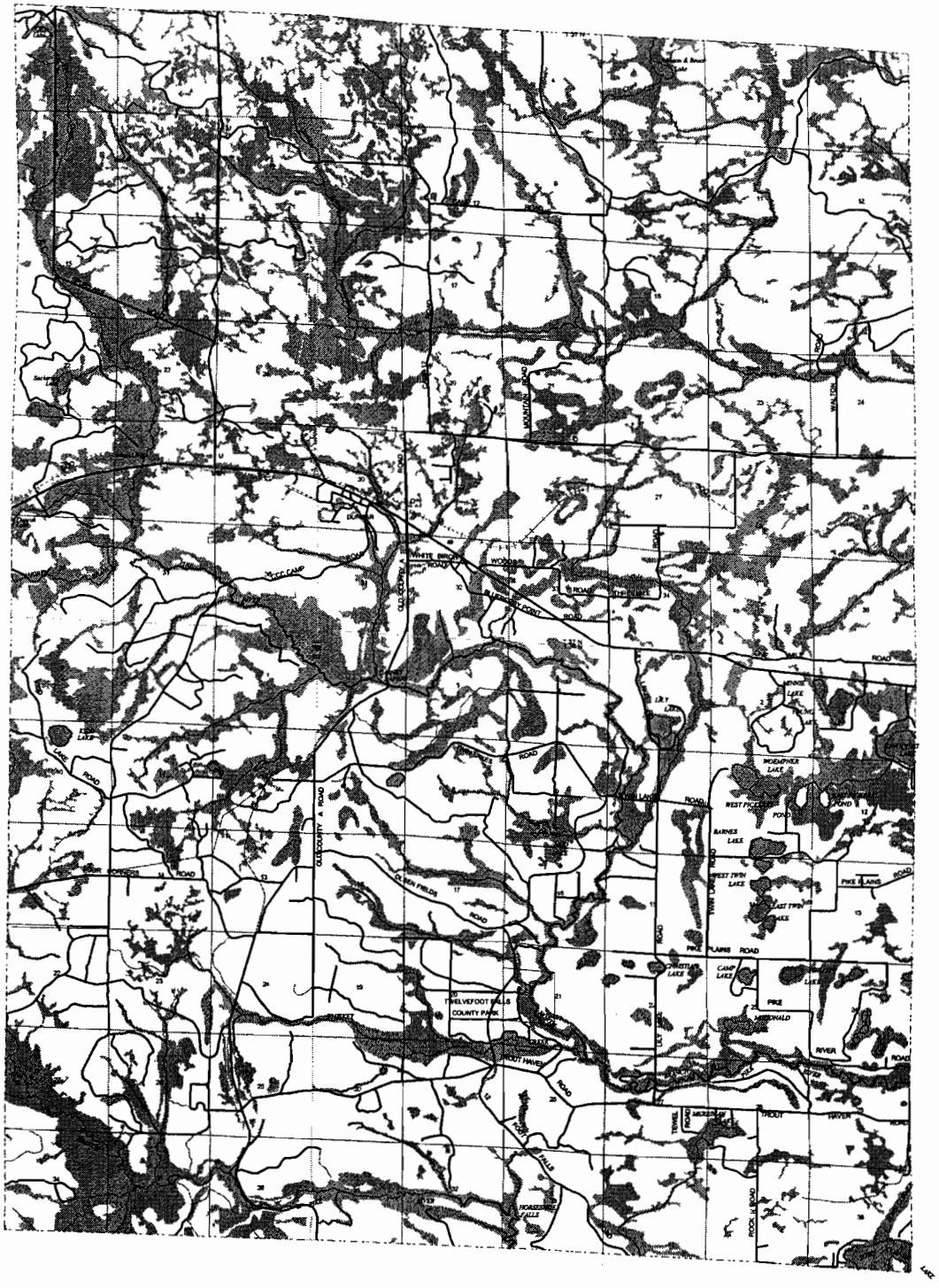
A detailed description of the more developed lakes are listed below in table form with a short description of what each element means to the overall quality of the lakes. Data from the Surface Water Features was not repeated because it was stated above. Where data was not available a "-" is used.

# Environmental Corridors

## Town of Dunbar

Marinette County Wisconsin

Map 2.12



N

4000 0 4000

Feet

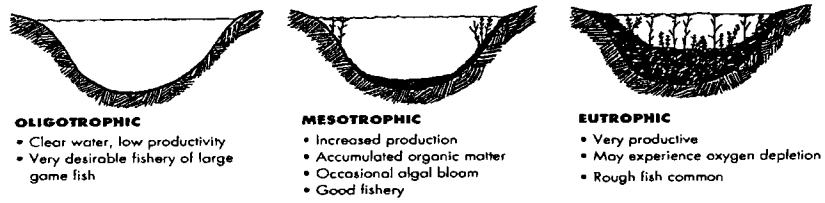
Environmental Corridors
WDNR Wetlands
100 - Year Floodplain
Slope Greater than 12 Percent
75 - Foot Water Setback

Source: WDNR, 1991; Bay Lake Regional Planning Commission, 2001.

## Trophic Classification of a Lake

Lakes can be divided into three general categories based upon their fertility: oligotrophic (low fertility) mesotrophic (medium fertility) and eutrophic (high fertility). Oligotrophic lakes are generally cold, clear and free of weeds or large algae blooms. Although they do not generally support large fish populations, they do have an efficient food chain supporting a desirable fishery of predatory fish. Mesotrophic lakes are an intermediary stage between oligotrophic and eutrophic lakes. The bottoms of these lakes generally lack oxygen during the later months of summer, limiting cold water fish. Eutrophic lakes are high in naturally occurring sediments such as nitrogen and phosphorous. They are likely to be weedy and/or experience large algae blooms. They support large fish populations, but are susceptible to "winterkill" due to a lack of dissolved oxygen in the later winter months. Figure 2.1 shows the different stages of lakes.

