LPT-091

Surface Water Inventory of Door County

Prepared by the
Door County Soil and Water Conservation Department

December of 2000

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Preface

The *Surface Water Inventory of Door County* is a document of compiled information. The known surface water resources of Door County are addressed by giving general descriptions, locations and small narratives about the resource. Lakes, streams, and bays are listed by official and/or known local names when possible. Other less distinct surface water resources, such as wetlands and ridge-swale complexes, are discussed in a general overview and may again be noted in the narratives of a specific named resource. The inventory portion of the document is followed by other relevant information concerning the use and protection of Door County's surface water resources.

Introduction

Door County has been referred to as one of the most environmentally sensitive and ecologically important areas in the Midwest. Many features throughout the county, such as the rock outcroppings, sand dunes and wetlands, are an integral part of what gives Door County this status and makes this area aesthetically pleasing. The surface waters are a large component of the ecological importance and they add to the popularity of the county.

The Surface Water Resources of Door County, published in 1965, was the first surface water inventory for Door County. Since then, many areas of the county have had land disturbances and alterations, including dredging, construction and filling, some of which have greatly affected the surface waters. The changing landscape has spurred concern for the health of surface waters from resource professionals and the community. Research was the answer to the concern, and over the years this research has included water quality monitoring, fisheries inventories, and habitat inventories, with few results being formally published. This document is based on the need to update the 1965 report and have current and historical information on the surface water resources in one report.

This report addresses the geographical, geological, and ecological components of the streams, lakes, bays, harbors, and partially bounded coastal waters along with overviews of wetlands, ridge-swale complexes and the geology of the county. Existing information from numerous formal and informal sources were gathered and incorporated to develop the updated surface water inventory. Much of the information contained in this document has been researched by agencies including the Department of Natural Resources (DNR), The Nature Conservancy (TNC), the Door County Soil and Water Conservation Department (SWCD), University of Wisconsin, and the U.S. Fish and Wildlife Service (USFWS). Other information sources consisted of informal interviews and the personal knowledge of resource professionals and community residents. The compilation of this information in an organized format will serve as an effective resource protection instrument to be used by resource professionals to preserve or restore the resources that are a primary attraction of the county. The information can also be used as a reference for those who want to simply enjoy these resources.

Lake Michigan and Door County

A significant portion of the economy of the Door Peninsula benefits from the water resources, be it a direct source of commercial or sport fishing and shipping routes, or an indirect source of tourism and general recreation. All the surface waters are potentially at risk for overuse and abuse. Our understanding of surface waters is important to maintaining and sustaining the habitat and recreational values it provides.

Lake Michigan, the sixth largest lake in the world, averages 279-feet in depth. Lake Michigan is long and narrow, 307-miles by 118-miles. A relatively small amount of water flows out of the bottleneck morphology located in the north east portion of the lake at the straits into Lake Huron yielding a retention time of nearly 100 years. This long flushing time is important when considering such issues as pollution because the largely closed basin is heavily influenced by interactions at the land-water interface.

Lake Michigan has substantial effects on Door County and its many islands. The large volume of water has climatic effects on the terrestrial areas. The peninsula's eastern shore has a buffered climate in the summer due to nearshore areas being cooler than inland areas. Conversely, nearshore areas remain warmer in the winter due to the heat capacity of the adjacent lake. The warmer lake and nearshore areas in winter also attribute to what is termed lake effect snows. The western shore of the peninsula has a slightly different micro-climate. The Green Bay nearshore waters are shallower allowing for water temperatures to be warmer than the eastside waters in summer and also for extensive ice cover in the winter. During certain winters, the ice cover can extend completely across to the west shore of Green Bay.

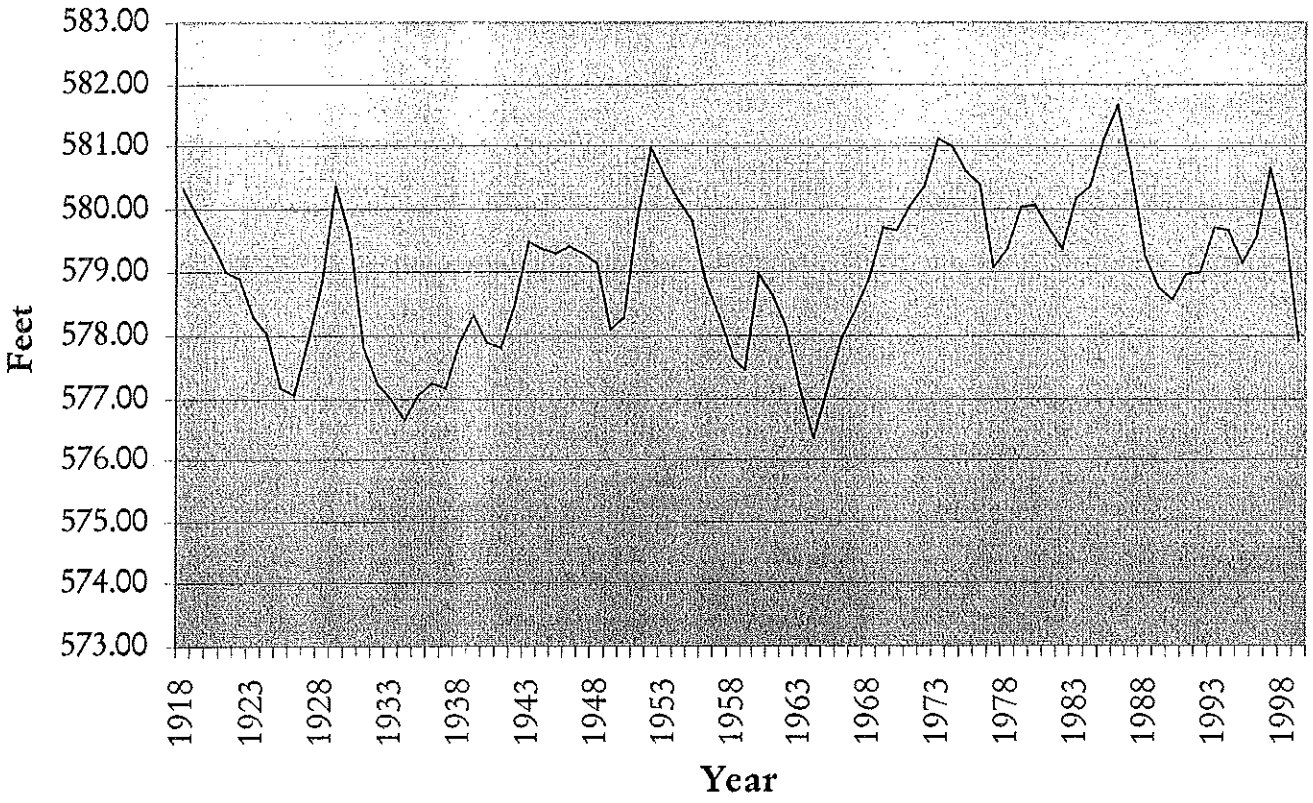
Besides temperature changes, Lake Michigan water level fluctuations can affect surface waters. Water level fluctuations can be placed into three categories based on the time/duration of the fluctuation.

The short-term water fluctuation effect is called *seiche*. A seiche is the free oscillation of water in a closed or semi-closed basin and can be frequently observed in harbors and bays. It is usually started by meteorological disturbances and can displace water as a result of atmospheric pressure or high winds. The water surges back and forth, like water sloshing around in a bathtub, until the friction from the oscillation dampens it. They generally only last for a few oscillations, but can be generated frequently. A seiche effect at certain times may change water levels inland and can often redirect the flow of streams near their mouths.

Seasonal water level fluctuations reflect the annual hydrologic cycle. These changes take place as a result of storm actions, surface water runoff or ground water flow. In spring, water levels tend to rise due to snowmelt, heavier rains and reduced evaporation over the basin. This trend will continue until the lake level peaks, usually sometime during summer. In summer, more persistent winds and drier air intensify evaporation; run-off and groundwater flow also reach their lowest values. As the water supplied to the lake becomes less than the outflows, the water levels begin their downward trend toward winter minimums.

Long-term water level fluctuations are the result of persistent low or high water supply conditions within the basin. Water levels can rise or fall as much as 6.5-feet over a period of years, but annual fluctuations average 11-18 inches. Historically, lake levels have fluctuated by about six feet on the time scale of decades or less, making the coastal boundary a dynamic area. These fluctuations become important considerations when deciding upon waterfront property use, property ownership and/or construction. Figure 1 shows the hydrograph of Lake Michigan-Huron.

Figure 1: Historic Lake Levels for Lake Michigan-Huron (Data provided by the U.S Army Corp of Engineers, Detroit and monthly level readings were averaged for an annual reading).

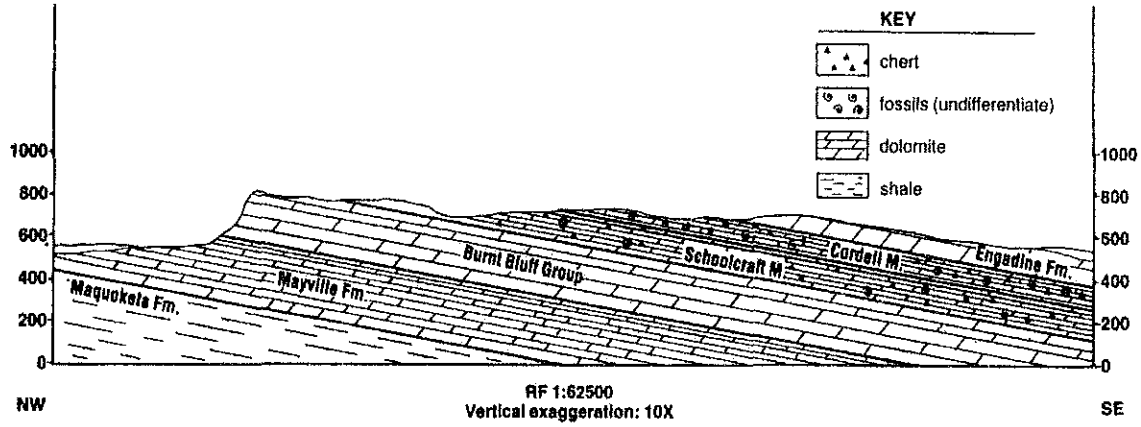


Geology and Geological Components Related to Surface Waters

Door County is part of a narrow peninsula referred to as the Door Peninsula. The Door Peninsula base is an arbitrary line that approximately connects the city of Green Bay with Kewaunee. The peninsula then extends approximately 70-miles northeast into Lake Michigan. The peninsula is approximately 18-miles at its greatest width and gradually tapers to three-miles wide at its northern extent. The Door Peninsula also has numerous associate islands belonging to Door County. The largest are Washington Island and Chambers Island, both of which have inland waters.

The peninsula is formed by a portion of the Niagara Escarpment, expressed as a prominent ridge with a steep west-facing scarp with rock outcroppings that reach 150-feet in height and a gentle eastward backslope merging with the waters of Lake Michigan. The youngest and most familiar bedrock component of the county geology is the Silurian age dolomite, a calcareous unit with high concentrations of magnesium and small concentrations of iron. The chemical nature of the dolomite creates a reactive base easily modified through dissolution, leading to the development of enlarged vertical crevices and horizontal bedding planes.

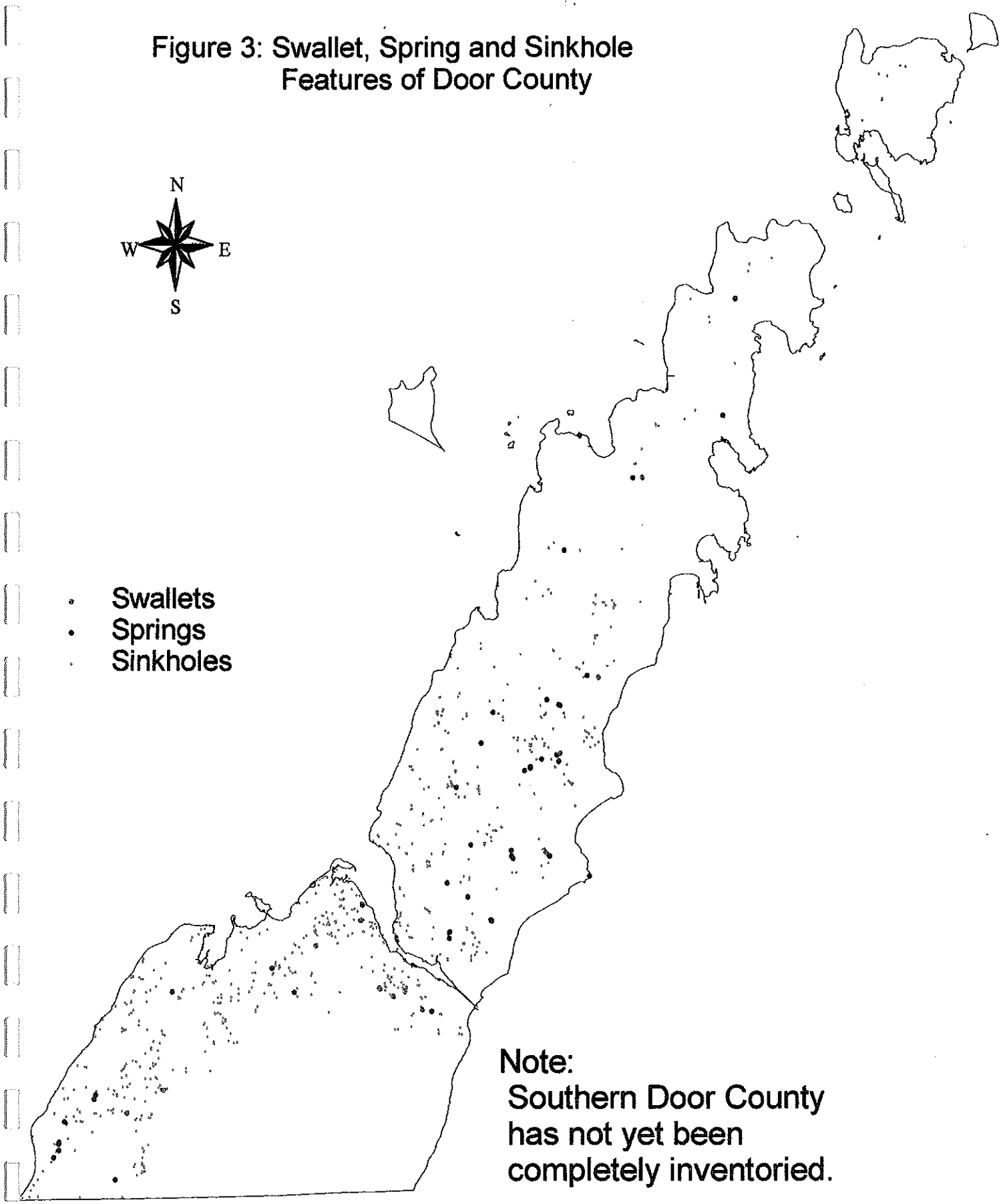
Figure 2: Generalized cross section of the Door Peninsula illustrating gentle inclination of the bedrock and the northwest facing escarpment. (Stieglitz 1989)



Southern portions of the county have areas where the ridge of the bluffs are some distance inland from the bay of Green Bay, but north of Sturgeon Bay the bluffs increase in elevation, remain nearly continuous, and stay in close proximity to Green Bay waters. Figure 2 illustrates the geologic orientation of the escarpment. The eastward inclination in the landscape influences the drainage pattern in a southeasterly direction. Most of the streams that drain west are fairly short and have small watersheds that encompass the terrace below the escarpment. More northerly streams tend to have a higher gradient at their source and drop near their mouth to lake level, whereas more southerly streams tend to have a low gradient for the entire course.

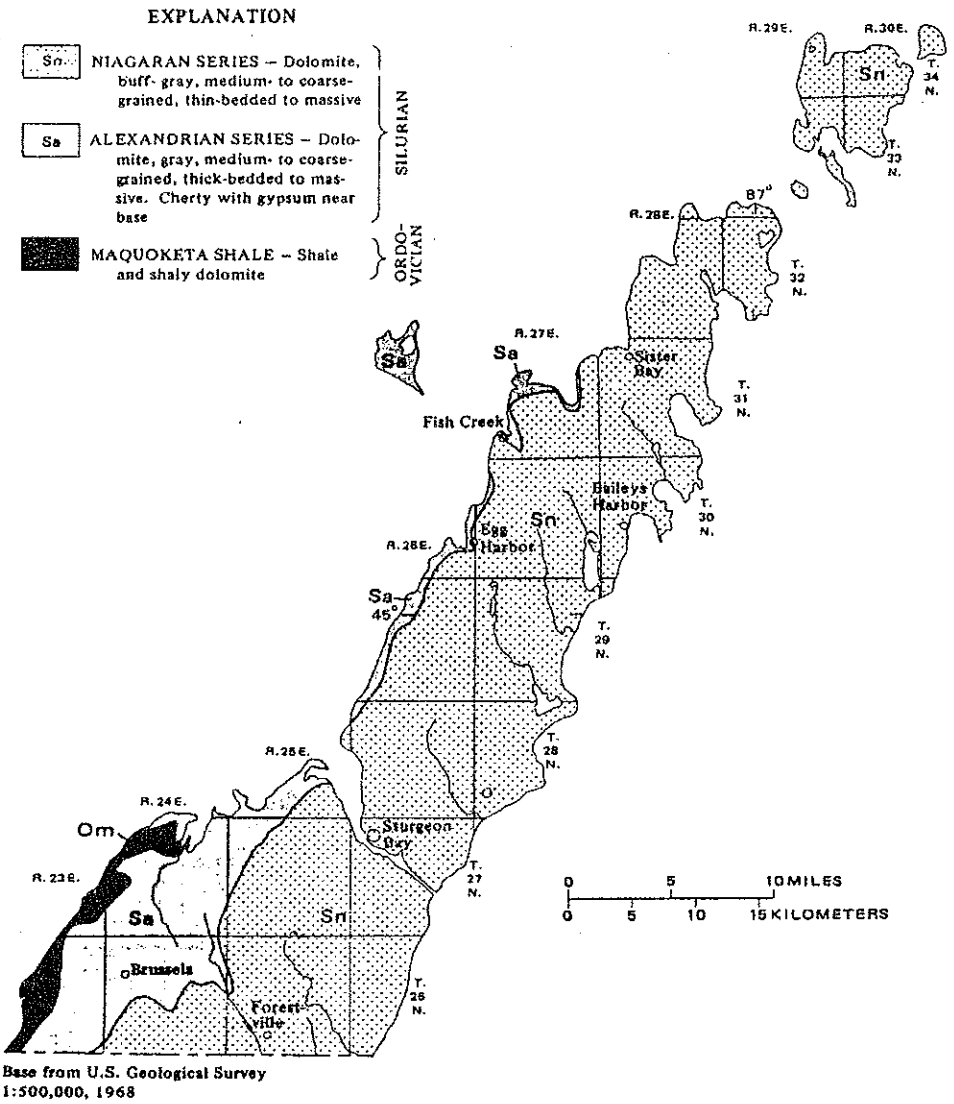
The rocks of the escarpment are susceptible to the formation of karst or solution features. Surface water can drain into sinkholes, caves or crevices. As these features grow, organic matter can accumulate in certain portions giving way to highly unique micro-habitats, some of which can mimic cold air slopes. The karst topography, formed on the solution modified bedrock, is found scattered throughout the county. Sinkholes, swallets, solution widened joints, and crevices provide direct routes into the groundwater aquifer with minimal filtering action due to thin overlying soils. Chemical reactions can occur along the entire extent of any water route with limited buffering. The direct groundwater conduit provided by solution modified bedrock magnifies the importance of limiting surface water pollution since surface contaminants are easily routed through the secondary porosity. Cliff habitats and groundwater resources are very sensitive due to this high contamination potential. Figure 3 shows the swallet, spring, and sinkhole features of Door County, although southern Door County has not been completely inventoried at this time. Surface water impacts are known to have effects on groundwater resources due to the above mentioned features.

Figure 3: Swallet, Spring and Sinkhole Features of Door County



Underlying the dolomite is the Maquoketa Formation which functions as an aquitard often inhibiting water movement from the overlying Silurian aquifer to the underlying aquifers. These shales are primarily present in a band contouring the county from Little Sturgeon Bay south. Continuing under the Maquoketa Formation are Ordovician dolomites and shales and Cambrian sandstones. Figure 4 shows the general distribution of bedrock units.

Figure 4: Generalized geologic map of Door County. (Sherrill, 1978)



Soils throughout the county are derived from weathering of calcareous till and other glacial deposits giving them a very alkaline quality. Most of the soils of the county are very shallow, especially in the northern two-thirds of the peninsula where 22% of the soil in the county is less than 18-inches in depth and an additional 17% is between 18 to 36-inches in depth.

Different soil types can have varying effects on surface water. This can be a significant problem if soil is carried through the watershed into a concentrated surface water. Generally, finer textured soils with high amounts of clay and silt have a higher potential to be detached and transported by surface waters. This results in siltation of slower moving water bodies. The sediment can accumulate as bottom material and may have detrimental effects if excess sediment covers bottom substrate and plant material. For this reason, the quality of a watershed is linked to the quality of a surface water resource. A soil influence on the water quality in a watershed may be distinct in such characteristics as run-off potential and aiding in the movement of nutrients. Soil erosion, limited buffering capacity, non-point source pollution, and development pressures are additional water quality concerns that are related to soil type and watershed use.

There are 75 different soil types found throughout Door County. Soil types with similar inherent properties are grouped into six general soil associations:

- Summerville-Longrie-Omena
- Emmet-Solona-Angelica
- Rousseau-Kiva-Markey
- Kewaunee-Kolberg-Manawa,
- Deford-Yahara
- Variant-Carbondale
- Carbondale-Cathro.

The distribution and description of these soil associations can been seen in Appendix A.

Primary Surface Water

Although watersheds are not specific water resources, they are an important part of surface water resource inventories and protection efforts. Watershed delineation allows for the prediction of the volume of water flowing from a given area into a surface water resource. It can also assist in tracking the positive and negative effects to a water resource by defining the land use factors within the watershed. The surface water runoff caused by precipitation within a watershed flows from unconcentrated sheet run-off to channels of concentrated flow, and eventually flows into streams, lakes or areas considered closed depressions. Closed depressions are internally drained whereas streams and certain lakes may have outlets. Figure 5 shows the delineated watersheds and closed depressions in the county along with the names of major watershed areas.

Individuals tend to think of surface water resources as the surface water that is visually obvious, usually named and concentrated. For the purpose of this document, these surface water resources will be referred to as "primary" surface water. Primary surface waters will include lakes, streams, bays, harbors and partially bounded coastal waters. A detailed description of the primary surface waters begins on page 17.

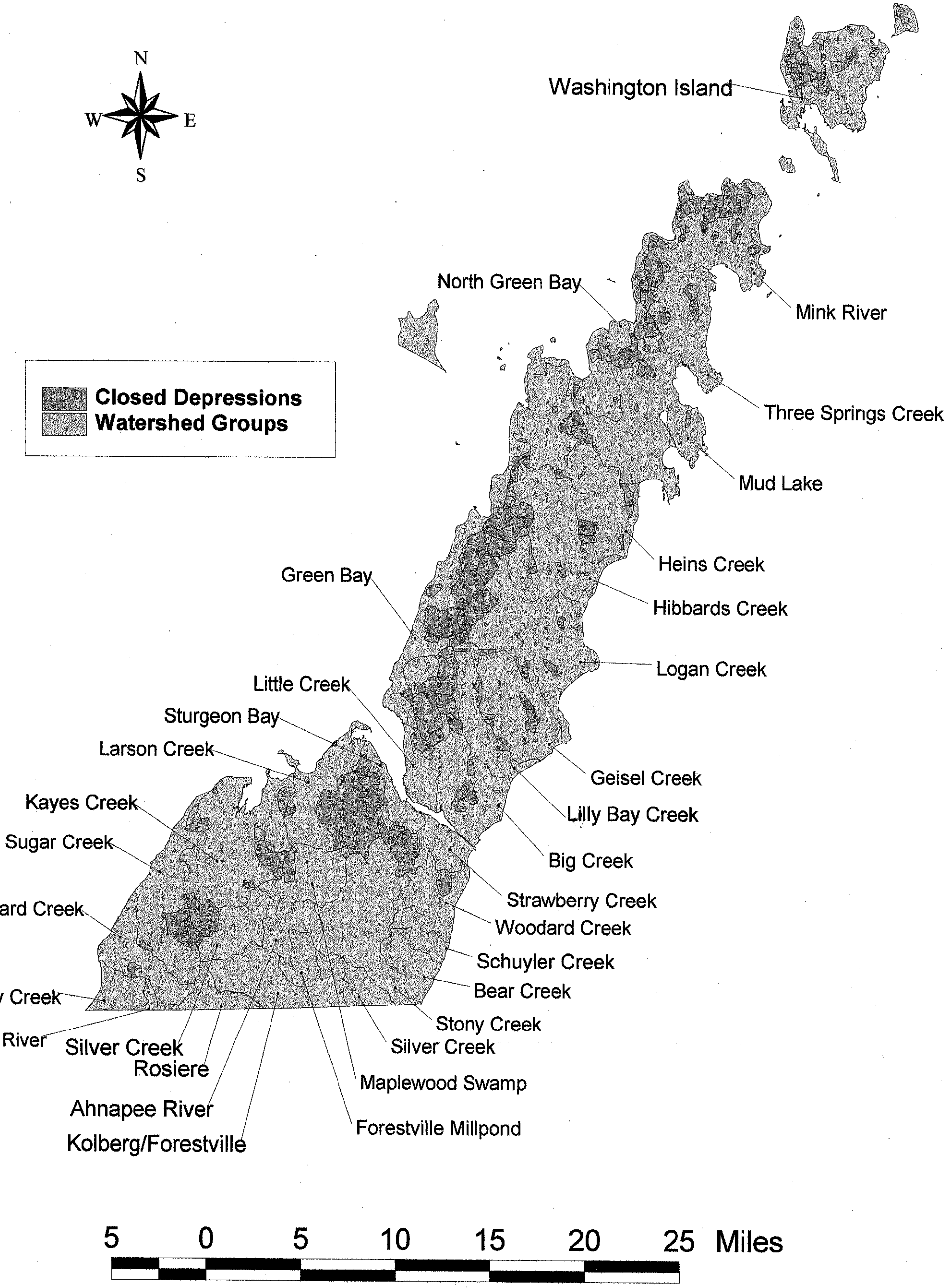
Secondary Surface Water

Many different habitat types are adjacent to or rely upon surface water and watershed functions. Besides the lakes, streams, bays, harbors and partially bounded coastal waters, a number of secondary surface water resources also provide important functions and resource values. These aquatic habitats have high importance, but generally are not utilized for human use as much as primary surface water. Nevertheless, these secondary surface water resources often have a unique nature or special value to wildlife. These habitats are often considered important resources individually, and are very relevant to water resources as a whole. Two major and one minor secondary surface water resources exist in Door County.

Ridge-Swale Habitats

The term ridge-swale is not well known by many members of the public. In Door County, the ridge-swale habitat is generally associated with wetland complexes on the Lake Michigan side of the peninsula. The habitat is composed of a parallel series of higher sandy ridges interspersed with lower swales with variable levels of water present. Ridge-swale habitats developed as a result of longshore transport of sand and subsequent wind action. They now parallel the shoreline of Lake Michigan, having become exposed as a result of changing water levels in the Holocene. The hydrology of a ridge-swale habitat is often complex, creating a diversity of micro-habitats which result in a high level of plant and animal diversity. Some species present are characteristic of wetland and bog communities, as in swales with standing water, while ridges often have sufficient drainage to support mixed deciduous forests. Perhaps the most well known example of ridge-swale habitat in Door County is protected within The Ridges Sanctuary.

