Door County Land & Water Resource Management Plan 2021 - 2030

Prepared by the
Soil & Water Conservation
Department

DOOR COUNTY

LAND & WATER RESOURCE MANAGEMENT PLAN

2021 - 2030

Prepared by the Door County Soil & Water Conservation Department

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Table of Contents

PART 1. Introduction 1
Purpose 1
Executive Summary 2

PART 2. Land, Water & Related Resource Needs 7
Land and Water Resources and Status 7
Physical Settings 7
Geology 8
Soils 13
Land Use and Demographics 18
Population 19
Land Use 20
Agriculture 22
Residential 26
Beaches 28
Non-Metallic Mine Reclamation 29
Significant Habitat and Natural Areas 31
Wisconsin Land Legacy Places 38
Invasive Species 42
Surface Waters 44
Streams, Creeks and Rivers 45
Lakes 57
Existing Classifications 60
Lake Michigan Water Levels and Precipitation Trends 62
Wetlands 64
Wetland Classifications 64
Door Peninsula Ramsar Site 66
Potentially Restorable Wetlands 68
Groundwater Resources 70
Groundwater Contamination Susceptibility 70
Contaminants 70
Private Wells 72
Nitrate in Public Wells 75
Municipal Wells 78
Strategic Planning and Public Comment 82
Previous Land and Water Resource Management Plan Efforts 82
Door County Comprehensive and Farmland Preservation Plan 2035 83
Door County Citizen Survey Report 84
Door County Greenprint Project 85
Door County Invasive Species Strategy 2018-2023 85
2021-2030 Land and Water Resource Management Plan Efforts 86
Identification of Specific Land & Water Resource Needs 87
Resources Goals 88

PART 3. Plan of Implementation Addressing Land, Water & Resource Needs 90
Agricultural Implementation 90
Chapter 23: Agricultural Performance Standards and Animal Waste Storage Ordinance 91
Implementation Strategy for Agricultural Standards and Prohibitions 94
Nutrient Management 98
Chapter NR 243 – WPDES Concentrated Animal Feeding Operations (CAFOs) 99
Sources of Funding to Assist with Best Management Practice Installation 100
Priority Agricultural Implementation Actions 102
Urban and Rural Non-Agricultural Implementation 104
Voluntary Implementation 104
Stormwater Runoff Management and Construction Site Erosion Control 105
Nonmetallic Mining and Reclamation 106
Beach Contamination – Source Identification and Reduction 106
Watershed Restoration Projects 107
Wildlife Damage Abatement and Claims 108
Priority Urban and Rural Non-Agricultural Implementation Actions 109
Additional Groundwater Protection Programs 110
Well Abandonment 110
Municipal Wellhead Zone of Contribution Protection 111
Lead and Arsenic Contaminated Sites 112
Priority Additional Groundwater Protection Actions 112
Invasive Species 113
Door County Invasive Species Team (DCIST) 113
Education and Outreach 114
Control 114
Municipal Outreach 114
Priority Invasive Species Actions 115
Technical Assistance & Information and Education 116
General Resource Management Assistance 116
Research Assistance Pertaining to Door County's Natural Resources 117
Information and Education 117
Priority Actions 117

PART 4. Summary of Work Plan and Fiscal Management 119
Work Plan 119
Fiscal Management 133
Progress Assessment 136

PART 5. Plan Adoption Process 138

APPENDIX A Water Quality Data Referenced in Section 2 – Resource Assessment 139

APPENDIX B Results of Public Input Sessions to Identify Land and Water Resource Needs 161

APPENDIX C Local Advisory Committee 164

APPENDIX D Agricultural Performance Standards and Manure Management Prohibitions and Conservation Practices to Address Them 165

APPENDIX E 167

APPENDIX F 168

GLOSSARY 169

REFERENCES 172

ACRONYMS 175

Figures

Figure 2-1. General Location Map of Door County 7
Figure 2-2. Generalized Bedrock Geology Map 8
Figure 2-3. Generalized Karst Landscape with Common Solution Features 9
Figure 2-4. Generalized Geologic Cross-Section of the Door Peninsula 10
Figure 2-5. Bedrock Geology Cross-Section in Northern Door County 10
Figure 2-6. Glacial Lobes of the Late Wisconsin-Age Glaciation 11
Figure 2-7. Glacial Deposits in Door County 12
Figure 2-8. Average Soil Depth to Bedrock 13
Figure 2-9. Major Soil Associations of Door County 15
Figure 2-10. Soil Hydrologic Groups of Door County 17
Figure 2-11. Door County Municipalities 18
Figure 2-12. Generalized Land Use in Door County 21
Figure 2-13. Door County Cropland and CAFO Presences 25
Figure 2-14. Active POWTS in Door County 27
Figure 2-15. Location of Major Door County Beaches 28
Figure 2-16. Location of Non-Metallic Mines in Door County 30
Figure 2-17. Significant Wildlife Habitat and Natural Areas 37
Figure 2-18. Invasive Species of Focus in Door County 42
Figure 2-19. Inventory of Invasive Species of Focus in Door County of Door 43
Figure 2-20. Major Door county Watersheds 44
Figure 2-21. Locations of Streams in the Red River/Sturgeon Bay Watershed 46
Figure 2-22. Locations of Streams in the Ahnapee River Watershed 49
Figure 2-23. Locations of Streams in the Stony Creek Watershed 52
Figure 2-24. Locations of Streams in the Upper Door Watershed 55
Figure 2-25. Location of Major Lakes in Door County of Door 59
Figure 2-26. Location and Distribution of Wetland Classes in Door County 65
Figure 2-27. Ramsar Designation Sites in the United States 66
Figure 2-28. Door Peninsula Coastal Wetlands Ramsar Site 67
Figure 2-29. Potentially Restorable Wetlands in Door County of Door 69
Figure 2-30. Groundwater Susceptibility in Door County of Door 71

Figure 2-31. Percentage of Coliform Bacteria Detect per Section (Fall 2019) 73
Figure 2-32. Average Nitrate Level per Section (Fall 2019) 74
Figure 2-33. Nitrate Level Trend in Public Wells 76
Figure 2-34. Nitrate Levels in Public Wells 77
Figure 2-35. Location and Zones of Contribution for the City of Sturgeon Bay Municipal Wells 79
Figure 2-36. Wellhead Protection Areas for the Village of Sister Bay Municipal Wells 80

Figure 3-1. Locations of Parcels That Have Been Inventoried and Notified of Compliance Status Under Chapter 23 94
Figure 3-2. Example of Parcel Ranking for Geographic Prioritization 96
Figure 3-3. Status of notifications to Livestock Operations Ranked Using Geographic Prioritization 97
Figure 3-4. Door County Cropland Acres in Nutrient Management Plans 99

Figure A-1. Sample Locations in the Red River/Sturgeon Bay watershed 140
Figure A-2. Sample Locations in the Ahnapee River Watershed 148
Figure A-3. Sample Locations in the Stony Creek Watershed 153
Figure A-4. Sample Locations in the Upper Door Watershed 157
Figure A-5. Ahnapee River Watershed EVAAL Analysis 160

Tables

Table 2-1. Population Trends of Door County Municipalities 19
Table 2-2. Land Use Totals 21
Table 2-3. Door County Farm Census Statistics 22
Table 2-4. Wastewater Facilities with WPDES Permits 26
Table 2-5. Characteristics of Streams in the Red River/Sturgeon Bay Watershed 45
Table 2-6. Summary of Total Phosphorus (TP) and Total Suspended Solids (TSS) data for streams in the Red River/Sturgeon Bay Watershed 47
Table 2-7. Characteristics of Streams in the Ahnapee River Watershed 48
Table 2-8. Characteristics of Streams in the Stony Creek Watershed 51
Table 2-9. Summary of Total Phosphorus (TP) and Total Suspended Solids 53
Table 2-10. Characteristics of Streams in the Upper door Watershed 54
Table 2-11. Summary of Total Phosphorus (TP) for streams in the Upper Door Watershed 56
Table 2-12. Characteristics of Major Lakes and Ponds in Door County 58
Table 2-13. Summary of Door County Private Well Sampling Program Results 72
Table 2-14. Nitrate Level Trend in Public Wells 75

Charts

Chart 2-1. Trend of Total Population in Door County 19
Chart 2-2. Trends of Farms with Cattle and Calves 23
Chart 2-3. Percentages of Dairy Farms and Beef Farms 23
Chart 2-4. Number of Dairy Animals and Beef Animals 24

Chart 2-5. Door County Cropping Trends 24
Chart 2-6. US Army Corps of Engineers Great Lakes Water Levels (1918-2020)..... 63

Chart A-1. Total Phosphorus Measurements in Sugar Creek 141
Chart A-2. Total Phosphorus Measurements in Silver Creek (Union) 141
Chart A-3. Total Phosphorus Measurements in Renard Creek..... 142
Chart A-4. HBI Values for Sugar, Silver and Renard Creeks 143
Chart A-5. EPT Richness Values for Sugar, Silver and Renard Creeks..... 143
Chart A-6. Total Phosphorus measurements in Twin Harbor Creek 144
Chart A-7. Total Phosphorus Measurements in Kayes Creek 144
Chart A-8. Total Phosphorus Measurements in Malvitz Creek 145
Chart A-9. Total Phosphorus Measurements in Krueger Creek..... 145
Chart A-10. Total Phosphorus Measurements in May Creek 146
Chart A-11. Total Phosphorus Measurements in Larson Creek..... 146
Chart A-12. M-IBI Values for Kayes, Malvitz and Larson Creeks..... 147
Chart A-13. Total Phosphorus Measurements in the Ahnapee River at County H 149
Chart A-14. Total Phosphorus Measurements in Silver Creek (Brussels) 149
Chart A-15. Total Phosphorus Measurements in the Ahnapee River at County J..... 150
Chart A-16. M-IBI Values for the Ahnapee River at County H 150
Chart A-17. Total Phosphorus Measurements Above the Forestville Dam..... 151
Chart A-18. Total Phosphorus Measurements in the Forestville Millpond Sediment Cores 151
Chart A-19. Dissolved Oxygen Measurements Above the Forestville Dam..... 152
Chart A-20. Total Phosphorus Measurements in Stony Creek at County H 154
Chart A-21. Total Phosphorus Measurements in Stony Creek at Rosewood Road 154
Chart A-22. Total Phosphorus Measurements in Bear Creek..... 155
Chart A-23. Total Phosphorus Measurements in Woodard, Schuyler and Silver (Forestville) Creeks..... 155
Chart A-24. M-IBI Values for Stony Creek at Three Locations..... 156
Chart A-25. Total Phosphorus Measurements in Upper Door Watershed Streams 158
Chart A-26. Total Phosphorus Measurements in Geisel Creek at Haberli Road 158
Chart A-27. M-IBI Values for Lily Bay, Whitefish Bay and Three Springs Creek 159
Chart A-28. M-IBI Values for Locations in Geisel Creel..... 159

Part 1

Introduction

Contents

1.1 **Purpose**
1.2 **Executive Summary**

1.1 Purpose

Soil and Water Conservation Department Mission Statement

The Door County Soil & Water Conservation Department (SWCD) is created under the authority of Chapter 92 of Wisconsin Statutes. Chapter 92 gives the SWCD the responsibility for the administration of the county soil and water conservation program and the authority to exercise the powers granted to the Land Conservation Committee. The legislative declared policy of the State in Chapter 92 is to halt and reverse the depletion of the State's soil resources and pollution of its waters. The SWCD has a responsibility, and directive under Chapter 92, to promote land uses and programs which advance conservation and the protection of Door County's natural resources. The mission of conservation and environmental advocacy is the standard by which SWCD programs are developed and implemented.

Land and Water Resource Management Plan Concept

In the fall of 1996, conservationist professionals assembled to consider the redesign of Wisconsin's nonpoint source pollution programs. From this assemblage, the county land and water resource management plan concept was proposed. Promoted by the Wisconsin Land and Water Conservation Association (WLWCA) and the Wisconsin Association of Land Conservation Employees (WALCE) and supported by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP), the Wisconsin Department of Natural Resources (WDNR), and the United States Department of Agriculture Natural Resource Conservation Service (NRCS), Chapter 92.10 of the Wisconsin Statutes was amended in October 1997 through Wisconsin Act 27 with the requirement for counties to develop land and water resource management plans.

The first Door County Land and Water Resource Management Plan was developed in 1999 and was structured to identify the resource needs of Door County, establish goals to meet these needs, and to initiate a course of action to attain these goals. The intent of the plan was to form work plans that use existing and future SWCD programs to protect and improve the natural resources of Door County. This is the same strategy that was employed in subsequent updates, including this plan developed for implementation in 2021-2030. Woven through this plan is a strategy, design, and implementation emphasizing cooperation and integration of the public with various agencies and officials to accomplish a common goal. This plan should serve as a guide to streamline decision-making, coordinate program administration, and better utilize federal, state, and local funding to address the established resource needs of Door County. The plan is meant to be versatile to allow for adaptation as changing laws are adopted and brought into practice.

1.2 Executive Summary

Part 1 – Purpose and Summary

The Door County Land and Water Resource Management Plan was developed in accordance with the requirements in Chapter 92 of the Wisconsin Statutes. An assessment of current natural resource conditions has been established , current challenges have been identified, goals were created, and strategies have been developed to reach the established goals to protect the land and water resources of Door County through existing programming and funding. This plan has incorporated federal, state, and local agencies, as well as the general public, to aid in the identification and development of goals and will coordinate with these agencies and individuals to implement strategies and processes to attain these goals.