**Figure 2.1: Aging Process in Lakes**




Source: Wisconsin Department of Natural Resources

Natural eutrophication is the process by which lakes gradually age and become more productive. It normally takes thousands of years to progress. However, humans, through their various cultural activities, have greatly accelerated this process in lakes all over the country. Cultural or anthropogenic "eutrophication" is water pollution caused by excessive plant nutrients entering into a lake.

Humans add excessive amounts of plant nutrients (primarily phosphorus, nitrogen, and carbon) to streams and lakes in various ways. Runoff from agricultural fields, field lots, urban lawns, and golf courses is one source of these nutrients. Untreated, or partially-treated, domestic sewage is another major source. Sewage contains large amounts of phosphates. These phosphates can act as water softeners to improve the cleaning action, but can also be powerful stimulants to algal growth when they were washed into lakes. These algal blooms can lead to oxygen depletion and resultant fish kills. Many native fish species can disappear, to be replaced by species more resistant to the new conditions.

The Trophic Status Index (TSI) numbers provide general indicators of a lake's trophic class. There are three types of TSIs. TSI (TP) is an indicator based on the total amount of phosphorus available in the lake as indicated by lake monitoring. TSI (CHL) is an indicator based on the amount of Chlorophyll a, a measure of the amount of algae present, and TSI (SD) is a measure based on the Secchi depth, and indicator of water clarity. Table 2.1 shows the ranges for TSI values and their associated trophic state.

**Table 2. 2: TSI Values, Water Chemistry, and Trophic State (Adapted from Carlson, 1977)**

| TSI | Secchi (ft.) | Total Phosphorus (mg/l) | Chlorophyll a (mg/l) | Trophic State |
|---|---|---|---|---|
| 0 | 210 | 0.75 | 0.04 | Oligotrophic |
| 10 | 105 | 1.5 | 0.12 | |
| 20 | 52 | 3 | 0.34 | |
| 30 | 26 | 6 | 0.94 | |
| 40 | 13 | 12 | 2.6 | Mesotrophic |
| 50 | 7 | 24 | 6.4 | |
| 60 | 3 | 48 | 20 | Eutrophic |
| 70 | 1.6 | 96 | 56 | |
| 80 | 0.83 | 192 | 154 | |
| 90 | 0.42 | 384 | 427 | |
| 100 | 0.21 | 768 | 1183 | |

**Source: Bay-Lake Regional Planning Commission, 2001; Carlson, 1977.**

### *Dissolved Phosphorus*

Dissolved Phosphorus is the form of phosphorus that is dissolved in the water and is readily available for aquatic plant uptake. Phosphorus is a vital element that contributes to both the fertility and growth of plants in lakes

### *Total Phosphorus*

Total phosphorus is the total phosphorus available in a lake for aquatic plant growth. It is the sum of dissolved phosphorus and the phosphorus contained in suspended plant and animal material in the water. The concentration of phosphorus varies widely over the year, due to such things as thermal stratification and settling of organic matter from the lake surface to the bottom. In addition to naturally occurring in nature, phosphorus enters lakes through many human activities. These include livestock wastes, sewage effluents and applications of agricultural fertilizers. Table 2.2 lists water quality compared to the amount of total phosphorus in the lake.

**Table 2. 3: Water Quality Index by Total Phosphorus**

| Water Quality Index | Total Phosphorous (mg/l) |
|---|---|
| Very Poor | >150 |
| Poor | 55-150 |
| Fair | 32-55 |
| Good | 16-32 |
| Very Good | 2-16 |
| Excellent | <2 |

Source: MMA, Inc., Bay-Lake Regional Planning Commission, 2001.

Within the town of Dunbar. Table 2.3 lists the total phosphorus found in the five most developed lakes and the TSI number that corresponds to it.

**Table 2. 4: Total Phosphorus, Water Quality Index and TSI**

| Lake | Total Phosphorus (mg/l) | Water Quality Index | Total Phosphorous Trophic Status Index (TP) |
|---|---|---|---|
| Barnes | 10.0 | very good | 46.0 |
| Lily | 12.0 | very good | 47.5 |
| Lindquist | 9.0 | very good | 45.2 |
| Town Corner | 14.0 | very good | 48.6 |
| Young | - | - | - |

Source: Marinette County LCD, 1999; Bay-Lake Regional Planning Commission, 2001.

Four out of the five lakes had low enough phosphorus readings and TSI's to be labeled as having a "very good" water quality index. Young Lake was not tested.

### *Chlorophyll a Pigment Concentration*

This parameter is used as an estimation of algae, or phytoplankton biomass, in lakes. Lakes that appear to be clear or blue will generally have chlorophyll levels less than 10 micrograms per liter (mg/l). Within the state of Wisconsin, the average concentration of chlorophyll a in lakes was 14.8 mg/l with sixty-five percent of the lakes having a value of less than 10 mg/l. None of the lakes in the town of Dunbar were tested for chlorophyll a levels

### *Secchi Depth*

Secchi depth is a good indicator of a lake's overall water quality. It measures color and turbidity while taking into account algae growth as well. Table 2.4 shows the water quality corresponding to the Secchi depth.

**Table 2. 5: Secchi Depth and Water Quality**

| Water Clarity | Secchi Depth (ft.) |
|---|---|
| Very Poor | 3 |
| Poor | 5 |
| Fair | 7 |
| Good | 10 |
| Very Good | 20 |
| Excellent | 32 |

Source: MMA, Inc., Bay-Lake Regional Planning Commission, 2001.

Seven of the lakes in the town have been tested for Secchi disk depth by the LCD. Below are the results of three of those lakes, including the water clarity interpretation and the TSI number that corresponds to it. All the lakes were tested in the 1975 study to complete the Surface Water Features of Marinette County study.