Figure 5: Watershed Groups and Closed Depressions of Door County



Wetlands

The DNR Wetland Inventory Program estimates that about half of Wisconsin's original wetlands have been destroyed since pre-settlement times. Preserving those that remain has become a major effort in the last decade because protection is less expensive than restoration and in certain cases, restoration may not be possible. There are three layers of regulations which apply to and help protect wetlands: local, state and federal.

Wetlands are defined as "those areas where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which have soils indicative of wet conditions." This is the state definition used by the DNR and listed in Section 23.32(1) of Wisconsin Statutes. The Door County Zoning Ordinance uses the same definition at a local scale. The federal jurisdictional wetland criteria differ slightly from the state definition in regard to the wetland soil type parameter. Wetland determination is based on hydrophitic plants, wetland hydrology and wetland soils. The Corps of Engineers, in certain cases, may make a determination that an area is not a wetland, but the state/county will determine the area as a wetland based on the presence or absence of the wetland soil type. To have a wetland determination performed, contact the local DNR or Planning Department.

Landowners may also have the opportunity to enroll in a wetland reserve program which allows the landowner to receive payments for restoring or protecting wetlands on their property. Currently, only 21 acres are enrolled in Door County.

Wetlands are a very important part of the water cycle and the surface water resources of Door County. Throughout the landscape they function as buffers, water retention areas, and groundwater recharge areas.

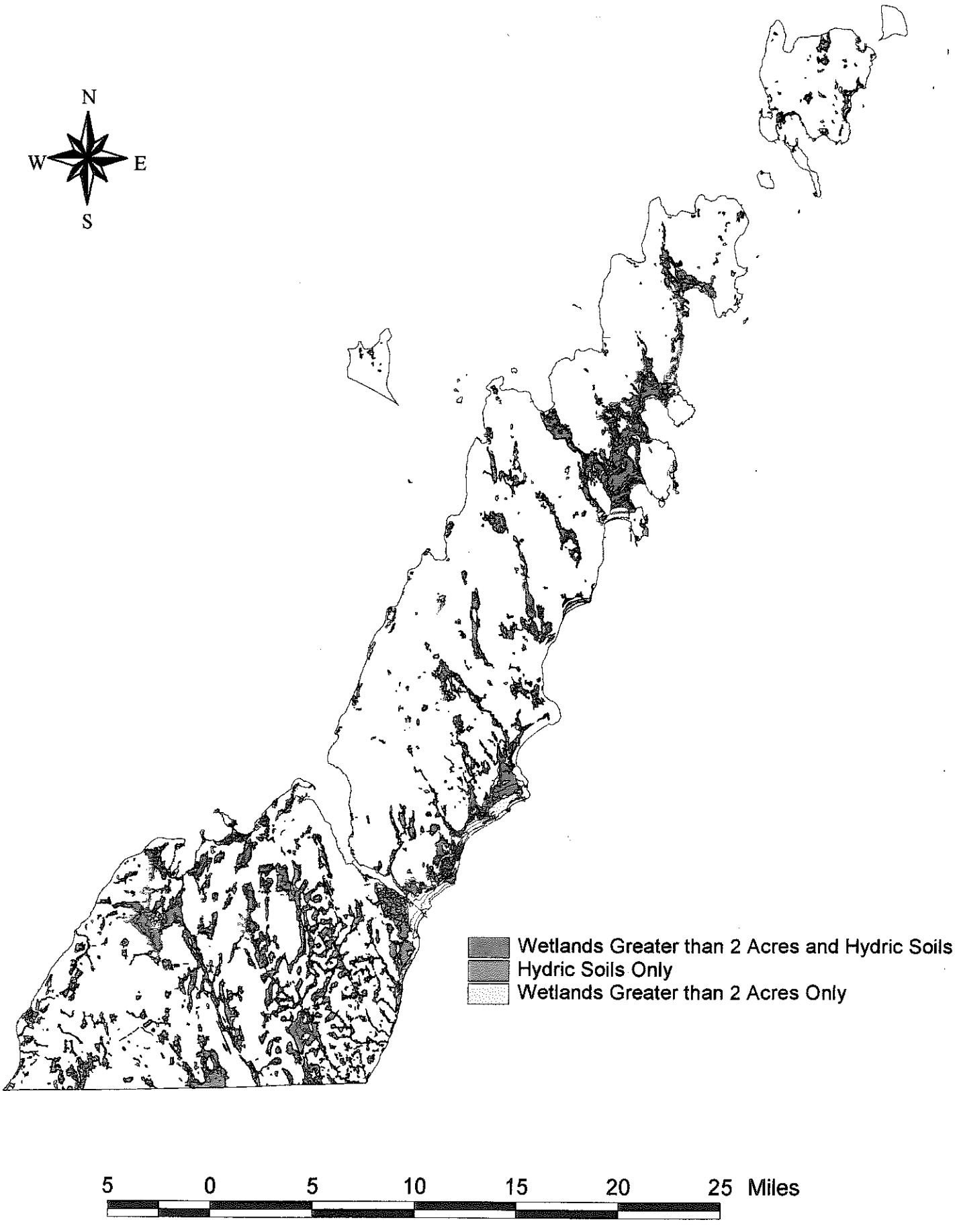
Changes in water regimes can drastically change the physical extent and biotic composition of wetlands. The water quality of the wetland greatly influences the variety of plant and animal species present. Surface and groundwater hydrology of the coastal wetlands are also affected by Lake Michigan water level changes. Nearly all the surface water sources in Door County are adjacent to, flow through, or are supplied by wetlands.

Wetlands may house an abundance of threatened and endangered species and serve important functions such as fish spawning areas, bird nesting areas, amphibian and reptile habitat, and habitat for a host of other plant and animal species. Disruptions in the hydrology of a wetland area can cause it to become less suitable for any number of species. Besides providing important habitats for many plant and animal species, they also retain and filter surface water runoff and slow sedimentation, increasing their value in the landscape.

According to figures available in 1995, Door County had 52,559 acres of wetlands which account for 16.7% of land in the county. Figure 6 shows the mapped wetlands of Door County two-acres and greater in size, and the mapped hydric soils which are soils characteristic of wetlands.

A wealth of information on the wetlands of Door County is available as a result of the Special Wetland Inventory Study (SWIS). The SWIS was a study funded by the U.S. Environmental Protection Agency and carried out by the U.S. Fish & Wildlife Service in the early 1990's. SWIS researchers conducted field inspections of over 4,000 wetlands in northeastern Wisconsin, including all of the wetlands in Door County which appeared on Wisconsin Wetland Inventory maps. Information was recorded on numerous parameters describing the functions and values of each wetland, which was then organized into a database. This information is available upon request from a number of different agencies, including the Door County Planning Department, the Wisconsin DNR, and the Fish & Wildlife Service.

Figure 6: Hydric Soils and Wetlands of Door County



Significant Seasonal Surface Waters

Significant seasonal surface waters are those areas which temporarily retain water. They are usually present during the spring and fall in all or most years, and include ephemeral ponds, natural sedimentation/retention ponds or collection basins. Significant seasonal surface waters collect water from adjacent upland areas, and then either slowly drain into adjacent surface waters or wetlands, infiltrate into subsurface groundwater or lose water to evaporation/transpiration. This gentle release of stored waters performs the important function of filtering out sediments and pollutants.

Seasonal surface waters are most noticeable in spring and can provide important wildlife habitat during this period. They are often found in areas which seem unlikely as wildlife habitat, such as a flooded agricultural field, and are generally limited in size. Although not readily visible during all seasons, they may provide critical habitat on an annual basis for certain wildlife such as ducks, frogs and salamanders. Most seasonal surface waters in Door County occur in marginal or wet farmland and flooded cedar stands. The majority are privately owned. While the values of these areas are not generally recognized, their loss would result in long-term detrimental effects to local water quality and wildlife abundance.

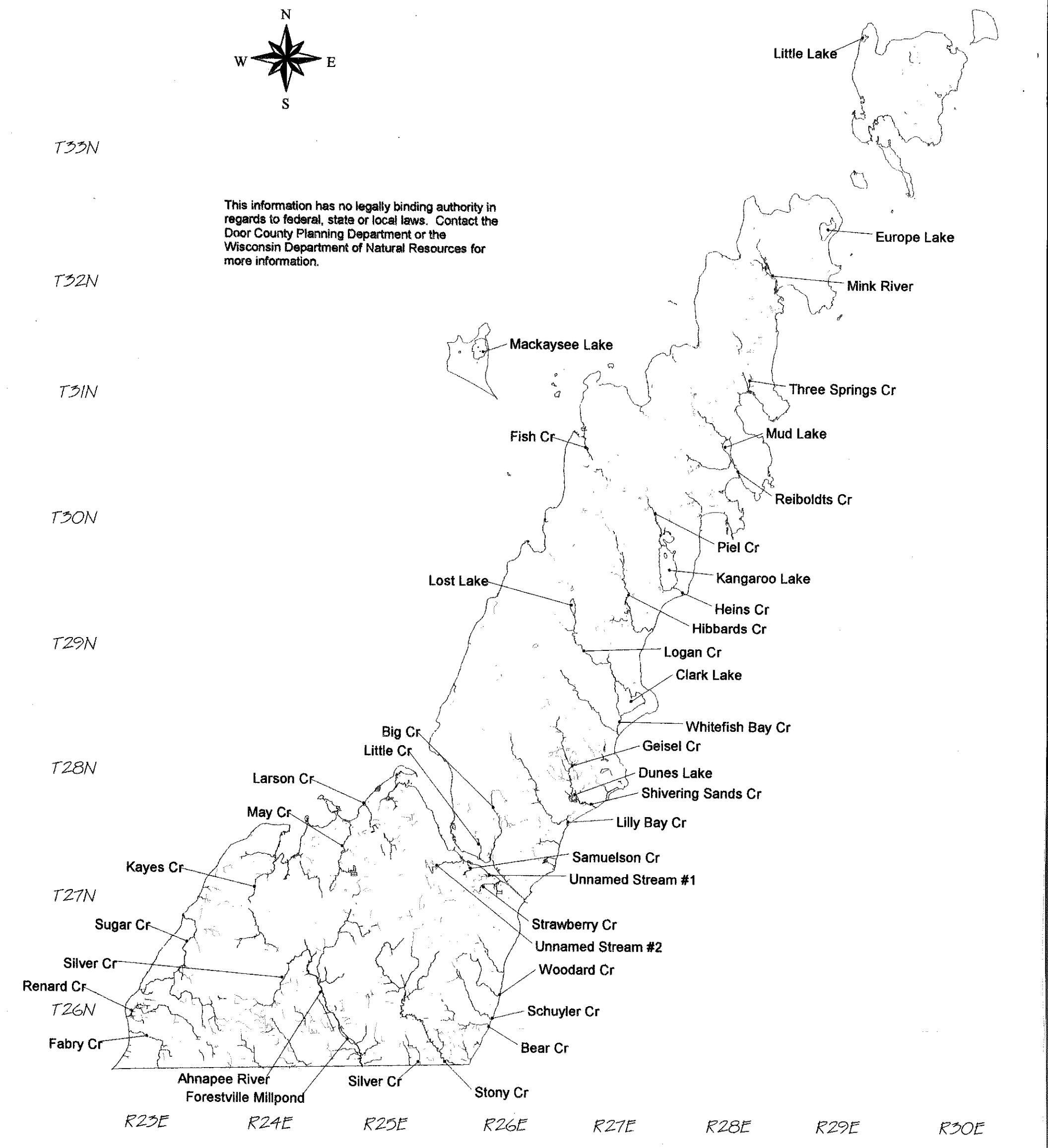
Navigability

Navigability determines whether a waterway is *public* or *private*. Navigable lakes and streams are public waterways. Navigable waterways are defined by the Wisconsin's Supreme Court as "those bodies of water that have a bed differentiated from adjacent uplands and levels of flow sufficient to support navigation by a recreational craft of the shallowest draft on an annually recurring basis". For example, a stream which is navigable by a skiff or canoe during normal spring high water is navigable under the laws of the state though it may be dry during other seasons. Many individuals are often confused when they encounter a stream or lake that has been declared navigable because it, in fact, may not be easily navigated.

An individual may use navigable waterways for boating, hunting, fishing, swimming or other recreational activities provided public access is available or the individual has permission from the landowner. Contrary to common belief, there is no strip of public ownership along the bank of a navigable waterway. If the land along a navigable waterway is privately owned, a person may be prosecuted for trespassing if that person crosses the land to use the waterway without permission.

The DNR is the agency responsible for making the legal determination of navigable waters. The presence of legally navigable waters makes the waters and adjacent lands subject to certain state and county water quality related regulations. Navigable waters are protected by law in order to guarantee all citizens their water rights. A person may need to obtain a permit or plan approval for projects which affect navigable waters. Projects in the shoreland zone may need local zoning permits as well. Figure 7 shows the known navigable waterways of Door County with information provided by the Door County Planning Department. Certain waterways may not have been inventoried or located on this map, therefore, contact the DNR for the official navigability determination of a waterway.

Figure 7: Navigable/Non-Navigable Waters of Door County



What's in a Name?

Unlike the plants and animals of the world, surface waters do not have scientific names with which to uniformly label them. Instead, names are derived from the local people who live near them, a distinguishing physical characteristic, animals which have some relationship to the locality or a folk story that is associated with the individual resource. This can lead to confusion when one body of water is referred to by more than one name or when more than one body of water has the same name.

The official name of a surface water is considered the name that appears on the United States Geological Survey (USGS) topographic maps. All surface waters are also assigned a waterbody identification number/code by the DNR. Waterbodies without an official name can be identified with this number/code. The official names of surface waters may change more frequently than the USGS maps are reprinted, in which case, information from an official report held in Madison with the Bureau of Facilities and Lands section of the DNR may be obtained.

A geographical naming council meets once a year to discuss any new or changing names. This process works in cooperation with the Door County Board of supervisors and the State Board on Geographic Names. The geographical naming council then forwards their approved changes to the U.S. Board on Geographic Names.

The Door County Surface Water Inventory lists the surface waters in alphabetical order by their official name. If the surface water is referred to by more than one name, the historic or local names will be listed within the narrative description.

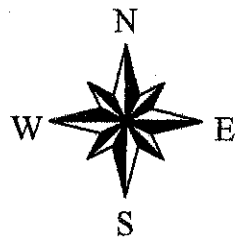
303(d) Listed Waters

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which sets the basic structure for regulating discharges of pollutants to waters of the United States. The CWA gave the Environmental Protection Agency (EPA) the authority to set effluent standards on an industry basis (technology-based) and continued the requirements to set water quality standards for all contaminants in surface waters. Additionally, the CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained under the Act. The state of Wisconsin uses a different variation of the NPDES and the permits are administered by the DNR.

The listing of waters under the CWA, also referred to by its section number 303(d), identifies waters that are not meeting water quality standards, including both water quality criteria for specific substances or designated uses. The list is also used as the basis for development of Total Maximum Daily Loads (TMDLs) under the provisions of section 303(d)(1)(C) of the Act. TMDLs are required by the CWA for estimating the pollutant loading reductions necessary to meet water quality standards on an impaired waterbody and recommending control measures to achieve loading reductions.

Recommendations for impaired water to be listed are submitted to EPA by the state. There are four surface waters in Door County which are on the 303(d) list. The Ahnapee River and Clark Lake are both listed for the concern of PCBs. Stony Creek is listed for the loss of instream habitat. The Sturgeon Bay Shipping Canal is listed for aquatic toxicity.

Figure 8: Door County Streams



T34N

T33N

T32N

T31N

T30N

T29N

T28N

T27N

T26N

Mink Rv
Three Springs Cr
Hidden Spring Cr
Ephraim Cr
Fish Cr
Reiboldts Cr
Pell Cr
Hidden Br
Hibbards Cr
Heins Cr
Horseshoe Bay Cr
Logan Cr
West Branch of Whitefish Bay Cr
Geisel Cr
(Maples/Donlan)
Whitefish Bay Cr
Lilly Bay Cr
Shivering Sands Complex
Goldenrod/Fischer Cr
Shivering Sands Cr
Lost Cr
Larson Cr
Twin Harbor Cr
Krueger Cr
May Cr
Unnamed Stream #2
Little Cr
Big Cr
Samuelson Cr
Unnamed Stream #1
Malvitz Cr
Kayes Creek
Strawberry Cr
Sugar Cr
Claybanks Cr
Silver Cr
Silver Cr
Ahnapee Rv
Woodard Cr
Renard Cr
Schuyler Cr
Bear Cr
Fabry Cr
Forestville Millpond
Silver Cr
Stony Cr

R23E R24E R25E R26E R27E R28E R29E R30E

5 0 5 10 15 20 25 Miles

Primary Surface Water Descriptions

Streams

Many of the terms used to describe the health and quality of streams can be further reviewed in **Appendix B.** This appendix describes the different stream parameters and the three different rankings/ratings used in this report. Biotic index levels may fluctuate based on where the sampling location was along the stream course. A summary of the Door County streams can be found in Table 1 and Table 2, which follow the stream narratives. Definitions of the terms in the Tables are located in **Glossary B.** The known streams of Door County are shown in Figure 8.

Ahnapee River T26N R25E Sec. 32

The Ahnapee River is 8.5-miles in length within Door County boundaries and averages 25-feet in width. Its gradient is 7.7-feet/mile. The headwaters of the Ahnapee River consist of springs and waters flowing from Silver Creek. Many portions of the Ahnapee's 18.2-surface acres tend to become stagnant in times of low flow. Along its course there are also intermittent areas that can limit recreational use. This low gradient stream drains a primarily agricultural landscape in Emmet-Solona-Angelica soil association. The stream also experiences heavy seasonal siltation. The watershed is 4.8-square miles and encompasses small residential and small wooded areas in addition to the aforementioned agricultural areas. Near the Village of Forestville the river is impounded by a dam. This dam creates the Forestville Millpond. Although this 1st and 2nd order stream is stressed from non-point pollution, it has a stream habitat ranking of *fair*. Water chemistry analysis during 1994 yielded average values for pH at 8.72, hardness at 313.3 mg/L, BOD at 2.19 mg/L, total Kjeldahl nitrogen at 1.6 mg/L, and total phosphorus at .042 mg/L. The river sustains annual fish runs in spring and fall below the dam. A warm water fishery is supported throughout most of its reaches, and trout and salmon are also stocked annually. The Ahnapee River is a 303(d) listed water for PCB contaminants and an advisory remained on smallmouth bass and carp in 2000. The Ahnapee River empties into Lake Michigan near the City of Algoma in Kewaunee County. The Forestville County Park is where it is most easily accessible, but other county road bridges can provide access as well.

Bear Creek T26N R26E Sec. 28

Bear Creek is 3.8-miles long with an additional mile of branched stream route at the headwaters. This high gradient stream of 33.3-feet/mile drains glacial drift. Though the stream has a high gradient, it originates in a marshland and flows though a marshy valley with soils in the Emmet-Solona-Angelica association. The creek is composed of 1st and 2nd order streams with rocky substrate giving way to silty banks. The lower half of the stream does flow continuously. Spring sampling for macroinvertebrates yielded a biotic index rating of *very good* for water quality (4.24 and 3.92), but filamentous algae and periphyton covering the rocky substrate by fall may indicate otherwise. Dissolved oxygen, pH and temperature readings all fell in the acceptable range. Longnose and white sucker use the stream for spawning runs and occasionally rainbow trout and brown trout will enter at the mouth. The stream is not stocked, but will attract trout and salmon seasonally.

Big Creek T27N R26E Sec. 09

Big Creek is five-miles long with a moderate gradient and a width ranging from 4.5-feet to 50-feet. This intermittent stream was given a *fair* stream habitat ranking from an evalutation conducted on a stretch of the stream near Utah Road. Water chemistry samples collected in November of 1992 show only moderate concentrations of nutrients, biochemical oxygen demand and suspended solids, however, bacteria counts were relatively high. A macroinvertebrate sample collected in October of 1992 yielded a Hilsenhoff Biotic Index value of 6.55. The stream drains a watershed of 14.9-square miles. Most of the soils in the watershed are in the Emmet-Solona-Angelica association. Big Creek and its associated marshy estuary attract a wide array of fish including walleye, northern, musky, rainbow trout, brown trout, chinook salmon, catfish, carp, bullheads, and suckers. The stream is not stocked and does serve as spring spawning grounds for walleye, northern pike and suckers. Stream substrate is mostly rubble and gravel with portions of silt, sand, and boulders. Historically, the City of Sturgeon Bay has used the banks of this stream for snow disposal.

Ephraim Creek T31N R27E Sec. 23

Ephraim Creek is a short, one-mile, intermittent stream about nine-feet wide with a 15-feet/mile gradient. It has a habitat ranking of *good*, a biotic index value average of 5.061 from three samples taken at the Hwy 42 crossing in 1986 and also has Class I & II trout waters. Its watershed is 3.9-square miles in a Summerville-Longrie-Omena soil association. Approximately 60% of the stream substrate is rubble and the remaining is silt and sand. This stream may attract spring runs of smelt, suckers and also an occasional rainbow trout.

Fabry Creek T26N R23E Sec. 28

This 3.7-mile long, high gradient stream is classified as LFF with a *fair* habitat ranking. Its watershed is approximately 2.7-square miles within Door County borders. This rather small stream is usually unnoticed and little information exists on it. The headwaters of the stream are primarily wooded wetland. The narrow stream flows through mid-successional wooded and agricultural areas. The stream resembles a wooded ditch along its final reach as it flows through agricultural fields before emptying into Green Bay.

Fish Creek T31N R27E Sec. 29

Fish Creek is a small stream (1.5-miles in length, and eight-feet in width) with a moderate gradient of 15-feet/mile. Springs supply water to a wetland area that feeds the stream. (Button Marsh is usually associated with Fish Creek.) The stream flows along the edge of the escarpment until it reaches a ponding area where a small dam was installed. The ponding area outlets the remaining portion of the stream where it flows through the village of Fish Creek before discharging into Fish Creek Harbor. Peninsula State Park borders the northeast side of the stream's mouth. Fish Creek often supports spring spawning runs of longnose and white suckers, but walleye are also known to frequent this stream. The emergent plants are variable, but include cattails, bluejoint grass, various sedges and rushes. In May of 1985, the biotic index value averaged 6.552 from three samples taken at the Hwy 42 crossing. Water chemistry data from 1999 from various locations along the stream at different times throughout the year are available.

Fischer Creek T28N R27E Sec. 28

Fischer Creek is a small, two-mile, perennial stream that begins as a small spring near the south end of Bechtel Road and flows south, slowly increasing in volume, mostly through the

large white cedar swamp west of Glidden Drive. The stream empties into Lake Michigan just south of Whitefish Point. Near Glidden Drive several flooded swales drain into this stream in the spring after heavy rains. Little is known about the invertebrate or fish assemblage of this stream. Some individuals may refer to this stream as Goldenrod Creek.

Geisel Creek T28N, R27E, Sec. 30

This stream is also known as Donlan's or Maple, but Geisel Creek is the official stream name. Geisel Creek is the largest stream within the Shivering Sands wetland complex. This complex includes three streams (Geisel, Shivering Sands, and Fischer) and three Lakes (Dunes, Schwartz, and Arbter). The 20-feet wide, 5.25-mile long stream drops 9.7-feet/mile along its route and drains a 9.8-square mile watershed. The landscape is primarily agricultural and rural residential and includes four of the six soil associations found in Door County. Most of the creek's bottom is gravel and the remainder rubble, sand, and sporadic boulders. The area at the mouth of the creek has a loose organic bottom with lush aquatic plant growth of duckweed and filamentous algae. Geisel Creek flows into Dunes Lake, which is a very eutrophic lake that includes small basins. The stream is ranked as *fair* and given a LAL biological use class for it's entire length. The biotic index value was 6.222 from one sample taken near Haberli Road in 1985. A study done in 1995 reported a pH value of 7.9, alkalinity at 183.5 mg/L and total suspended solids at 2.75 mg/L. Limited fisheries information exists for this stream. However, in 1981 there was a reported fish kill. Some sources attribute the kill to mismanaged agricultural waste, but this cause could not be confirmed. A municipal sewage treatment pond which is surrounded by agricultural fields and rural residential development is located at the headwaters of the stream between the towns of Institute and Valmy. The biological significance of this stream is due to the fact that it feeds Dunes Lake and Shivering Sands Creek, both of which sustain outstanding wildlife diversity.

Heins Creek T29N R28E Sec. 06

The corridor of Heins Creek consists primarily of wet-mesic woodland, wooded sand dunes, and wooded residential lots. This stream connects the southern basin of Kangaroo Lake with Lake Michigan. Its one-mile route is approximately 14-feet in width and drops 7.8-feet per mile. The stream drains a ridge-swale complex with a soil association of Rousseau-Kiva-Markey. Stream habitat ranked *fair* and 0.71-miles are classified Class II trout stream. A sample taken above Hwy 57 in 1985 showed a biotic index value of 6.25. The stream has abundant fishing resources that seasonally include brook trout, rainbow trout, brown trout, and chinook salmon. The small, cool water stream provides a holding area for stocked rainbow and in recent years has had an increasing spring run of walleye. Historically, there has been a carp die-off due to entrapment when low water levels occur. The streams east shoreline is near the boundary for Meridian Park and Lyle Harter-Matter Sanctuary. The park and sanctuary hold a wide array of unique and endangered terrestrial plants associated with the sand dune ridges that the stream helps drain.

Hibbards Creek T29N R27E Sec. 14

Hibbards Creek is the only stream in Door County that is monitored by the USGS under the National Water Quality Assessment (NWQA) Program. Hibbards Creek is a benchmark stream for the program which means that this site has been selected to represent standards of reference for comparison to other streams in similar physical settings. Much of the Hibbards Creek watershed is actively used for agriculture (73%), but a portion of the stream

corridor is still forested (14% of the total watershed area). A sand and gravel quarry site adjacent to the stream and future residential development are both concerns for the future quality of this resource. This 15-feet wide, 7.4-mile long low gradient (7.6-feet/mile) stream originates just southeast of Thorp Pond in a series of springs in an emergent wetland and drains a watershed of 21.9-square miles. The northern portions of its watershed are wet-mesic and dry-mesic woodlands. It flows through conifer swamp and shrub-carr before leaving a ridge-swale series and emptying into Lake Michigan. The majority of its route is underlain with Summerville-Longrie-Omena soil association. There has been a history of sea lamprey invasion in the stream, however, 2.8-miles of the stream is still classified as Class II trout water and the remainder has a WWFF biological use classification. The stream is annually stocked with steelhead (rainbow) trout. Steelhead and suckers make spring runs upstream as do chinook salmon in the fall when water levels and water flow permit. Overall stream habitat has been ranked as *good*. The stream corridor provides numerous habitat types and has historically housed two state special concern plant species, slender bog arrow-grass and marsh horsetail. According to the USGS survey of the stream for ecological components, the habitat, algae, benthic invertebrates, and fish all scored *fair*. Three samples taken in 1985 above the Hwy 57 crossing show an average biotic index value of 4.247. Canoe access is possible from Cty A and Junction Road.