Part 2 – Land, Water & Related Resource Needs

Land and Water Resources and Status

The unique geography, geology, hydrology and soils of Door County present many challenges in the protection of its natural resources. The geology is comprised of dominantly Silurian-aged dolostone. This fractured, calcareous bedrock is easily modified by the dissolution of the bedrock into solution features, which combined with the relatively thin soil layer found through much of the county, create a high potential for groundwater and surface water contamination. A landscape that has been highly-modified by erosion and glacial activity provides a diverse terrain and hydrology that is conducive to highly diverse ecosystems, yet highly susceptible to the negative impacts of poor land use decisions.

This section of the plan provides a description of and/or status update of current conditions for: land use and demographics, significant habitats and natural areas, invasive species, surface water resources (including beaches, streams within major watersheds, and lakes), wetlands, and ground water resources within Door County. This provides the context and background for development of the goals and activities further developed within the plan.

Strategic Planning and Public Comment

To identify and address the concerns and needs of Door County's land and water resources for the purposes of this update, the SWCD consulted with the general public through input sessions held in February 2020, a Local Advisory Committee established following the guidelines of ATCP 50.12, Wisconsin Administrative Code, and the Land Conservation Committee. The SWCD also compared established goals with those developed in other recent county efforts, including:

- Door County Comprehensive and Farmland Preservation Plan 2035
- Door County Citizen Survey Report
- Door County Greenprint Project
- Door County Invasive Species Strategy 2018-2023

Identification of Specific Land & Water Resource Needs

Through the efforts of the input from the public, the Local Advisory Committee, SWCD staff and consideration of priorities developed in existing plans, a prioritized list of major land and water resource needs was developed. The resource needs are listed in order of priority, however many of the concerns are interconnected and can be addressed concurrently.

1. Groundwater protection and improvement
2. Surface water protection and improvement
3. Impacts of human use and development on natural resources
4. Changing climate and lake levels
5. Human waste management
6. Animal waste management
7. Stormwater management
8. Soil erosion control; agricultural and construction site
9. Invasive species control
10. Education and awareness of environmental issues and sustainable farming practices
11. Fertilizer and chemical use
12. Natural Resources information sharing
13. Non-Metallic mine reclamation
14. Agricultural sustainability and land protection

Resource Goals

The following overarching resource goals are the broad goals that reflect each of the identified land and water resource needs. These establish the basis for the programs that the SWCD uses to address protection of the natural resources of the county.

1. Groundwater protection and improvement
   Goal: Protect or improve, when and where necessary, groundwater resources to applicable State standards.

2. Surface water protection and improvement
   Goal: Protect or improve, when and where necessary, surface water resources to applicable State standards.

   Goal: Protect surface water resources through identification and abatement of beach contamination sources.

3. Impacts of human use and development on natural resources
   Goal: Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).

4. Changing Climate and Lake Levels
   Goal: Collaborate with partners (e.g. other County Departments, NOAA, WDNR, and others) to develop climate adaptation best practices to protect natural resources and support development of long-term climate resilient mitigation practices for agriculture and other land uses.

5. Human waste management
   Goal: Reduce the risks to water quality through proper repair/replacement of failing septic systems.

6. Animal waste management

Goal: Reduce the risks to water quality through proper storage, handling and disposal of animal waste.

7. Stormwater management
   Goal: Reduce the risk to water quality and prevent flooding through proper stormwater runoff management.

8. Soil Erosion Control; agricultural and construction site
   Goal: Reduce soil erosion rates on agricultural fields through proper soil conservation practices.

   Goal: Reduce soil erosion from construction sites through proper soil erosion control measures.

9. Invasive species control
   Goal: Protect the habitat and biodiversity of native fauna and flora through the control of aggressive, invasive non-indigenous species.

10. Education and awareness of environmental issues and sustainable farming practices
    Goal: Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

11. Fertilizer and chemical use
    Goal: Reduce the risks to water quality through proper storage and handling of fertilizer and chemicals.

12. Natural resources information sharing
    Goal: Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

13. Non-metallic mine reclamation
    Goal: Reduce the impacts to water quality and other natural resources from nonmetallic mines through proper operation and/or reclamation procedures.

14. Agricultural sustainability and land protection
    Goal: Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.

Part 3 - Plan of Implementation Addressing Land, Water & Related Resource Needs

This section discusses the existing SWCD programming. There is a discussion of history, the current status and the program goals of each, as well as overarching resource goals identified in Part 2 that are addressed through each program. These are the existing tools that the SWCD has to address the identified concerns.

Agricultural Implementation

Implementation of the Agricultural Performance Standards and Animal Waste Storage Ordinance, Chapter 23 Door County Code, provides the foundation for the SWCD programs to address agricultural land use and promote conservation practices. This ordinance has incorporated all of the applicable performance standards and manure management prohibitions established by the State of Wisconsin so that they can be implemented locally to protect ground and surface water resources. A detailed implementation strategy emphasizes a combined approach that ranges from voluntary participation through county enforcement and notification requirements. Nutrient management priorities are outlined as well as the various sources of funding the SWCD uses to implement the agricultural programs.

Urban and Rural Non-Agricultural Implementation

In an effort to address conservation impacts from other non-agricultural land uses the SWCD has developed additional urban and rural conservation programs. These include assisting in the review of storm water runoff management and construction site erosion control plans, oversight of nonmetallic mines and reclamation, identification and reduction of sources of beach contamination, watershed restoration projects, and wildlife damage abatement and claims.

Additional Groundwater Protection Programs

Given the sensitivity of Door County's groundwater resources the SWCD participates in additional groundwater protection programs including well abandonment, municipal wellhead zone of contribution protection, and identification of lead and arsenic contaminated sites.

Invasive Species

The presence of invasive species represents one of the highest threats to Door County's exceptional number of rare species and natural communities. The Door County Invasive Species Team (DCIST) is a collaborative effort with local conservation and government groups to protect irreplaceable sites from the threat of invasive species. The SWCD engages in programs to support DCIST, address both aquatic and terrestrial invasive species, provide education and outreach opportunities, control populations and work with municipalities to implement their noxious weed ordinances.

Technical Assistance & Information and Education

The SWCD provides technical assistance to a variety of partners including the general public, municipalities within Door County, and other natural resources agencies and partners in a variety of ways. Research assistance is also provided to advance joint priorities and foster valuable working relationships with other natural resources professionals. Information and Education programs are offered to promote conservation issues and programs within the county.

Part 4 – Summary of Work Plan and Fiscal Management

The Door County Land and Water Resource Management Plan includes short-term and long-term activities within existing programs, to be implemented in phases, to address the identified goals. Short-term work tasks are estimated to be accomplished annually or within two – three years; whereas, long-term work tasks are considered work tasks that are further out in planning and will be considered in later years of this plan. Both the long-term, as well as the short-term, activities will require periodic revision due to changing resource needs and program designs and demands.

The 2020 operating budget for the SWCD is comprised of approximately 33% county appropriations and 67% outside grant funds. County appropriations support the SWCD core operations. A combination of long-term and annual grants provides additional support for staff and program implementation which includes the range of conservation and environmental protection efforts described in this plan. The SWCD budget in future years will need to continue to rely on a combination of county appropriations, state staffing and cost share support, and a variety of additional competitive grants. The SWCD actively seeks as much funding as possible through grants that advance program priorities and support implementation to meet the goals of this plan. In preparing annual budgets, the SWCD uses all available funding sources to maintain the staffing, cost sharing and operating costs necessary to address the goals and objectives of its programs vital to protection of Door County's natural resources. The fiscal management portion of this document contains a projected budget from 2021 -2025, but these are projections based on the 2020 budget and it should be understood that the source of funds is largely unknown and the allocations through state funds and county levy support cannot be predicted with enough assurance to make precise budget projections beyond 2020.

The measures to be used for monitoring progress at implementing this Land and Water Resource Management Plan are listed in the progress assessment section. Short-term program goals and activities are reviewed whereas long-term assessments will be more comprehensive as there are program updates and revisions to the Land and Water Resource Management Plan.

Part 5- Plan Adoption Process

This section of the plan covers the plan adoption process. A chronological history of dates associated with plan development, review and approval is listed.

Part 2

Land, Water & Related Resource Needs

Contents

2.1 Land and Water Resources and Status
2.2 Strategic Planning and Public Comment
2.3 Identification of Specific Land and Water Resource Needs
2.4 Resource Goals

2.1 Land and Water Resources and Status

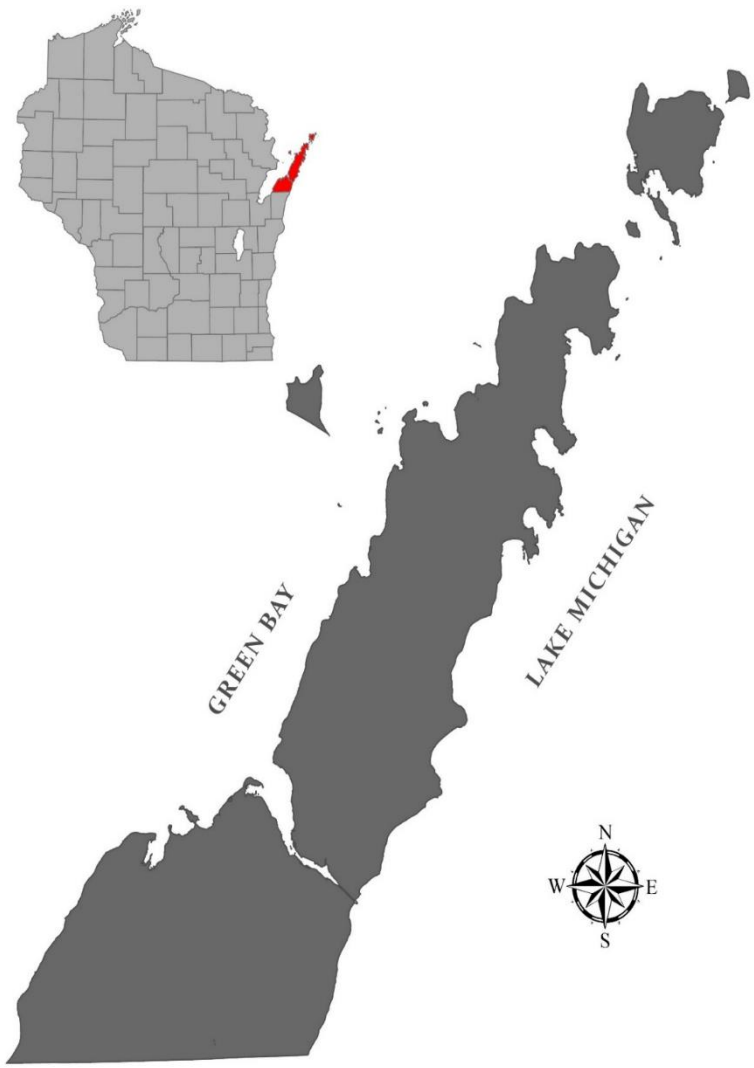


Figure 2-1. General Location Map of Door County.

Physical Setting

Door County is in northeastern Wisconsin and covers most of a narrow peninsula that extends into Lake Michigan to form Green Bay (See Figure 2-1). The landscape of Door County is approximately 482 mi^2, ranking it at 59 out of the 72 counties, according to land mass. A unique feature of the county is the large area that is covered by water, as its boundaries extend into Lake Michigan and Green Bay. The 482 mi^2 of land accounts for only 20% of the county's total area and the inclusion of the 1,888 mi^2 that are covered with water place the total area at 2,370 mi^2 and position Door County as the largest county in the state by total area.

Geology

The peninsula on which Door County is situated is a cuesta with a west-facing scarp and eastward dipping back slope that forms the western portion of the Niagara Escarpment, which is a reef complex consisting of Silurian and Ordovician-aged dolostones and shales (See Figure 2-2). The uppermost bedrock unit in Door County is Silurian-aged dolostone, a calcareous rock with high concentrations of magnesium. Below the Silurian Dolostone lies Ordovician-aged dolostones and shales; underlying the Ordovician units are the sandstones of the Cambrian.