**Table 2. 6: Secchi Depth, Water Quality and TSI**

| Lake | Feet | Interpretation | Secchi Depth Trophic Status Index (SD) |
|---|---|---|---|
| Barnes | 13.5 | Good | 39.6 |
| Lily | 9.5 | Fair | 44.7 |
| Lindquist | 11.5 | Good | 41.9 |
| Town Corner | 11.0* | Good | - |
| Young | 5.0* | Poor | - |

* Secchi Disk data from the 1975 Surface Water Feature Study.
Source: Marinette County LCD, 1999; WDNR, 1975 Bay-Lake Regional Planning Commission, 2001.

Barnes, Town Corner and Young lake all have a "good" reading for secchi disk depth. Lily Lake is on the border of "fair" and "good", while Young Lake has a "poor" reading. It should be noted that the readings for Town Corner and Young lakes were taken in 1975, and should be verified again.

### *pH*

pH is a measure of the hydrogen ion concentration in lakes. This parameter has been shown to have important consequences in aquatic ecosystems. Different pH values will support different compositions of both plant and animal species in a lake. Some factors that affect the pH of lakes include bedrock composition and acid rain. A pH less than 7 is considered acidic; a pH of 7 is considered neutral and more than 7 is considered alkaline. The lakes in the town have not been recently tested for pH. Lindquist Lake was tested many times in 1980/81 and had an average pH of 7.9, and Town Corner Lake was tested in 1976 with an average pH of 7.8. Table 2.6 lists the effects on fish species at different pH levels.

Alkalinity and Hardness are closely related to pH. Alkalinity is the ability to buffer lakes from the effects of acid rain. Bicarbonate (HCO3-) and carbonate (CO3--) neutralize the hydrogen ions from acid input. The greater amounts of bicarbonate and carbonate in the lake, cause more hydrogen ions to be neutralized which increases (makes less acidic) the pH. Alkalinity is measured in two units, milligrams per liter (mg/l) or parts per million (ppm) and microequivalents per liter (ueq/l). Table 2.7 shows the sensitivity of lakes to acid rain based on their alkalinity.

**Table 2.7: Alkalinity Values and Sensitivity to Acid Rain**

| Sensitivity to Acid Rain | Alkalinity in ppm CaCO3 | Values ueq/l CaCO3 |
|---|---|---|
| High | 0-2 | 0-39 |
| Moderate | 2-10 | 40-199 |
| Low | 10-25 | 200-499 |
| Non-sensitive | >25 | $\geq$ 500 |

Source: Wisconsin Department of Natural Resources

Hardness is the amount of two ions (Ca++ and Mg++) present in the water and therefore is closely related to alkalinity. High levels of hardness may cause marl ($CaCO_3$) to precipitate out of the water. Hard water lakes tend to be more productive in fish and aquatic plant life compared to soft water lakes. These hard water lakes are found in watersheds with fertile soil and add nutrients such as phosphorus to the lake. Phosphorus precipitates with marl, to control algae

blooms that may happen with too much phosphorus. Table 2.8 shows the level of hardness associated with total hardness in the lake

**Table 2.8: Water Hardness Levels**

| Level of Hardness | Total Hardness (mg/l $CaCO_3$) |
|---|---|
| Soft | 0-60 |
| Moderately Hard | 61-120 |
| Hard | 121-180 |
| Very Hard | >180 |

Source: Wisconsin Department of Natural Resources

Hardness and alkalinity will be low if the surrounding soils are sandy and composed of other insoluble materials such as quartz, or if the main input of the lake is rainfall. This is the case in much of northern Wisconsin where glacial deposits contain little limestone. Lakes with low amounts of alkalinity and hardness are more susceptible to acidification by acid rain and are generally less productive.

**Table 2. 9: Alkalinity and Hardness Levels**

| Lake | Alkalinity (mg/l $CaCO_3$) | Hardness Level | Sensitivity to Acid Rain |
|---|---|---|---|
| Barnes | 29 | Soft/Mod Hard | Non-sensitive |
| Lily | - | Hard** | - |
| Lindquist | 153* | Hard | Non-sensitive |
| Town Corner | 84* | Moderately Hard | Non-sensitive |
| Young | - | Moderately Hard** | - |

Source: Marinette County LCD, 1999; Bay-Lake Regional Planning Commission, 2001
*Lindquist Lake data from 1980-81; and Town Corner Lake data from 1976 and are average calculations.
**Taken from *Surface Water Resources of Marinette County*

Only five of the lakes in the town have been tested for alkalinity by the Marinette County LCD. Lindquist and Town Corner lakes were tested in the past by the WDNR. Of the lakes tested, Barnes Lake had the lowest alkalinity, and is considered to be non-sensitive to acid rain. Lindquist and Town Corner lakes have much higher alkalinity so the are even less likely to be sensitive to acid rain. The hardness levels in this case are based on alkalinity instead of total hardness because total hardness was not calculated. The two numbers are usually very closely related though. Barnes Lake has a hardness of soft according to the CaCO3 content, but according to the *Surface Water Resource* book it was moderately hard.

**Table 2. 10: Effects of Acidity on Fish**

| pH | Effect |
|---|---|
| 6.5 | Walleye spawning inhibited |
| 5.8 | Lake trout spawning inhibited |
| 5.5 | Smallmouth bass disappear |
| 5.2 | Walleye, lake trout disappear |
| 5.0 | Spawning inhibited in many fish |
| 4.7 | Northern pike, suckers, sunfish disappear |
| 4.5 | Perch spawning inhibited |
| 3.5 | Perch disappear |
| 3.0 | Toxic to all fish |

Source: Olszyk, 1980; Bay-Lake Regional Planning Commission, 2001

### *Fecal Coliform*

Fecal coliform are coliform bacteria originating from animal feces. A high count of fecal coliform (greater than 200 colonies per 100 ml sample) usually indicates raw sewage is entering the lake. There is currently no data on the amount of fecal coliform entering any of the lakes within the town of Dunbar.