Hidden Brook Creek T30N R28E Sec. 17

Very little is known about this stream and there are no documented stream rankings/ratings or fishery surveys. The stream has an intermittent flow and is relatively short. It begins in a wetland area and is generally supplied by surface water runoff and possibly an intermittent spring. A ridge-swale system lies along the stream route. The stream outlets to Baileys Harbor, but during certain times of the year the discharge is not distinct. This is due to the backwaters consisting of swales where water can pond to discharge later or infiltrate to the ridge-swale complex. When the stream outlet is into Baileys Harbor, suckers have been attracted to the stream for spawning, however, most years the water drains into a large swale along the stream route. Near the end of summer, the stream becomes stagnant and a filamentous algae dominates the stream.

Hidden Spring Creek T31N R27E Sec. 23

Hidden Spring Creek is one-mile long, about two-feet wide and has a gradient of 10-feet/mile. It originates in the Ephraim Swamp and it flows through Summerville-Longrie-Omena soil associations. Classified as a Class I trout stream for 0.5-miles, it is known to have white suckers and brook trout, although no recent information can confirm the presence of the brook trout.

Kayes Creek T27N R24E Sec. 10

Kayes Creek is the official name, but it was formerly known as Keyes Creek. It is a seven-mile long perennial stream which originates in a network of springs. It has an approximate width of four-feet with an eight-feet/mile gradient and flows through the Gardner Swamp State Wildlife Area before emptying into Little Sturgeon Bay. Three different soil associations surround the stream as it drains a portion of the Kayes Creek sub-watershed of 12-square miles. The lower reaches of the stream are classified WWSF and WWFF while the upper reaches are Class I and II trout waters. The stream was stocked with brook trout from 1956-1970, but a fish survey in 1976 found only forage fish. The stream earned a *good* to *fair* stream habitat ranking, but biotic index sampling values (7.53 and 7.6 at Pickeral

Road) demonstrate that water quality is poor with significant organic pollution. It does support spring fish runs. Suckers, northern pike, and walleye have all been documented. It also has been known to contain large bowfin. Portions of this stream have been ditched and certain areas are pastured allowing livestock to have access to the stream. On numerous occasions dissolved oxygen monitoring showed violations in water quality. Runoff samples in 1993 showed high levels of bacteria in the stream. The rural agricultural landscape contributes to many problems for the stream's health including sedimentation, nutrient input, and streambank erosion since portions of the stream have been ditched or pastured.

Krueger Creek T27N R24E Sec. 11

This stream is a small, one-mile long stream and drains a 5.6-square mile watershed. The stream received a *fair* ranking for habitat and is classified as LFF. Filamentous algae can be rather abundant on its rocky substrate. Summerville-Longrie-Omena is the soil association that surrounds the stream. This intermittent stream tends to attract only spring runs of white suckers.

Larson Creek T28N R25E Sec. 28

Larson Creek is four-miles in length, *fair* in habitat quality and WWFF classified. This intermittent stream originates in Cunningham Swamp and flows through rural areas, pastures and feedlots before it empties into Sand Bay. Substantial amounts of sediment have been noticed, especially during snow melt and rain events when the water is very turbid. The stream quality is limited by minimal base flow, dense algae growth, sedimentation from cattle and upland erosion, and nutrient input from agricultural runoff. Walleye, northern pike, and white sucker are known to use the stream. This stream drains soils of the Summerville-Longrie-Omena association in a 8.9-square mile watershed.

Lilly Bay Creek T27N R27E Sec. 06

Lilly Bay Creek is considered the official name, but it is also known locally and historically as Lily Bay Creek. Lilly Bay was originally called St. Joseph in honor of Mr. Joseph, a partner of Wm. H. Horn. When Mr. Joseph retired from the partnership the name was changed to Lily Bay in honor of Mr. Horn's daughter, Lily. Lilly Bay Creek is seven-miles long, five-feet wide and has a gradient of 19.1-feet/mile. Lilly Bay Creek drains a watershed of 13-square miles. It shares Summerville-Longrie-Omena and Emmet-Soloana-Angelica soil association types with its 1st and 2nd order reaches. The substrate is 80% sand with the remainder gravel and sparse rubble. The stream is classified as Class II for 1.6-miles and Cold for 1.4-miles. The habitat ranking is *fair* and the average biotic index value from three samples taken above the CTH T crossing in 1985 averaged 3.83. Brook trout were last stocked in 1956. The upper reaches flow intermittently, but the lower reaches flow nearly continuous and empty into Lilly Bay upon exiting a ridge-swale system.

Little Creek T27M R26E Sec. 08

This small stream drains a large amount of Sturgeon Bay's east side with a 3.6-square mile watershed. Portions of the stream are routed under ground. Little information regarding the stream's parameters are documented, although a stream habitat evaluation near Utah Road indicated *fair* habitat. The Little Creek watershed, on the other hand, has been extensively studied for water capacity and load. A report by McMahon Associates, Inc. contains analysis on the area's hydrology and sedimentation. This information was used in

the design and construction of three sedimentation ponds located at the Door County Fair Park. The stream empties into Sturgeon Bay at a location between the city's bridges near the intersection of South 15th Ave and South 3rd Ave. The stream corridor and route become apparent as it nears its mouth. When fall water levels are adequate, the stream will attract spawning chinook salmon.

Logan Creek T29N R27E Sec. 33

Logan Creek is 5.4-miles in length and eight-feet wide with a gradient of 17.7-feet/mile. From Lost Lake it flows southeast and empties into Clark Lake. The largest portions of the landscape are Summerville-Longrie-Omena soil association types. The creek corridor is largely flanked by lowland cedar/black ash forest. The adjacent lands are a patchwork of cleared cropland, stump pasture, pasture, and orchards. The overall stream habitat is ranked as *fair* with the majority of the stream WWFF, but 0.4-miles are Class I and 0.25-miles Class II. The average biotic index value from three samples taken in 1985 above the Hwy 57 crossing is 4.047. This is the only creek in the county that has been known to have its own self-sustaining population of brook trout, however, none were found in a survey conducted during the last five years. Logan Creek is one of Door County's few Outstanding Water Resources as determined by the Outstanding Resource Waters portion of the Natural Resource (NR) Wisconsin Administrative codes. A significant spring is located just north of the Hwy 57 bridge.

Lost Creek T28N R25E Sec. 27

Lost Creek is a 2.5-mile long stream with a 2.2-square mile watershed draining soils of the Kewaunee-Kolberg-Manawa association. The habitat ranking is *fair* and is classified as LFF. The creek has had walleye, northern pike, rainbow trout and spring runs of white suckers. Silt has covered much of the streambed and macrophytes are abundant. A local golf course and county landfill operate nearby.

Malvitz Creek T27N R24E Sec. 11

This small, one-mile stream is intermittent and classified as WWFF and LFF. The stream habitat ranking is *fair*. Carp, longnose and white suckers and walleye are known to use the stream. Large bowfin have been seen here as well. Malvitz Creek drains soils of the Emmet-Solona-Angelica association in the rural, one-square mile watershed. Sedimentation does not seem to be a problem at this time.

May Creek T28N R25E Sec. 32

May Creek is a five-mile intermittent stream of *fair* stream habitat quality and is LFF classified. Fish use this stream for spring spawning runs, but dense algae growth, low flow, and sedimentation from run-off limit their use. The substrate is hard, but covered with filamentous algae and silt. May Creek drains agricultural lands with soils in Kewaunee-Kolberg-Manawa and Summerville-Longrie-Omena associations and has a 5.3-square mile watershed. May Creek discharges into Sand Bay.

Mink River and Rogers Lake T32N R28E Sec. 24

The Mink River is actually a fresh water estuary located near the northern tip of the county. It drains extensive wetlands and discharges into Rowley Bay, Lake Michigan. Rowley Bay and the Mink River lie in a bedrock valley that extends across the Peninsula from Lake Michigan to Green Bay. During the Algonquin period, when the water levels were much

higher, the valley formed a strait that connected the two large water bodies. The declining lake level and land rebound have separated the Mink River watershed from Green Bay. By reviewing past aerial photos, researchers indicate that the location of the channel has not changed appreciably in almost 50 years. This channel is thought to be controlled by bedrock. The 880-acre area of the estuary and surrounding habitat is very unique in that it features a mosaic of wetlands, lowland forests, emergent aquatics, northern sedge meadows, alder thicket, shrub-carr, hard springs and spring runs and beach. Extensive research exists in regard to the vegetation and the vegetative response to changing water levels. The Mink River is also referred to as Rogers Lake although it is unclear as to if a lake has actually existed there. In the 1965 document *Surface Waters of Door County,* Rogers lake is documented as being 69.5-acres with a maximum depth of 12.5 feet and a S.D.F. of 2.22. The area referred to as Rogers Lake may be the wide open area of the headwaters of the Mink River and the area to the northeast that can experience some ponding or segmentation from the river channel depending on the fluctuating water levels. The Mink River is 2.8-miles long and flows continuously. The average width of the primary channel is 300-feet, but the small streams that feed the Mink River are considerable smaller (15-feet wide). The primary sources of water for the estuary are precipitation, groundwater springs, and Lake Michigan. The precipitation and spring flow have little annual variability. The hydrology is not completely known and although there is a net discharge, water exchange rates are questionable and may be low. The seiche activity of Lake Michigan plays a very significant and dominant role in the wetland community composition. The marsh area along the Mink River is underlain by alluvial fine sand, silt, clay, and organic material. Smallmouth bass are dominant and provide an excellent fishery. There is also good northern pike fishing in spring and fall. The Mink River and estuary provide spawning habitat for smallmouth bass and northern pike. Other species include rock bass, pumpkinseeds, bullheads, carp, and even various gar species. Public access is available through a boat launch on Lake Michigan.

Piel Creek T30N R27E Sec. 24

Piel Creek is the official name as listed on the USGS topographic map, but it is recognized locally as Peil Creek. Piel Creek is a small stream flowing south-southeast to Kangaroo Lake from a large wetland complex 2.5-miles north of the lake. Springs discharge throughout its length and several are visible where the creek enters the lake. The creek is a soft bottomed, slow to moderate flow, warm water stream with a high pH. The absence of a stream canopy yields high water temperatures and pH in the high 7.0 to low 8.0 range. Additional water chemistry data on Piel Creek was published in 1994 and reported phosphorus less than .44 mg/L, TDS at 362 mg/L, pH at 7.8, alkalinity of 315 mg/L and hardness at 331 mg/L among other parameters. Some stream damage has occurred where the corridor is interrupted by an open field at a portion north of Cty Hwy 'EE'. Near its mouth, the stream widens to a uniform channel of 20-feet. Spring holes are present here and can reach depths of six feet, but the bottom still consists of organic silt and debris. Few fish inhabit the stream year round, but it is used as spawning grounds in early spring by northern pike. A lowland forest dominates the area surrounding the mouth and the showy lady slipper orchid grows in patches of younger stands in this forest type. The hydrology of Piel Creek and the northern portions of Kangaroo Lake creates different seasonal microhabitats producing a forest type of high structural complexity. Piel Creek is unique in the landscape because of the alkaline marshes and fen-marl flats that feed headwaters. This is a site for many rare species as well, including the bald eagles, osprey, and caspian terns that can be seen feeding in the area near the mouth of the stream. In addition, the marsh provides important

breeding and migrational staging for other waterfowl. There have been few documented occurrences of exotic terrestrial plants.

Reiboldt Creek T30N R28E Sec. 10

This one-mile long, 1.9-acre stream flows from Mud Lake to Moonlight Bay. Reiboldt Creek drains portions of the Baileys Harbor swamp and the Mud Lake Wildlife area and has a gradient of five-feet/mile. Two other unnamed streams flow into Mud Lake from the west and north. Most of the year the stream is inhabited by forage fish, although northern pike have been observed using the area as spawning grounds. Yellow perch, smallmouth bass, rainbow trout, brown trout, and chinook salmon are other species that may occur in the stream seasonally. Samples taken in 1986 above the CTH Q crossing yielded an average biotic index value of 6.539 from three samples. Water chemistry data was documented in the Mud Lake Wildlife Area Management Plan and noted pH as 7.6, total alkalinity at 256 mg/L and specific conductance at 495 mg/L.

Renard Creek T26N R23E Sec. 21

Renard Creek is a six-mile long six-feet wide stream, has a gradient of 35-feet/mile and drains a 7.2-square mile watershed of moraine deposits. Emmet-Solona-Angelica is the primary soil association group in the watershed. Its *fair to poor* habitat ranking may be attributed to numerous small dairy farms. Much of the land directly adjacent to the north branch of the stream is pastured or cropped with minimal buffering zones. Nearly the entire length of the stream is absent of continuous canopy due to the land use. Small springs feed the north branch to assure some water flow nearly all year, and it is classified as a WWFF. The south branch of the stream is shorter and again sustained by springs. The upper reaches of the stream are intermittent and flood easily. The headwaters of the south branch are primarily agricultural as well. Wooded residential is the primary land use from where the two stream branches converge to where they empty into Green Bay. The stream attracts spring runs of suckers and occasionally smelt. The macroinvertebrate samples taken at Pleasant Ridge Road receive biotic index values of 6.66 and 4.35; quite a wide range, rating the water quality from fairly poor to very good. The macroinvertebrate samples taken at Shoemaker Road received values of 7.6 and 7.56 which rates that portion of the stream as fairly poor to poor water quality with very significant organic pollution. Additionally, water chemistry samples were taken from 1992-1993.

Samuelson Creek T27N R26E Sec. 17

Samuelson Creek is a flashy, intermittent, 1.25-mile long stream. The stream is rated as *fair*. Suckers and chinook salmon have been noted as using this resource which is classified WWFF. It flows through a landscape with Summerville-Longrie-Omena soil associations and has primarily a rocky substrate, much of which is covered by filamentous algae. The stream is limited by minimal flow, dense algae growth and urban runoff. Much of the drainage area is low to medium density residential. This stream is included in the Sturgeon Bay watershed and empties into the waters of Sturgeon Bay. Chinook salmon are attracted to the stream in fall if water level and flow are adequate.

Schuyler Creek T26N R26E Sec. 21

This is a four-mile long WWFF classified stream with only the lower most reaches flowing continuously. The substrate is mostly rock and rubble with some deposition of soft sediment in slower current areas. Kewaunee-Kolberg-Manawa and Emmet-Solona-Angelica

are the soil associations in this low to medium density rural landscape. A cursory inventory performed in 1996 showed the stream bank to be in stable condition. Macroinvertebrate samples in the spring of 1994 received a biotic index rating of 6.47. Macroinvertebrate samples collected in 1979 at CTH U and Midway Road also received fair water quality ratings. The habitat rating given was *fair* and the biotic index water quality ranking was also *fair*. Dissolved oxygen and temperature values recorded were normal. Suckers, smelt, and rainbow trout are known to frequent this stream during spawning runs.

Shivering Sands Creek T28N, R27E, Sec. 32

Shivering Sands Creek is a 1.1-mile long, and 27-feet wide stream with a gradient of 12.5-feet/mile. It connects Dunes Lake with Lake Michigan. The creek drains a Rousseau-Kiva-Markey soil association in a wetland complex. This stream has a steeper gradient than its headwater partner, Geisel Creek. The adjacent lands are part of the Shivering Sands wetland complex and have a diversity of habitat types housing numerous species. This stream has direct connections to the ridge-swale series that it helps to drain. Neighboring lands are wooded or wooded residential with limited access points. Brook, rainbow, and brown trout all use the stream along with chinook salmon. Longnose and white suckers have also been documented. The creek is classified as WWFF for one-mile and *good* stream habitat is noted. Three samples were taken in both 1985 and 1986 showing an average biotic index value of 4.395 and 4.693 respectively. A study released in 1995 reported pH at 7.3, alkalinity at 199.5 mg/L and total suspended solids at 1.70 mg/L. Spring runs of smelt occasionally occur in this stream. Since its location is within a relatively large intact forest, larger land animals such as otters, fisher, and black bear utilize the stream.

Silver Creek T26N R23E Sec. 09

This is one of the three Silver Creeks in Door County and is a small, flashy, intermittent stream. This Silver Creek is located in the Town of Union. In years with high water levels, this stream may connect at its headwaters with Sugar Creek via a wetland. Very little is known about this Silver Creek. Filamentous algae cover sparse rocky substrate and aquatic habitat is ranked as *poor*. Agricultural land use surrounds much of the stream's 2.5-mile length. Suckers and smelt will sometimes use the mouth of the stream during spring spawning runs, but this stream is often very shallow. Young muskrat have been seen in the creek portions where the water is relatively deep.

Silver Creek T25N R26E Sec. 07

Silver Creek is a five-mile long WWFF stream that originates in wetlands. It has a 3.7-square mile watershed. Two miles of Silver Creek are located in the Town of Clay Banks and the rest of the route continues into Keawaunee County. Spring spawning runs have been documented for white suckers, and rainbow trout and chinook salmon are known to use the area in fall. The creek flows through a landscape of Emmet-Solona-Angelica soils with the stream maintaining a primarily rocky substrate. The steep gradient provides *good* habitat when flows are significant and *fair* when flows are lower, but overall, aquatic habitat is ranked as *fair*. The upper reaches of the stream have been ditched and sedimentation is apparent. However, biotic index values of 4.2 show very good water quality.

Silver Creek T26N R24E Sec. 01

This stream is 5.25-miles long with an eight-feet width at the widest portions. It is one of three Silver Creeks in Door County and is located in the Town of Brussels. Very little is

known about this stream, but it is part of the headwaters for the Ahnapee River. The watershed for this stream drains portions of primarily agricultural lands southeast of Brussels and north of Kolberg, and then flows into wooded wetlands where significant springs exist. These springs support the perennial portion of the stream where it then converges with the Ahnapee River. This stream has no formal rankings/ratings, but small forage fish are present in the stream. Some individuals believe that these and other headwaters of the Ahnapee River have native populations of brook trout, but that has not been confirmed.

Stony Creek T26N R26E Sec. 31

This stream is 13.6-miles long with a width of approximately 16-feet. It has a rather low, 8.5-feet/mile gradient as it flows through soils of the Emmet-Solona-Angelica and Carbondale-Cathro associations. The upper 11-miles of this stream are classified as WWFF and the lower five-miles are classified as Cold Class II water. Stony Creek changes considerably from the upper to lower reaches. In the upper reaches at CTH H, the creek is slow moving. Some portions of the creek have been ditched. In early spring, aquatic life habitat rated *good* because the abundance of water; however, in fall, it received a *poor* water quality rating. The dark stained water had a low oxygen reading in 1994 and duck weed was abundant during low water levels. A spring macroinvertebrate sample taken at the CTH H site in spring of 1994 received a biotic index value of 6.52. At Maplewood Road, aquatic life habitat received *fair* ratings. The creek then travels through extensive wetlands and has a slow, meandering flow. The rocky substrate had some riffles and deep pools at the time of the inventory. Biotic index values at Maplewood Road were 7.27 in spring and 7.13 in fall. Macroinvertebrate samples at Rosewood Road received biotic index ratings of 5.33 in spring and 5.03 in fall. At CTH U near the creek mouth, the stream gradient increased significantly and an improvement in aquatic life habitat is noticeable. The large rocks and increased gradient provides numerous riffle areas. The stream banks are well protected from erosion with diverse tree and shrub growth. A macroinvertebrate sample at CTH U received biotic index values of 3.83 in spring and 3.67 in fall. Monthly water chemistry samples collected in 1994 at CTH U found occasional elevated concentrations of phosphorus, ammonia and bacteria. This stream is stocked annually with steelhead trout, which make spawning runs upstream in spring.

Strawberry Creek T27N R26E Sec. 16

This is a small, 1.6-mile long stream southeast of Sturgeon Bay. It is known for the chinook salmon egg harvesting facility that the DNR maintains three-quarters of a mile upstream. The stream is given a *good* habitat ranking and is classified as Cold water fish use, however, WWFF are also supported. The dissolved oxygen concentrations remained above 6 mg/l during monitoring (1992-93). The stream is perennial and has been noted to be "flashy" during runoff and storm events. A section of the stream has been straightened and ditched which led to a significant decrease in aquatic habitat. This stream drains a watershed of 4.4-square miles through soils of Deford-Yahara Variant-Carbondale association.

Sugar Creek T27N R23E Sec. 26

This ten-mile long stream with a nine-foot average width has a gradient of 17.8-feet/mile and flows through a rural landscape of Kewaunee-Kolberg-Manawa soils. Sugar Creek has an 11.6-square mile watershed. The upper reaches flow intermittently through marshy areas, but the lower reaches flow continuously over more stable rocky substrate. Sugar Creek is

perennial and classified WWFF with habitat ranking of *good* to *fair*. Macroinvertebrate samples were taken at Sugar Creek County Park and Lovers Lane. Biotic index values at the Park were 6.26 and 6.74 (fair to fairly poor with significant organic pollution), but at Lovers Lane were 5.42 and 6.12, showing that the upper portion of the creek has good to fair water quality. Fair to poor water quality is probably due to portions of the stream being ditched, pastured, or having feed lots adjacent to its banks. Addtionally, water chemistry samples were taken in 1992 and 1993. Nutrient, sediment, and bacteria loading have been indicated in the water samples. Despite these factors, Sugar Creek is very popular in spring when smelt and suckers spawn. Sugar Creek County Park often becomes very active when the spring fish runs are strong.

Three Springs Creek T31N R28E Sec. 14

Three Springs is a 2.3-mile long intermittent stream that drains wetlands and empties into North Bay. It is four-feet in width with a 10.9-feet/mile gradient that flows through the Carbondale-Cathro soils association. The creek is classified as WWFF with a *fair* habitat ranking. In 1986, the average biotic index value from three samples taken at CTH ZZ was 6.229. Additional water chemistry data on Three Springs Creek was published in 1994 and reported phosphorus less than .44 mg/L, TDS at 334 mg/L, pH at 7.7 and hardness at 294 mg/L among other parameters. Suckers and northern pike are known to use the area along with chinook salmon, but no species have been stocked. *Myriophyllum spp.* is present as the dominant aquatic plant. This stream is quite small and access is very limited.

Twin Harbor Creek T27N R24E Sec. 10

Twin Harbor Creek is a small creek that drains a 3.3-square mile watershed. It flows two-miles before emptying into Little Sturgeon Bay. It is intermittent and WWFF classified. Suckers frequent the area, but yellow perch are known to use the stream, especially near the mouth during spawning season. Silt and sediment are not a problem in the rocky substrate of this stream. Twin Harbor Creek lies in the Summerville-Longrie-Omena soil association that surrounds this stream. Dense algae growth and minimal flow have been known to limit this creek.

Unnamed Stream #1 T27N R26E Sec. 16

This unnamed stream is classified as a small, intermittent limited forage fish (LFF) stream. Silt has covered much of the stream bed. A macroinvertebrate sample taken in the fall of 1992 gave a biotic index ranking of 7.45, resulting in a fairly poor water quality rating due to significant organic pollution. Macrophytes are very abundant. This one-mile long stream has a 0.7-square mile watershed. It is most easily recognized where is crosses Tacoma Beach Road before emptying into the Sturgeon Bay Shipping Canal.

Unnamed Stream #2 T27N R26E Sec. 07

This is a very small, intermittent unclassified stream. This stream has been extremely channelized through the west side of Sturgeon Bay and little information is available. Observations note that silt has covered much of the stream bed and macrophytes are abundant. It is considered part of the Sturgeon Bay watershed and outlets near the west side fire station.

Whitefish Bay Creek T28N R27E Sec. 10

Whitefish Bay Creek is a relatively short, 1.1-mile long and 28-feet wide, stream that connects Clark Lake with Lake Michigan. In past years, it has also been known as Lauscher's Creek after the fisherman whose fish house was at the mouth of the creek. Whitefish Bay Creek empties into Lake Michigan near the south end of Whitefish Dunes State Park. The property immediately east of south Cavepoint Drive, where the mouth is located, is privately owned. The landscape is rather wooded but residential land use is dense near the shore of the lake. The creek flows through the Rousseau-Kiva-Markey soil association. Brook, brown and rainbow trout, smelt, suckers, and chinook salmon utilize this Class II stream even though the habitat ranking is *poor*. A sample taken in 1985 at Cave Point Road yielded a biotic index value of 7.5. Rainbow trout are stocked annually.

Woodard Creek T26N R26E Sec. 16

Woodard Creek is a four-mile long, WWFF classified stream. The upper reaches flow intermittently and the lower reaches are perennial; however, flow can be minimal near the mouth during summer months. Habitat ranking is from *good* to *fair*. At Mount Lookout Road, the rocky substrate is covered by silt and soft sediment; riffles are rare. The Mount Lookout Road site also has a culvert that impedes fish passage unless water levels are high. Macroinvertebrate samples for biotic index rates the water quality as very good with only slight organic pollution (3.99 in spring and 3.90 in fall of 1994). Dissolved oxygen, pH, and temperature readings were all normal. The stream is not currently stocked, but suckers, smelt, and rainbow trout are known to occur seasonally. Emmet-Solona-Angelica and Carbondale-Cathro are the soil associations in the stream's 2.2-square mile watershed.