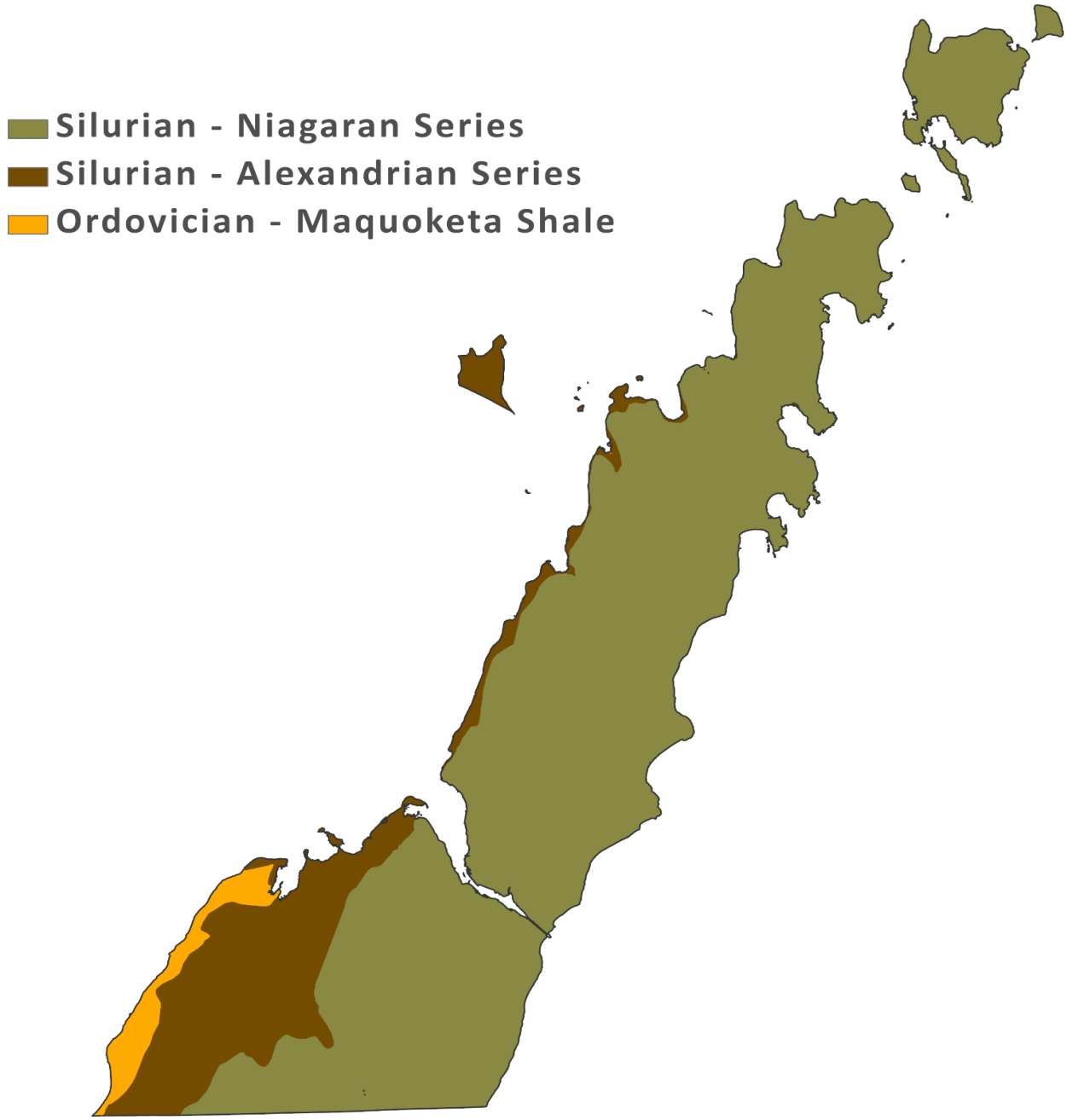


Figure 2-2. Generalized Bedrock Geology Map

The dolostone bedrock is highly fractured and modified through dissolution by water. Solution activity has produced enlarged vertical crevices and horizontal bedding planes as well as a prominent karst landscape. Karst features or solution features such as sinkholes, swallets, and collapse features, are numerous throughout the county and are potential conduits for surface water to enter the aquifer with little filtration or attenuation of contaminants before entering the drinking water supply (See Figure 2-3) originating from bedrock aquifers, which for most of the county lie within the Silurian Dolostones.

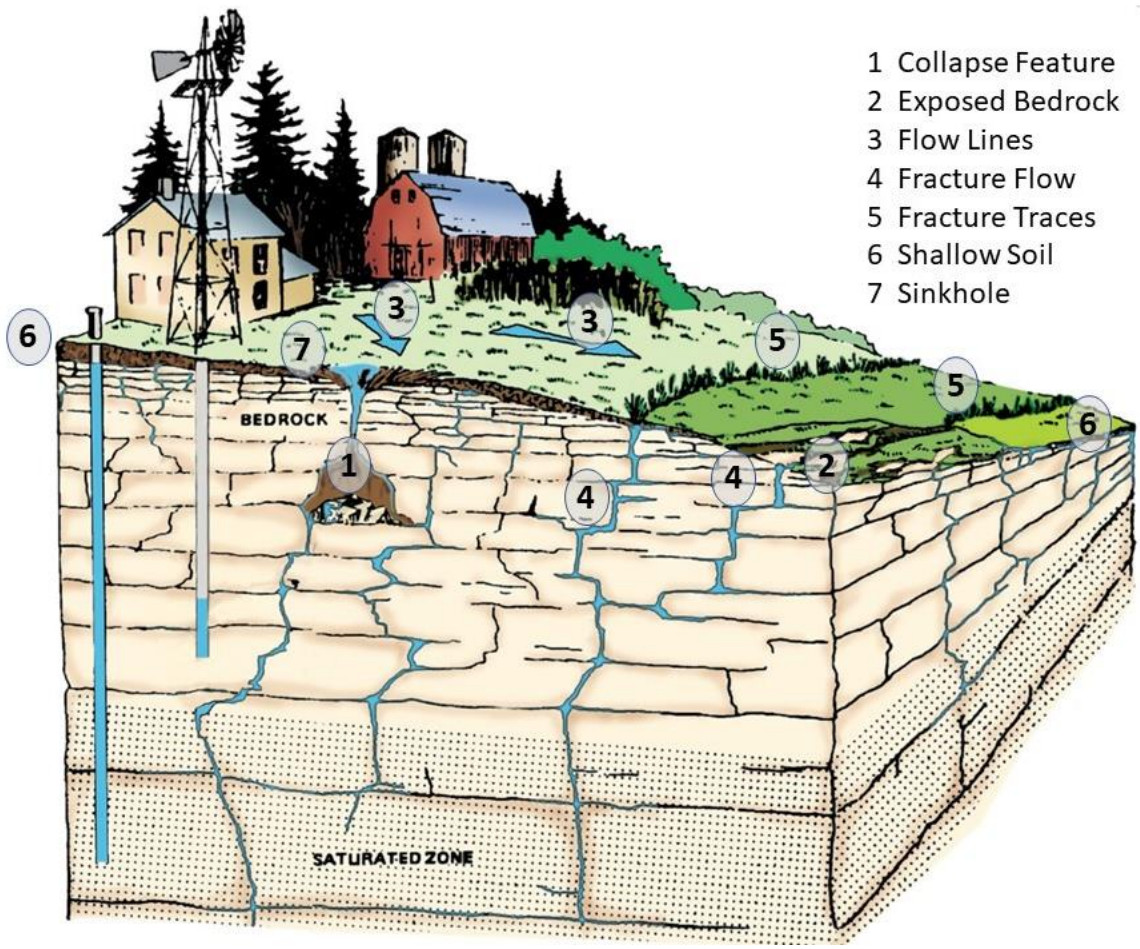


Figure 2-3. Generalized Karst Landscape with Common Solution Features. Source: Modified from WDNR WT-466-96 (1996).

The aquifer in the Silurian Dolostones can be divided into two hydrologically connected subaquifers. The upper, or Niagaran aquifer, exists within the Engadine Dolostone, Manistique Formation, and the Burnt Bluff Group. The lower, or Alexandrian aquifer, resides in the Mayville Dolostone. The Ordovician-aged Maquoketa Formation consists of a layer of shale beneath the Mayville. The shale acts as a confining unit, or aquaclude, between the Silurian aquifers and the Ordovician aquifer below (See Figures 2-4 and 2-5).

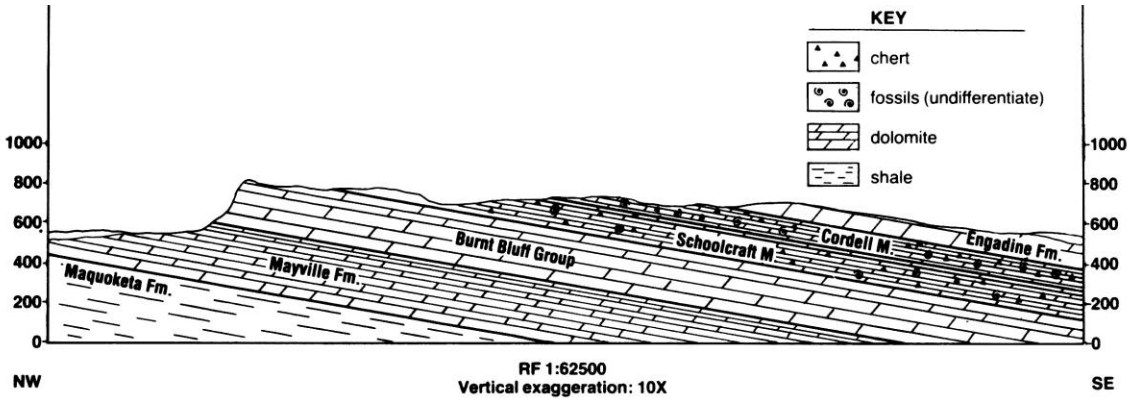


Figure 2-4. Generalized Geologic Cross-Section of the Door Peninsula. Source: Stieglitz 1989.

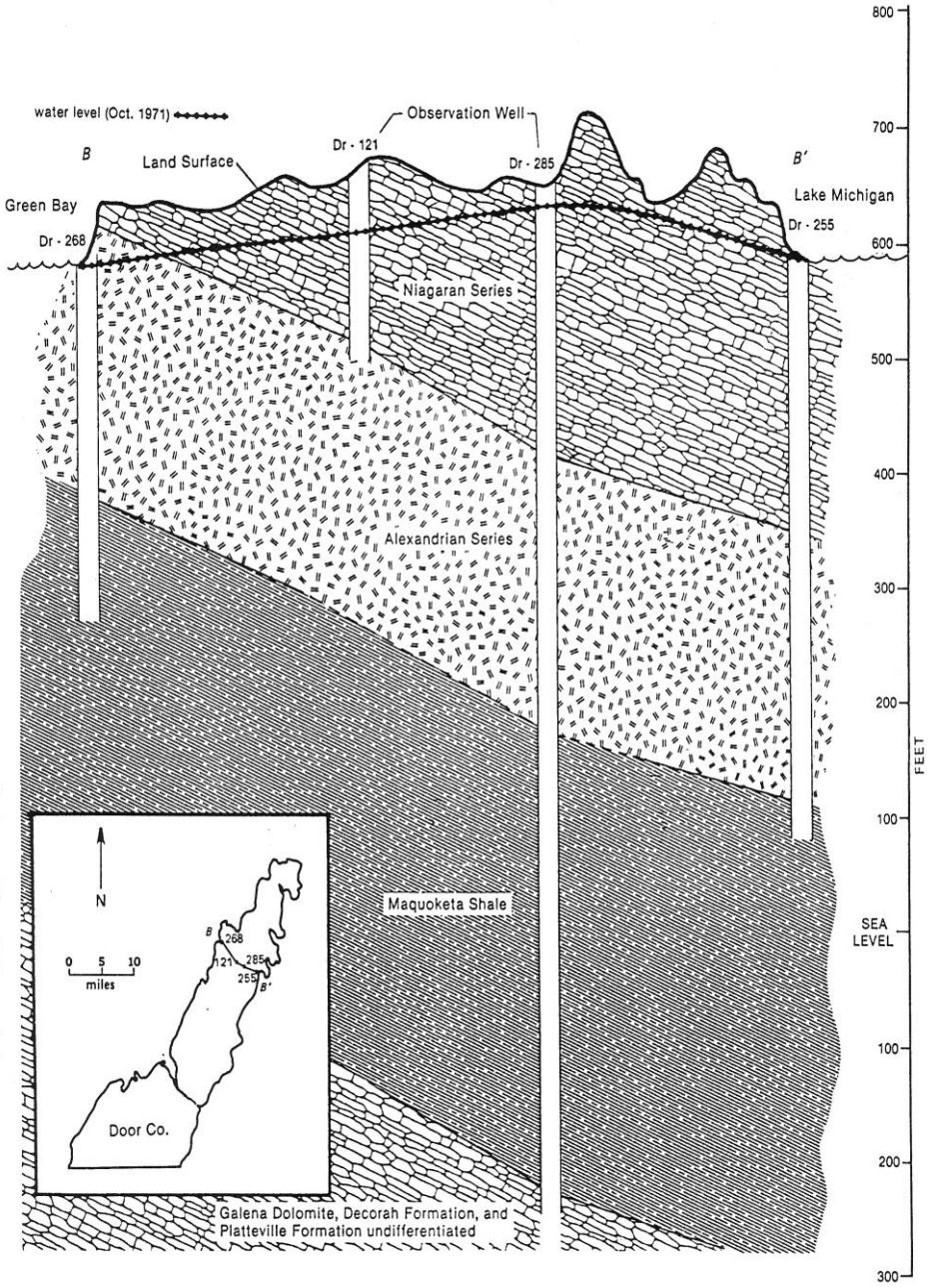


Figure 2-5. Bedrock Geology Cross-Section in Northern Door County. Source: Modified from M.G. Sherrill 1978.

During the Pleistocene epoch, the Door County Peninsula was glaciated numerous times. Two glacial advances, which occurred during the Late Wisconsin Age have been recorded. During these glacial advances, the Green Bay Lobe expanded in a southeasterly direction out of the present-day Green Bay Basin and across the entire peninsula as the Lake Michigan Lobe advanced on the east side (Figure 2-6).