### *Color*

The color of lake water reflects the type and amount of dissolved organic chemicals it contains. Measured and reported as standard color units on filtered samples, color's main significance is aesthetic. Color may also reduce light penetration, slowing weed and algae growth. Many lakes possess natural, tan-colored compounds (mainly humic and tannic acids) from decomposing plant material in the watershed. Brown water can result from bogs draining into a lake. Before or during decomposition, algae may impart a green, brown or even reddish color to the water. Color can also affect the Secchi disc readings. Table 2.7 lists the lake color in developed lakes in the town.

**Table 2. 11: Lake Color, Town of Dunbar Lakes**

| Lake | Color |
|---|---:|
| Barnes | Very Clear |
| Lily | Very Clear |
| Lindquist | Very Clear |
| Town Corner | Light Brown |
| Young | Light Brown |

Source: Marinette County LCD, 1999;WDNR 1971; Bay-Lake Regional Planning Commission, 1999.

### *Turbidity*

The turbidity of a lake is the measure of the amount of organic and inorganic matter that is suspended in the water. Turbidity directly affects heat absorbency and light penetration of lakes, therefore affecting the depth at which plants can grow and thereby decreasing the amount of dissolved oxygen in the water. The level of turbidity can be measured using either Jackson Turbidity Units (JTU) or Nephelometric Turbidity Units (NTU). The two measurements can be

assumed to be the same. The average level of turbidity in Wisconsin lakes has been measured at 3.1 JTU. There is no available data on turbidity for the lakes within the town of Dunbar.

***Dissolved Oxygen (D.O.)***

Dissolved oxygen is vital for both fish and other aquatic life. It is the amount of oxygen in the water that is available to these species. Most sport fish species cannot survive long with D.O. levels below 5 mg/l. Few fish tolerate levels below 2 mg/l. The total amount of oxygen that water holds inversely varies with the temperature of the water. For example, water at 33 degrees Fahrenheit contains approximately 14.2 mg/l at saturation, while water at 75 degrees is saturated at 8.4 mg/l. Lakes acquire oxygen from two sources, exchange with the atmosphere and oxygen production by aquatic plants. This means oxygen is produced only in the upper area of the lake. In stratified lakes this oxygen rich layer gets circulated to the bottom every spring and fall. This is called turnover. More nutrient (eutrophic) stratified lakes suffer oxygen depletion at a much faster rate than less nutrient (oligotrophic) lakes (Marinette County LCD, 1999). The only two lakes sampled for dissolved oxygen were Town Corner Lake in 1976, and Lindquist Lake in 1980-81.

The purpose of gathering lake water quality data is to assign a trophic class level to the lakes in order to determine the best means of managing the lake. Based on numbers in table 2.1, a trophic class can be predicted for each of the lakes. Table 2.8 lists the predicted trophic class for the most developed lakes in terms of Secchi disk and total phosphorus.

**Table 2.12: Trophic Class, Town of Dunbar Lakes**

| Lake | Trophic Class (Secchi Disk) | Trophic Class (Total Phosphorus) |
|---|---|---|
| Barnes | Mesotrophic | Mesotrophic |
| Lily | Mesotrophic | Mesotrophic |
| Lindquist | Mesotrophic | Meso/Oligotrophic |
| Town Corner | Mesotrophic | Mesotrophic |
| Young | Meso/Eutrophic | - |

Source: WDNR 1980, 1993; Bay-Lake Regional Planning Commission, 2001.

## Findings

From the data presented above, the more developed lakes seem to have pretty good water quality. This is a positive sign because simple measures can be taken to make sure that the lakes within the town stay of high quality. The carrying out of best management practices (BMPs) is one way of controlling nutrient loading into lakes. BMPs are practical, affordable approaches to conserving water resources in farming (both crop and timber) without sacrificing productivity. Some of these practices can also be used in residential settings along the water. Some of these solutions are:

- Plant a buffer of native vegetation between lawn and shoreline to catch runoff into the lake
- Reduce impervious surfaces around structures to let rainwater soak into ground rather than runoff into lake
- Use infiltration trenches with filter fabric and crushed stone around drip line of house instead of traditional gutters and downspouts

- Control shoreline erosion with rebanking, revegetation, or rock rip rap instead of concrete, steel or wood seawalls
- Native grasses and vegetation will need less (if any) pesticides and fertilizers. Plant these around your property instead of non-native species.

These are just a few simple ways to help keep and improve the water quality around lakes. The local DNR office will have much more information on how to help with shoreline restoration.

Below is a general description of the more developed lakes.

***Barnes Lake***

The Secchi disk readings for Barnes Lake were 13.5 feet and a TSI 39.6. These numbers are on the border between oligotrophic and mesotrophic. The phosphorus readings were 10 mg/l and a TSI of 46. These numbers indicate the lake being mesotrophic. Barnes Lake is almost completely developed (92 percent of the shoreline), and probably will not see much more development. Care should be taken to keep the existing undeveloped shoreline natural and to restore developed shoreline to reduce sediment loading impacts from development.

***Lily Lake***

Lily Lake has Secchi disk readings (9.5 feet, TSI of 44.7) and phosphorus readings (12 mg/, TSI of 47.5) that indicate that the lake is mesotrophic. The lake is mostly developed (90 percent of the shoreline) and does not seem to have much more development in the future. The shoreline of the lake is undisturbed, and steps should be taken to see that it stays natural.

***Lindquist Lake***

Lindquist Lake is a mesotrophic, or moderately nutrient rich lake in terms of both Secchi disk and total phosphorus. The Secchi disk readings were 11.5 feet, and 41.9, while the phosphorus readings were 9 mg/l and 45.2. Lindquist Lake is divided into two towns, Dunbar and Pembine and is not likely to have much more development on the Dunbar side. The entire west side of the lake is on steep slope (greater than 12 percent). Care should be taken to make sure runoff into the lake is reduced on this side which is more susceptible to erosion. There are two small wetlands on the south side that should remain intact to help with the water quality on the lake.