Other Streams (Unnamed)

Door County has several other unnamed streams. No documented inventories or information exists for these waters. They are as follows:

- A small stream north of Kelners fen.
- A stream discharging to the west shore of Mud Lake.
- A small stream connecting Pluff Pond to Mud Lake.
- A small stream channel that outlets to Horseshoe Bay via Murphy Park. (one-mile)
- A stream in Clay Banks located north of Woodard Creek.
- Whitefish Bay Creek West Branch or also locally known as Maple Creek. (4.8-miles)

Table 1: Popular Fish Species Distribution for Streams (Information compiled by the Door County SWCD from resource professionals and various sources; refer to Bibliography for detailed documents)

	LFF / LAL or Various small fishes	Sucker spp.	Rainbow Smelt	Carp	Bullhead	Catfish	Pumpkinseed	Yellow Perch	Walleye	Rock Bass	Smallmouth Bass	Large mouth Bass	Northern Pike	Muskellunge	Brook Trout	Rainbow Trout	Brown Trout	Chinook Salmon
Ahnapee River		•									•	•	•			•	•	•
Bear Creek		•													•	•		
Big Creek		•		•	•	•			•				•	•		•	•	•
Ephraim Creek		•	•													•		
Fabry Creek	•																	
Fish Creek		•							•									
Fischer Creek	•																	
Geisel Creek	•	•																
Heins Creek		•			•				•						•	•	•	•
Hibbards Creek		•	•										•		•	•	•	•
Hidden Brook	•																	
Hidden Spring		•													•			
Kayes Creek		•							•				•					
Krueger Creek	•	•																
Larson Creek		•							•				•					
Lilly Bay Creek	•																	
Little Creek		•							•							•		•
Logan Creek															•			
Lost Creek	•	•							•							•		
Malvitz Creek		•			•				•									
May Creek	•																	
Mink River				•	•		•			•	•		•					
Piel Creek																		
Reiboldt Creek								•			•		•			•	•	•
Renard Creek		•																
Samuelson Creek		•																•
Schuyler Creek		•	•															
Shivering Sands Creek		•													•	•	•	•
Silver Creek --Brussels	•																	
Silver Creek --Forestville		•														•		•
Silver Creek -- Union		•																
Stony Creek		•	•													•		•
Strawberry Creek		•							•				•			•		•
Sugar Creek		•	•															
Three Springs Creek		•											•					•
Twin Harbors Creek		•							•									
Unnamed #1	•																	
Unnamed #2	NA																	
Whitefish Bay Creek		•	•												•	•	•	•
Woodard Creek		•	•													•		

NA No information available

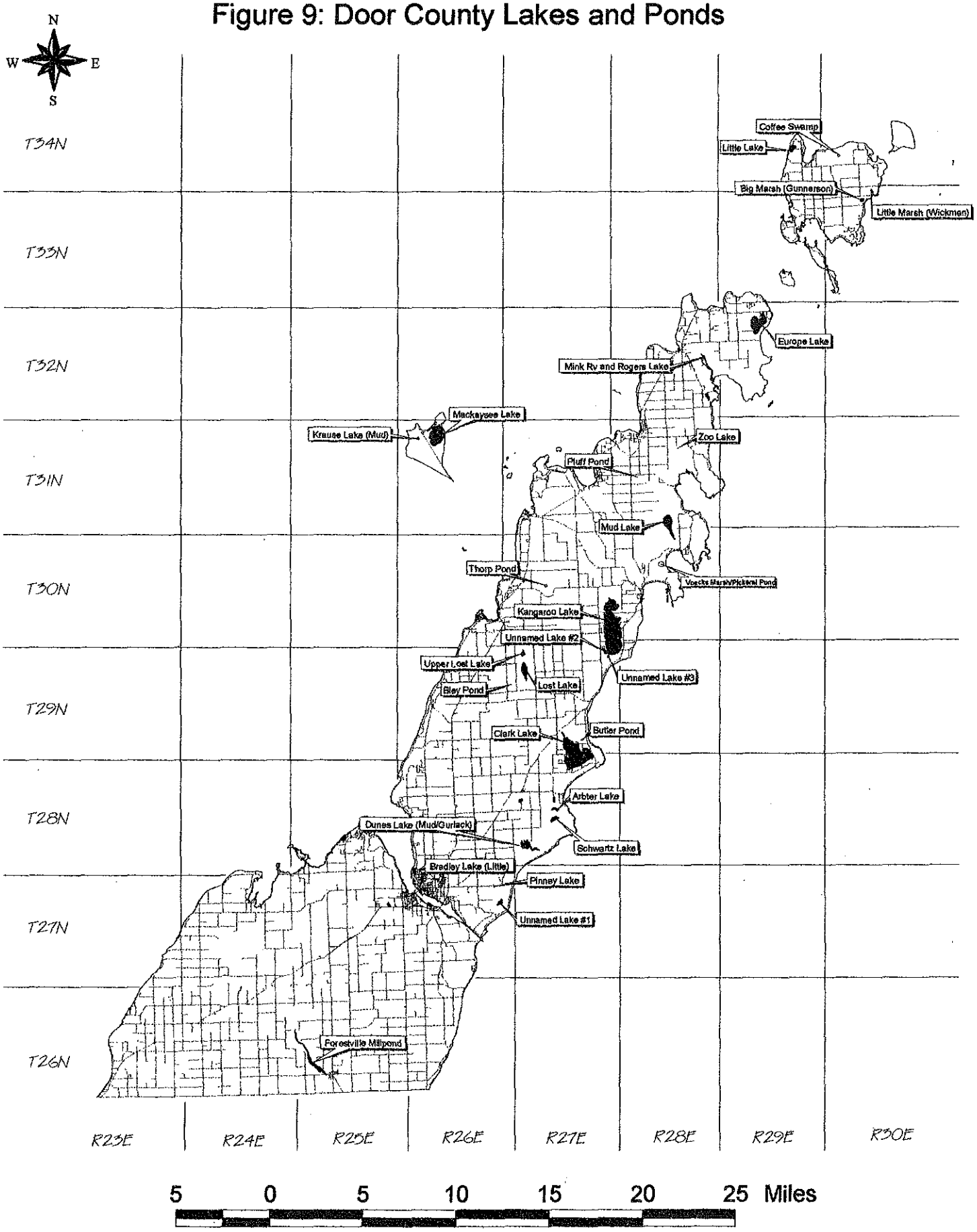
Table 2: Summary of Stream Morphology and Biology[1] (Information compiled by the Door County SWCD from resource professionals and various sources; refer to Bibliography for detailed documents)

	Length in miles	Flow	Width in feet	Gradient in feet/mile	Watershed in square miles	Biological Use Class	ORW	Substrate	Vegetation	Biotic Index– Highest value or sample average	Habitat Ranking
Ahnapee River	8.5	C	25	7.7	44	WWSF		R,G,S	All		Fair
Bear Creek	3.8	C/I		33.3	4.8			R,OM, G, S	FA	4.24	----
Big Creek	5	I	4.5	14	14.9			R,G,S		6.55	Fair
Ephraim Creek	1	I	9	15	3.9			R,S,G		5.06	Good
Fabry Creek	3.7	I	4	43	2.7	LLF		R,S,G			Fair
Fish Creek	1.5	C	8	15	12			R,G,O M	EV	6.55	----
Fischer Creek	2	I	3	16.5	3.4						----
Geisel Creek	5.25	C	20	9.7	9.8	LAL		R,G	All	6.22	Fair
Heins Creek	1	C	14	7.8	.26	Cold II		G,S, OM		6.25	Fair
Hibbards Creek	7.4	C	15	7.6	21.9	WWFF, Cold II		Silt,R,G, OM		4.25	Good
Hidden Brook	1.6	I	3	14.4	3.4			S,R			----
Hidden Spring	1	C	2	10	1.3	Cold I		OM,R,S	EV		----
Kayes Creek	7	C/I	4	8	12	WWSF, WWFF, Cold I&II		R,S,Silt, OM,G		7.6	Good to Fair
Krueger Creek	1	I		20	5.6	LLF		R	FA		Fair
Larson Creek	4	I		29.5	8.9	WWFF		OM,S, G,R	FA		Fair
Lilly Bay Creek	7	C/I	5	19.1	13	Cold II		S		3.83	----
Little Creek			4		3.6			OM			Fair
Logan Creek	5.4	C	8	17.7	9	WWFF, Cold I&II	•	Silt,S,G		3.8	Fair
Lost Creek	2.5	I		8	2.2	LLF		Silt	All		Fair
Malvitz Creek	1	I		16	1	WWFF, LFF		R,S,OM ,G			Fair
May Creek	5	I		14.6	5.3	LFF		R, Silt	FA	4.04	Fair
Mink River	2.8	C	300	8.2	7.5		•	Silt, OM, S	All		----
Piel Creek	2.5	I		16	5			OM	All		----
Reiboldt Creek	1	C		5.0	.55			OM,Silt, R,G		6.54	----
Renard Creek	6	C	8	35	7.2	WWFF		G, Silt		7.6	Poor
Samuelson Creek	1.25	I		24	3.2	WWFF		R,G,Silt	FA		Fair
Schuyler Creek	4	C/I	27	27.5	3.6	WWFF		R,S,G, Silt		6.47	Fair
Shivering Sands Creek	1.1	I	14	12.5	.7	WWFF, Cold I		R,S,G, Silt		4.69	Good
Silver Creek – Brussels	5.25	C	8	17	8			G	All	6.5	----
Silver Creek – Claybanks	5	I		16	3.7	WWFF		R	FA	4.35	Fair
Silver Creek -Union	2.5	I	6	32	2.4			G			Poor
Stony Creek	13.6	C/I	16	8.5	23.2	WWFF. Cold II		R,G		7.27	Good to Fair

	Length in miles	Flow	Width in feet	Gradient in feet/mile	Watershed in square miles	Biological Use Class	ORW	Substrate	Vegetation	Biotic Index-- Highest value or sample average	Habitat Ranking
Strawberry Creek	1.6	C	12	12.5	4.4			S,OM, Silt		4.4	Good
Sugar Creek	10	C/I	9	17.8	11.6			R,S,G, Silt		6.74	Good to Fair
Three Springs Creek	2.3	I	4	10.9	9.6	WWFF		OM,S, G	EV, SV	6.23	Fair
Twin Harbors Creek	2	I		20	3.3	WWFF		R,S,G, Silt			
Unnamed #1	1	I		120	0.7	LFF		Silt	EV, SV	7.45	
Unnamed #2	1	I		10	3.3			Silt	EV, SV		
Whitefish Bay Creek	1.1	C	28	10	13.7			Silt,S,G, R		7.5	Poor
Woodard Creek	4	C/I		30	2.2					3.99	Good to Fair

[1] Definitions for abbreviations and symbols located in Glossary B.

Figure 9: Door County Lakes and Ponds



Many of the terms used to describe the health and quality of lakes can be further reviewed in **Appendix B**. This appendix describes the different lake parameters and lake types used by limnologists. A summary of the Door County lakes can be found in Table 3 and Table 4 which follow the lake narratives. The information explaining the terms in the tables are located in **Glossary B**. Door County's named lakes are shown in Figure 9.

Arbter Lake T28N R27E Sec. 16,21
Arbter Lake is a brown water, shallow, alkaline bog lake that suffers from winterkills and fluctuating water levels as a part of the Shivering Sands complex. This 16-acre lake is also known as Schmoke Lake or Mud Lake. An intermittent outlet connects this lake to nearby Schwartz Lake. A wide channel enters the lake and has historically been traversed by canoe; however, many fallen trees and other vegetation rarely permit canoeing anymore. The lake is bordered by wooded swamp, and has no public access. Recreational fishing is very limited. The surrounding area provides habitat suitable for terrestrial species with low tolerance for disturbance including species listed as threatened or endangered.

Big Marsh T33N R30E Sec. 04
Big Marsh may also be known or listed at Gunnerson Marsh. It is a 31.1-acre drainage lake with two-feet at maximum depth. Although last classified at a drainage lake, the marsh appears to have no inlet or outlet. It has a S.D.F. of 1.4 and is a shallow landlocked lake in sand deposits on the east side of Washington Island. Northern pike are thought to use the area, but no public access is available and fishing is uncommon. The has high aesthetic value.

Bley Pond T29N R27E Sec. 18
Bley Pond is a small 4.5-acre seepage lake having a S.D.F. of 1.68 and a maximum depth of three-feet. It is a kettle lake occupying a small depression in ground moraine where bedrock constitutes much of the lake bottom. No fishery information is available and there is no public access.

Bradley Lake T27N R26E Sec. 6
Bradley Lake is also often referred to as Little Lake, Mud Lake, or The Duck Pond. Bradley Lake is a 19-acre seepage lake with a maximum depth of seven-feet. This small sand bottom lake bordering Sturgeon Bay has a S.D.F. of 1.42. The lake had an intermittent outlet, but water level is maintained at one foot above natural level by a low dam. The outlet for the lake is generally never used. The lake is located within Sunset Park and the primary use is that of a "kids fishing pond". Carp and bullheads tend to be the dominant species, but bluegill, yellow perch, and other panfish are present. Small numbers of walleye and smallmouth bass may be present. On occasion, private interests have stocked panfish, but no surveys have been done to determine current population status. Winterkills of fish may occasionally occur. Waterfowl use the pond extensively, which leads to nutrient rich water conducive to outbreaks of excessive algae or rooted macrophytes. In 1999, a water quality survey was conducted to determine the suitability of the lake to hold a fishery. It was determined that the lake is eutrophic approaching hypereutrophic and can be designated as having a WWSF or WWFF.

Butler Pond T29N R27E Sec.34

Butler Pond is a small 3.2-acre seepage lake located in a wooded swamp just north of Clark Lake. It has a maximum depth of two-feet and a S.D.F of 3.14. The aesthetic value is high, but there is no public access available. A fish inventory is not available for the pond.

Clark Lake T28,29N R27E Sec. multiple

Clark Lake is an 864-acre drainage lake with a maximum depth of 22-feet and a S.D.F. of 1.53. It drains a watershed of 25-square miles. The lake's water supply is provided by Logan Creek and seepage from groundwater. Water levels are controlled by an outlet dam in the southwest corner that drains to Lake Michigan by way of Whitefish Bay Creek. Development is extensive with many year round and seasonal homes with onsite septic systems. This lake was one of the few lakes monitored on a continuous basis by the DNR. (The DNR monitoring has since been discontinued.) Extensive macrophyte and water chemistry data are available for this lake that go as far back as 1975. Walleye are the dominant predator fish and rock bass are the dominant panfish. Northern pike are also present and bluegills and yellow perch are low in abundance. Fish sampling surveys show rockbass and bluegills primarily 6-8 inches and walleyes 12-19 inches. Rooted aquatic plants are low in abundance due to water level fluctuations and re-suspended marl, which limits light penetration. Overall, Clark Lake is oligotrophic with limited productivity. It can be accessed by one boat launch or two other shore access points.

Coffee Swamp T34N R30E Sec. 30

Coffee Swamp is a small, 2.2-acre freeze-out hardwood swamp surrounded by woodlands and is considered a seepage lake with a maximum depth of 1.5-feet. The area of standing water is very shallow, and the lake is located on private property. It is unique in that it is a large abrupt depression which transitions sharply into upland deciduous forest with an old canopy. The pond is surrounded by acres of floating bog mat. This buoyant mat supports white cedar trees up to an impressive eight-inches in diameter along with rare sedges and orchids. It periodically earns the attention of botanists and ecologists because of the plant communities located on the bog. Frogs and waterfowl also use the secluded, low disturbance area. Whitetail deer yard up in the area and the browse line is evident.

Dunes Lake T28N R27E Sec. 30

This lake may also be known as Gurlack (Gerlach) or Mud Lake. Dunes Lake lies in a low, shallow basin that is fed by Geisel Creek and drained by Shivering Sands Creek which empties into Lake Michigan. It is considered a drainage lake and is 80.4-acres having a maximum depth of 1.1-feet and a S.D.F. of 1.77. The lake bottom consists of an extremely dark brown muck at the outlet of Geisel Creek and a firmer, grey/tan colored marl throughout the rest of the lake. These two different bottom types support a contrasting aquatic macrophyte assemblage. A soft sedge mat backed by alder, tamarack, and white cedar borders the entire lake. The lake does not sustain a large fish population because winterkill occurs annually due to its shallow nature.

Europe Lake T32N R29E Sec. 09

Europe Lake is a 273-acre seepage lake averaging six-feet in depth with a maximum depth of ten-feet. A public boat access is located on the southwest side of the lake. In 1994, Europe Lake was monitored as part of the Twin-Door-Kewaunee Basin assessment. Europe Lake is

classified as oligotrophic . Average surface phosphorous levels of 5 ug/L and chlorophyll concentrations of 1.75 ug/L indicate that nuisance algae blooms are not likely. This lake is also classified as a hardwater lake based on alkalinity readings of 167mg/L and pH readings around 8.7. The lake is surrounded by birch, white cedar, and pines with a marsh at the northern end. Fine, flocculent, nutrient poor bottom substrate is the primary reason for the lake lacking aquatic plants. Some rooted aquatic plants are scattered throughout, but the vegetation that does appear is generally concentrated in the lake's northeast corner. The potential for development along portions of the lake exists, but currently, only a few residential/seasonal homes are present on the southwest edge of the lake. Newport State Park borders the southeast shore of Europe Lake. Walleye, smallmouth bass, northern pike, rock bass, yellow perch, and pumpkinseed are present with yellow perch being the dominant panfish and northern pike the dominant predator. Even though it's shallow, the low biological production helps to prevent winterkill conditions because oxygen is still available. At present, water quality for the lake is very good. Expanded boating pressure may substantially increase the turbidity of the lake.

Forestville Flowage T26N R25E Sec. 29

The Forestville Flowage may also be referred to as the Forestville Millpond. This impoundment of the Ahnapee River is 72.1-acres with a maximum depth of about seven-feet and a S.D.F. of 2.06. Access is obtained through various trails and a boat ramp at the county park near the dam. Weeds and fluctuating water levels still seem to be the major use problems. Rich sediments deposited in the millpond from upstream sources promote excessive weed growth and provide ideal habitat for certain fish species. A 1990 fish kill was the last significant winterkill reported, and upon investigation, was attributed to critically low oxygen levels from low flushing rates and the consumption of oxygen through anaerobic decomposition. Bullheads are generally the most tolerant of these conditions. The millpond is managed for largemouth bass and northern pike predator populations with bluegill and rock bass as the primary panfish. Other species that may have been accidentally or intentionally introduced after chemical treatment include yellow perch, black crappie, and carp. Because of the occasional winter kills (most often from excessive macrophytes) restocking of largemouth bass and northern pike has occurred, but no evaluation of recent stocking has been performed.

Kangaroo Lake T29, 30N R27E Sec. multiple

Kangaroo Lake is the largest Door County lake with a surface area of 1,109-acres. The northern portion of Kangaroo Lake is separated by a causeway which has been in place since the late 1800's. Three culverts under the causeway link the two sections of the lake. The larger south basin is approximately 800-acres and the northern basin is approximately 300-acres. The lake is elongated north to south, lies parallel near the Lake Michigan shore and has a S.D.F. of 1.89. The north basin is clear and very shallow having a maximum depth of only 4.5-feet. This basin contains a variety of open water and wetland species, and is surrounded by relatively undisturbed forest. Along the north basin shoreline, development occurs only on at the western end of the causeway. Much of the shoreline and adjacent woodlands of the north basin are part of the Kangaroo Lake Preserve natural area, and the water is designated a non-motor "sensitive area" in accordance with Chapter NR 107 of Wisconsin Administrative Code accessible to non-motorized boats. Shoreline development and considerable recreational use are significant in the south basin. This basin is also very

shallow with an average depth of six-feet and12-feet at its greatest depth in one small area. The south basin is characterized by turbid water, Secchi depth of 4.5 feet, and lacks diverse aquatic vegetation. It includes a 15-acre island that can be seen from the causeway. Herbarium records show northern wild rice being documented in the lake in 1933. The most current survey was conducted in 1994 and wild rice was present among other species. Water chemistry data exists since 1968, but a more recent data set was collected by the Kangaroo Lake Association in 1993. Recent efforts to improve water quality have included the installation of a special grate along the dam during the spring of each year to prevent migration of carp into the lake for spawning. This practice appears to have contributed to improved water quality with annual Secchi depth readings of seven-feet since the installation. Piel Creek enters the lake at the north end of this basin. This drainage lake is accessible from the causeway and a small path originates in the area and allows for canoe access. There is a boat ramp on the east side of the south basin which provides for launching small craft with small motors. Two very shallow drop-in locations (no ramps) are located at the ends of Beach Road and O'Brien Road on the west side of the southern basin. Shoreline development and recreation use are prevalent. Eurasian water milfoil is also a concern. Walleye, smallmouth bass, largemouth bass, northern pike, yellow perch, bluegill, rockbass, and pumpkinseed are the most common species with walleye, smallmouth bass and northern pike being the dominant predators. Yellow perch are by far the most abundant panfish. The opportunity to catch bluegill and rockbass greater than ten-inches is present in this lake. Carp inhabit the area as well as longnose gar.

Krause Lake T31N R26E Sec. 05

Krause Lake (also known as Mud Lake) is a small landlocked lake on Chambers Island having 3.7-surface acres and a maximum depth of 24-feet. The S.D.F. is 1.63 and public access is not available. Historically, largemouth bass and bluegills were noted as the dominant species. Current fishery information does not exist.

Little Lake T34N R29E Sec. 23

Located at the northwest portion of Washington Island, Little Lake has high aesthetic value. It is 23.6-acres in size with a maximum depth of seven-feet and a S.D.F. of 2.06. At the southwest portion of the lake lies a small museum and a little dock that can serve as a public access point. A large portion of the lake is shallow. On the east side, a limestone shelf is evident and this is where the depth is greatest. The lake may support fish through the winter, but winterkill does occur. Yellow perch and smallmouth bass have occasionally been planted from Lake Michigan waters. In the case of a very high water event, the possibility exists that outlying waters may mix with lake waters via a cobble causeway on the west side of the lake. Only a few residential houses are located along the south side. The entire lake is surrounded by various wooded vegetation with older stands of white cedar and hemlock on the north side. The northeast corner is associated with a floating bog mat. Blue-spotted salamanders, various frog species and waterfowl breed in the small depressions within the bog mat.

Little Marsh T33N R30E Sec. 04

Little Marsh is also known as Wickman Marsh. This is a 14-acre open water area in a bullrush marsh on the eastern side of Washington Island. The area of open water is segmented by an intrusion of woodland creating a smaller south basin with a poorly defined

connection to the north basin. It has a maximum depth of 1.5-feet and a S.D.F. of 1.91. The surrounding land is heavily wooded and no fishery information is available. The lake provides resting grounds for waterfowl and has no public access.

Lost Lake T29N R27E Sec. 07 & 08

Lost Lake is a shallow, marl-bottom, spring lake, classified as a seepage lake. It has a surface area of 91.2-acres, a S.D.F. of 2.06 and a maximum depth of 5.5-feet. At its north end lies a diverse northern sedge meadow. Surrounding the remainder of the pond and sedge meadow is a forested wetland dominated by tamarack and white cedar trees. The marl bottom, with a pH of 8.8-8.9, yields very sparse bottom vegetation. Small stands of yellow water lillies can be found in the northwest part of the lake. Fish commonly found in the lake include carp, bullheads, northern pike, and yellow perch, though fishing is uncommon. Northern water snakes, snapping turtles, and painted turtles are also present. Canada geese, wood ducks, and mallards are known to use the area as a stop over point during migration. Lost Lake feeds Logan Creek which then empties into Clark Lake creating a corridor between the two lakes. Lost Lake is one of the few lakes that has little development along its shoreline.

Mackaysee Lake T31N R27E Sec. 03 & 04

Mackaysee Lake is a 347-acre landlocked lake on Chambers Island in Green Bay. It has a maximum depth of 27-feet, an S.D.F. of 1.18 and is thought to be spring fed. An assessment in 1994 showed no evidence of exotic plant species present. Species composition and water chemistry have changed little when compared to historical data. However, there is still a high potential for aquatic exotics to invade the lake because it is surrounded by Green Bay waters. Abbreviated fishery surveys have been conducted on the lake and suggest that there are excellent populations of largemouth and smallmouth bass as well as northern pike. Bluegills and yellow perch are also present. Because of limited public access, fishing opportunities are restricted. Lake sturgeon have been reported to be seen in the lake, but have not been officially documented.

Mud Lake T30, 31N R28E Sec. 33

Mud Lake is a shallow 155-acre drainage lake with a predominantly marl bottom. The maximum depth is five-feet and 55 percent of the lake is less than three feet deep. It is more long than wide, has a total shoreline of approximately 3.2 miles and empties southerly into Moonlight Bay via Reiboldts Creek. The last recorded water chemistry values indicate a pH of 8.5, a total alkalinity of 181 mg/L, and a specific conductance of 324 mg/L. Two unnamed streams enter Mud Lake and drain the large, state wildlife wetland area surrounding the lake. Public access is available, but many find access to the lake through the wildlife area difficult and primitive. Access to the lake is usually by small watercraft using Reiboldt Creek. Even though the wildlife area boundaries are not well marked, recreation activities in this area primarily include deer and waterfowl hunting. Small game trapping and fishing also occur.

Pinney Lake T27N R26E Sec. 11

This small 2.3-acre lake with a maximum depth of 5.5-feet is surrounded by wooded swamp. It has a S.D.F. of 2.10, and there has been an irrigation ditch dug for use at a tree nursery. There is no public access for this lake and no fishing has been observed. A fish inventory is not available.

Pluff Pond T31N R28E Sec. 20
Historically, Pluff Pond was a small 0.52-acre lake that remained clear and cool throughout summer because it was spring fed. There is no established fishery, but some locals have suggested that trout used the area. The lake has undergone many alterations and development in the past. Currently, the lake only has a small remnant of an open water area. The remainder of the is now wooded swamp bordered by CTH Q to the north and residential houses.

Rogers Lake T32N R28E Sec. 24
Rogers Lake is often referred to or associated with the Mink River. See the Mink River description on page 22-23.

Schwartz Lake T28N R27E Sec. 21
Schwartz Lake is a 30-acre lake with a maximum depth of four-feet and a S.D.F. of 1.43. The lake lies in an area of wooded swamp. Winterkill occurs in this seepage lake and allows for little fish management; however, waterfowl hunting exists.

Thorp Pond T30N R27E Sec. 16
Thorp Pond is a small 6.4-acre nearly circular lake with a S.D.F. of 1.13. It has a maximum depth of 2.5-feet and is classified as a drainage lake by the WDNR however, the pond has no distinct inlet or outlet and the hydrology remains unclear. The pond has a peat bottom, is also spring fed and is surrounded by emergent aquatic communities dominated by cattails. The pond is bordered by upland and lowland forests and wetlands, and a second tier of land comprised of a patchwork of cleared cropland, stump pasture, and orchards. A very sensitive boreal rich fen is located at the north end of the pond. The area serves as a staging area for waterfowl in the spring and fall. Often, Canada geese and mallards nest along the shore and in the adjacent woods. No fishing has been observed here.

Unnamed Lake #1 T27N R26E Sec. 12
This water body has no official name, but is locally referred to as Kelner's Fen or Mud Lake. It is a complex of fen and open water approximately 60 to 80-acres in size. The area includes a large fen, a transition zone of wet shrubs and small trees, coniferous swamps, and mixed hardwood-conifer swamps. The area south of the fen includes forested ridge and swale topography. The dominant vegetation of the fen is largely sedges, including one species of special concern in Wisconsin. Two ditches were dug before 1938 to drain the wetland to Lake Michigan to the east. Presently, only one of the ditches appears to drain the wetland. Historically, portions of this wetland were used to raise bullfrogs.

Unnamed Lake #2 and #3 T29N R27E Sec. 01
Two small unnamed lakes exist in close proximity of the southwest end of Kangaroo Lake. The lake to the north(#2) is 4.1-acres and within the boundaries of property owned by The Rushes resort. A trail and viewing platform lead to the lake from The Rushes. The lake to the south(#3) has approximately two acres of open water with wetland areas extending to the south. There is not an established trail to this lake and it is located partially on private property and within the Lyle-Harter Matter Sanctuary. An intermittent outlet drains to Kangaroo lake from the northeast shore of unnamed lake #3. There is also an intermittent

outlet from the associated wetland that drains the area and may reach Kangaroo lake in certain years.

Upper Lost Lake T29N R27E Sec. 06
This is a 4.5-acre drainage lake with a maximum depth of three-feet and a S.D.F. of 1.80. Drainage through a swamp connects this lake with Lost Lake, but the drainage system is indistinct. A small subdivision is located northwest of the lake. Other information on Upper Lost Lake is limited or does not exist.

Voecks Marsh T30N R28E Sec. 09
Voecks Marsh is a shallow depression in a lowland forest that borders Lake Michigan. A narrow stream connects this 19.1-acre body of water to Moonlight Bay. This drainage lake has a maximum depth of two-feet and has a S.D.F. of 1.8. Today, it may be referred to more frequently as Pickerel Pond.

Zoo Lake T31N R28E Sec. 10
Zoo Lake is a spring fed pond at the headwaters of Three Springs Creek with approximately 0.9-surface acres, an S.D.F. of 3.16, and a maximum depth of three-feet. Forested wetland borders the pond. No evidence of a fishery has been noted.

Table 3: Popular Fish Species Distribution for Lakes (Information compiled by the Door County SWCD from resource professionals and various sources; refer to Bibliography for detailed documents.)