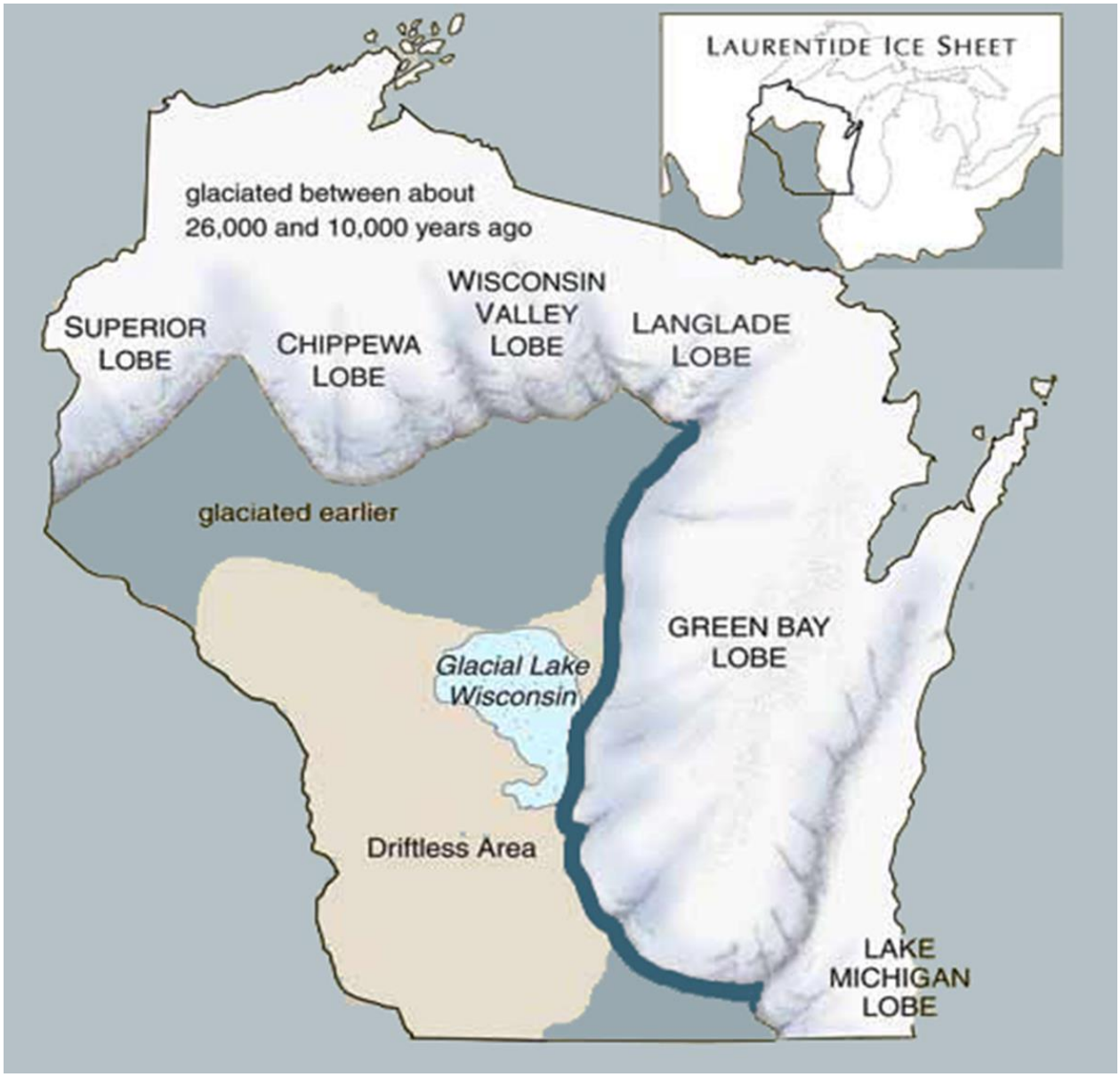


Figure 2-6. Glacial Lobes of the Late Wisconsin-Age Glaciation. Source: Dott and Attig, 2004.

The advance of the Green Bay Lobe is thought to be responsible for glacial features such as drumlins, moraines, and eskers found in the county. The Niagara Escarpment was also accentuated during this time as less resistant Ordovician dolostones and shales were scoured out of the Green Bay Basin. Evidence of the Lake Michigan Lobe can be seen along the eastern shore of Door County in the form of ancient shorelines that were shaped as water levels fluctuated during glacial advances.

The Liberty Grove Member, a thin till unit of buff-colored pebbly loam with a high carbon content, is the prominent till type deposited in Northern Door County during the older Woodfordian advance. The second recorded advance, the Greatlakean, deposited a fine-grained reddish till referred to as the Glenmore till throughout the southern part of the county. Lacustrine sediments can be found along the shorelines of Green Bay and Lake Michigan (Figure 2-7).

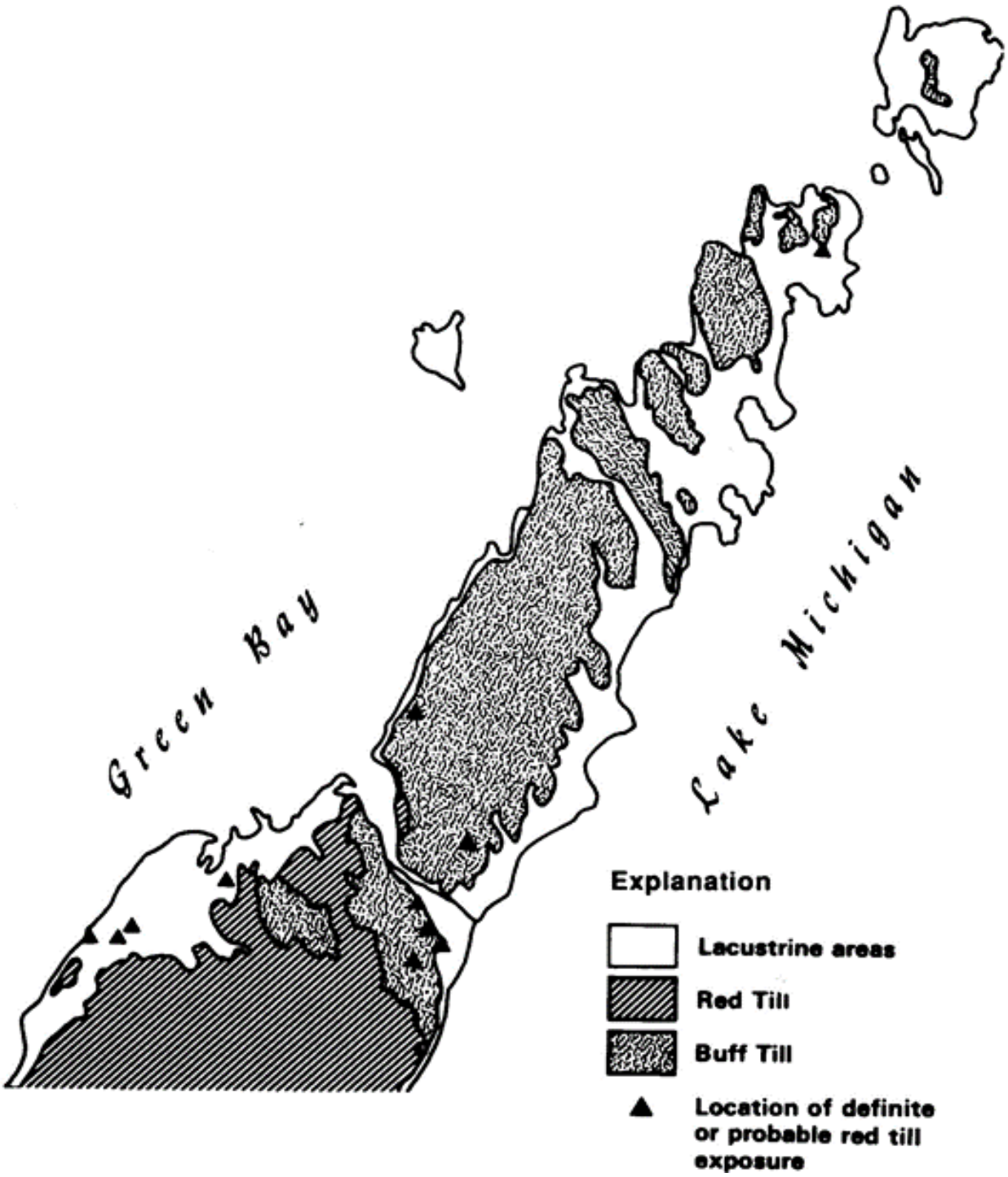


Figure 2-7. Glacial Deposits in Door County. Source: Schneider, 1989; Modified from Thwaites and Bertrand, 1957.

Soils

The soils throughout the county originate from glaciation, bedrock weathering, and fluvial activity. The majority of the soils are formed in glacial till, but a smaller portion is also formed in outwash sand and gravel or lacustrine sediment. Due to the calcareous nature of the parent material from which they originated, the soils of Door County are characteristically alkaline.

The unique qualities of the soils of Door County result in many land use and water quality challenges. Many of the soils of the county have very shallow depth to bedrock, especially in the northern two-thirds of the peninsula; Approximately 24% of the soil in the county is less than 20 inches in depth, and an additional 17% is less than 60" in depth (See Figure 2-8). Much of the landscape that has shallow depth to bedrock is situated in topographically higher areas, such as the Niagara Escarpment or the tops of ancient bedrock valleys oriented from the northwest to the southeast; these areas have thin layers of glacial till remaining as they have been subject to erosion of deposited material by wind and water. Deeper soils in the county are generally associated with historic drainage systems of both former and present waterways and post-glacial lacustrine deposits that occasionally exceed fifty feet of depth above bedrock. These are many times the location of current surface water systems such as streams, lakes and wetlands; these areas of deeper soils are representative of those depositional areas.

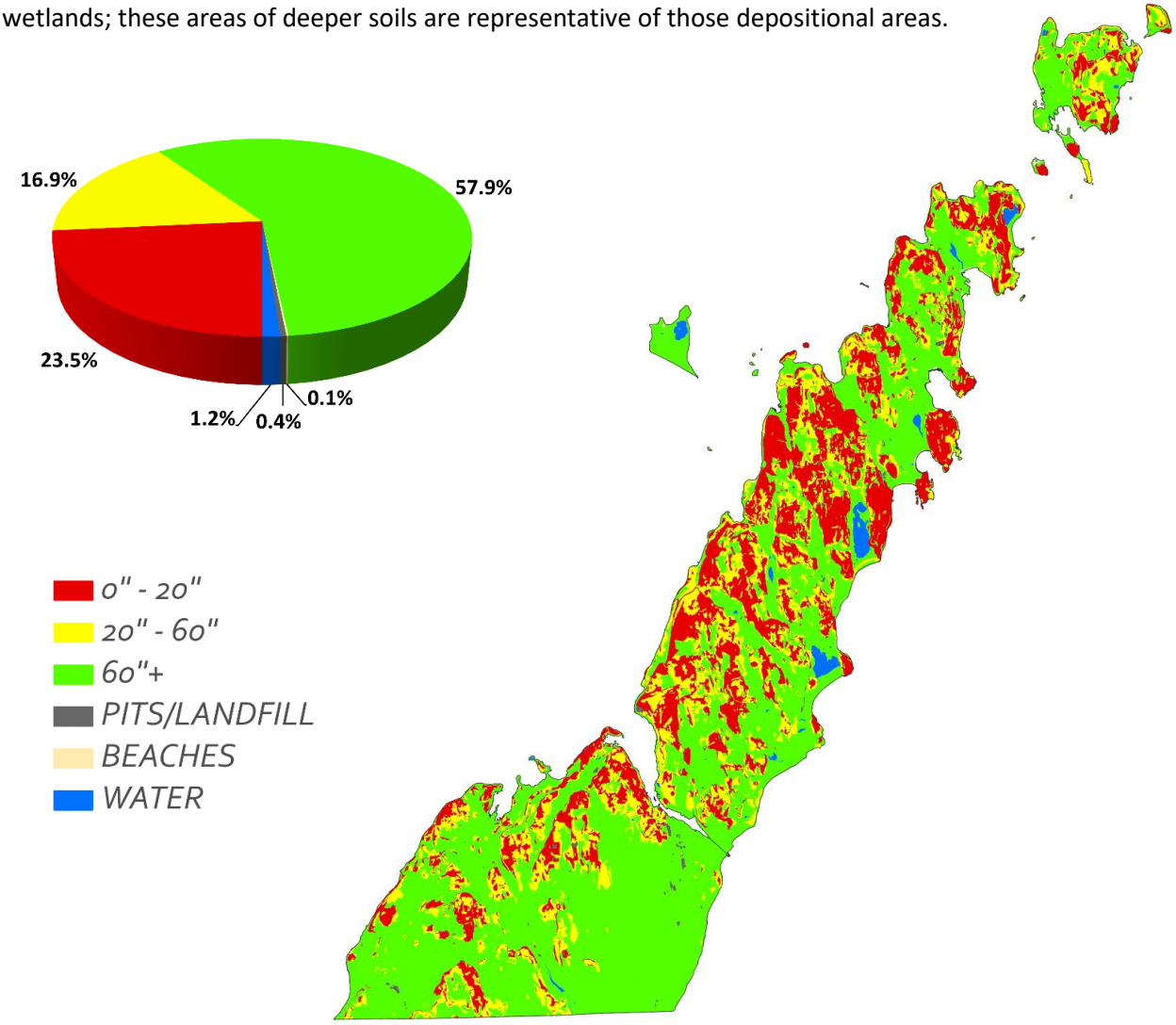


Figure 2-8. Average Soil Depth to Bedrock.