***Town Corner Lake***

Town Corner Lake encompasses four towns, Dunbar, Beecher, Amberg and Athelstane, with the majority of it being in Dunbar and Beecher. The lake is mesotrophic in terms of both Secchi disk and total phosphorus TSI. The secchi reading was 11 feet and the TSI for total phosphorus was 48.6. There is not a lot of development on the lake within the town, (34 percent of the entire shoreline is developed) due to the fact that most of the northern and southern parts of the lake in the town are wetlands. These wetlands should stay intact, and any future development should follow best management practices to reduce the impact on the lake.

***Young Lake***

Young lake is on the border between mesotrophic and eutrophic in terms of Secchi disk readings (5 feet). There were no phosphorus readings taken on this lake. Young Lake is one of the most developed of the lakes in the town and will not see much more development. There is some second tier development on the southwest side of the lake that may be increasing sediment loading into the lake. The residents on the lake should look into installing best management practices to slow the down the eutrophication process and decrease sediment loading into the

lake. The east side of the lake lies on steep slope which makes runoff and erosion more susceptible. Residents on this side of the lake should be even more careful about decreasing the sediment loading into the lake.

The data previously listed, where available for the town of Dunbar lakes, was obtained from the following resources:

Carlson, R.E. A Trophic State Index for Lakes. Limnology and Oceanography; 25(2): 379-82. 1977.

Marinette County Land & Water Conservation Department, Lake Classification Study-Reports, 2001.

Olszyk, D. 1980. Biological Effects of Acid Rain. Testimony, Wis. Public Service Commission Docket No. 05-EP-2. 5 pp.

Wisconsin Department of Natural Resources. 1975. Surface Water Resources of Marinette County. Madison, Wisconsin.

**Data Needs**

In order to determine what is happening to the lakes within the town of Dunbar, basic water data information is needed in order to determine a trend in water quality. The Wisconsin Department of Natural Resources has developed criteria for developing a long term trend lake monitoring program.

At a minimum the WDNR recommends testing surface total phosphorous five times per year, with one being during the spring turnover; Secchi disk readings as much as possible, but a minimum of five times per year; and test for chlorophyll a four times per year. These tests will allow for a Trophic State Index (TSI) to be developed and approximate the relative age of a lake, as well as provide a base level of information to determine water quality trends over a period of time. Table 2.9 lists the entire process for long term monitoring of a lake, as prescribed by the Wisconsin Department of Natural Resources:

**Table 2. 13: Long Term Trends Lake Monitoring Methods Summary**

| Parameter | Approximate Date of Collection | | | | | Remarks |
|---|---|---|---|---|---|---|
| | Spring Turnover | Mid June | Mid July | Mid August | February | Sampling site should usually be located at the deepest point for natural lakes and large reservoirs |
| Complete water chemistry | X | | | | | Two depths: 1 foot from the water surface and 2 feet above the lake bottom. Eighteen constituents:NO2-N + NO3-N, NH3-N, KJN-N, Cl, Org.N, Dissolved P, Ca, Mg, Na, K, pH, SO4, total alkaline, Fe, Mn, color, turbidity, total dissolved solids, volatile solids, and suspended solids. |
| Total Phosphorous | X** | X*** | X*** | X*** | X** | ** = 2 depths: 1 foot below water surface and 2 feet above the lake bottom.<br>*** = Third additional depth at the top of the hypolimnion |
| Water Temperature, dissolved oxygen, pH and specific conductance | X | X | X | X | X | Profile - 1 foot below water surface and proceed to lake bottom using 3-6 foot intervals, depending on existing conditions and/or total lake depth. pH and conductance dependent on meter availability. |
| Chlorophyll a | X | X | X | X | X | One depth - 1 foot below water surface and at depth of observed metalimnion oxygen maxima |
| Secchi disk depth | X | X | X | X | | Minimum frequency - Weekly by local observer is better |
| Lake water level | X | X | X | X | | Minimum frequency - Weekly by local observer is better |
| Fish survey | | | | | | Netting during spawning season, boom shocking after September 1. Shocking every other year. Gill netting every sixth year |
| Perch (Hg) | | | | X | | |
| Macrophyte | | | X | X | | Survey every third year (general abundance and location by species) |
| Phytoplankton | X | X | X | X | X | Water collected at 1 foot depth with Kemmerer (identification and general abundance). |
| Zooplankton | X | X | X | X | X | One vertical tow with a plankton net (identification and general abundance). |
| Macroinverte-brates | | | | | X | Late winter sampling in lake and in stream. |

Source: Wisconsin Department of Natural Resources, 1998.

## LAND USE ISSUES

In the process of inventorying the current land use and natural features for the town of Dunbar, two areas of concern were analyzed for the current and future effects development may have. The potential areas of concern are the lakes and shorelines, and wetlands.

### Land Use and Natural Resources Conflicts

#### Lakes and Shorelines

The town of Dunbar has over eighteen miles of lake shoreline with an average density of development of only 4.5 developed lots per mile on the shoreline. Seventeen of the lakes in the town have some private ownership, 10 of these only have one or two owners. The lakes that have any private ownership have 15 miles of shoreline with an average density of 5.8 developed lots per mile. These numbers compare very favorably with places such as the eastern shore of the Bay of Green Bay, where the density can reach upwards of one hundred dwellings per mile.

Further development on the lakes is becoming increasingly unlikely due to much of the available shoreline being considered wetland or owned by Marinette County or is already developed.

#### Wetlands

Wetlands in the town of Dunbar total approximately 14,793 acres of land. The wetlands are not necessarily concentrated in any one part of the town, rather they are generally associated with the many water features in the town, especially in the northwest quarter of the town (see map 2.10). Although development is not occurring in any of the wetlands, there is development at the fringes of some of the wetlands. On the southern portions of Lindquist and Barnes lakes, there is residential development adjacent to the wetlands that drain into those lakes. The same type of development adjacent to wetlands is occurring along the North Branch Pike River and along Old County A, east of Dunbar. Future development may possibly occur along the wetlands adjacent to the North Branch Pike River and Cole Creek, and should be an issue to consider in the future. Although there are a few isolated cases where wetlands are being encroached upon, the vast majority of the wetlands in the town of Dunbar are not being directly impacted by development.