		Sucker spp.	Rainbow Smelt	Carp	Bullhead	Catfish	Pumpkinseed	Bluegill	Yellow Perch	Walleye	Rock Bass	Smallmouth	Large mouth	Northern Pike	Muskellunge	Brook Trout	Rainbow Trout	Brown Trout	Chinook Salmon
Arbter Lake	⊗																		
Big Marsh														•					
Bley Pond																			
Bradley Lake				•	•			•	•	•		•							
Butler Pond																			
Clark Lake								•	•	•	•	•		•					
Coffee Swamp	*																		
Dunes Lake	*	•		•	•									•					
Europe Lake							•		•	•	•	•		•					
Forestville Flowage		•		•	•			•			•		•	•					
Kangaroo Lake				•			•	•	•	•	•	•	•	•					
Krause Lake	**																		
Little Lake	**																		
Little Marsh	**																		
Lost Lake				•	•				•					•					
Mackaysee Lake								•	•			•	•	•					
Mink River				•	•		•				•	•		•					
Mud Lake				•					•					•					•
Pinney Lake	⊗																		
Pluff Pond	⊗																		
Schwartz Lake	⊗																		
Thorp Pond	⊗																		
Upper Lost Lake	⊗																		
Voeks Marsh	⊗																		
Zoo Lake	⊗																		

Note: Information for unnamed lakes is not available.

* No fishery established due to freeze out conditions
** No information available
⊗ Fishing not observed on these waters

Table 4: Lake Summary Information and Water Chemistry[2] (Information compiled by the Door County SWCD from resource professionals and various sources; refer to Bibliography for detailed documents.)

	Surface Area (in acres)	Maximum Depth	Public Access	Lake Map Available	Lake Type	S.D.F.	Limited Fishery	Bottom Type	Contaminant Advisory	pH	Alkalinity (mg/l)	Chlorophyll a	Total Phosphorous (mg/l)	Chloride (mg/l)
Arbter Lake	16	2			Dg	1.96	•	Silt		----	----	----	----	----
Big Marsh	31	2			Dg	1.40	•			----	----	----	----	----
Bley Pond	5	3			Se	1.68	•	Bedrock		----	----	----	----	----
Bradley Lake	19	7	•		Se	1.42		Sand		----	----	----	.067	----
Butler Pond	3	2			Se	3.14	•			----	----	----	----	----
Clark Lake	868	25	•	•	Dg	1.53		Marl,R,S	•	8.37	191	2.08	.012	9.6
Coffee Swamp	2	2			Se		•	OM		----	----	----	----	----
Dunes Lake	80	1			Dg	1.77	•	Muck, Silt		----	----	----	----	----
Europe Lake	273	10	•	•	Se	1.38		Marl,S,G		8.3	135	5.84	.008	1
Forestville Flowage	65	5	•	•	Dg	2.06		Silt,OM	•			33.5	.076	
Kangaroo Lake	1123	12	•	•	Dg	1.89		Marl,S, G,R		8.0	183	1.73	.011	3
Krause Lake (mud)	4	24			Sp	1.63	•			----	----	----	----	----
Little Lake	24	6			Sp	2.06	•	OM,R,G		----	----	----	----	----
Little Marsh					Sp	3.16	•			----	----	----	----	----
Lost Lake	91	5			Se	2.06		OM,Silt		8.8				
Mackaysee Lake	347	27	•	•	Sp	1.18		S,R,G, Silt	•	8.2	122	2.0	.02	
Rogers Lake	70	13	•		Sp	2.22		Silt OM		----	----	----	----	----
Mud Lake	155	5	•		Dg	1.83		OM		----	----	----	----	----
Pinney Lake	2	6			Se	2.10	•			----	----	----	----	----
Pluff Pond	1	5			Sp	1.30	•			----	----	----	----	----
Schwartz Lake	30	4			Se	1.43	•	OM		----	----	----	----	----
Thorp Pond	6	3			Dg	1.13	•	OM		----	----	----	----	----
Unnamed Lake #1														
Unnamed Lake #2														
Unnamed Lake #3														
Upper Lost Lake	5	3			Dg	1.80				----	----	----	----	----
Voeks Marsh	19	2			Dg	1.91	•			----	----	----	----	----
Zoo Lake	1	3			Sp					----	----	----	----	----

Note: Information is limited for unnamed lakes.

[2] Definitions for abbreviations and symbols located in Glossary B.

Bays, Harbors & Partially Bounded Coastal Waters

In the 1965 report, *Surface Water Resources of Door County*, bays and harbors were generalized into waters of Lake Michigan or waters of Green Bay. The differences in the characteristics of these large waterbodies has resulted in many individuals grouping the bays and harbors into *bayside* waters and the *lakeside* waters. This report addresses the individual bays and harbors of both the bayside and the lakeside not from the standpoint of Green Bay vs. Lake Michigan, but rather inland and nearshore waters vs. outlying waters.

A bay is defined as a wide inlet of a body of water partially enclosed by land, and a harbor is a sheltered anchorage for ships. A sound classification system that takes into account both physical and biological components for bays and harbors does not exist.

Many of the bays and harbors of Door County have physical and biological differences from the connecting Green Bay or Lake Michigan waters. The bays and harbors that are recognized as having unique characteristics differing from the connecting outlying waters are partially bounded coastal waters or PBCW's.

A PBCW may have many or few distinguishing characteristics. One such characteristic is the extent of enclosure by land. For example, does the bay open widely or is it nearly 'pinched shut' and open narrowly. What percentage of the bay is enclosed by its shoreline? The extent that the shoreline or land features can 'pinch shut' the bay or harbor from outlying waters can effect the clarity, chemistry and turnover time of the water within the bay or harbor.

As a result of being a PBCW, recreational use tends to increase. The bay or harbor is sheltered from weather conditions. Wildlife and boaters may seek refuge in these calmer waters as opposed to outlying waters not sheltered from wind and other weather. Smaller sized watercrafts may use the area more intensely similar to inland lakes. Fishing is active also since nearshore areas are ideal spawning grounds for certain species. The nearshore areas have different subaqueous features than the outlying waters that attract fish and therefore anglers. For Door County, many of the bays and harbors have greater accessibility than inland waters.

The importance of the bays, harbors, and PBCWs in Door County to the surrounding communities is evident. This may be based simply on the physical orientation and characteristics, but it also includes aesthetic and intrinsic values. The bays, harbors, and PBCWs for this report are delineated and shown in Figure 10. Table 5 lists the physical characteristics of each resource as determined by the Door County SWCD.

Figure 10: Door County Bays, Harbors and Partially Bounded Coastal Waters

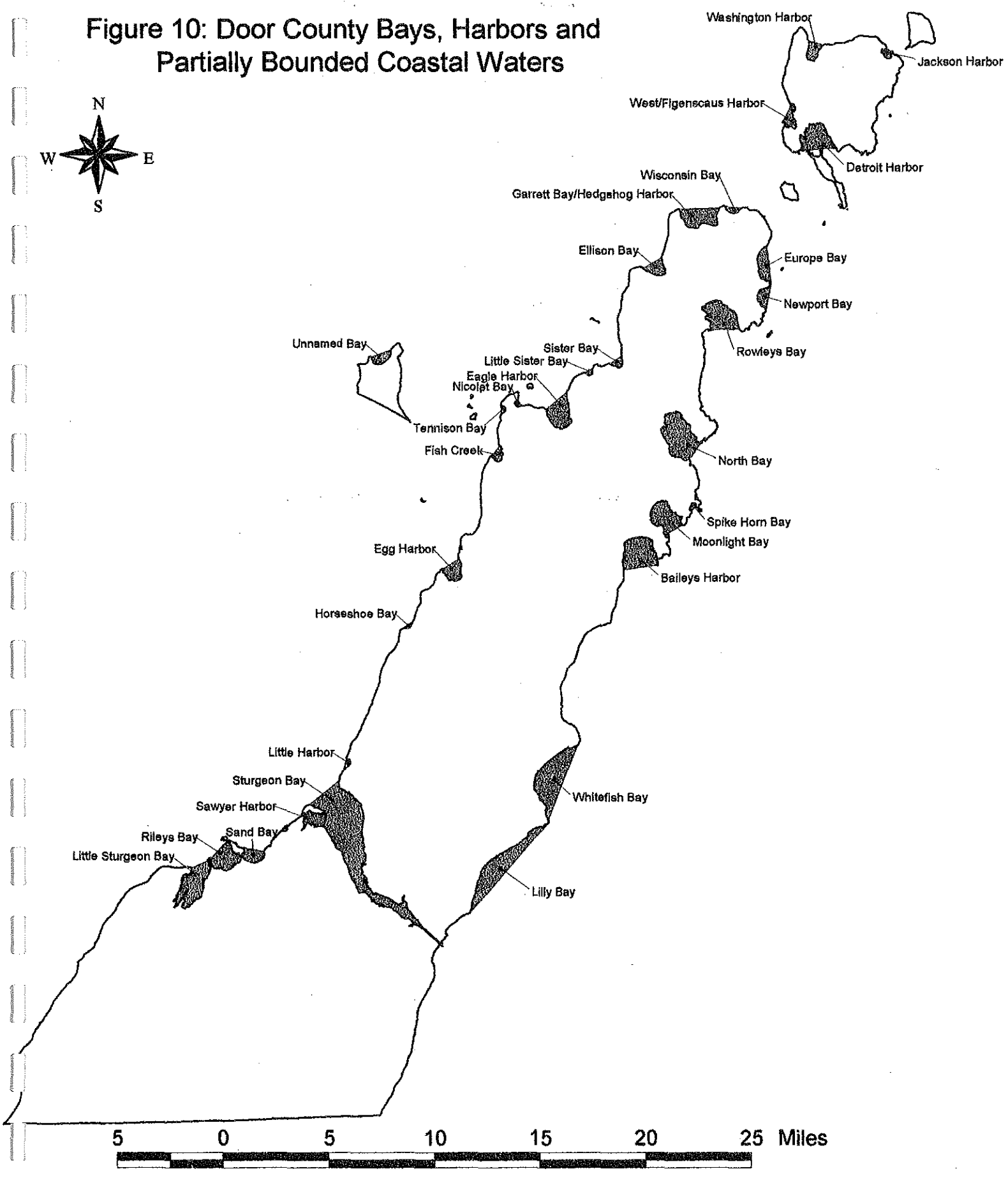


Table 5: Physical Characteristics of Bay and Harbors
(Information compiled by the Door County SWCD from resource professionals and various sources; refer to Bibliography for detailed documents)

Name	*PBCW*	*Acres*	*Shoreline (feet)*	*Shoreline (mi)*
Baileys Harbor*	X	1,283	28,402	5.38
Detroit Harbor*	X	923	37,180	7.04
Eagle Harbor*		801	19,240	3.64
Egg Harbor*	X	401	17,204	3.26
Ellison Bay	X	317	14,166	2.68
Europe Bay		445	11,886	2.25
Fish Creek Harbor*	X	147	14,736	2.79
Garrett Bay/ Hedgehog Harbor		861	21,377	4.05
Horseshoe Bay		31	4,089	0.77
Jackson Harbor*	X	89	10,586	2.00
Lilly Bay		1,933	26,567	5.09
Little Harbor		54	5,755	1.09
Little Sister Bay		43	4,380	0.83
Little Sturgeon Bay*	X	1,193	64,157	12.15
Moonlight Bay	X	929	27,284	5.17
Newport Bay		249	9,778	1.85
Nicolet Bay		36	2,773	0.53
North Bay*	X	1,617	38,862	7.36
Rileys Bay*	X	752	23,459	4.44
Rowleys Bay*	X	1,043	28,653	5.43
Sand Bay		338	12,509	2.37
Sawyer Harbor		362	30,686	5.81
Sister Bay	X	108	10,004	1.89
Spike Horn Bay	X	42	4,500	0.85
Sturgeon Bay		4,778	153,186	29.01
Tennison Bay		38	3,989	0.76
Unnamed Bay #1		233	8,349	1.58
Washington Harbor*	X	271	11,531	2.18
West Harbor	X	232	19,978	3.78
Whitefish Bay		3,874	37,767	7.15
Wisconsin Bay		94	6,231	1.18
Totals: 31 Bays and Harbors		23,516	709,562	134.38

* Indicates those waters which are listed as a bay in 29.417 of the 1999 Wisconsin State Statutes in regard to the take of rough fish.

X Indicates the bay/harbor is considered a Partially Bounded Coastal Water (PBCW).

Baileys Harbor T30N R28E Sec. 20, 21, 29

This is one of the four distinct bays on the east side of the Door Peninsula. This bay opens southward and is approximately 1.55-miles in width. The coastal area in the inner bay is composed of sand beach, bordered on the east and west sides by Silurian dolostones. An 1,100-acre protected area called The Ridges Sanctuary is located along the east side and inner portion of the Baileys Harbor and on the west side of Moonlight Bay to protect the unusual habitats and endangered species found at the site. Within the area are unique microhabitats such as conifer swamps, swales, and bogs. A diversity of unique wetlands has developed here over time due to the fluctuating lake levels. The west shore of Baileys Harbor supports a residential land use with one boat ramp. The remainder of the west shore is a combination of exposed bedrock, gravel beaches and mixed sand. On the east side of the bay is Toft Point, also a state natural area. The shoreline here consists of sheltered scarps, shelved bedrock, and gravel beaches. The bay itself supports a wide variety of salmonids and some bass species. Shallow reefs located near the southern bay mouth are a prime location for spawning of lake whitefish. There is an annual stocking of brown trout as well. This small harbor has high recreation value and throughout the summer is a refuge from the inland heat.

Detroit Harbor T33N R29E Sec 13

This is a south facing bay on the southwest portion of Washington Island. The Wisconsin Ferry Line, a service that transports people and vehicles between the island and mainland, have docking areas on the west shore of the harbor which is mainly composed of hard structures. The rest of the shoreline is an alternating pattern of wetland fringe and mixed beaches. The substrate of the outlying waters are silt, rock, sand, gravel, rubble and cobble. The harbor provides spawning habitat for smallmouth bass, yellow perch, and northern pike. Fishing for smallmouth bass and northern pike are dominant although other sport fish are available. Brown trout are stocked annually.

Eagle Harbor T31N R27E Sec. 14, 23

Eagle Harbor is a high use recreational bay easily accessed from the Village of Ephraim. The shoreline is composed of numerous docks or shore protection riprap, although some areas of sand beach do exist. Other substrate includes gravel, clay, cobble and rubble. A public beach is located within the inner bay. Boat access to the bay is easily attainable with two small marinas located on the eastside. A portion of the west side of the bay is within the boundaries of Peninsula State Park. Fisheries for brown trout, walleye, smallmouth bass, and yellow perch occur in the harbor area.

Egg Harbor T30N R26E Sec. 25

Egg Harbor opens in a northwesterly direction and is relatively protected. The majority of the bay use is from pleasure boaters which are supported by the various marinas and boat launches. Shoreline development is prevalent with the highest density of establishments along the portion of the bay bordering the Village of Egg Harbor. A few small areas of sand have been maintained and a public beach is located on the southwest portion of the shoreline. Other substrates in the harbor are sand, cobble and rubble. Fisheries for brown trout, walleye, smallmouth bass, and yellow perch occur in the harbor area.

Ellison Bay T32N R28E Sec. 15
Ellison Bay is encompassed by gravel beach shoreline and has substrate of cobble and sand. Two small marinas lie within the harbor. Ellison Bay bluff comprises the majority of the southern boundary and is a highly aesthetic area. Ellison Bluff County Park has a scenic overlook available to the public. Within the bay, anglers pursue brown trout, chinook salmon, and smallmouth bass.

Europe Bay T32N R29E Sec. 09, 16
Europe Bay is very similar to Newport Bay; they both lie within the boundaries of Newport State Natural Area and are separated by Lynd Point. The dominant shoreline type is sand beach. Smallmouth bass, bluegills, and yellow perch inhabit the bay, which is comprised of sand, rock, and rubble. Access points are located within the state park property and Europe Bay Park operated by the Town of Liberty Grove.

Fish Creek Harbor T31N R27E Sec. 29
Fish Creek Harbor opens to the northwest. The eastern shoreline has well kept sand beaches and some corresponding wetland areas. Fish Creek discharges into the harbor at this point. Wetland areas fringe the stream and act as a border to Peninsula State Park. The western shore is the business district of the Village of Fish Creek. Here, bedrock is slightly exposed, but a marina and two additional boat launches make up the majority of this shore. A public beach also lies within the inner bay. Angler's fish for northern pike, smallmouth bass, walleye, and yellow perch in the area, all of which tend to use the area for spawning.

Garret Bay/Hedgehog Harbor T32-33N R28-29E Sec. 36, 31
This area is the western neighbor of Wisconsin Bay. Garret Bay is enclosed within Hedgehog Harbor (a bay within a bay). Garret Bay is the portion separated by a small point along the south shoreline that is considered the inner bay of the larger, Hedgehog Harbor which is enclosed by larger points to the east and west. Because the two bays are so similar they are often talked about interchangeably. Portions of hard exposed bedrock can be found on the east and west shores of Garret Bay along with the substrates of bedrock, cobble and rubble. Both bays have fisheries for brown trout and chinook salmon.

Horseshoe Bay T29N R26E Sec. 03
Horseshoe Bay is a small bay located just south of Egg Harbor and often serves as a resting point and refuge for pleasure boaters. The shoreline is gravel, sand and some cobble. It faces northwest and Frank E. Murphy County Park occupies the inner portion of the bay. The area is highly used for recreation as a mooring and swimming beach. A solid pier and boat launch are located at the park. A destructive tornado ripped through the south portion of the park in 1998, but since then trees have been planted and restoration has begun. At times an unnamed intermittent stream empties into the bay through the park. The stream has remained dry through years of low water levels, and it generally functions as an overflow outlet from the neighboring wetland. No inventories of the waterway exist. The bay is a popular fishing spot for smallmouth bass, yellow perch, and occasional brown trout and walleye.

Jackson Harbor T34N R30E Sec. 28

Jackson Harbor is a little bay that opens to the northeast and faces Rock Island State Park. Commercial fishing boats use the dock area in Jackson Harbor, as do many outdoor enthusiasts that venture to Rock Island. The eastern shoreline is sand beach with wetlands and the remaining shore is similar with the addition of some sheltered scarps of bedrock, silt, and rubble. The Jackson Harbor Ridges State Natural Area helps to preserve the beach, dunes, and swales along with many rare plant species. Fluctuating water levels impact much of the shoreline throughout the bay. The bay provides a fishery and spawning habitat for smallmouth bass, northern pike, and yellow perch.

Lilly Bay T28N R27E Sec. 31, 32 ,06

As with Lilly Bay Creek, this bay is often locally known as Lily Bay. Lilly Bay is titled as being a bay, and is an obvious example of when a bay is not a PBCW. The bay's mouth faces east and is very wide. The two points that border the bay to the north and south are generally non-distinct because of their width. To the north is Whitefish Point and to the south is Portage Point. Lilly Bay County Park lies within the inner bay. Most of the beach is sand and sand gravel that transitions into exposed scarps as it nears Whitefish Point. Shoreline development is composed of residential homes with wooded lots.

Little Harbor T28N R26E Sec. 06, 07

As the name implies, this is a very small harbor. A small residential area occurs along the shores of the bay but cobble and rubble beach shores still remain. Smallmouth bass, yellow perch, and walleye are sought after sport fish in the nearshore area.

Little Sister Bay T31N R28E Sec. 06

Little Sister Bay is located on the southwest shores of the Village of Sister Bay. The shoreline is primarily cobble and rubble over bedrock beaches with some shelving bedrock in the offshore waters. A beautiful and well-known pebble beach is also located within Little Sister Bay.

Little Sturgeon Bay T27N R24E Sec. 10, 11, 02

This is one of the more heavily used bays because of the variety of opportunities it provides. Four small streams feed this bay, one of which also drains the Gardner Swamp. The bay is partially segmented into two smaller basins in the south by Squaw Island Point emerging out of the inner bay. This point provides a reef habitat for various fish and is a popular fishing spot. A large portion of the shoreline is composed of wetland areas that reach inland to some extent and are prominent in the inner bay. Wetland degradation is a concern because some of the remaining shoreline is undergoing redevelopment from small residential homes and cottages to larger homes and condominiums. Those areas not developed are primarily gravel, sand, and silt beaches. Muck bottom in the inner bay transitions into sand with depth. Impacts on the surrounding wetlands from development may have serious effects on the fish populations that utilize the area as spawning grounds. The primary fish species in this bay include smallmouth bass, yellow perch, northern pike, muskellunge, and walleye, although other panfish are present. The bay and its tributaries provide spawning habitat for all these species. Five access points on the west shore and two on the east shore make this bay accessible to the public by either a boat launch, small marina, or public road. Eurasian water milfoil has become established in the bay and is a concern for many recreationists.

Moonlight Bay T30N R28E Sec. 09, 10
The west shore of this bay has a high concentration of wetlands hydrologically connected to the bay. The sheltered bay has sand beaches within and shelving bedrock on its sides. Reiboldt Creek empties into the bay from the north-northeast and provides an area of suitable habitat for many bird species. Yellow perch, smallmouth bass, and northern pike are dominant. This bay provides a nursery/rearing area for lake and round whitefish which spawn on the reefs near the bay mouth. The whitefish population is abundant enough that a commercial fishery exists in this area. The area is also stocked annually with brown trout. A boat access is present at the eastern side of the mouth of the bay. Until the mid-1900's this bay was known as Mud Bay.

Newport Bay T32N R29E Sec. 21
Newport Bay is a small bay facing east with a consistent shoreline of shelving bedrock and sparse gravel beaches. Lying within the boundaries of Newport State Park, this Lake Michigan shoreline is vegetated with the northern mesic, northern wet-mesic, and boreal forest communities. Several rare plants occur in the Newport Bay area. Smallmouth bass are the dominant fish species in the small embayment.

Nicolet Bay & Tennison Bay T31N R27E Sec. 16, 17
Nicolet and Tennison Bay are two small bays which mirror each other, separated by Eagle Bluff. These three areas all lie within the boundaries of Peninsula State Park. The beaches are primarily a mixture of sand and gravel. People use the bays within Peninsula State Park for camping areas, swimming, and other recreational water sports. More information on recreation opportunities are available through Peninsula State Park. Smallmouth bass, yellow perch, and walleye provide sport-fishing opportunities within the bays.

North Bay T31N R28E Sec. 22, 23, 27, 26
North Bay is a rather shallow bay that opens southward. Three Springs Creek empties here and a large portion of the inner embayment has a wetland shoreline. Two jetties and some revetments are located along the west shore. As the shoreline continues, there is a transition from sand/gravel beaches to exposed portions of bedrock, clay and rubble. Despite the human activity, this area supports a wide assemblage of birds. The eastern shoreline has one boat landing located at the end of North Bay Road on a sand beach. The rest of this shore is primarily shelving bedrock. Offshore habitat is sand, rock, and rubble bottom type. Most people using the area fish primarily for smallmouth bass and northern pike although many other species inhabit the area. The bay provides nursery grounds for lake whitefish as well, which use the nearby reefs for spawning. No stocking occurs in this bay.

Rileys Bay R28N R25E Sec. 31
Rileys Bay is separated from Little Sturgeon Bay by Rileys Point to the west and is separated from Sand Bay by Sand Bay Point to the east. The importance of this bay is similar to that of Little Sturgeon Bay, but the adjacent wetlands are limited here. Much of the southern shoreline is gravel beach with some bedrock. The western and eastern shoreline is developed, primarily with cottages, so riprap is often in place over the mixed sand and rubble gravel beaches. This area is heavily fished for walleye, yellow perch, smallmouth bass, northern pike, and muskellunge. The closest access point for the bay is on Riley's Point where a boat launch is located in a low bank sand/mud flat.

Rowley Bay T32N R28E Sec. 24, 25

Rowley Bay (or Rowley's Bay) is part of a unique portion of Door County because it is the outlet for the Mink River. This complex of the inner bay and Mink River is a fresh water estuary. The shoreline is mainly sand beach interspersed with gravel. In certain areas the bedrock is exposed. There is one boat launch access point on the west shore that is located within a small marina. Newport State Park forms the east boundary of the bay. Smallmouth bass and northern pike dominate the area and are the focus of the fishing opportunity. Both species use the bay for spawning. Brown trout are stocked annually, and whitefish spawn along the reefs located outside of the mouth of the bay.

Sand Bay T28N R25E Sec. 32

Sand Bay is the outlet for May Creek and Larson Creek. The shoreline, as the name implies, is primarily sand with a bottom type consisting of sand and sand/gravel. Gravel beaches do, however, extend along the eastern shore. Wetlands occupy the areas where the streams converge with the bay. Sand Bay Point separates this bay from Rileys Bay. Development in the area consists of a mosaic of cottages and homes. Snake island is a small island located at the tip of the peninsula that makes up Sand Bays west shore. In years of low water the island connects with the mainland. The entire Snake Island peninsula is an area of developed wetland habitat that experiences fluctuating hydrology with water level changes. Smallmouth bass, yellow perch, and walleye are sport fish sought in this area.

Sawyer Harbor T28N R25E Sec. 22, 23

Sawyer Harbor has high recreational use with two access points on the north side and one from Potawatomi State Park on the south side. The bay opens to the east into Sturgeon Bay's outer bay/channel. The entire west shore is coastal wetland, but there is a transition to rubble and cobble along the north and south shores. Near the confluence with Sturgeon Bay, gravel beaches exist. Two small islands are located within the bay, both with cobble and rubble shores and close to the State Park shoreline. Two houses are located on the larger unnamed island and one house is located on Hoe Island. The bay is rather shallow, but a small seasonal marina has moored power and sailboats. Considerable recreation occurs here as well because of the sheltered nature of the bay. Boating and water skiing are popular in the summer while fishing is popular all year round. Typically, northern pike are sought in the winter and small mouth bass in the summer, but good to fair fishing for other species does exist (i.e., yellow perch, rock bass, and brown trout). A unique species of panfish called the long-eared sunfish resides in this bay as well. The bay provides considerable spawning habitat for all these species. Most of the bottom type is sand or sand/rock and large areas of submerged aquatic weedbeds are evident. Aquatic vegetation, pigment analysis, bottom type, coliform and other water chemistry data were collected in 1974, but nothing more recent is available.

Sister Bay T31N R28E Sec. 05

The shores of Sister Bay are located entirely within the boundaries of the Village of Sister Bay. The bay opens to the northwest. The shoreline is mostly sand, gravel, and rubble beaches, although some construction projects have placed riprap and pier structures along the shore. A marina is located along the northern reach of the shore. This area supports good sport fisheries for smallmouth bass and yellow perch, as well as walleye at times. These fish species, as well as others, use the area for spawning.

Spike Horn Bay T30N R28E Sec. 11
Spike Horn Bay is a small bay located just north of Moonlight Bay. The shores of Spike Horn Bay are exposures of bedrock with a small expanse of sand beach along the inner shore. The gravel and cobble beaches at Cana Island form the eastern border of the bay. The federal government owns the island and the Cana Island lighthouse is located there. At times of low water levels, individuals can walk the gravel/cobble peninsula to the island proper.

Sturgeon Bay T27N R26 E Sec. 22, 16 ,08, 07, 06
The shorelines of this bay are composed of gravel, cobble, boulder, rubble and/or concrete. The east portion of the bay is a constructed channel. The bay separates the peninsula into what is referred to as southern Door and upper or northern Door. The bay has a wide mouth which opens to the west. Located on the north end of the west shore is a large stone quarry and county park where many people fish from the remnant shipping docks and pilings. A boat launch is also available. Other access points are available within the city through public launches, various marinas and shipping docks. The development of this area dates back many years, as do the fishing stories. Nearly everything is fished for at some point along the stretch of Sturgeon Bay. Northern pike, walleye, yellow perch, bass, brown trout, and chinook salmon provide excellent fishing opportunities. Chinook salmon are stocked from Strawberry Creek and brown trout are stocked at either end of the channel. Walleye are stocked on a biennial basis. Smallmouth bass are by far the most dominant species. Several annual bass fishing tournaments have headquarters located at Sawyer Park in the city of Sturgeon Bay. Bass, northern pike, walleye, and several species of panfish use the bay for spawning. A unique species found in the area is the spotted musky. White perch, Eurasian water milfoil, and zebra mussels have been noted as exotic nuisances.