The shallow depth of soil to the underlying fractured bedrock, and the density of karst features throughout the county presents many problems with suitability of septic system absorption fields, agricultural practices, and construction development.

Soil Associations

There are 75 different soil types found throughout Door County. Soil types with similar inherent properties are grouped into six general soil associations (See Figure 2-9). These six soil associations can be used to determine the large-scale suitability for certain types of land use, planning, and management. The six major soil associations found in Door County are:

Summerville-Longrie-Omena association:
Occupies approximately 48 percent of the county; found mostly in northern Door County.
Shallow to deep, well-drained, nearly level to moderately steep soils that have a sandy loam or loam subsoil over sandy loam, fine sandy loam till, or dolostone bedrock.

Emmet-Solona-Angelica association:
Occupies approximately 23 percent of the county; found mostly in the southeastern portion of the county. 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.

Rousseau-Kiva-Markey association:
Occupies approximately 9 percent of the county; mainly found along the eastern coast and in southern Washington Island. Deep, well-drained and moderately well-drained, and 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.

Kewaunee-Kolberg-Manawa association:
Occupies approximately 11 percent of the county; found in Southern Door, primarily in the southwest. 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 dolostone bedrock.

Deford-Yahara Variant-Carbondale association:
Occupies approximately 3 percent of the county; found in the Mink River and northern Baileys Harbor areas and the eastern half of the canal. 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.

Carbondale-Cathro association:
Occupies approximately 7 percent of the county; scattered across the county.
Very poorly drained, nearly level organic soils (poorly drained mucks).

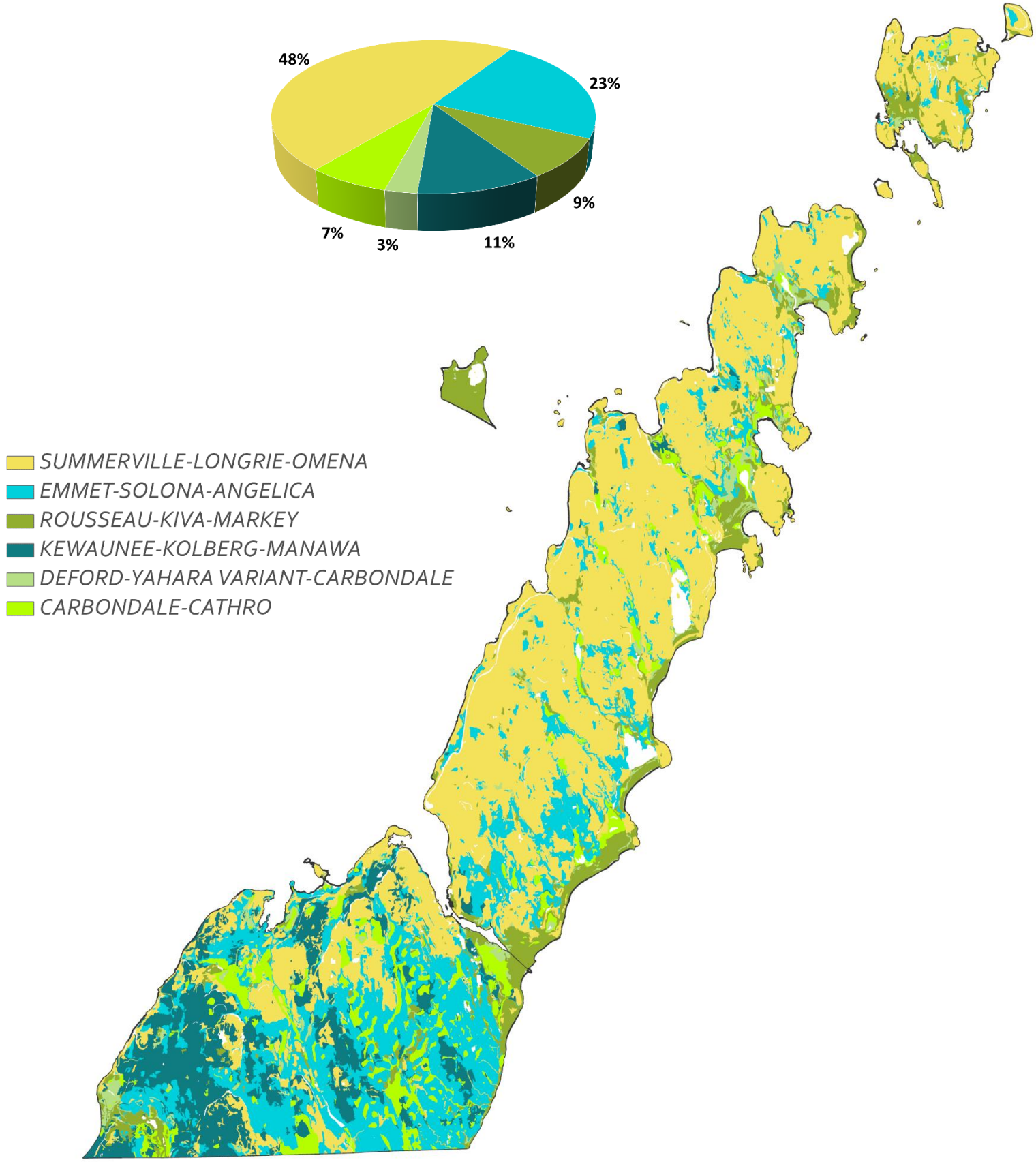


Figure 2-9. Major Soil Associations of Door County.

Soil Hydrologic Groups

Hydrologic soil groups are based on an estimate of runoff potential based on soil characteristics. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. Group A soils make up approximately 6% of Door County.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Group B are the largest group and constitute approximately 35% of the county.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission. Group C soils make up approximately 20% of Door County.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils in high water table conditions, soils that have a claypan or clay layer at or near the surface and those that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. Group D soils make up about 25% of the landscape.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes. Approximately 10% of the county is made up of A/D soils and 3% is made up of B/D soils. The breakdown of Hydrologic Groups is shown in Figure 2-10.

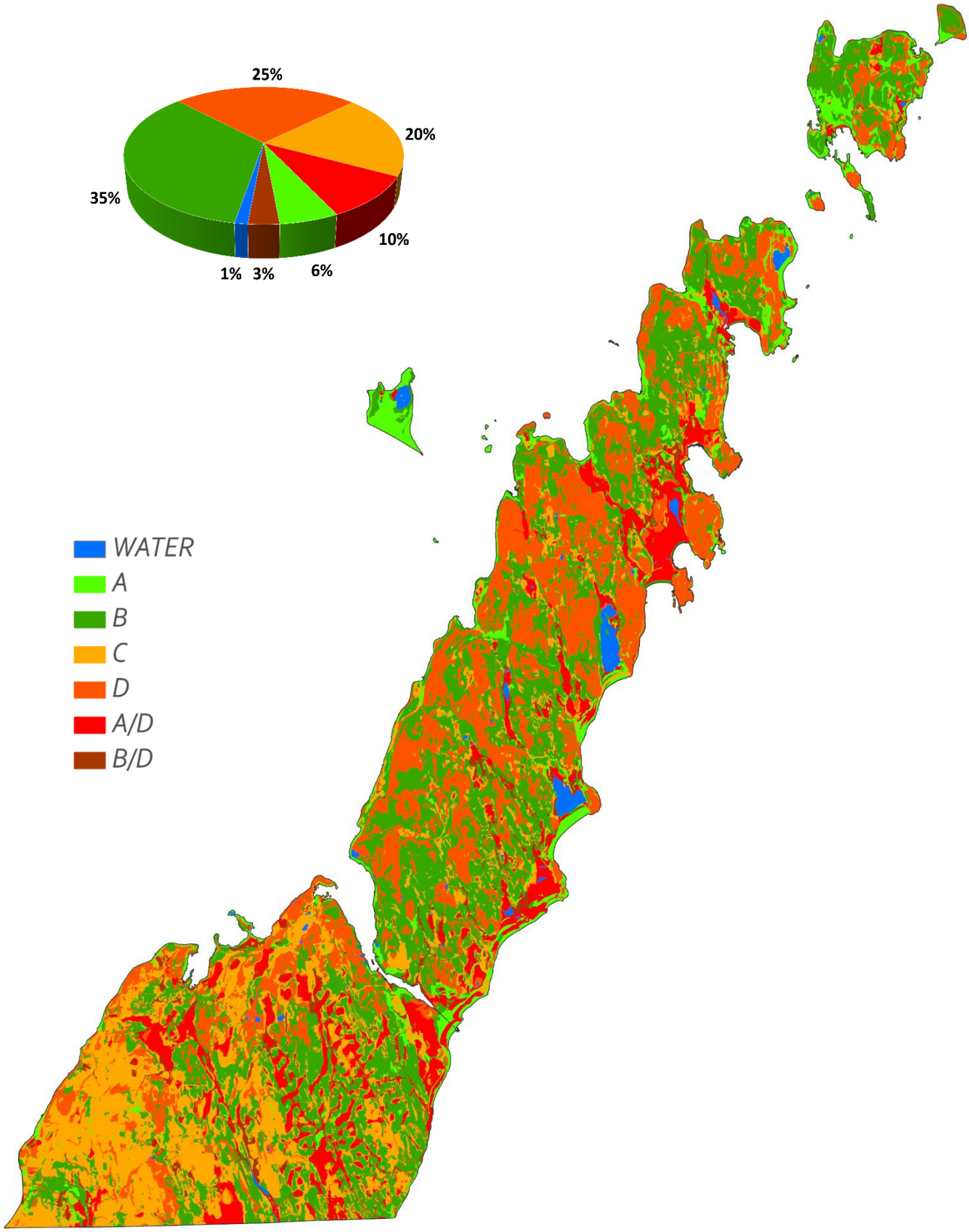


Figure 2-10. Soil Hydrologic Groups of Door County.

Land Use and Demographics

Door County, established in 1851, has just under 30,000 year-round residents as well as a seasonal population that fluctuates throughout the year. A five-year average of approximately 2,750,000 annual visitors has been estimated based on data tracked by Door County tourism industries. The county seat is the City of Sturgeon Bay. The county consists of the city, fourteen towns and four villages covering the approximately 482 square miles of land on the Door Peninsula (See Figure 2-11). The following tables are illustrative of trends in population, industry and farming within the county; categories important to this plan as they have the ability to impact goals and objectives of many of the resource concerns. Population by municipality and the whole county in the 1990, 2000 and 2010 censuses and an estimate for 2019 are depicted in Table 2-1 and Chart 2-1.

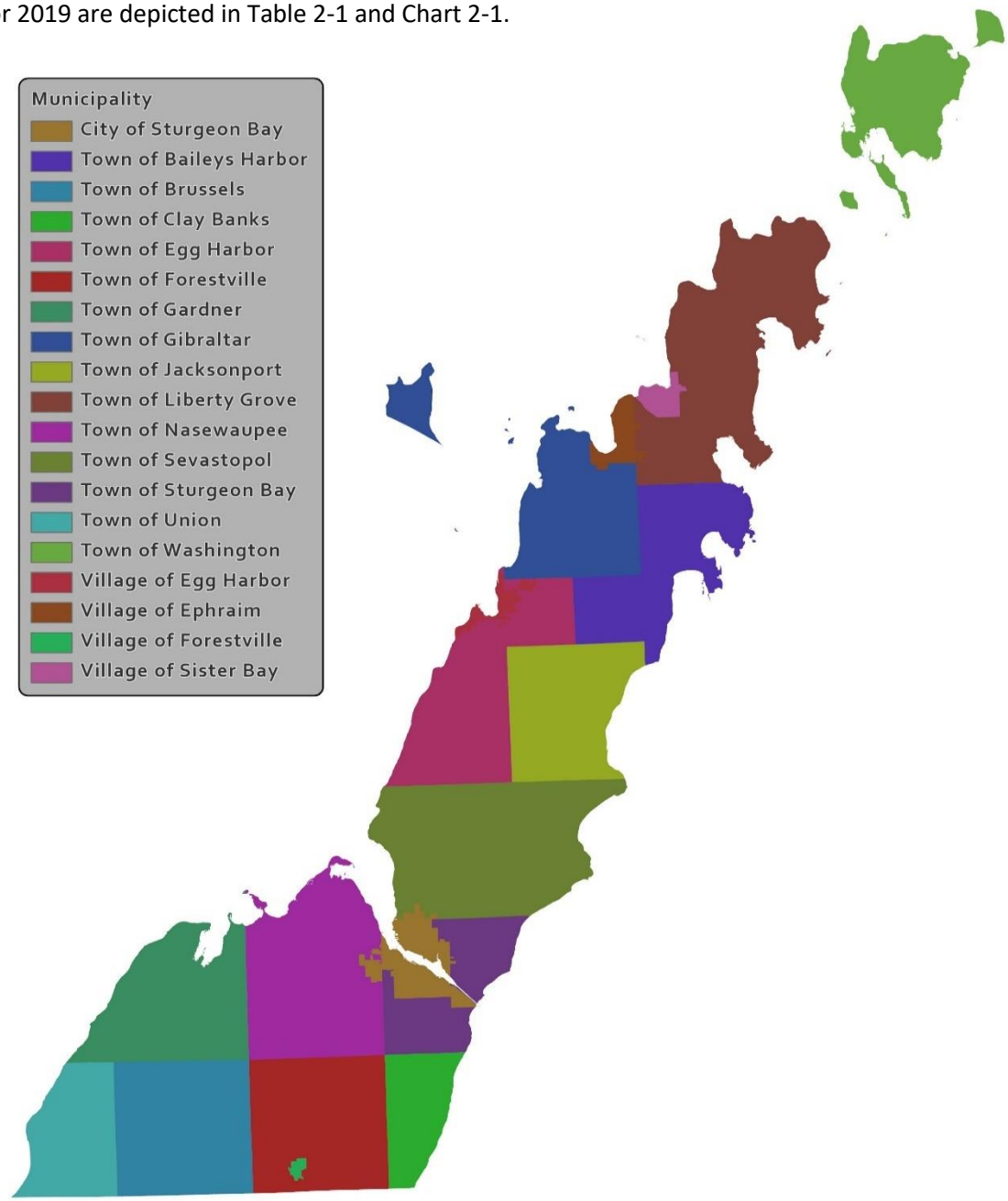


Figure 2-11. Door County Municipalities.