### Seasonal Use Impacts

Although the town of Dunbar experiences two times as many seasonal residents as year-round residents, the overall number of people using the resources at one time is relatively small at approximately 2,596 persons versus the year-round total from the 2000 census of 1,303 persons. If the total acres of lakes that have any type of public access totaling 325 acres are divided out by the approximate number of total seasonal and year-round residents of 2,596 the result is approximately 0.13 acres of lake for every person. It is unlikely that every person will be using the lakes at the exact same time, and it appears that there is enough water resources for everyone to enjoy.

### Zoning and Land Use Conflicts

In utilizing the Commission's Geographic Information System to overlay the current (2001) land use with the county zoning districts, there do not appear to be any major conflicts between zoning and land use. The only exceptions to this are around the lakes, where residences are within the 75 foot county setback requirements, although these dwellings were constructed before the minimum setbacks were in place.

## SUMMARY

Land use within the town of Dunbar is dominated by the town's forests and lakes, making up 91 percent of the entire town. Although this is the case, the majority of development in the town is located either within the community of Dunbar, along USH 8, or around the shorelines of Young, Lindquist and Lily lakes. In order to maintain the natural setting, which makes Dunbar desirable as a vacation destination or a place to live, care must be taken when developing the remaining lakes and shoreline, including: enforcing of setback, shoreland/floodplain ordinances, and education on the importance of shoreline vegetation and revegetation, and erosion minimization processes.

# CHAPTER 5 - FINDINGS

## INTRODUCTION

The purpose of this study is to inventory the existing natural features and land use and based on that determine the needs for water quality data. The following findings and recommendations will help future planning and proper management of the land and water based natural resources. Based on the information contained within this report, recommendations regarding future development and planning activities have been developed which, if implemented, should assist in lessening any negative impacts on the water quality associated with increased shoreline development. These recommendations are broken down into several categories with specific recommendations contained below them.

### Water Quality Data Needs

The Marinette County Land and Water Conservation Department has a good start in obtaining complete, up to date data on the lakes within the county. Other data that should be collected include pH, fecal coliform, chlorophyll a, and turbidity. If possible, data should be gathered four to five times a year, as indicated by the DNR The most complete data set to be gathered is listed in the Chapter 2, Long Term Trends Lake Monitoring Chart. If all of the data within the table cannot be gathered then at a minimum Secchi disk readings, temperature, chlorophyll a, total phosphorous and dissolved oxygen should be obtained as much as possible. In time, this data will show trends, so that any developmental impact on water quality within the town can be identified early. This will allow ample time to try to fix any problems that might have occurred.

In order to maintain the water quality within the town of Dunbar, the county should use the U.S. Forest Service's Best Management Practices in conjunction with the Shoreland/Wetland Ordinance Permitting Process to control shoreline erosion.

### Land Use and Zoning Recommendations

#### Comprehensive Land Use Planning

The town of Dunbar should start thinking about starting a Smart Growth Comprehensive Plan and Marinette County should update their 1990 Marinette County Community Development Plan. Such a plan should incorporate, at a minimum:

- An analysis of past/projected demographic trends;
- An inventory of existing natural features and current development patterns;
- An inventory of existing community facilities/public services;
- A formally adopted land use plan for a 20 year period which is recommended to include measures to:

  Promote logical contiguous development;

  Avoid negative environmental impacts (identify conservancy areas);

  Minimize conflicting land uses;

  Establish housing development densities;

  Promote rural cluster developments rather than sprawled/scattered single family homes on larger lots.

Provide public access to recreational/natural areas;

Provide for efficient transportation;

The local land use plan should be checked for consistency with county comprehensive plans as well as with land use plans for adjacent civil divisions and should follow the guidelines under the smart growth initiative.

**Ordinances**

- Local and county-wide ordinances should be periodically reviewed and updated on a regular basis to reflect changes in the physical, social, and economic trends;
- Continue education efforts with regard to the water quality benefits of the 75-foot building setback from the town's shorelines.
- Encourage residents to maintain more than the minimum vegetative screening as called for in the Marinette County Shoreland/Wetland Ordinance.
- Provide consideration to a setback area around wetlands for development, to maintain or improve the water quality of the lakes in the town of Dunbar.
- Encourage Marinette County to develop separate ordinances on rivers and tributaries designated as wild and scenic, and other cold water streams to ensure protection.
- Create a land division ordinance that would require public access to lakes as they become developed.

**Public Access Recommendations**

- Continue routine maintenance on the boat landings and improve as necessary.
    - Improve public access point on Lindquist Lake, the town already owns land
    - Create better access on the county owned land on Mud Lake
- Improve "wilderness type" access points.
- Obtain land when available to create access points on lakes as they develop.
    - Obtain land on Town Corner Lake when it becomes available to create public access on the north side.b

**Future Planning Needs**

- Future planning needs within the town of Dunbar include developing a vision for the next twenty years in the form of a comprehensive land use plan.
- Develop a town wide survey to get a better understanding of the issues and needs of the residents, both seasonal and year round.
- Apply for future grants to sample lakes for lacking water quality data.