Unnamed Bay #1 T32N R26E Sec 33
This bay is located on the northeast corner of Chamber's Island. It has been locally referred to as North Bay, but no official name is listed. The shoreline is sand and many boaters moor in the bay for recreation. The area is known to many for the great smallmouth bass fishing. Brown trout are known to frequent the area as well.

Washington Harbor T34N R29E Sec. 25
This bay faces north and is located in the northwest corner of Washington Island. Cobble and rubble beaches form the shoreline, but a small portion of sand beach is present along the inner bay. Washington Harbor is bounded by Bowyer Bluff to the west. Coffee Swamp lies to the east, but is located inland. Numerous archaeological sites speckle the neighboring areas and a historical site is located on the southeast shoreline. The bay substrate is mostly rock and rock rubble. Smallmouth bass seem to dominate the fishery. Yellow perch and northern pike are sought here and there is a chinook salmon fishery in nearby waters.

West Harbor T33N R29E Sec. 11
West harbor is often considered part of Figenschau Harbor, so they may be referred to interchangeably. West Harbor is located on the southwest side of Washington Island. The sand and cobble shoreline is primarily unconsolidated material with some gravel beaches. At various points along the shoreline, wetland areas can be found. An access point is located at

the northern point of the harbor. Lobdell's Point separates this harbor from Detroit Harbor. West Harbor provides fishing opportunities for small mouth bass and yellow perch.

Whitefish Bay T28N R27E Sec. 10, 16, 22

Whitefish Bay is a large open bay facing east. This area is surrounded primarily by sand beach shoreline and is a portion of the Whitefish Dunes State Park. The coastal area is inhabited by rare terrestrial plants such as dune thistle, dune goldenrod and thickspike wheatgrass. The dune ecosystem tends to be very fragile and in high water years, the park has historically closed the beaches to protect the dunes from detrimental human impacts. The northern boundary is called Cave Point. The shoreline here is exposed bluffs and is said to be one of the most photographed areas of Door County. The southern border is Whitefish Point. Development along the shore is almost exclusively large residential homes. The bay itself harbors many Lake Michigan fish species and lake trout are noted to inhabit the bay. The habitat is mainly sand and rock. The trout and salmon fishery dominate here and brook, brown, rainbow, and lake trout have been stocked, usually at or near Whitefish Bay. Rubble and cobble surround the mouth of Whitefish Bay Creek and a boat ramp access is located at the end of Whitefish Bay Road.

Wisconsin Bay T33N R29E Sec. 31, 32

Wisconsin Bay is the northern most bay at the tip of the peninsula's mainland. There is a private boat launch access to the bay at Gill's Rock. The shoreline is rubble, cobble, and gravel beach with minute portions of shelving bedrock. Some smallmouth bass provide a fishing opportunity. Chinook salmon and brown trout are stocked annually nearby and provide a seasonal fishery.

Resource Threats

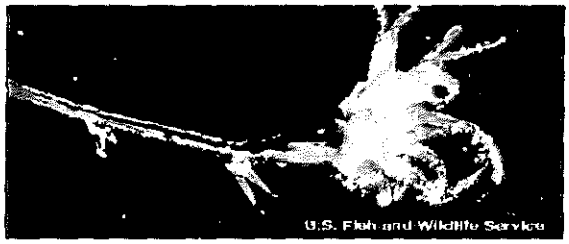
The surface water resources of Door County are generally considered as being of good quality. Different threats to aquatic systems can quickly change the quality and composition of these resources. The primary surface water threats can be categorized into three areas: exotic species threats, pollution threats and threats from shoreline changes.

Exotic Species Threats

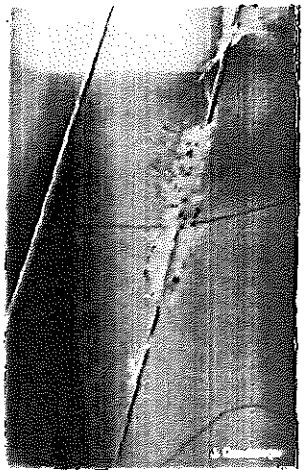
Exotic species have played a significant role in the ecosystems of the waters in, but primarily surrounding, the Door Peninsula. Many introductions of exotic aquatic species have been accidental due to the improvement of shipping routes and the transfer of species carried undetected in ballast water of ships as they enter the Great Lake's shipping routes. Historically, some introductions occurred with good intentions. Unfortunately, we often discovered too late about the adverse effects of some of these species. One of the few examples of positive benefits from the intentional introduction of non-native species is the stocking of brown and rainbow trout and chinook and coho salmon into Lake Michigan to control the exotic alewife. The lakewide stocking effort that began over 30 years ago also created a world famous sport fishery that continues today.

Fish resources were unparalleled 150 year's ago. With introductions came declines in populations and extirpation of certain native species. Many exotic species are now so naturalized we forget they were introduced. Some of the better known species are sea lamprey, alewife, smelt, carp, and white perch. Not all exotic species in Door County waters are fish. A sampling of these varied species and an explanation of their threats follow.

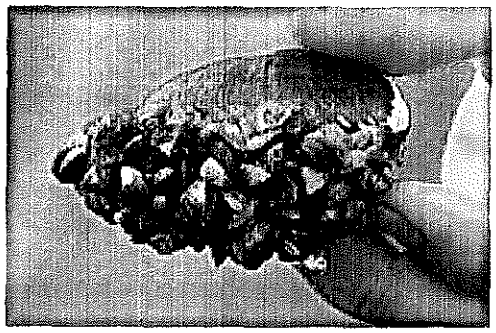
➢ *Bythotrephes cederstroemi* (B.C.), or the spiny water flea has been a recent cause for concern. It is more abundant in the offshore waters than nearshore waters of Lake Michigan. This is thought to be due to temperature preference or predation pressure. Bythotrephes is a rather large zooplankton which feeds on other zooplankton and competes for habitat. It is also in direct competition with young of the year fish for small zooplankton food sources. B.C. is fed upon by a number of fishes although accumulations of the spiny water flea can cause damage to the digestive systems of some fish. Some believe B.C. to be an additional trophic level between algae and fish from a food web standpoint, but others feel that it acts as an energy sink from a fish production standpoint. A relative of B.C., *Ceropagis*, or the Russian water flea, was discovered in Lake Michigan in 1999.



▲ *Bythotrephes (spiny water flea) under magnification*



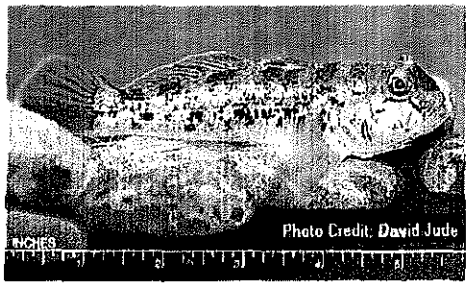
▲ *Bythotrephes on down rigger line*



Dresenia polymorpha (zebra mussels) on native dam

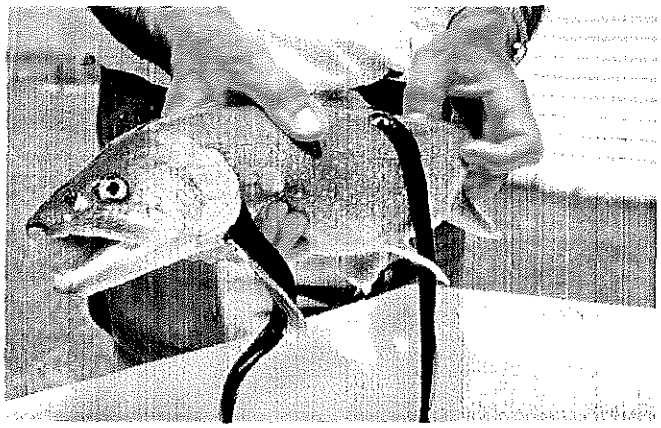
➢ Zebra mussels spend most of their life cycle attached to hard substrates, primarily at the bottoms of lakes. They have become a nuisance as they attach to man made structures. Some believe that the zebra mussel is an asset because it has improved water clarity in certain areas; however, the "siphon effect" that promotes water clarity has also decreased native zooplankton abundance by removing phytoplankton in the water. They directly compete with larval fish for this plankton. Colonization potential is high in our area due to the range of available calcium, dissolved oxygen, pH, and low salinity.

➢ Round goby (*Neogobius melonostomus*) have been the most recent of the exotic concerns in the area. The small, five inch, bottom dwelling fish has expanding populations throughout the Great Lakes and has been sighted in Green Bay waters, including Sturgeon Bay. Like most exotics, it competes for habitat and food. Many of the predator fish are not familiar with the gobies erratic jerking and scooting movements, although some larger predators seemingly adapt to the unexpected behavior.



Neogobius melonostomus (round goby) profile

Although the management approach is to limit the goby spread, there is no formal control strategy. This fish does bring some optimism since the zebra mussel is a prefered food. However, it also prefers eggs, fry, and any other fish sharing their habitat. Scientists believe that with its sharp biting teeth and shell-crushing molars in the back of its throat, the goby evolved as a predator of the zebra mussel.



Sea Lamprey on Lake Trout (Great Lakes Fishery Commission)

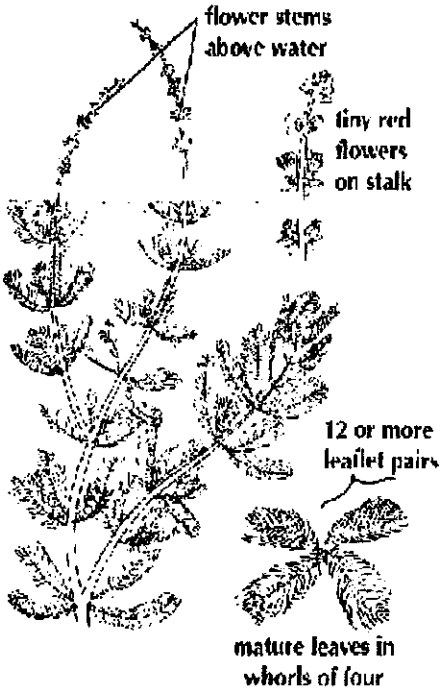
➢ Sea lampreys (*Petromyzon marinus*) are aquatic vertebrates resembling eels, but unlike eels, they feed on large fish. The sea lamprey is native to the coastal regions of both sides of the Atlantic coast and entered the Great Lakes through the Welland Canal about 1921. Sea lampreys, now found in all of the Great Lakes, attach to fish with a sucking disk and sharp teeth. They feed on body fluids of their host, often scarring and killing the host fish. Sea lampreys were a major cause of the collapse of lake trout, whitefish, and chub populations in the Great Lakes in the 1940's and 50's for this reason.

Under the present control program of lampricides and control barriers, the sea lamprey population is now at only 10% of what it used to be with the exception of northern Lake Huron. This control has enabled phenomenal success in re-establishing valuable commercial and non-commercial fisheries throughout the Great Lakes.

➢ Purple Loosestrife (*Lythrum salicaria*) is two to seven feet tall and has numerous purple flowers on an upright, rigid, four-sided stem. The leaves are usually opposite in arrangement, and are attached directly to the stem without stalks. It is most commonly found in wetlands, ponds, ditches, and shorelines. This plant, although very pretty, has detrimental impacts. It has no natural enemy and provides limited wildlife habitat. Purple loosestrife easily degrades wetland areas; its aggressive nature limits plant diversity. Currently there are experiments to control the species by using beetles, but initial results show that the beetles have a hard time moving from plant to plant unless under very dense conditions. Populations in Door County have remained under control in past years. Recently, efforts have been made to control and isolate those areas where purple loosestrife has established. The potential for this plant to cause serious impacts to resources in Door County is very high.

➢ *Lythrum salicaria (purple loosestrife) in wetland*

➢ Eurasian water milfoil (*Myriophyllum spicatum*) is a submerged aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has a slender stem whorled by submersed feathery leaves and tiny flowers produced above the water surface. Eurasian water milfoil is difficult to distinguish from northern milfoil, but northern milfoil typically has 7-11 pairs of leaflets and Eurasian water milfoil has 9-21 pairs of leaflets. Unlike many plants, Eurasian water milfoil does not rely on seed for reproduction. It can reproduce vegetatively by fragmention, allowing it to disperse over long distances. These pieces of vegetation can be carried by currents or inadvertently picked up by boats, motors, trailers, bilges, live wells, or bait buckets. This milfoil will grow best in fertile, fine-textured , inorganic sediments. Optimal growth occurs in alkaline systems with high concentrations of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.



Myriophyllum spicatum descriptive drawing

Eurasian water milfoil is an aggressive plant that can create dense monotypic stands. It can effectively block out sunlight needed for native plant growth and

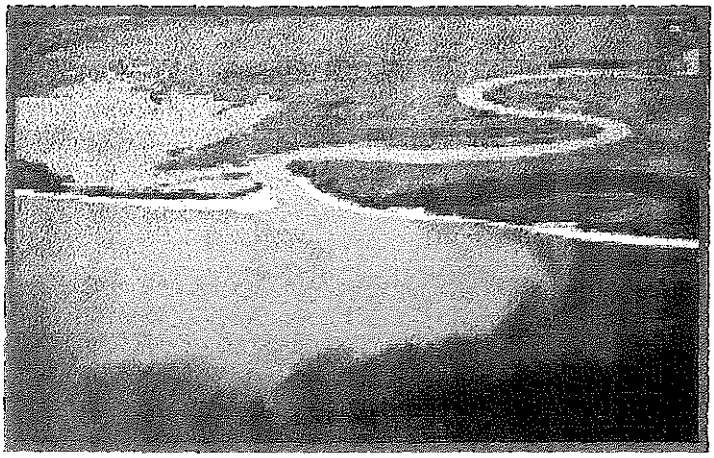
create a single habitat type. This disrupts the integrity of the aquatic communities in numerous ways by reducing native plants, reducing availability of forage plants for waterfowl and disrupting predator-prey relationships by fencing out larger fish. These dense stands also inhibit recreational uses like swimming, boating and fishing.

Myriophyllum spicatum (Eurasian water milfoil) stalk photograph

The DNR requires a permit for chemical treatments, bottom screening, and buoy/barrier placement as control methods. A new biological control involving weevlis has been introduced on 12 Wisconsin inland lakes. The weevil, *Eurhychiopsis lecontei,* feeds on stems and leaves and causes extensive damage to the plant when the larvae bore into the plant tissue. Up to three generations of weevils will hatch each summer. As of 1994, the following waters had established populations of Eurasian water milfoil: Clark Lake, Forestville Millpond, Kangaroo Lake, Little Sturgeon Bay, Moonlight Bay, North Bay, Rowley's Bay, Sawyer Harbor and the Sturgeon Bay Ship Canal; however, the plant can be found in nearly all bays and harbors of Door County.

Non-point Source Pollution Threats

Although exotic species can be responsible for detrimental habitat impacts, non-point source pollution is also a threat to surface waters. Non-point source pollution refers to the polluting of water resources by diffuse sources rather than single, identifiable sources. Some of the most apparent non-point sources include such things as animal lot run-off, upland and stream bank erosion, and sediment delivery from upland erosion. Other commonly occurring nonpoint source pollutants can come from urban areas and include heavy metals and other toxic materials. Excessive nutrient input and toxic effects from nonpoint source pollution can lead to fish habitat destruction. Fish kills, siltation of harbors and streams, and a decline in the ability of surface waters to support recreational activities can all be the result of non-point pollution.



Non-point source pollution-soil erosion plume

Many surface water and non-point source pollution regulations currently exist. The use of these regulations is often dependent upon the coordinating agency, the level of implementation, (be it governmental or landscape initiated), and the focus or goal of the resource protection. The regulations currently in use cover a myriad of surface water topics ranging from wetland delineation to other zoning and land use topics.

Shoreline Development and Permanent Structure Threats

The magic and abundance of water has drawn, and continues to annually draw, countless people to the hundreds of miles of Door County shoreline. Most come to the shores to vacation, but many settle in as part- or full-time residents. To accommodate this demand for housing, the pace and scale of shoreline development has accelerated dramatically during the past two decades. A high rate of rural and shoreline development was observed in the 1970's and subsided slightly during the 1980's. Urbanization began to increase again in the 1990's with the rampant parcelization of shoreline areas combined with relatively reasonable waterfront property prices. With this increasing shift in land use has come increasing pressure and demands to alter the shoreline and near shore areas.

Nearly half of Door County's agricultural land use in the coastal zone has been lost to residential uses. Significant increases in shoreline modification have accompanied this urban/residential development.

Conversion of naturally vegetated shorelines to tightly crowded cottages, homes, and condominium developments has increased the amount of impervious surfaces, leading to increased storm runoff into protected bays. Surfaces that are not impermeable (i.e. not having pavement) are often used as lawns that stretch to the water's edge. These lawns are often not appropriately managed and result in fertilizer, pet waste, and other additional nutrient runoff. Nutrients from these sources eventually find their way into the water, leading to increased growth of rooted aquatic plants or algae blooms, often followed shortly by public demands to chemically treat the weed problem. Sturgeon Bay and Little Sturgeon Bay are examples of this and have perceived aquatic plant control problems, as do some other village marinas and private solid piers.

During the past decade requests by private homeowners to build solid piers have been on the increase, especially along the Green Bay shoreline. Construction of these piers can reduce natural and scenic beauty along the shore and interrupt the natural currents and transport of material. Additionally, they can result in destruction of fish spawning habitat and fry nursery areas, elimination of invertebrates important in the aquatic food chain for fish, and creation of habitat favorable to the spread and establishment of exotic species.

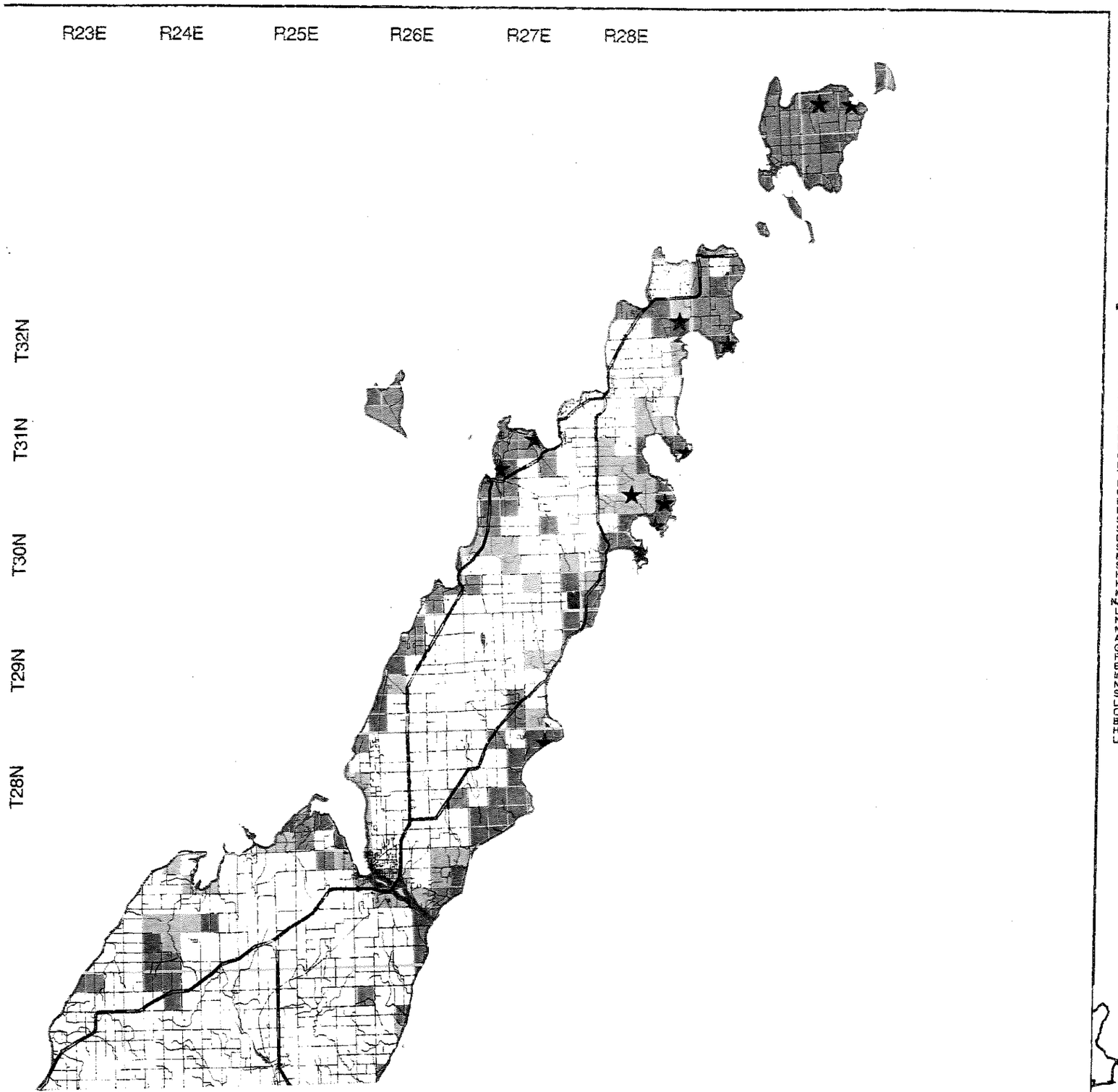
Annually, thousands of recreational, fishing, and commercial boats are launched or moored along the Door County shoreline at private residences, private, village, and city marinas and ramps. Naturally occurring low water cycles in the lake and bay create demands for dredging to maintain minimum water levels for dockage and access to deep water. Dredging, while in some cases justifiable and necessary, can be a destructive activity to the water resources. Potential impacts on the aquatic environment due to dredging are similar to those mentioned above for construction of solid piers.

Rare and Endangered Species of Door County

The Door Peninsula has long been recognized as an area of the state that houses outstanding biological diversity. Door County has at least 30 state threatened or endangered plants and nine state listed animals. Of these, species which are also federally listed include the bald eagle, Hine's emerald dragonfly, dwarf lake iris, and dune thistle. Twenty-nine State Natural Areas are located within the boundaries of the county, harboring much of the best remnants of ecological wealth. Much of this high level of biodiversity can be attributed to a combination of varied surface water resources and the unique environments created by the presence of limestone bedrock. Figure 11 shows the general distribution on Door County's rare species. Much of this information has been based on historic records, and may not reflect current distribution for all species.

Under Wisconsin's endangered species statute, it is illegal to take, transport, possess, process, cut, root up, sever, injure, destroy or sell endangered or threatened species. An environmental review process is also set up whereby an individual can receive a permit to allow an incidental taking that results from an otherwise legal activity. Intentional violations of the endangered species laws without first obtaining a permit could result in loss of hunting privileges, fines up to $5000, up to nine months imprisonment, plus additional penalties. The federal Endangered Species Act provides an even higher level of protection of federally listed species. Criminal violations provide for up to $50,000 in fines or up to one year in jail or both.

Door County



AQUATIC OCCURRENCES

ANIMALS
- Hine's emerald *Somatochlora hineana* 1997
- American bittern *Botaurus lentiginosus* 1998
- Red-shouldered hawk *Buteo lineatus* 1998
- Blanded killifish *Fundulus diaphanus* 1965
- Black-crowned night-heron *Nycticorax nycticorax* 9999
- Arrowhead spiketail *Cordulegaster obliqua* 1992
- Bloater *Coregonus hoyi* 9999
- Striped shiner *Luxilus chrysocephalus* 1982
- Swamp darner *Epiaeschna heros* 1993
- Delicate emerald *Somatochlora franklini* 1991
- Northern ringneck snake *Diadophis punctatus edwardsii* 9999
- Dion skipper *Euphyes dion* 1990
- Two-spotted skipper *Euphyes bimacula* 1982
- Northern ribbon snake *Thamnophis sauritus* 1983
- Citrine forktail *Ischnura hastata* 1991
- Yellow rail *Coturnicops noveboracensis* 1999
- Lake sturgeon *Acipenser fulvescens* 1914
- Lake herring *Coregonus artedi* 1914
- Amber-winged spreadwing *Lestes eurinus* 1992
- Ski-tailed emerald *Somatochlora elongata* 1990
- Mottled darner *Aeshna clepsydra* 1991
- Hooded warbler *Wilsonia citrina* 1986
- Blanchard's cricket frog *Acris crepitans blanchardi* 1983
- Aurora damselfly *Chromagrion conditum* 1991

PLANTS
- Variegated horsetail *Equisetum variegatum* 1998
- Leafy white orchis *Platanthera dilatata* 1998
- Crawe sedge *Carex crawei* 1999
- Tufted hairgrass *Deschampsia cespitosa* 1998
- Slender bog arrow-grass *Triglochin palustre* 1998
- Small yellow lady's-slipper *Cypripedium parviflorum* 1996
- Swamp-pink *Arethusa bulbosa* 1996
- Ram's-head lady's-slipper *Cypripedium arietinum* 1997
- Slim-stem small-reedgrass *Calamagrostis stricta* 1999
- White adder's-mouth *Malaxis brachypoda* 1998
- Ohio goldenrod *Solidago ohioensis* 1999
- Lesser fringed gentian *Gentianopsis procera* 1996
- Fairy slipper *Calypso bulbosa* 1973
- Livid sedge *Carex livida var radicaulis* 9999
- Marsh horsetail *Equisetum palustre* 1983
- Common bog arrow-grass *Triglochin maritimum* 1998
- Northern bog sedge *Carex gynocrates* 1979
- Tussock bulrush *Scirpus cespitosus var callosus* 1998
- Few-flower spikerush *Eleocharis quinqueflora* 1999
- Coast sedge *Carex exilis* 1998
- Elk sedge *Carex garberi* 1998
- Round-leaved orchis *Amerorchis rotundifolia* 1985
- Sticky false-asphodel *Tofieldia glutinosa* 1999
- Showy lady's-slipper *Cypripedium reginae* 1998
- Downy willow-herb *Epilobium strictum* 1999
- Slenderleaf sundew *Drosera linearis* 1995
- Marsh ragwort *Senecio congestus* 1935
- Sheathed sedge *Carex vaginata* 1981
- Hair-like sedge *Carex capillaris* 1965
- Hidden-fruited bladderwort *Utricularia gammiscapa* 1972
- Marsh willow-herb *Epilobium palustre* 1983

NATURAL COMMUNITIES
- Lake--shallow, very hard, drainage (marl) ^ 1988
- Northern sedge meadow ^ 1998
- Northern wet-mesic forest ^ 1999
- Alder thicket ^ 1976
- Great lakes alkaline rockshore ^ 1998
- Forested seep ^ 1998
- Emergent aquatic ^ 1998
- Interdunal wetland ^ 1988
- Northern wet forest ^ 1976
- Springs and spring runs, hard ^ 1976
- Lake--shallow, hard, drainage ^ 1986
- Open bog ^ 1976
- Boreal rich fen ^ 1998
- Hardwood swamp ^ 1998
- Lake--shallow, hard, seepage ^ 1998