Population

Municipality	1990 Census	2000 Census	2010 Census	2019 Estimate	30-Year Trend
Baileys Harbor	780	1,003	1,022	1,069	+37%
Brussels	1,042	1,112	1,136	1,129	+8%
Clay Banks	379	410	382	392	+3%
Egg Harbor (Town)	1,019	1,194	1,342	1,404	+38%
Egg Harbor (Village)	183	250	201	207	+13%
Ephraim	261	353	288	288	+33%
Forestville (Town)	999	1,086	1,096	1,109	+11%
Forestville (Village)	470	429	430	427	-9%
Gardner	1,025	1,197	1,194	1,228	+20%
Gibraltar	939	1,063	1,021	1,057	+13%
Jacksonport	689	738	705	727	+6%
Liberty Grove	1,506	1,858	1,734	1,783	+18%
Nasewaupee	1,798	1,873	2,061	2,114	+18%
Sevastopol	2,552	2,667	2,628	2,743	+8%
Sister Bay	675	886	876	966	+43%
Sturgeon Bay (Town)	853	865	818	826	-3%
Sturgeon Bay (City)	9,176	9,437	9,144	9,467	+3%
Union	721	880	999	995	+38%
Washington	623	660	708	719	+15%
County Total	25,690	27,961	27,785	28,650	+12%
Source: State of Wisconsin, Demographic Services Center					

Table 2-1. Population Trends of Door County Municipalities.

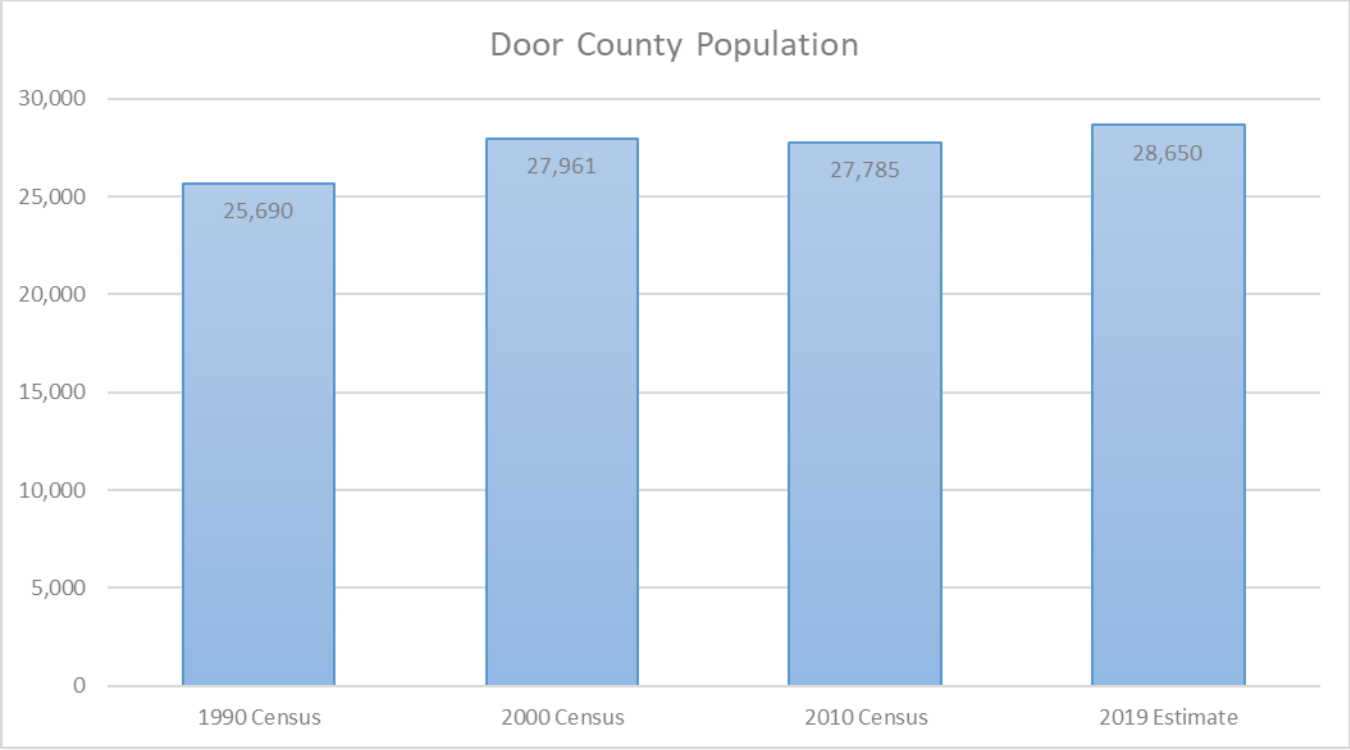
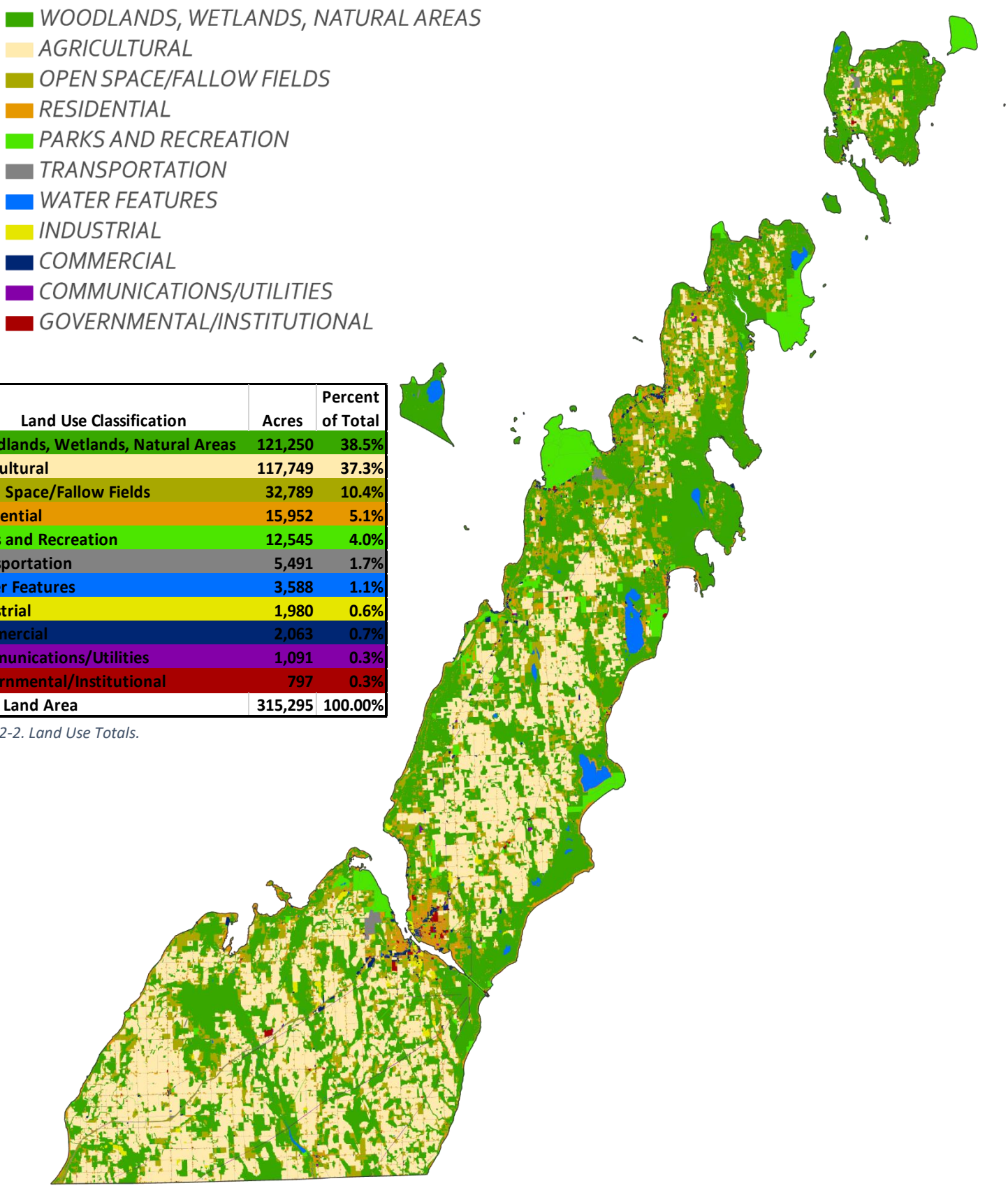


Chart 2-1. Trend of Total Population in Door County.

Land Use

In 2014, the Door County Planning and Zoning Department developed the Comprehensive and Farmland Preservation Plan 2035. As part of the resource report in that document, county land use was analyzed and assigned to categories based on the Standard Land Use Category Methodology, developed in 1974 and 1975 by a consortium of statewide groups, under the guidance of the State Planning Office. The following categories of land use in door county are not zoning designations, but indicators of existing development and land uses. A breakdown of acres of land comprising each category and their percentage of total county acres can be reviewed in Table 2-2 and Figure 2-12.

Residential - Use of land for non-transient-occupant dwelling units, both transportable and permanent structures. Uses are coded into subcategories of single-family, two-family, multi-family, mobile home, and group quarters, although are generalized and depicted as "residential" on the 2014 land use inventory maps.
Commercial - Use of land for retail sales or trade of goods and/or services, including lodging and commercial headquarter offices.
Industrial - Use of land for fabrication, wholesaling, or long-term storage of products and for extraction (mining) or transformation of materials.
Transportation - Use of land corridors for the movement of people or materials, including local, county, and state roads and parking facilities. Other transportation uses include air, marine, and nonmotorized-related transportation.
Communications/Utilities - Use of land for generation, processing, and/or transmission of electronic communication; water, electricity, petroleum, or other transmittable products; and the disposal, waste processing, and/or recycling of byproducts.
Governmental/Institutional - Use of land for public and private facilities for education, health, or assembly; cemeteries and related facilities; and all government facilities used for administration or safety except public utilities and areas of outdoor recreation.
Parks and Recreation - Use of land for out-of-doors sport and general recreation facilities, for camping or picnicking facilities, nature exhibits, and the preservation or protection of historical and other cultural amenities.
Open Space/Fallow Fields - Land in transition from agricultural use to natural area, open meadows, and large lawn areas.
Agricultural - Use of land for growth or husbandry of plants and animals and their products and for associated facilities such as sheds, silos, and other farm structures. This category also includes cropland, pasture areas, and silvicultural uses.
Water Features - Lakes, ponds, rivers, and flowages.
Woodlands, Wetlands, Natural Areas - Land primarily in a natural state, including wetlands and woodlands, and conservancy areas.



Land Use Classification	Acres	Percent of Total
Woodlands, Wetlands, Natural Areas	121,250	38.5%
Agricultural	117,749	37.3%
Open Space/Fallow Fields	32,789	10.4%
Residential	15,952	5.1%
Parks and Recreation	12,545	4.0%
Transportation	5,491	1.7%
Water Features	3,588	1.1%
Industrial	1,980	0.6%
Commercial	2,063	0.7%
Communications/Utilities	1,091	0.3%
Governmental/Institutional	797	0.3%
Total Land Area	315,295	100.00%

Table 2-2. Land Use Totals.

Figure 2-12. Generalized Land Use in Door County.

Agriculture

As evidenced in the land use data, agriculture is the second largest land use category in Door County, following Woodlands, Wetlands and Natural Areas. Agriculture has long been a part of Door County's history and includes a broad array of categories including animal husbandry, dairy farming, raising beef animals, cropping for forage, cropping for cash crops, orchards, silviculture and many other uses that generate production from the land.

Agriculture in Door County has changed over time, from the number of farms and cropped acres to the type of farms that exist throughout the county. Table 2-3 displays the total number of farms, the acreage of land in farms and the average acreage of individual farms from 1982 – 2017 in Door County. The agriculture census describes a farm as any place from which $1,000 or more of agricultural products were produced and sold in the Census year; this equates to many categories; including, but not exclusively, cash cropping, animal production, dairy cattle and milk production, beef cattle, cattle feedlots, vegetable farming, greenhouses, orchards, nurseries, floriculture, aquaculture, poultry and egg production, apiaries and horses and other equine. As portrayed in these statistics, the number of farms and the associated acreage is decreasing while the average size of farms is increasing.

	1982	**1987**	**1992**	**1997**	**2002**	**2007**	**2012**	**2017**
Number of Farms	1,032	911	760	861	877	854	803	626
Land in Farms (acres)	155,318	147,860	130,051	136,149	135,128	134,472	131,955	114,508
Average Size of Farm (acres)	151	162	171	158	154	157	164	183
Source: USDA Census of Agriculture								

Table 2-3. Door County Farm Census Statistics.