# APPENDIX A - COMPLETE LAKE DATA RESULTS

| Lake Name | Ownership | Lake Type | Maximum Depth | Average Depth | Surface Area | Watershed Area | Shoreline Length | Shoreline Dev. Factor |
|---|---|---|---|---|---|---|---|---|
| Barnes | Many Private | se | 19 ft. | 8.7 ft. | 27.9 ac. | 65.94 ac. | 4824.6 ft. | 1.2 |
| Camp | Private (1) | se | 14.0 | 7.2 | 8.1 | 111.90 | 2928.6 | 1.4 |
| Christian | Private (2) | se | 16.0 | 7.8 | 5.8 | 36.90 | 2141.0 | 1.2 |
| Dvorak | MCF | sp | 2.0 | - | 4.0 | - | 1847.0 | - |
| East Pickerel Pond | Private (2) | dg | 35.0 | 13.7 | 9.1 | 66.53 | 2912.3 | 1.3 |
| East Twin | Private (1) | se | 21.0 | 9.4 | 6.8 | 42.22 | 2119.6 | 1.1 |
| Johnson & Beach | MCF | dg | 7.0 | 3.8 | 14.2 | 1043.70 | 3475.3 | 1.2 |
| Kidd | MCF | se | 5.0 | 4.4 | 20.3 | 203.10 | 3622.6 | 1.1 |
| Lily | Many Private | dg | 17.0 | 7.3 | 23.7 | 128.60 | 4180.0 | 1.2 |
| Lindquist | Many Private | dg | 58.0 | 21.9 | 69.3 | 657.20 | 8527.0 | 1.4 |
| McDonald | Private (1) | sp | 8.0 | 4.3 | 14.9 | 130.00 | 3835.0 | 1.3 |
| Merriman | Many Private | se | 12.0 | 6.6 | 28.3 | 175.60 | 5071.5 | 1.3 |
| Minnie | Private (1) | se | 7.0 | 5.0 | 9.1 | 123.70 | 2639.0 | 1.2 |
| Mud | MCF | sg | 5.0 | 3.0 | 11.1 | 683.66 | 3715.3 | 1.5 |
| Phillips | Private (1) | se | 18.0 | 8.4 | 10.9 | 86.34 | 2917.3 | 1.2 |
| Sackerson | Private (1) | sp | 23.0 | 10.3 | 12.4 | 95.80 | 3179.6 | 1.2 |
| Spur | MCF | sp | 24.0 | 10.8 | 13.6 | 251.90 | 4715.0 | 1.7 |
| Town Corner | Many Private | sp | 8.0 | 5.9 | 174.2 | 597.90 | 16885.0 | 1.7 |
| West Pickerel Pond | Private (2) | sp | 39.0 | 16.8 | 14.4 | 67.36 | 3677.3 | 1.3 |
| West Twin | Private (4) | se | 15.0 | 7.5 | 15.1 | 41.75 | 3737.0 | 1.3 |
| Woempner | Private (1) | se | 8.0 | 5.3 | 26.8 | 232.47 | 4332.6 | 1.1 |
| Young | Many Private | se | 13.0 | 6.9 | 27.6 | 228.80 | 5715.0 | 1.5 |

| Lake Name | Stratification Factor | Flushing Index | Drainage Basin/ Lake Area Ratio | Soil Erodibility | Septic Suitability | Public Shoreline | Wet Shoreline | Public Access |
|---|---|---|---|---|---|---|---|---|
| Barnes | 16.3 | 0.3 | 2.4 | 1 | 1 | 0 ft. | 440 ft. | - |
| Camp | 20.4 | 1.9 | 13.8 | 75 | 100 | 0 | 0 | - |
| Christian | 26.9 | 0.8 | 6.4 | 100 | 100 | 0 | 0 | R |
| Dvorak | - | - | - | - | 0 | 0 | - | - |
| East Pickerel Pond | 41.2 | 0.5 | 7.3 | 82 | 100 | 0 | 530 | - |
| East Twin | 30.6 | 0.7 | 6.2 | 0 | 100 | 0 | 370 | - |
| Johnson & Beach | 10 | 19.5 | 73.5 | 0 | 100 | 3475.3 | 3475.3 | W |
| Kidd | 7.3 | 2.3 | 10 | 9 | 100 | 3622.6 | 1950 | T |
| Lily | 15.6 | 0.7 | 5.4 | 20 | 100 | 100 | 0 | B |
| Lindquist | 34 | 0.4 | 9.5 | 27 | 100 | 2180 | 2020 | B |
| McDonald | 10.7 | 2 | 8.7 | 100 | 100 | 0 | 0 | - |
| Merriman | 11.4 | 0.9 | 6.2 | 74 | 100 | 0 | 0 | - |
| Minnie | 12 | 2.7 | 13.6 | 0 | 100 | 0 | 2639 | - |
| Mud | 9.1 | 20.2 | 61.6 | 0 | 100 | 3715.3 | 3715.3 | W |
| Phillips | 21.7 | 0.9 | 7.9 | 100 | 100 | 0 | 0 | - |
| Sackerson | 25.2 | 0.7 | 7.7 | 100 | 71 | 0 | 0 | - |
| Spur | 25.1 | 1.7 | 18.5 | 8 | 100 | 4715 | 4345 | T |
| Town Corner | 5.6 | 0.6 | 3.4 | 0 | 47 | 2100 | 6786 | B |
| West Pickerel Pond | 37.6 | 0.3 | 4.7 | 95 | 100 | 0 | 183 | - |
| West Twin | 16.5 | 0.4 | 2.8 | 33 | 100 | 0 | 621 | - |
| Woempner | 8.8 | 1.6 | 8.7 | 43 | 100 | 0 | 2320 | - |
| Young | 12.1 | 1.2 | 8.3 | 86 | 100 | 0 | 490 | T |