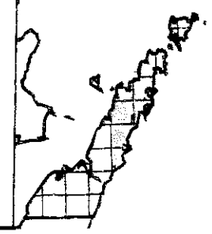
TERRESTRIAL OCCURRENCES

ANIMALS
- Dentate supercoil *Paravitrea multidentata* 1998
- Iowa pleistocene vertigo *Vertigo iowaensis* 1998
- Northern goshawk *Accipiter gentilis* 1998
- Bat hibernaculum *Bat hibernaculum* 1986
- Sculpted glyph *Glyphyalinia rhoadsi* 1997
- Appalachian pillar *Cochlicopa morseana* 1997
- Fine-ribbed striate *Striatura milium* 1995
- Cherrystone drop *Hendersonia occulta* 1998
- Midwest pleistocene vertigo *Vertigo hubrichti* 1998
- Black striate *Striatura ferrea* 1997
- A land snail *Succinea "beken"* 1997
- Mystery vertigo *Vertigo paradoxa* 1997
- Bright glyph *Glyphyalinia wheatleyi* 1995
- Brilliant granule *Guppya sterkii* 1997
- Lake huron locust *Trimerotropis huroniana* 1988
- Olithona tiger moth *Grammia olithona* 1991
- Pleistocene catinella *Catinella exile* 1995
- Loggerhead shrike *Lanius ludovicianus* 1983
- Transparent vitrine snail *Vitrina limpida* 1996
- Phyllira tiger moth *Grammia phyllira* 1991
- Tapered vertigo *Vertigo elatior* 1995

PLANTS
- American sea-rocket *Cakile edentula* 1998
- Hooker orchis *Platanthera hookeri* 1998
- Low calamint *Calamintha arkansana* 1998
- Bird's-eye primrose *Primula mistassanica* 1998
- Climbing fumitory *Adlumia fungosa* 9999
- Dwarf lake iris *Iris lacustris* 1999
- Dune thistle *Cirsium pitcheri* 1998
- Sticky goldenrod *Solidago simplex var gillmanii* 1999
- Thickspike *Elymus lanceolatus ssp psammophilus* 1999
- Maidenhair spleenwort *Asplenium trichomanes* 1998
- Seaside spurge *Euphorbia polygonifolia* 1999
- Autumn coral-root *Corallorhiza odontorhiza* 1998
- Cooper's milkvetch *Astragalus neglectus* 1934
- Moonwort grape-fern *Botrychium lunaria* 1997
- Beautiful sedge *Carex concinna* 1967
- Lake huron tansy *Tanacetum huronense* 1982
- Indian cucumber-root *Medeola virginiana* 1931
- Long-spur violet *Viola rostrata* 1998
- Large roundleaf orchid *Platanthera orbiculata* 1983
- Western fescue *Festuca occidentalis* 1982
- Crinkled hairgrass *Deschampsia flexuosa* 1989
- Spreading woodfern *Dryopteris expansa* 1997
- Northern comandra *Geocaulon lividum* 1998
- Large-flowered ground-cherry *Leucophysalis grandiflora* 1998
- Small yellow water crowfoot *Ranunculus gmelinii* 1938
- Cuckooflower *Cardamine pratensis* 1998
- Giant pinedrops *Pterospora andromedea* 1999
- One-flowered broomrape *Orobanche uniflora* 1998
- Rock whitlow-grass *Draba arabisans* 1998
- Small-flower grass-of-parnassus *Parnassia parviflora* 9999
- Adder's-tongue *Ophioglossum vulgatum* 1950
- Lanceolate whitlow-cress *Draba lanceolata* 1994
- Sand reed-grass *Calamovilfa longifolia var magna* 1982
- Christmas fern *Polystichum acrostichoides* 1975
- Northern black currant *Ribes hudsonianum* 1983
- Pale green orchid *Platanthera flava var herbiola* 1987
- Heart-leaved foam-flower *Tiarella cordifolia* 1984
- Spoon-leaf moonwort *Botrychium spathulatum* 1982
- Canada gooseberry *Ribes oxyacanthoides* 1926
- Purple false oats *Trisetum melicoides* 1997
- Green spleenwort *Asplenium viride* 1999
- Limestone oak fern *Gymnocarpium robertianum* 1979
- Drooping sedge *Carex prasina* 1999
- Chilean sweet cicely *Osmorhiza chilensis* 1972
- Tufted club-rush *Scirpus cespitosus* 1998
- Low spike-moss *Selaginella selaginoides* 1994
- Mingan's moonwort *Botrychium minganense* 1998
- Handsome sedge *Carex formosa* 1994

NATURAL COMMUNITIES
- Great lakes beach ^ 1998
- Boreal forest ^ 1989
- Northern mesic forest ^ 1998
- Northern dry forest ^ 1998
- Northern dry-mesic forest ^ 1999
- Forested ridge and swale ^ 1997
- Moist cliff ^ 1998
- Lake dune ^ 9999
- Great lakes barrens ^ 1998
- Southern mesic forest ^ 1998

Figure 11
General Distribution of Rare Species and Habitats in Door County



This map represents the known occurrences of rare species and natural communities that have been recorded in the Wisconsin Natural Heritage Inventory (NHI). Colored sections indicate the presence of one or more occurrences within that section. Townships shaded in the inset map to the left indicate one or more occurrences reported only at the township level. The date following the names above notes the most recent year the occurrence was recorded in the county.

Map generated using 07/27/1999 NHI data.

Bureau of Endangered Resources

Commercial Fishing: Past and Present

Door County has a long and rich commercial fishing history in both nearshore and outlying waters. Commercial fishing in outlying waters is regulated by the Department of Natural Resources as specified in Wisconsin Statute 29.33 and Wisconsin Administration Code Chapter 25. The various gear used to harvest commercial species includes gill nets, trap nets, pound nets, drop nets, and trawls. In Door County, the commercial species commonly fished for consist primarily of yellow perch, lake and round whitefish, bloater chubs, and smelt. Burbot and suckers have also been taken at times under a rough fish contract. Harvest limits regulate the commercial fishing industry along with specified seasons, gear type restrictions, area restrictions and, for some species, minimum size limits.

Harvest trends in the commercial fishery of Door County have changed substantially during the past 30 years due to the dynamics of non-indigenous species, namely the decline of alewife populations and the control of the parasitic sea lamprey. Lake whitefish had very low abundance during the 1960's, caused by sea lamprey attacks and smelt predation, but whitefish have rebounded to record levels in recent years. Sadly, lake herring, a staple of commercial fishing and a popular sport species in northern Green Bay prior to the 1960's, have yet to recover from a combination of lamprey attacks and alewife competition. The species is now rare in Green Bay and Lake Michigan. Lower alewife abundance allowed bloater chubs and yellow perch to rebound as well during the 1980's. Currently, the abundance of these species along with smelt is very low due to poor recruitment of larval and juvenile fish during the past decade. Many factors may contribute to this cause, but most evidence points to the continuing and increased competition with established and new exotic species present in Lake Michigan. Carp, a rather large rough fish, remains abundant today. Historically, this species was sought commercially, usually through the ice. However, they can no longer be commercially harvested due to the high levels of contaminants that accumulate in the flesh.

During the 1998-99 fishing period, there were 32 licensed commercial fisherman operating out of the Door County ports of Little Sturgeon Bay, Sister Bay, Ellison Bay, Gills Rock, Washington Island, Rowleys Bay and Baileys Harbor. During the winter months, some commercial fishermen set nets under the ice in northern Green Bay for lake whitefish. Commercial fishing occurs year round, especially on Lake Michigan since much of the lake remains ice-free. Table 6 lists the fish species encountered in the sport and commercial fishery along with the corresponding body of water where the fish species are sought.

Table 6: Species Encountered in Sport and Commercial Fishing

Common name	Scientific name	Sport	Commercial
Lake whitefish	*Corengonus clupeaformis*		L B
Round whitefish	*Prosopium cylindraceum*		L B
Bloater chub	*Coregonus hoyi*		L B
Yellow perch	*Perca flavescens*	L B I	L B
Burbot	*Lota lota*	L B	L B
Rainbow smelt	*Osmerus mordax*	L B	L B
Lake trout	*Salvelinus namaycush*	L B	
Brook trout	*Salvelinus fontinalis*	L B I	
Brown trout	*Salmo trutta*	L B	
Rainbow trout	*Salmo gairdneri*	L B	
Northern pike	*Esox lucious*	L B I	
Muskellunge	*Esox masquinongy*	L B	
Smallmouth bass	*Micropterus dolomieui*	L B I	
Largemouth bass	*Micropterus salmoides*	L B I	
Walleye	*Stizostedion vitreum*	L B I	
Bluegill	*Lepomis macrochirus*	L B I	
Black crappie	*Pomoxis nigromaculatus*	B I	
Rock bass	*Ambloplites rupestris*	L B I	
Pumpkinseed	*Lepomis macrochirus*	L B I	
Black bullhead	*Ictalurus melas*	L B I	
Brown bullhead	*Ictalurus nebulosus*	L B I	
Carp	*Cyprinus carpio*	L B I	
White sucker	*Catostomus commersoni*	L B I	
White perch	*Morone americana*	L B	
Sheephead	*Aplodinotus grunniens*	L B	
Coho salmon	*Oncorhynchus kisutch*	L B	
Chinook	*Oncorhynchus tshawytscha*	L B	
Splake	*Salvelinus fontinalis x Salvelinus namaycush*	L B	
Lake sturgeon	*Acipenser fulvescens*	L B	

L= Lake Michigan water I= Inland waters B= Bay of Green Bay waters

Ownership and Public Access Issues

The majority of the inland surface waters of Door County are surrounded by privately owned property. Table 7 shows the current land distribution types in the county of which slightly over 1% are surface water. Public access to surface water resources can be limiting because this small percent of resource is privately held and in public demand.

Table 7. Approximate Land Use Distribution. (Door County Land and Water Resource Management Plan, 1999)

Land use	Acres	Percent of Total
Agricultural	119,498	38%
Forest	62,725	20%
Surface Water	3,370	1.1%
Residential/Commercial/Manufacturing	75,714	24%
Swamp and Waste	16,102	5%
Tax exempt	21,285	7%
Total Land in Door County	314,560*	100%

*Not all land use categories are included.

The shorelines of lakes and streams in Door County are areas that generally have limited public access. Access to streams can be found primarily at road crossings or by going upstream by entering the mouth of streams that empty into Lake Michigan or Green Bay. Many of the inland lakes can be accessed by traversing a connecting stream. Permission from a private landowner is often required if a person is looking to enjoy the small lakes with no inlets or outlets. The larger lakes in the county (such as Clark, Kangaroo, Mud, and Europe) have small public access areas. Roads that dead-end to the shoreline of an inland lake are also access possibilities for small watercrafts.

The majority of surface water recreational use is concentrated in the county's sheltered bays and harbors. These partially bounded coastal waters have differences in size, water clarity, and temperature that appeal to recreationists. Door County PBCWs typically act as inland lakes do in other parts of Wisconsin in regard to recreation.

There are approximately 31 PBCWs compared to 25 inland lakes. The overall surface area of the PBCWs (i.e. 23,000 acres) is greater than inland lakes (i.e. 3,251 acres). This difference in acres is a factor in the availability of the resource for public use and, therefore, access. Access to PBCWs can be achieved with relative ease. Figure 12 shows public access information for the bays, harbors, PBCWs, and significant lakes.

Much of the water recreation and resource use is located adjacent to property already set aside for that purpose. The water bodies where the water resource use occurs are not actually part of the park set-aside, however, the park may offer access or other recreational opportunities. Figure 13 shows the locations of county parks, many of which have maintained points of public access to surface waters. Table 8 gives the location of the parks owned by the county and the miles of surface waters associated with each park. Door County also has five State Parks: Potawatomi, Whitefish Dunes, Peninsula, Newport, and Rock Island. Specific information about the park areas can be obtained by directly contacting the park information centers.

Table 8: Information on Door County Parks System

Year Acquired	Name	Township	Acreage	Water Frontage Miles
1927	Tornado Memorial	Gardner	2.60	0
1929	Robert LaSalle	Claybanks	8.20	0.08
1933	Frank E. Murphy	Egg Harbor	14.00	0.25
1937	Baileys Harbor Ridges	Baileys Harbor	30.10	0.10
1943	Cave Point	Sevastopol	18.60	0.17
1944	Chaudoir's Dock	Union	5.00	0.12
1945	Sugar Creek	Gardner	40.80	0.20
1945	Door Bluff Headlands	Liberty Grove	155.70	1.29
1945	Lyle-Harter-Matter Sanctuary	Jacksonport	40.00	0
1947	Meridian	Jacksonport	92.00	0
1947	Percy Johnson	Washington Island	5.20	0.09
1950	Ellison Bluff	Liberty Grove	88.00	0.95
1963	Forestville Dam	Forestville	79.00	0.45
1987	Lilly Bay	Sevastopol	1.00	0.03
1990	Door County Fair Park	Sturgeon Bay	59.00	0
1994	Olde Stone Quarry Park	Sturgeon Bay	9.00	0.19
1994	Ahnapee State Trail - Leased	Sturgeon Bay Forestville & Nasewaupee		Unknown
Total:			144.24	(12 miles)

Figure 12: Public Access

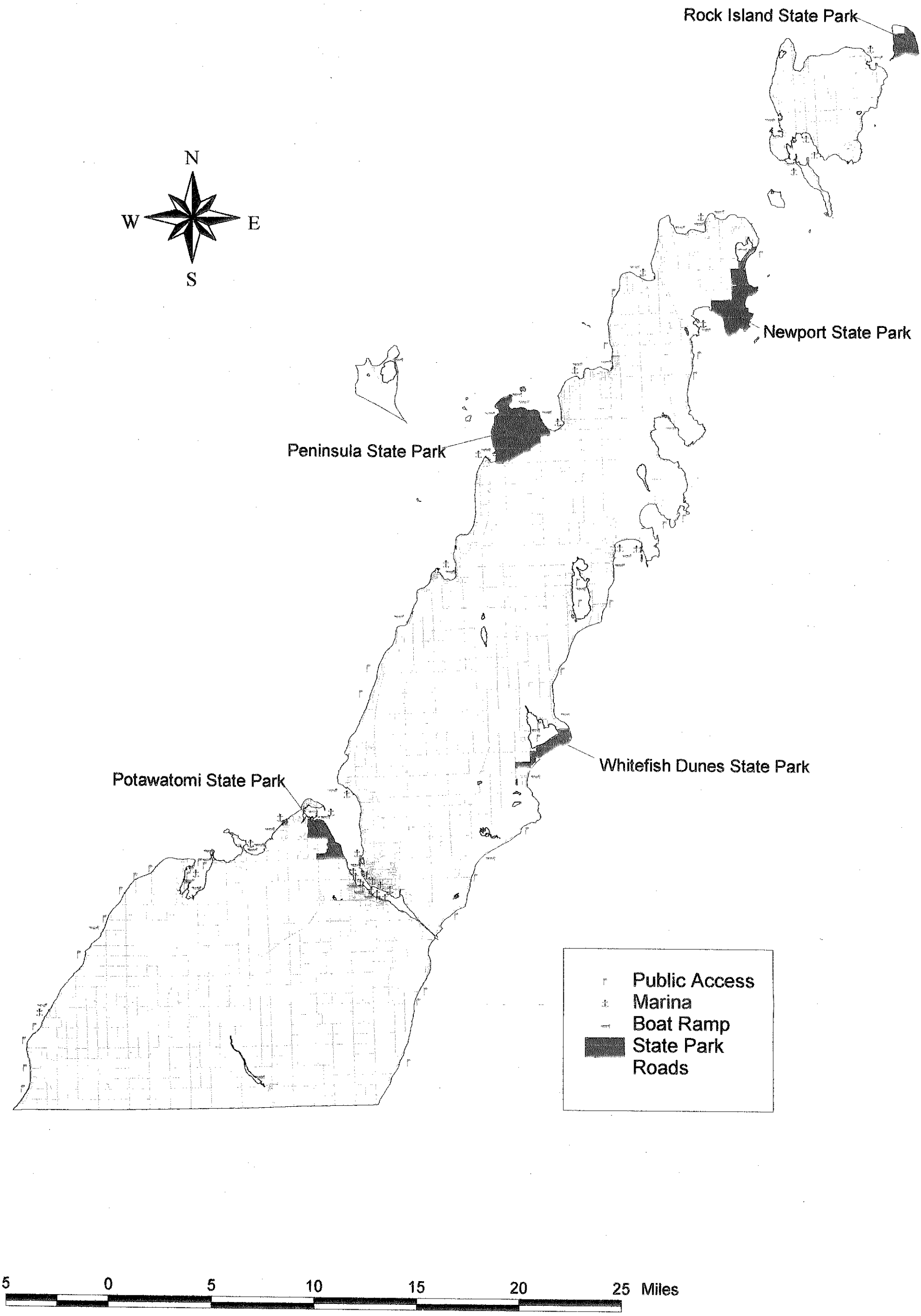
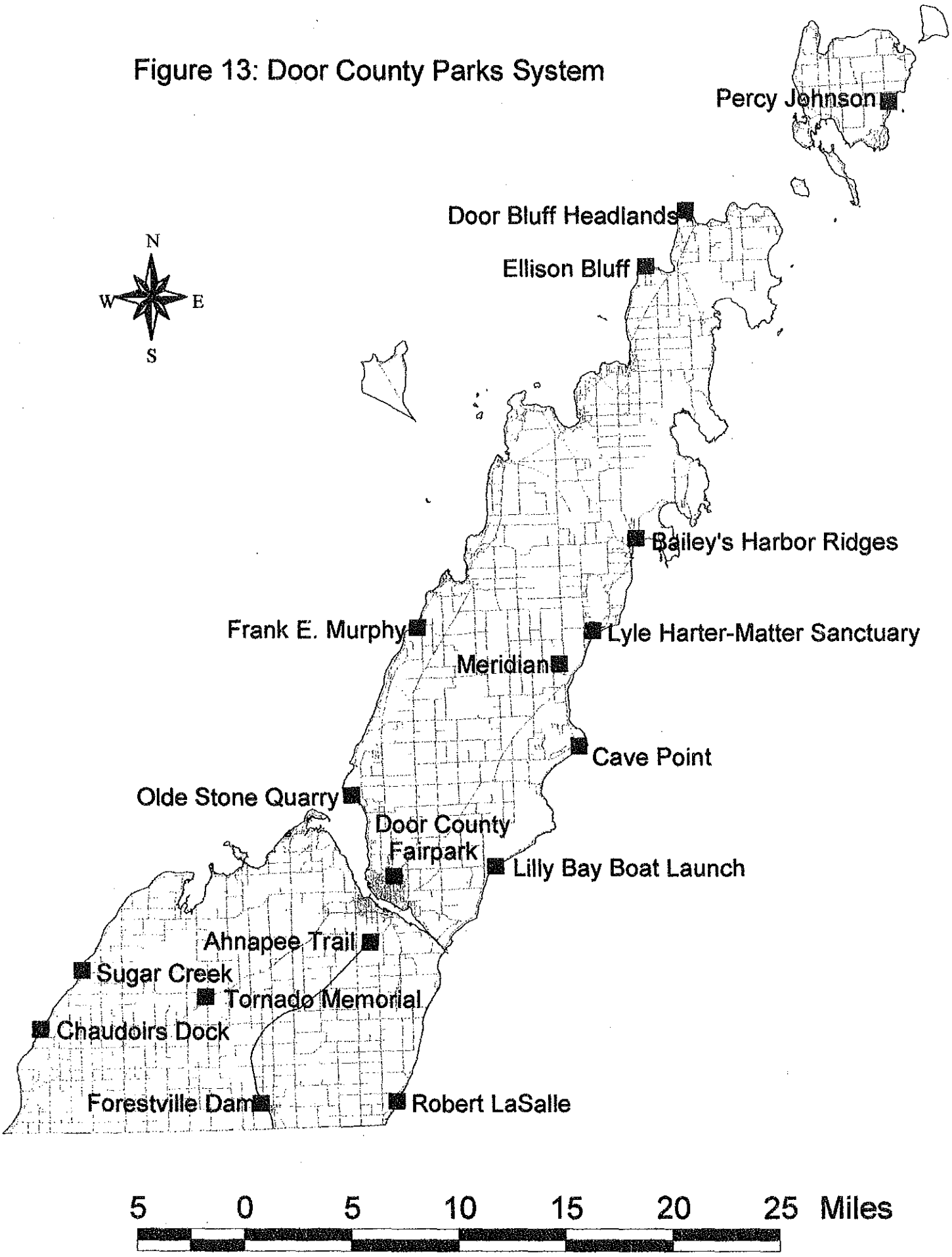


Figure 13: Door County Parks System



Surface Water Inventory Recommendations

Door County surface waters encompass a wide array of different habitats and support a myriad of recreation activities. Complete and comparable inventory data for surface waters does not exist, but the data compiled in this document serves as a beginning basis for such an effort.

The unique properties of water make it a very difficult resource to manage and it can often be hard to utilize this resource properly. Surface water, being the most recognizable water resource, also has a high potential to be misused. As a result, the following actions are recommended to successfully monitor the future status and use of surface waters:

1. Stream and lake monitoring stations should be established and monitored by resource managers, non-profit groups, local associations, or schools.

2. Continue the work necessary to complete the inventory data gaps that exist in this document.

3. The development of a classification system, based on physical and biological parameters, for bays, harbors and partially bounded coastal waters that would describe all the parameters used in the criteria for classification. This would enable the bays and harbors to be monitored, establishing base line data for future resource use decisions. The water quality data gathered through the suggested monitoring efforts should then be used as input in the development of classification tiers. The classification will enable the bays, harbors and PBCW's to be compared to themselves and possibly inland lakes.

4. The development of a ranking system for surface water sensitivity for all surface waters. This would include physical and biological parameters, watershed use and recreational factors. Based on the sensitivity ranking of a given surface water, a particular surface water may have limited use areas, certain use restrictions or revised management goals and strategies.

Contacts

Supplemental and updated information may be obtained from the following contacts when available:

Door County Soil and Water Conservation Department
421 Nebraska Street
Sturgeon Bay, WI 54235
(920) 746-2214

Door County Planning Department
421 Nebraska Street
Sturgeon Bay, WI 54235
(920) 746-2323

Wisconsin Department of Natural Resources Service Center
110 S. Neenah Street
Sturgeon Bay, WI 54235
(920) 746-2860

The Nature Conservancy
306 S. 3rd Ave
Sturgeon Bay, WI 54235
(920) 743-8695

Peninsula State Park
9462 Shore Road
Fish Creek, WI 54212
(920) 868-3258

Potawatomi State Park
Gitche Gumee Road
Sturgeon Bay, WI 54235
(920) 746-2890

Newport State Park
475 S. Newport Lane
Ellison Bay, WI 54210
(920) 854-2500

Whitefish Dunes State Park
3701 Clarks Lake Road
Sturgeon Bay, WI 54235
(920) 823-2400

Rock Island State Park Conservation Office
W4 N1924 Indian Point Road
Washington Island, WI 54246
(920) 847-2235

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Appendix A: Soil Associations

A soil association is a geographic region that has a distinctive pattern of soils in defined proportions. Soils that make up an association are similar in morphology. There are minor soils in each association, which have different properties than the soils making up the association name. These soils are usually found in the particular associations' geographic boundary. Door County is made up of six associations that will be described on the following pages. For a complete description of each soil, see the Door County Soil Survey.

(1) Summerville - Longrie - Omena Association –
consists of nearly level to moderately steep soils on upland till plains and ridges where bedrock strongly influences topography. This major association makes up approximately 48% of the county.

The Summerville series has approximately 24 percent of the association, Longrie - 24%; Omena - 20%; and minor soils - 36%. Minor soils are Alpena, Bonduel, Bonduel Shallow Variant, Bonduel Wet Variant, Namur, and Solona soils. Controlling erosion and maintaining organic matter content, tilth, and fertility are the main concerns of management for this association with regard to cultivation.

The association is well drained having a sandy loam, or loam subsoil, over a sandy loam or fine sandy loam till or dolomite bedrock. The moderately deep and deep soils are mainly utilized for cultivated crops such as corn, small grains and legumes. The shallow soils are mainly used for pasture or remains wooded.

(2) Emmet - Solona - Angelica Association –
consists of nearly level to sloping or upland till plains and broad ridges. Approximately 23% of the county's land is included in this association.

The Emmet series makes up a majority of the association at 44%, Solona - 16%; Angelica - 10% and minor soils - 30%. Minor soils are Cathro, Omena, Longrie, Namur and Summerville. Controlling erosion and maintaining organic matter content, tilth, and fertility are the main management concerns with regard to cultivation.

The association is well to poorly drained having a loamy sand to silt loam subsoils over sandy loam or loam till. Most well drained soils and artificially drained soils are well suited to crops commonly grown in the county. Undrained wet areas are used mainly for pasture, woodland, and wildlife habitat.

(3) Rousseau - Kiva - Markey Association –
consists of nearly level to sloping soils on out wash plains, stabilized dunes, beach ridges, and in depressions. It occupies approximately 6% of the county and is common to shorelines.

The Rousseau series makes up approximately 28% of the association; Kiva - 16%; Markey - 15%; and the minor soils - 41%. Boyer, Duel, Sisson, Wainola are minor soils.

The soils in this association are generally unsuited to crops commonly grown in the county, therefore, they are mainly used for pasture, woodland, and wildlife habitat. Erosion can be controlled by planting a suitable tree species.

(4) Kewaunee - Kolberg - Manawa Association –
Consists of nearly level to moderately steep soils on glacial till upland plains and ridges where, in some places, bedrock (Dolomite) has a strong influence on topography. It occupies approximately 11% of the county.

The Kewaunee series makes up approximately 39% of this association; Kolberg - 15%; Manawa - 14%; and minor soils - 32%. Minor soils are Manistee, Namur, Poygan, Suamico, and Kolberg Variant. This association is well drained to somewhat poorly drained having a dominant silty clay subsoil over a silty clay till or dolomite bedrock.