An important subset of the total number of farms in Door County is those with cattle and calves, representing nearly a third of total number of farms in 2017. The long-term trend over the last seventy-five years is a 90% decline in the number of farms with cattle and calves in Door County, from 1,822 farms in 1945 to 171 farms in 2017 (USDA Census of Agriculture data, see Chart 2-2). There was a 37% reduction in the number of cattle and calves in the county during that same time period.

In the last few decades the ratio of dairy cows and beef cows in Door County has also changed. The number of milk cows decreased 33% from 1982 – 2017, while the number of beef cows increased slightly in recent years (See Chart 2-3).

A similar trend is observed when comparing the percentage of dairy and beef farms as a percentage of all Door County farms. In 1982, dairy farms comprised 41% of all Door County farms, dropping to 10% in 2017. Beef farms have remained a steady percentage of total farms, ranging between 8% - 15% (See Chart 2-4). The observation of dairy farms becoming a smaller portion of the total number of farms is consistent with the increase of niche farms, such as produce markets, goats/sheep or even the rise of properties housing horses.

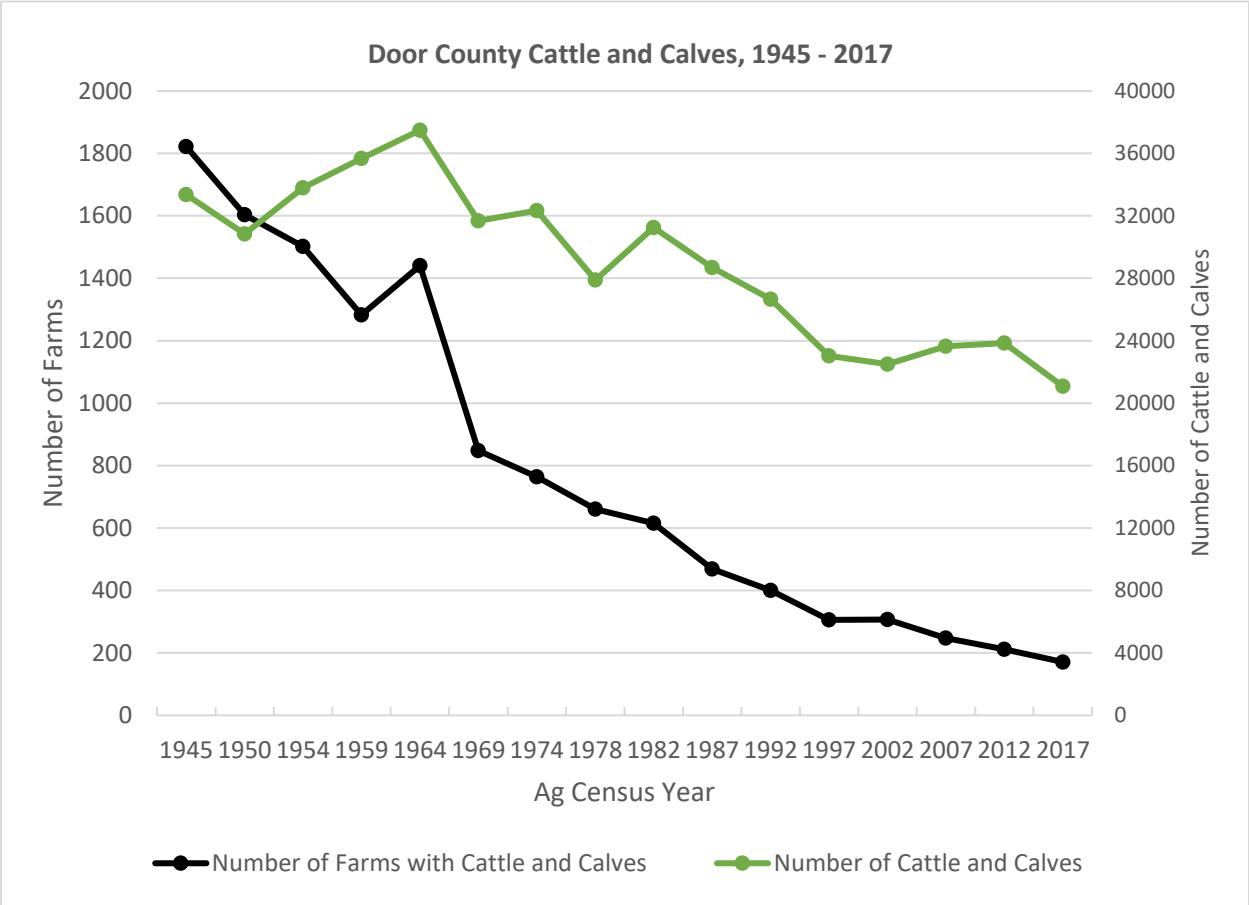


Chart 2-2. Trends of Farms with Cattle and Calves.

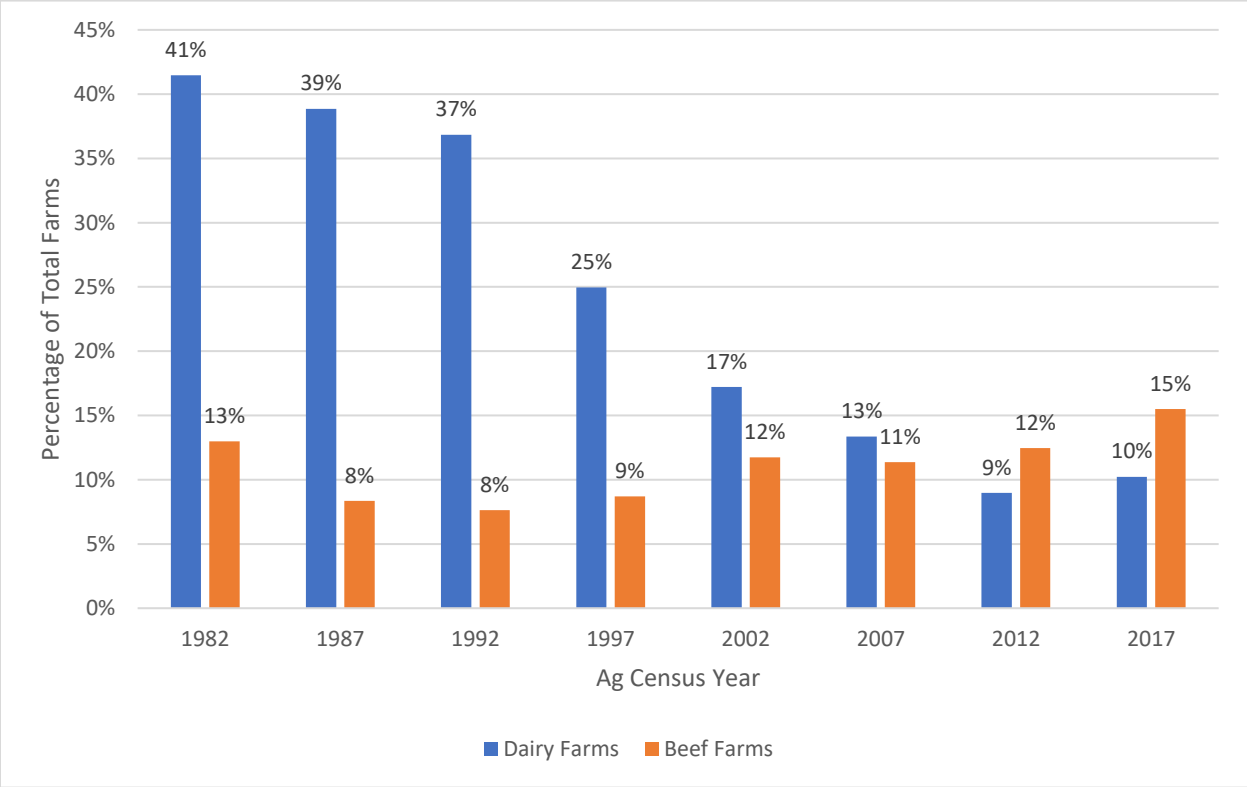


Chart 2-3. Percentages of Dairy Farms and Beef Farms.

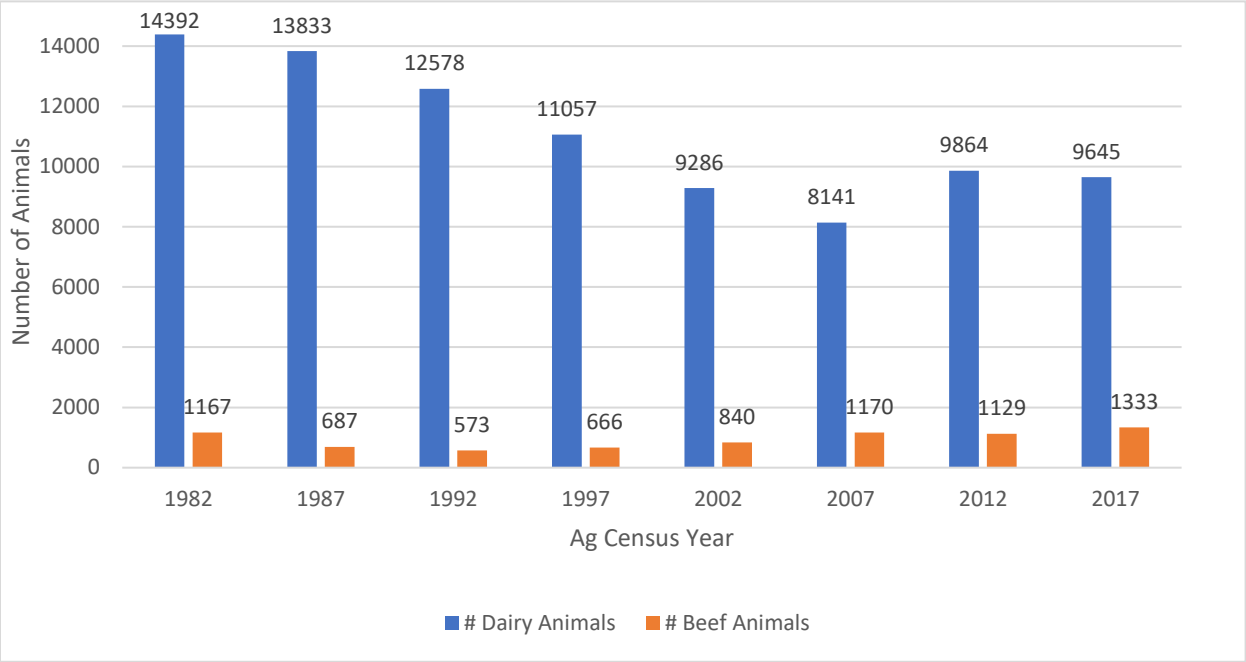


Chart 2-4. Number of Dairy Animals and Beef Animals.

A direct correlation that is observed with the change in the makeup of farms, is the type of crops planted on the landscape. A review of the same time period, 1982 – 2019, shows a steady increase in row crops such as corn and soybeans and a steady decrease of forage crops traditionally used to support dairy herds (See Chart 2-5).

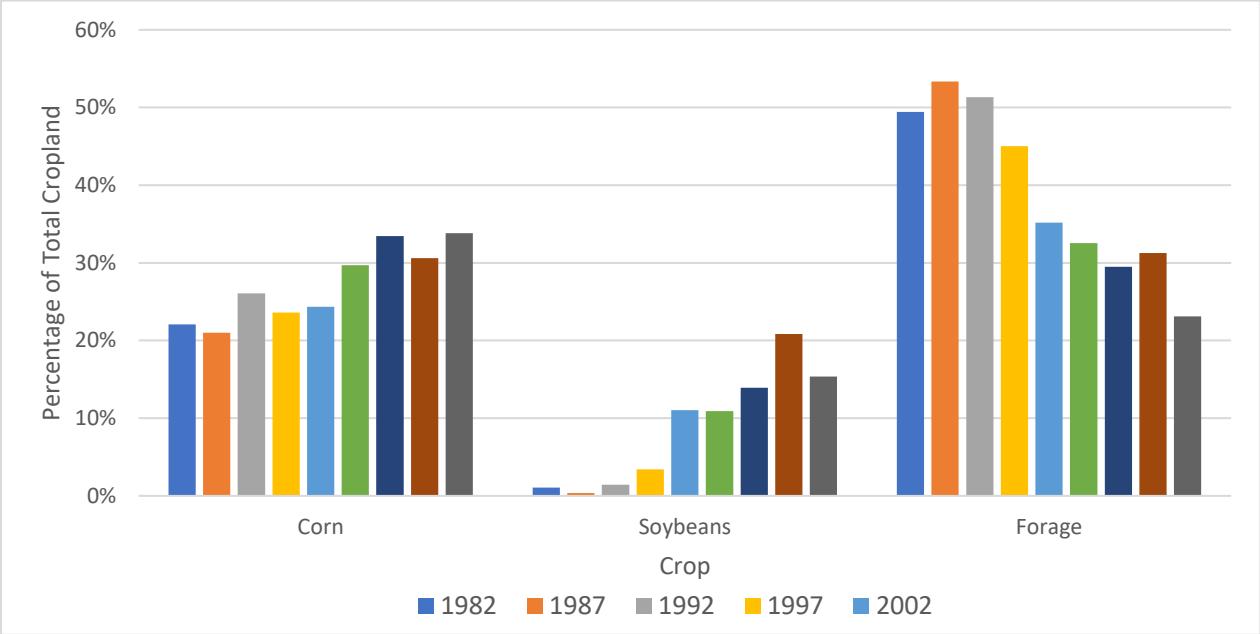


Chart 2-5. Door County Cropping Trends.