| Lake Name | Alkalinity | Phosphorus | Secchi Disk | TSI/tp | TSI/sd | Developed Lots | Undeveloped Shoreline | Ave. S.L. per Development | Shoreline Density |
|---|---|---|---|---|---|---|---|---|---|
| Barnes | 29 mg/l | 10 ug/l | 13.5 | 46.0 | 39.6 | 12.0 | 400 ft. | 368.72 ft. | 13.13 |
| Camp | - | 32.0 | 9.0 | 55.0 | 45.4 | Institional | 0 | NA | 0.00 |
| Christian | 33.0 | 11.0 | 13.5 | 46.8 | 39.6 | 2.0 | 1950 | 95.5 | 4.93 |
| Dvorak | - | - | - | - | - | 0.0 | 1847 | NA | 0.00 |
| East Pickerel Pond | - | - | - | - | - | 0.0 | 2912 | NA | 0.00 |
| East Twin | - | - | - | - | - | 0.0 | 2119 | NA | 0.00 |
| Johnson & Beach | - | 37.0 | - | 56.2 | - | 0.0 | 3475 | NA | 0.00 |
| Kidd | 71.0 | 39.0 | 2.5 | 56.6 | 63.9 | 0.0 | 3622 | NA | 0.00 |
| Lily | - | 12.0 | 9.5 | 47.5 | 44.7 | 16.0 | 400 | 236.3 | 20.21 |
| Lindquist | 153* | 9.0 | 11.5 | 45.2 | 41.9 | 16\23 | 3900 | 201.2 | 14.24 |
| McDonald | - | 12.0 | - | 47.5 | - | 0.0 | 3700 | NA | 0.00 |
| Merriman | 55.0 | 30.0 | - | 54.5 | - | 8.0 | 3000 | 258.9 | 8.33 |
| Minnie | - | - | - | - | - | 0.0 | 2400 | NA | 0.00 |
| Mud | - | - | - | - | - | 0.0 | 3715 | NA | 0.00 |
| Phillips | - | - | - | - | - | 0.0 | 2700 | NA | 0.00 |
| Sackerson | - | - | - | - | - | 1.0 | 3000 | 179.6 | 1.66 |
| Spur | 132.0 | 11.0 | 15.0 | 46.8 | 38.1 | 0.0 | 4715 | NA | 0.00 |
| Town Corner | 84* | 14.0 | - | 48.6 | - | 15\31 | 11200 | 183.4 | 4.69 |
| West Pickerel Pond | - | - | - | - | - | 1.0 | 3500 | 177.3 | 1.44 |
| West Twin | - | - | - | - | - | 0.0 | 3737 | NA | 0.00 |
| Woempner | - | - | - | - | - | 1.0 | 4000 | 332.6 | 1.22 |
| Young | - | - | - | - | - | 26.0 | 1600 | 158.2692308 | 24.02 |

Key to Abbreviations

Ownership

| | |
|---|---|
| MCF | Marinette County Forest Land |

Lake Type

| | |
|---|---|
| dg | Drainage |
| sp | Spring |
| se | Seepage |

Public Access

| | |
|---|---|
| R | Road |
| T | Trail |
| W | Wilderness |
| B | Boat |

| | |
|---|---|
| In developed lots category | #/# equals lots in the town/lots on total lake |

Note: Shoreline density was measured by taking the shoreline length in miles and dividing it by the number of developed lots.

Upper Green Bay Management Plan Data

| Lake Name | History Winterkill | TSI T-P | TSI Class | P | Sensitivity |
|---|---|---|---|---|---|
| Barnes | No | | | I | Ins |
| Lindquist | No | | | I | Ins |
| Town Corner | Yes | 46.9 | Meso | II | Ins |
| Woempner | Unk | | | II | Ins |

Phosphorus Sensitivity

Class I Lakes that are sensitive to increased phosphorus loading

Class II Lakes that are less responsive to changes in phosphorus loading

Ins Data inadequate or insufficient to assess trophic condition, classification monitoring recommended

# APPENDIX B - DETAILED LAND USE TABULATIONS

| CODE | LAND USE CLASSIFICATION | Acres |
|---|---|---|
| 100 | RESIDENTIAL | |
| 110 | Single Family Residential | 413.76 |
| 170 | Group Quarters | 3.63 |
| 180 | Mobile Homes | 37.95 |
| 190 | Land Under Residential Development | 1.66 |
| 199 | Vacant Residence | 1.98 |
| 200 | COMMERCIAL | |
| 210 | Retail Sales | 7.90 |
| 250 | Retail Services | 0.49 |
| 299 | Vacant Commercial | 0.69 |
| 300 | INDUSTRIAL | |
| 360 | Extractive | 6.08 |
| 380 | Storage | |
| 381 | Open | 0.90 |
| 382 | Enclosed | 7.92 |
| 400 | TRANSPORTATION | |
| 414 | Local Streets and Roads | 1,596.97 |
| 417 | Off-Street Parking | 0.70 |
| 440 | Rail Related | 115.41 |
| 500 | COMMUNICATION/UTILITIES | |
| 541 | Major Electric Power Transmission Lines R/W | 163.20 |
| 600 | INSTITUTIONAL/GOVERNMENTAL FACILITIES | |
| 611 | Administrative Buildings | 0.83 |
| 614 | Municipal Garages | 0.86 |
| 648 | Four-Year & Graduate Colleges/Universities | 36.72 |
| 651 | Libraries | 0.73 |
| 684 | Fraternal Organizations/Clubhouses | 2.41 |
| 691 | Churches/Temples/Synagogues | 0.38 |
| 694 | Cemeteries | 9.73 |
| 700 | OUTDOOR RECREATION | |
| 716 | Nature Study Areas | 4.77 |
| 736 | Parks/Parkways/Forest Related Picnic Areas | 98.42 |
| 741 | Playfields/Ball Diamonds/Volleybal Courts | 4.15 |
| 781 | Boat Launching Sites/Areas | 0.64 |
| 800 | AGRICULTURE/SILVICULTURE | |
| 810 | Croplands/Pastures | 1495.31 |
| 830 | Long-Term Specialty Crops | 22.79 |
| 870 | Farm Buildings/Accessories | 22.65 |
| 900 | NATURAL AREAS | |
| 910 | Water | |
| 911 | Lakes | 411.65 |
| 912 | Reservoirs and Ponds | 157.55 |
| 913 | Rivers and Streams | 120.14 |
| 950 | Other Natural Areas | 1227.65 |
| 951 | Woodlands | 61297.17 |
| 990 | Land Under Development | 0.29 |
| | TOTAL | 67,274.06 |