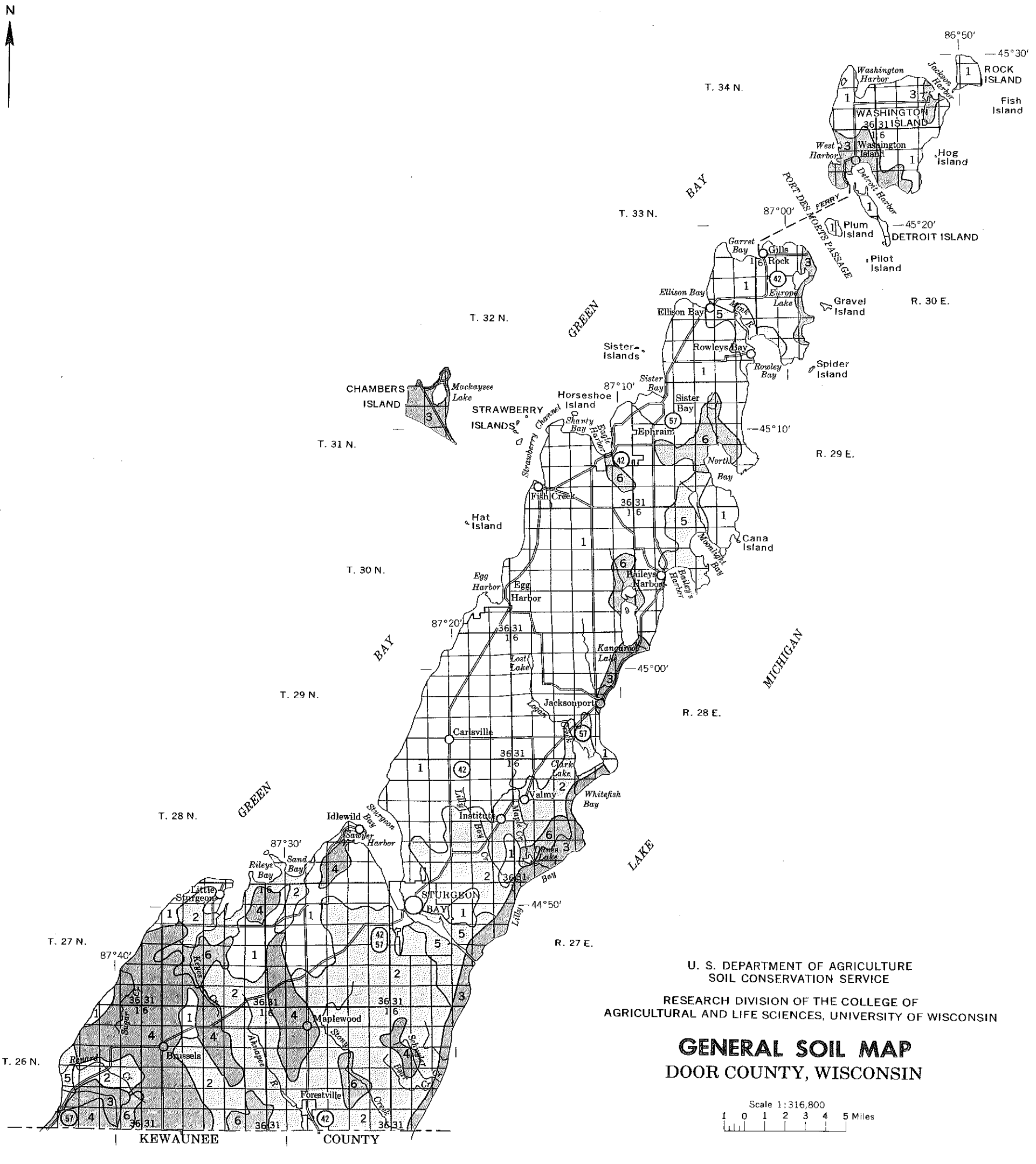
Most of the association is used for cultivated crops such as corn, small grain and legumes. Steeper areas or undrained wet areas are used for pasture, woodland, or wildlife habitat. Management concerns of this association are; controlling erosion, maintaining organic-matter content, tilth and fertility.

(5) Deford - Yahara Variant - Carbondale Association –
consists of nearly level soils in glacial Lake basins and on outwash plains. It occupies approximately 5% of the county.

Deford, Yahara Variant and Carbondale soils each make up about 14% of the association. The minor soils, Markey, Rousseau, Wainola and Yahara, make up about 58%. Most of the association is in woodland and wildlife habitat.

(6) Carbondale - Cathro Association –
consists of nearly level organic soils in glacial Lake basins and depressions. It occupies about 7% of the county. The Carbondale soils make up about 49% of the association and Cathro soils, 23%. Minor soils, Allendale, Angelica, and Pinconning make up 28%.

Most of this association is poorly suited to common crops of the county. Therefore, most is woodland or wildlife habitat.



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

RESEARCH DIVISION OF THE COLLEGE OF
AGRICULTURAL AND LIFE SCIENCES, UNIVERSITY OF WISCONSIN

GENERAL SOIL MAP
DOOR COUNTY, WISCONSIN

Scale 1:316,800
1 0 1 2 3 4 5 Miles

SOIL LEGEND

1 — Summerville-Longrie-Omena association: Shallow to deep, well drained, nearly level to moderately steep soils that have a sandy loam or loam subsoil over sandy loam or fine sandy loam till or dolomite bedrock

2 — Emmet-Solona-Angelica association: Deep, well drained to poorly drained, nearly level to sloping soils that have a loamy sand to silt loam subsoil over sandy loam or loam till

3 — Rousseau-Kiva-Markey association: Deep, well drained and moderately well drained, gently sloping and sloping soils that have a fine sand or sandy loam subsoil over sand or sand and gravel outwash, and very poorly drained, nearly level organic soils

4 — Kewaunee-Kolberg-Manawa association: Deep and moderately deep, well drained and somewhat poorly drained, nearly level to moderately steep soils that have a dominantly silty clay subsoil over silty clay till or dolomite bedrock

5 — Deford-Yahara Variant-Carbondale association: Deep, poorly drained, nearly level soils that are underlain by fine sand outwash or that have a silt loam subsoil over stratified lake sediments, and very poorly drained, nearly level organic soils

6 — Carbondale-Cathro association: Very poorly drained, nearly level organic soils

Compiled 1977

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Appendix B: Water Resource Categorizations, Classifications and other Parameters

Streams

The Wisconsin DNR , as required by the State Water Resources Act, has established a set of water use objectives and supporting water quality standards applicable to all surface waters of the state. All surface waters are classified into one of the following biological use objectives and are represented by the type of aquatic community a particular resource is capable of supporting. They are:

(1) Cold Water Communities (Cold) include surface waters capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water species. This use includes, but is not restricted to, surface waters identified as trout waters in the publication *Wisconsin Trout Streams*. Any Class I trout stream not classified as an ORW is noted as and ERW. The water quality guidelines applicable to cold water communities are shown in the following table.

Water quality Parameters	Cold Water Communities
Temperature F	Background
Dissolved Oxygen mg/l	6.0 and 7.0 minimum
pH range	6.0-9.0
Total Phosphorous mg/l	0.1, 0.02 maximum
Un-ionized Ammonia Nitrogen mg/l	0.02 maximum
Chloride mg/l	1000 maximum
Fecal Coliform (counts/ 100 ml)	200, 400 maximum

(2) Warm Water Sport Fish Communities (WWSF) are capable of supporting a community of warm water sport fish or of serving as a spawning area for warm water sport fish.

(3) Warm Water Forage Fish Communities (WWFF) are capable of supporting an abundant diverse community of forage fish and other aquatic like. The water quality guidelines for WWSF and WWFF are shown in the following table.

Water quality Parameters	WWSF &WWFF Communities
Temperature F	89.0 maximum
Dissolved Oxygen mg/l	5.0 minimum
pH range	6.0-9.0
Total Phosphorous mg/l	0.1, 0.02 maximum
Un-ionized Ammonia Nitrogen mg/l	0.04 maximum
Chloride mg/l	1000 maximum
Fecal Coliform (counts/ 100 ml)	200, 400 maximum

(4) Limited Forage Fishery Communities (LFF) are communities capable of supporting only a limited community of forage fish and aquatic life. Water quality guidelines are shown in the following table.

Water quality Parameters	LFF Communities
Temperature F	--
Dissolved Oxygen mg/l	3.0 minimum
pH range	6.0-9.0
Total Phosphorous mg/l	--
Un-ionized Ammonia Nitrogen mg/l	3.0, 6.0 maximum
Chloride mg/l	1000 maximum
Fecal Coliform (counts/ 100 ml)	1000, 2000 maximum

(5) Limited Aquatic Life Communities (LAL) include surface waters severely limited because of very low or intermittent flow and naturally poor water quality or poor habitat. Water quality guidelines are shown in the following table.

Water quality Parameters	LAL Communities
Temperature F	--
Dissolved Oxygen mg/l	3.0 minimum
pH range	6.0-9.0
Total Phosphorous mg/l	--
Un-ionized Ammonia Nitrogen mg/l	--
Chloride mg/l	--
Fecal Coliform (counts/ 100 ml)	1000; 2000 maximum

Stream classification can also include an additional classification used in determining trout streams. Generally, trout streams are classified as Cold and include the following;
Class I: Streams are high-quality where populations are sustained by natural reproduction.
Class II: Streams have some natural reproduction, but need stocking to maintain a desirable fishery.
Class III: Streams sustain no natural reproduction and require annual stocking of legal size fish for sport fishing.

Stream water quality can be determined/measured by the macroinvertebrate species that inhabit the stream. This is often a better indicator of water quality because the species are small with relatively short life cycles. Monitoring community composition will show the effects of water quality on the stream habitat more readily than the large fish communities because of the short duration of the species life cycle. The methodology for ranking stream water quality using this methodology is described by Hilsenhoff's (1987) biotic index. This is based on the fact that certain species require different parameters of water quality and each species is given a value. Any one stream sample can have a range of different species, so Hilsenhoff uses an equation to calculate a value between 0 and 10 where 0 is the best water quality and 10 is the worst. Table B1 shows the range of values and their corresponding water quality results.

Table B1: Ecological Interpretation of Biotic Index Values

Biotic Index Value	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No apparent organic pollution
3.51-4.50	Very Good	Slight organic pollution
4.51-5.50	Good	Some organic pollution
5.51-6.50	Fair	Fairly significant organic pollution
6.51-7.50	Fairly Poor	Significant organic pollution
7.51-8.50	Poor	Very significant organic pollution
8.51-9.50	Very Poor	Severe organic pollution

Stream quality also has a ranking system that takes into account the habitat and includes the following parameters: watershed erosion, watershed nonpoint source, bank erosion, bank vegetation, lower bank channel capacity, lower bank deposition, bottom scouring and deposition, bottom substrate, depth of riffles, depth of pools, flow, pool/riffle:run/bend ratio, and aesthetics. Each category is given a score and the total is rated where <70 is excellent, 71-129 is good, 130-200 is fair and >200 is poor. Nearly all the streams in Door County are rated as fair.

This report will include information, when available, on all three-stream rankings (1) Biological use class (2) Biotic Index and (3) Habitat category.

Water Resource Categorizations, Classifications and other Parameters

Lakes
Water quality of lakes and the lake type significantly influence a lakes habitat and therefore the species that reside there. As in nearly all cases, the habitat will select or dictate the limits of a species given range, therefore, lake classification becomes important in many management aspects.

Lakes are most often classified based on origin or trophic category. Oligotrophic lakes are generally clear, deep and free of weeds or large algae blooms. Though beautiful, they are low in nutrients and do not support large fish populations. Mesotrophic lakes lie between oligotrophic and eutrophic. Devoid of oxygen in late summer, their lower most layer limits cold water fish and causes phosphorus cycling from sediments. Swimming and boating can be enjoyed on this type of lake without limitations. Eutrophic lakes are high in nutrients and support a large biomass. They are usually weedy or subject to frequent algae blooms. They often support large fish populations, but are also susceptible to oxygen depletion. Trophic state is used primarily as an indicator of lake productivity. Table B2 presents trophic category description in relation to a corresponding range of Trophic State Index (TSI) value range. Geologically, all lakes naturally age in a progression from oligotrophic to eutrophic.

Table B2 Trophic Categories

Category	TSI	Lake Characteristic
Oligotrophic	1-40	Clear water, oxygen rich at all depths, except if close to Mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper Lakes
Mesotrophic	41-50	Moderately clear; increasing probability of low to know oxygen in bottom waters.
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom water during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive
Hypereutrophic	70-100	Heavy algae blooms throughout the summer; if>80, fish kills likely in summer and rough fish dominate

TSI's are indicators of the trophic state and are measured in three ways. First, total phosphorous or TP since phosphorous serves as an indicator of the amount of nutrients available for algae growth in lakes. Second, CHL or the measurement of chlorophyll a, which is a measurement of the amount of algae present. Third, SD which is Secchi depth, a simple measurement to gauge water clarity by recording the depth a black and white disk. Table B3 shows the category of lake with a higher level of detail in regard to the corresponding TSI, Trophic Status Index values

Table B3: Trophic class parameters

Trophic Class	Total Phosphorous (mg/l)	Chlorophyll a (mg/l)	Secchi Disk (feet)
Oligotrophic	.003	.002	12
	.010	.005	8
Mesotrophic	.018	.008	6
	.027	.010	6
Eutrophic	.030	.011	5
	.050	.015	4

Besides the trophic classification given to a lake based primarily on the water chemistry, lakes can be described by other unique physical characteristics. Frequently in Wisconsin the type of lake or hydrologic type is based on the source of a lake's water. The four types are:

Seepage Lakes: water sources are primarily rainfall and groundwater. Watersheds are generally small and very low flushing making them sensitive to shoreland-derived pollutants. They have no inlet or outlet (land locked).

Drainage Lakes: primary water source is overland flow from relatively large watersheds that are high flushing making them least sensitive to shoreland-derived pollutants. Permanent inlet and outlet streams are present.

Spring Lakes: primary water source is groundwater. Watershed size is relatively small. They have permanent outlets with substantial flow, but seldom have inlet streams. These high volume outlets make them rather insensitive to shoreland-derived pollutants.
Drained Lakes: similar to seepage lakes except an outlet with little or intermittent flow is present and watershed size is variable. Being low flushing, these lakes are generally sensitive to shoreland-derived pollutants.

Chemistry

Acidity-pH
By definition, pH is the negative logarithm of the hydrogen ion concentration and shows inversely the amount of hydrogen ions in the water. A lower pH value means the water is more acidic. A pH value of 7 is neutral. Because this is a logarithmic scale, for every 1.0 pH unit change, the hydrogen ion concentration changes tenfold. In Wisconsin, pH ranges from 4.5 in some acid bogs to 8.4 in hard water, marl Lakes. While often the acidity of a water body is not directly harmful, the effects of the metals that become soluble under low pH can be important. The effects acidity has on certain fish species is summarized in Table B4.

Table B4: How pH effects various fish species

Water pH	Effects
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth bass disappear
5.2	Walleye, burbot and Lake trout disappear
5.0	Spawning inhibited in many fish
4.7	Northern pike, white sucker, brown bullhead, sunfish, rock bass and pumpkinseed disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3.0	Toxic to all fish

Alkalinity and Hardness
A lakes alkalinity and hardness are a reflection of the geology of the area. These measures are effected by the soil type, the type of bedrock in the watershed and the amount of contact the water resource has with these minerals. Alkalinity measures carbonate and bicarbonate ions whereas hardness measures calcium and magnesium ions. In Door County, the bedrock of limestone and dolomite yields large amounts of calcite. These high levels of hardness and alkalinity can cause marl to precipitate out of the water. Alkalinity also acts as a buffer from the effects of acid rain. The carbonate and bicarbonate anions neutralize the hydrogen cations so the hydrogen ions for acid input are removed from the water.

$$\underset{\text{Limestone}}{CaMg(CO3)_2} \leftrightarrow \underset{\text{(hardness)}}{Ca^{++}} + Mg^{++} + \underset{\text{(alkalinity)}}{2CO_3^{-2}}$$

$$\underset{\text{Water}}{H_2O} \leftrightarrow \underset{\text{(hydrogen ion)}}{H^+} + \underset{\text{(hydroxide ion)}}{OH^-}$$

Buffering of pH by Carbonate

$$CO_3^{-2} + H^+ \leftrightarrow HCO_3^- + H^+ \leftrightarrow H_2CO_3 \leftrightarrow H_2O + CO_2$$

Marl deposits can form if the amount of carbonate is high enough. The carbonate will react with the calcium in the water to form marl. Marl precipitates out as a white substance in the sediment. This can often be seen on plant leaves. Marl also plays a role with phosphorous to help control the algae growth in such lakes.

Phosphorous
This is one of the most important nutrients to plant growth and the key nutrient affecting the amount of weeds and algae growth in water. It originates primarily from a variety of human sources such as runoff, organic waste and detergents. Total phosphorous is most often used because the levels of total phosphorous remain more stable than other forms. It is a better indicator of overall nutrient status and includes soluble phosphorous and the plant and animal fragments suspended in the water.

Chlorophyll a
This is a green pigment present in all green plant life because it is used in photosynthesis. The amount of this substance present in lake water depends upon the amount of algae and in-turn is used as an indicator of water quality. The amount of algae tends to correspond to the amount of phosphorous present.

Chloride
The presence of chloride where is does not occur naturally can indicate the possibility of water pollution. Throughout Wisconsin chloride is not common. In Door County, chloride ranges from 3-10 mg/l in most cases. This element does not affect plant or algae growth and most often is not toxic to aquatic organisms, however, if monitored over time, it can be an indicator of human waste, animal waste and fertilizer inputs which can contribute harmful nutrients.

Appendix C: Descriptions of County Parks

Ahnapee Trail: A multi-use twelve-mile trail in Door County for hiking, biking and snowmobiling. Access points are located in Sturgeon Bay, Maplewood, and Forestville at the Forestville Millpond. The trail continues into Kewaunee County.

Baileys Harbor Ridges Park: A sandy beach on Lake Michigan at Baileys Harbor with a picnic area and restrooms. Take Ridges Road from Highway 57.

Cave Point: Picturesque shoreline cliffs on Lake Michigan with picnic area and restrooms. Located adjacent to Whitefish Dunes State Park at the end of County Highway WD.

Chaudoirs Dock: Protected harbor and dock on Green Bay with a boat launch, picnic area and restrooms. Take County Highway N west from Namur and follow signs.

Door Bluff Headlands: Undeveloped natural area of forest and cliffs on Green Bay near Gills Rock. From Ellison Bay take Garrett Bay Road to Door Bluff Road. No facilities.

Ellison Bluff: Wooded bluff overlooking Green Bay near Ellison Bay with picnic area and restrooms. Take State Highway 42 to Porcupine Bay Road to Ellison Bluff Road.

Door County Fairpark: Amenities include soccer fields, picnic area, playground, restrooms, Saturday night stock car races, and Sunday afternoon go-cart races. County fair takes place in August. Located on 14th Avenue in Sturgeon Bay.

Forestville Dam: A millpond with access to the Ahnapee Trail and Ahnapee River with boat launch, playground, picnic area and restrooms. Take State Highway 42 to County Highway J to Mill Road.

Frank E. Murphy Park: Sand beach and dock on Green Bay with boat launch, playground, picnic area and restrooms. Take County Highway 42 to County Highway G.

Lilly Bay Boat Launch: Boat launches only, no facilities. Take State Highway 57 to County Highway T to Lake Michigan.

Lyle-Harter-Matter Sanctuary: Located at the south end of Kangaroo Lake. No facilities.

Meridian Park: Wayside on State Highway 57 between Jacksonport and Baileys Harbor with picnic area and restrooms. Located halfway between the Equator and the North Pole.

Olde Stone Quarry Park: Includes boat launch, pier fishing, picnic area and restrooms. Located on County Highway B 4.5 miles north of Sturgeon Bay.

Percy Johnson Park: Sand beach on Washington Island with picnic area and restrooms. From Detroit Harbor take County Highway W to the east side of the Island.

Robert LaSalle Park: Historical site which has access to Lake Michigan beach and includes a playground, picnic area, and restrooms. From State Highway 42 in Forestville take County Highway J to County Highway U.

Sugar Creek: Located on Green Bay with a boat launch, picnic area, and restrooms. Take County Highway N north from State Highway 57.

Tornado Memorial: A wayside at a historical site on State Highway 57 with picnic area and restrooms. Located 10 miles South of Sturgeon Bay.

Glossary A

Algae: A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Therefore, algae effect the oxygen content of water. Nutrient enriched water increases algae growth.

Alluvial: Deposition of glacial sediments from moving water such as melt water or streams ranging in size from fine silts to coarse gravels.

Aquitard: A low permeability unit that can store groundwater and also transmit it slowly from one aquifer to another.

Attenuation: The physical and chemical properties of soils that determine both the quantity and variety of materials which move through it. Soil attenuation may also be referred to as soils ability to filter or cleanse surface water and is often associated with infiltration.

Bay: A wide inlet of a body of water partially enclosed by land.

Benthic: Usually referring to benthic organisms which are organisms living in or the bottom of a lake or stream.

Biodiversity: The number of individual species per given area or habitat. A greater number is said to have a higher biodiversity and is often considered more ecologically significant.

Calcareous: Calcium bearing deposit.

Cambrian: The oldest system of rocks in which fossils can be used for dating and correlation. The Cambrian is estimated to have begun approximately 570 million years ago and lasted approximately 70 million years.

Closed Depression: An area of land surface which is internally drained with no surface outlet for runoff water. In order to leave the closed depression, water must enter the groundwater system or leave through evaporation.

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

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

Delineation (Watershed or Harbors): Determining the outline or boundaries of the physical feature.

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

Dredging: Removal of sediment from the bottom of water bodies

Dolomite: A sedimentary rock with a high ratio of magnesium and calcium carbonate. Sometimes referred to as limestone.

Ecosystem: The interacting system of the biological community and its non-living surrounding.

Emergent: To rise or become evident; referring to aquatic vegetation which is above the waterline.

Ephemeral: Lasting a short time, generally less than one season.

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

Eutrophic: Refers to a nutrient rich lake (see appendix 2)

Evapotranspiration: The sum of evaporation and transpiration.

Exceptional Resource Water (ERW): Surface waters which provide valuable fisheries, hydrologically or geologically unique features, outstanding recreational opportunities, unique environmental settings and which are not significantly impacted by human activities may be classified as ERW's.

Exotic species: Plants or animals that are not an original component of the habitat or ecosystem. Also referred to as non-native, non-indigenous, or introduced.

Fauna: Referring to animal life in general.

Fen: A peatland receiving water from an adjacent wetland usually rich in minerals and moderately high in productivity.

Flora: Referring to plant life in general.

Harbor: A sheltered anchorage for ships.

Hydric Soils: Angelica (Ax), Bonduel wet variant (Bp), Carbondale muck (Ca), Cathro muck (Cm), Chippeny (Cp), Deford (De), Duel variant (Dv), Fluvaquents (Fu), Markey muck (Mk), Pinconning (Pn), Poygan (Po), Rondeau (Rn), Saprists (Sa), Suamico (Su), Yahara variant (Yv).

Hydrology: The study of the occurrence, distribution, movement, and chemistry of waters of the earth.

Jetties: A wall built out into a body of water to protect a harbor or influence the current.

Karst: A type of topography formed over limestone/dolomite by dissolving or solution. Characterized by disorganized surface drainage patterns, surface terrain with sinkholes, closed depressions, and underground drainage.

Macroinvertebrates: Small insects visible without the aid of magnification and lacking a backbone or spinal column. Stream macroinvertebrates are used in determining the health of a given portion of a pond or riffle area of a stream.

Macrophytes: Aquatic plants.

Maquoketa Formation: A layer of Ordovician shale and carbonate rock that function as a confining unit or aquatard between the Silurian aquifers and the Ordovician aquifer below.

Marl: A soft calcium carbonate, usually mixed with clay.

Mesic: A habitat well supplied with moisture throughout the year; not overly dry or wet.

Mesotrophic: Refers to a moderately fertile nutrient level of a lake (see appendix 2).

Morphology: The structure or shape of a physical feature. Can also refer to a process.

Myriophyllum: A genus of submerged aquatic plants that according to Fassett 1957 are characterized by "calyx lobes 4, petals 4 or none, stamens 4 or 8, fruit of 4 joined nut-like bodies. With a few exceptions, the species look much alike, and some are nearly impossible to distinguish without flowers or fruits. In the foliage there are sometimes differences that may be seen by minute comparison of individuals, but these are almost impossible to describe intelligibly." Fassett, Norman C. – A Manual of Aquatic Plants UW Press page 263.

Niagara Escarpment: A reef complex consisting of Silurian and Ordovician aged dolomite and shales.

Oligotrophic: Refers to an unproductive and nutrient poor lake (see appendix 2).

Outstanding Resource Water (ORW): Outstanding resource waters are lakes, rivers and streams with the highest water quality in the state. They are mostly pollution free and highly valued for water related qualities they possess, such as diverse native fisheries and unimpacted shorelines.

Ordovician: Geologic period following the Cambrian Period. The Ordovician began approximately 500 million years ago and lasted approximately 65 million years.

Pelagic: Referring to open water portions of a lake.

Revetments: A facing of stone, concrete, fascines or other material to sustain and embankment.

Riprap: Broken rock, cobbles, or boulders placed on the bank of a stream or shoreline to protect it against erosion.

Seiche: Changes in water levels due to the tipping of water in an elongated lake basin where by water is raised in one end of the basin and lowered in another.

Silurian: A geological period of the Palaeozoic era following the Ordovician period and extending until the beginning of the Devonian period. It began about 440 million years ago and lasted for about 45 millions years.

Sinkhole: Cone-shaped depressions or hole which are expressed on the land surface with a subterranean passage developed by the solution process.

Solution Process: The enlargement of vertical crevices and horizontal bedding planes in dolomite bedrock resulting from acidic infiltrating water contacting the dolomite causing a chemical reaction which dissolves the dolomite.

Sub-watershed: A smaller delineation/component of a larger watershed.

Swallet: Sinkhole or rockhole that intercepts a stream, diverting all or a portion of it to the groundwater.

T_R_Sec.: This is the symbol for a legal or land description. A land description is a description of a tract of land in legally acceptable terms so as to show exactly where it is located and how many acres it contains. The land description uses the U.S. Public Land System or the Rectangular System. **'T'** stands for Township, a division of a 6 mile by 6 mile square. The townships are further divided into Sections (**Sec.**) which are one mile by one mile square and contain 640 acres. **'R'** stands for the Range number.

Trophic category: The level of growth or productivity of a lake as measured by the phosphorous content, algae abundance, and depth of light penetration.

Winterkill: A fish mortality resulting from extreme stagnation of water beneath the surface of an ice bound lake, wherein the dissolved oxygen concentration is lowered to a level incapable of sustaining fish life. Partial winterkill may occur in lakes having shallow bays or areas of shallow water, since these waters may not be circulated during ice cover periods.

Glossary B: TERMS FOR TABLES 1-4

Flow
C = continuous flow
I = intermittent flow
C/I = continuos at lower reaches; both intermittent & continuous

Biological Use Class
Cold = Cold Water Community; includes surface waters capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water fish species.
WWSF = Warm Water Sport Fish Communities; includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.
WWFF = Warm Water Forage Fish Communities; includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF = Limited Forage Fishery (intermediate surface waters); includes surface waters of limited capacity because of low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of forage fish and aquatic life.
LAL = Limited Aquatic Life (marginal surface waters); includes surface waters severely limited because of very low or intermittent flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.
Class I = streams are high-quality streams where trout populations are sustained by natural reproduction.
Class II = streams have some natural reproduction of trout but need stocking to maintain a desirable fishery.
Class III = streams sustain no natural reproduction of trout and require annual stocking of legal-size fish for sport fishing.

Substrate
R = rock &/or rubble
G = gravel
S = sand
OM = organic matter or soft bottom

Primary Vegetation
EV = Emergent vegetation
FA = Floating aquatic vegetation
SV = Submergent vegetation

Biotic Index Value = a value given a stream based on the composition of aquatic invertebrates and their corresponding levels of tolerance to pollution. The scale ranges from 0-10 where higher values correspond to decreased water quality. This may also be referred to as the Hilsenhoff index.

Lake Type
Dg = Drainage Lakes; primary water source is overland flow from relatively large watersheds that are high flushing making them least sensitive to shoreland-derived pollutants. Permanent inlet and outlet streams are present.
Se = Seepage Lakes; water sources are primarily rainfall and groundwater. Watersheds are generally small and very low flushing making them sensitive to shoreland-derived pollutants. They have no inlet or outlet (land locked).
Sp = Spring Lakes; primary water source is groundwater. Watershed size is relatively small. They have permanent outlets with substantial flow, but seldom have inlet streams. These high volume outlets make them rather insensitive to shoreland-derived pollutants.

S.D.F. = Shore Development Figure; the ratio of the length of the shoreline of a lake to the circumference of a circle having the same area as the lake. This is a method used to express the degree of irregularity of a shoreline. The number is never less than 1.0 since that is the value of a perfect circle.