Another trend in agriculture in Northeast Wisconsin is the increased presence of Concentrated Animal Feeding Operations (CAFOs) with a Wisconsin Pollutant Discharge Elimination System (WPDES) permit. A CAFO permit is required when an animal feeding operation exceeds 1,000 animal units or the Wisconsin DNR designates a smaller animal feeding operation based on pollutant discharges to navigable waters or groundwater. WPDES CAFO permits require zero discharge of pollutants from the livestock operation site, and also regulate all owned and operated cropland. There are currently two CAFO operations in Door County with WPDES permits that are overseen by the Wisconsin DNR. Cropland acreage owned and/or operated by these two operations, as well as CAFOs located in other counties, comprises approximately 21,926 acres, 25% of all Door County cropland (See Figure 2-13). It should be noted that this total is a snapshot for the 2020 cropping season of land that is eligible for manure applications from CAFOs. Ownership and fields receiving manure might change annually among cropland identified in nutrient management plans submitted to the WDNR and the SWCD.

The total amount of harvested cropland in Door County comprises approximately 86,500 acres and is largely concentrated in the land base spanning south of Sturgeon Bay to approximately an imaginary line spanning from Baileys Harbor to Egg Harbor (See Figure 2-13).

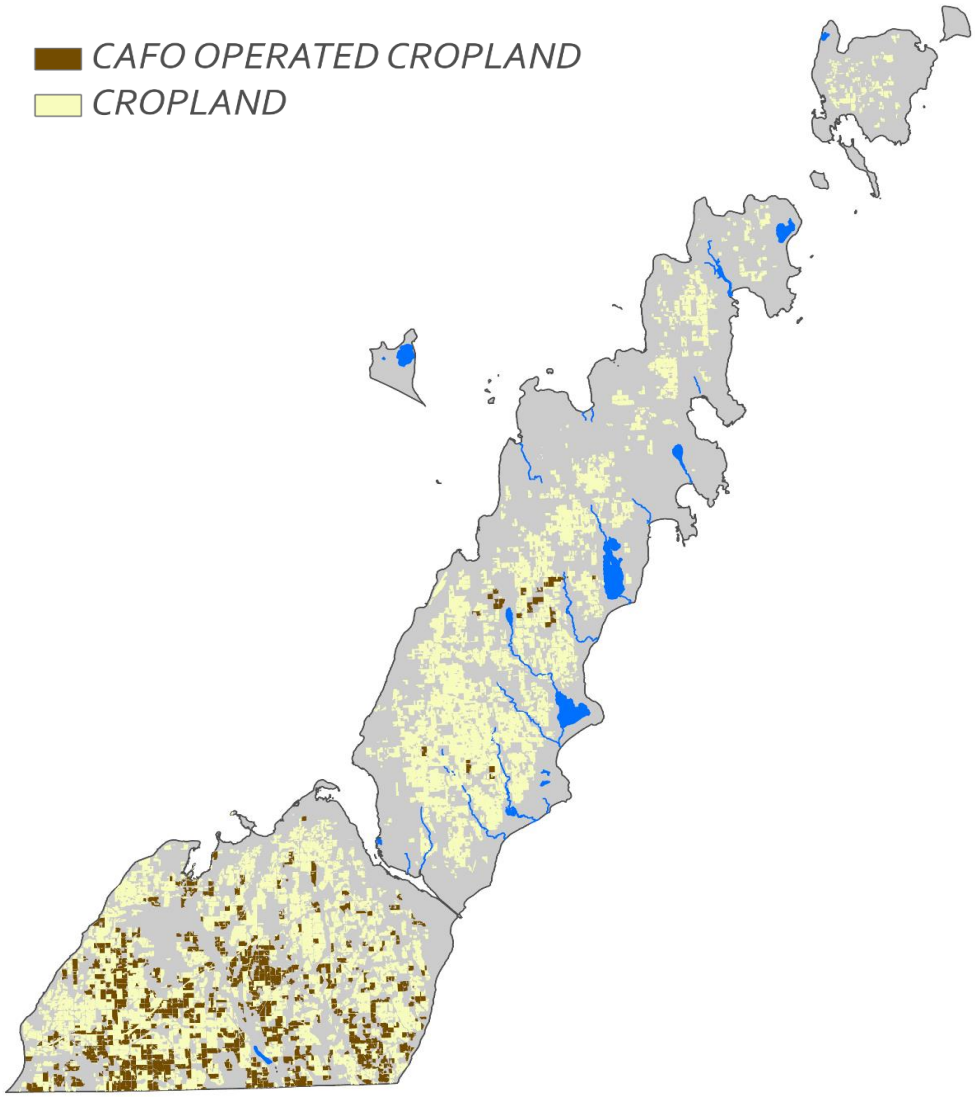


Figure 2-13. Door County Cropland and CAFO Presence.

Residential

Residential land use is the largest developed land use in Door County, comprising just over 5%. While a large portion of the population is concentrated in the City of Sturgeon Bay, villages and unincorporated town centers, much of Door County's residential population is rural. Several areas in the county have incorporated a sanitary district or wastewater treatment facility to address the waste generated in their geographic areas. These facilities are required to hold a Wisconsin Pollutant Discharge Elimination System (WPDES) issued by the Wisconsin DNR, and regulated effluent released to natural resources (See Table 2-4).

Facility Name	WPDES Number	Permit Expiration
Baileys Harbor Wastewater Treatment Facility	0035840	9/30/2021
Egg Harbor Wastewater Treatment Facility	0035661	9/30/2021
Ephraim Wastewater Treatment Facility	0061271	12/31/2021
Fish Creek SD1 Wastewater Treatment Facility	0035203	12/31/2021
Forestville Wastewater Treatment Facility	0028894	9/30/2019
Maplewood SD1	0036838	12/31/2022
Sevastopol SD1 Wastewater Treatment Facility	0026654	6/30/2021
Sister Bay Wastewater Treatment Facility	0022071	12/31/2021
Sturgeon Bay Utilities Wastewater Treatment Facility	0021113	12/31/2020
WI DNR Peninsula State Park Wastewater Treatment Facility	0029343	12/31/2021

Table 2-4. Wastewater Facilities with WPDES Permits.

Rural developed areas must rely on a Private Onsite Wastewater Treatment Systems (POWTS) to address wastewater defined as sewage. The Door County Sanitarian Department oversees the installation of new systems and tracks the maintenance of existing systems throughout the county. There are currently approximately 12,000 POWTS in Door County (See Figure 2-14). In a period from 1986 – 2015, the Sanitarian Department reviewed all existing systems in the county and determined a failure rate of approximately 26%. Failing systems are required to replace or repair within a timeframe determined by the Sanitarian Department.

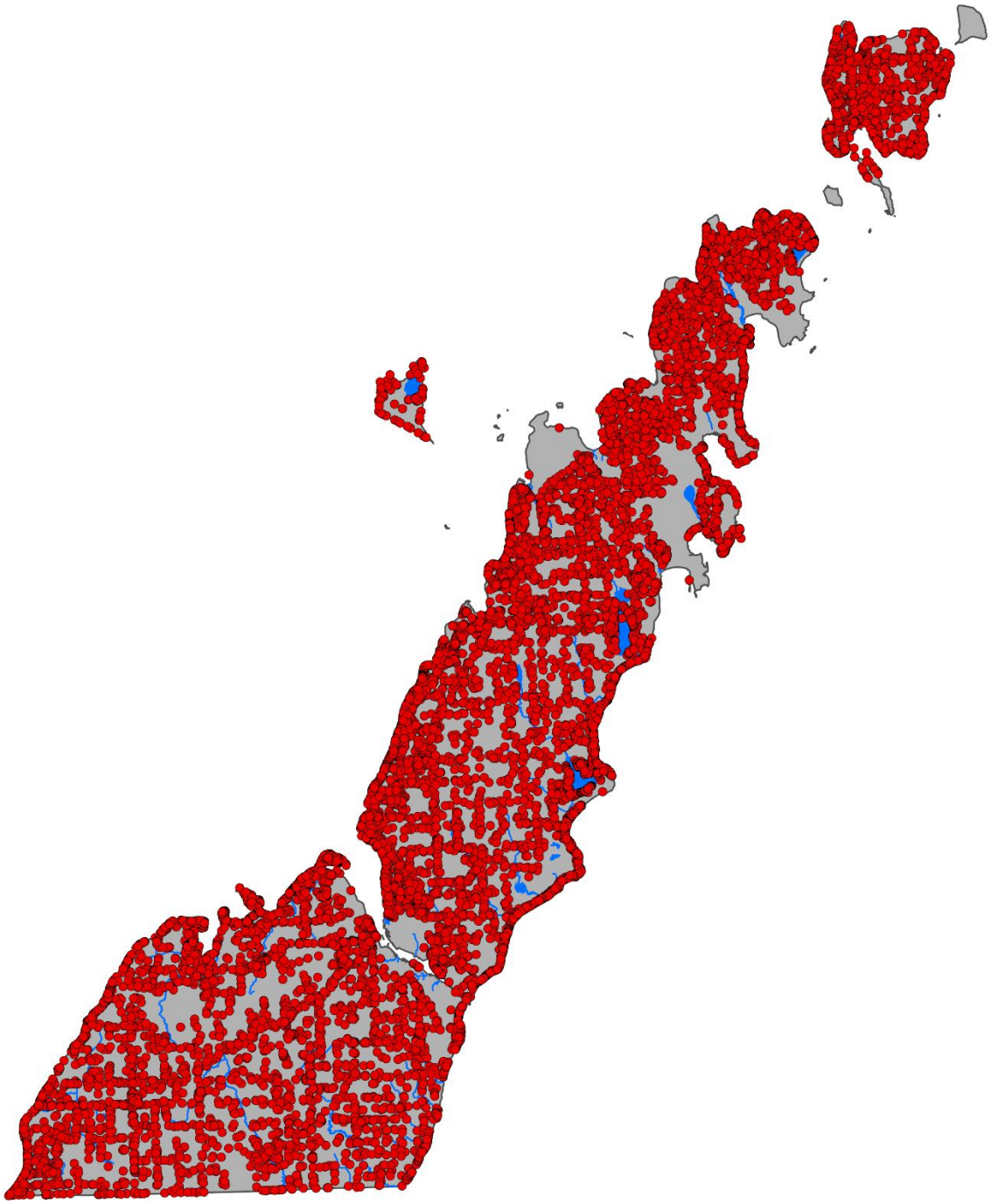


Figure 2-14. Active POWTS in Door County (2020).

Beaches

Approximately 4% of the county land use is made up of recreational uses, primarily consisting of local, county, and state parks. One of the largest portions of recreational areas that are of great concern from a natural resource perspective are the beaches located throughout the county. Concern lies in these regarding protection of the resource from surrounding land use, as well as protection of public health of those who recreate at the beaches.

Research conducted by the SWCD, Door County Public Health Department (DCPHD), and the University of Wisconsin-Oshkosh (UWO) from 2003-2007 revealed that storm water discharge and/or runoff increases E. coli counts in beach water during and after rain events. These early efforts have been built upon to create continued monitoring of approximately thirty beaches (See Figure 2-15) and an active alert system for swimming advisories at 235 colony forming units of bacteria per 100 milliliters and beach closures at levels above 1,000 colony forming units of bacteria per 100 milliliters. Monitoring during the 2019 season yielded 1,060 samples with 25 advisories posted and 8 closures.

Figure 2-15. Location of Major Door County Beaches.

There are currently thirteen beaches in Door County that have installed best management practices to address contamination concerns of the nearshore waters in those areas. Responsibility of the design, engineering, securing funding, installation and maintenance of these improvements has been combination of Door County, Wisconsin DNR and local municipalities. The beaches that have installed improvements to date are:

- Haines Park – Town of Nasewaupee
- Otumba Park – City of Sturgeon Bay
- Sunset Park – City of Sturgeon Bay
- Portage Park – Town of Sturgeon Bay
- Lakeside Park – Town of Jacksonport
- Murphy County Park –Town of Egg Harbor
- Egg Harbor – Village of Egg Harbor
- Anclam Park – Town of Baileys Harbor
- Ridges County Park – Town of Baileys Harbor
- Nicolet Beach – Peninsula State Park
- Sandy Bay Park – Town of Liberty Grove
- Hotz Park – Town of Liberty Grove
- Ellison Bay – Town of Liberty Grove

Non-Metallic Mine Reclamation

One of aspect of industrial land use that is monitored and regulated by SWCD activities is non-metallic mining of topsoil, clay, sand, gravel, and aggregate for concrete, asphalt, construction and road building as well as dimensional stone for shore land protection, landscaping, building and decorative use throughout the county. The operators of all non-metallic mining sites that operate on or after August 1, 2001 must apply for a reclamation permit from Door County to ensure that the site is returned to an environmentally acceptable state once mining ceases at the site. There are currently fifty permitted sites in Door County (See Figure 2-16) comprising approximately 1,684 acres approved for mining, of which 869 acres are considered active. There have been 6 sites that have completed reclamation efforts on 75 acres since the adoption of Chapter 36 of the Door County Code.

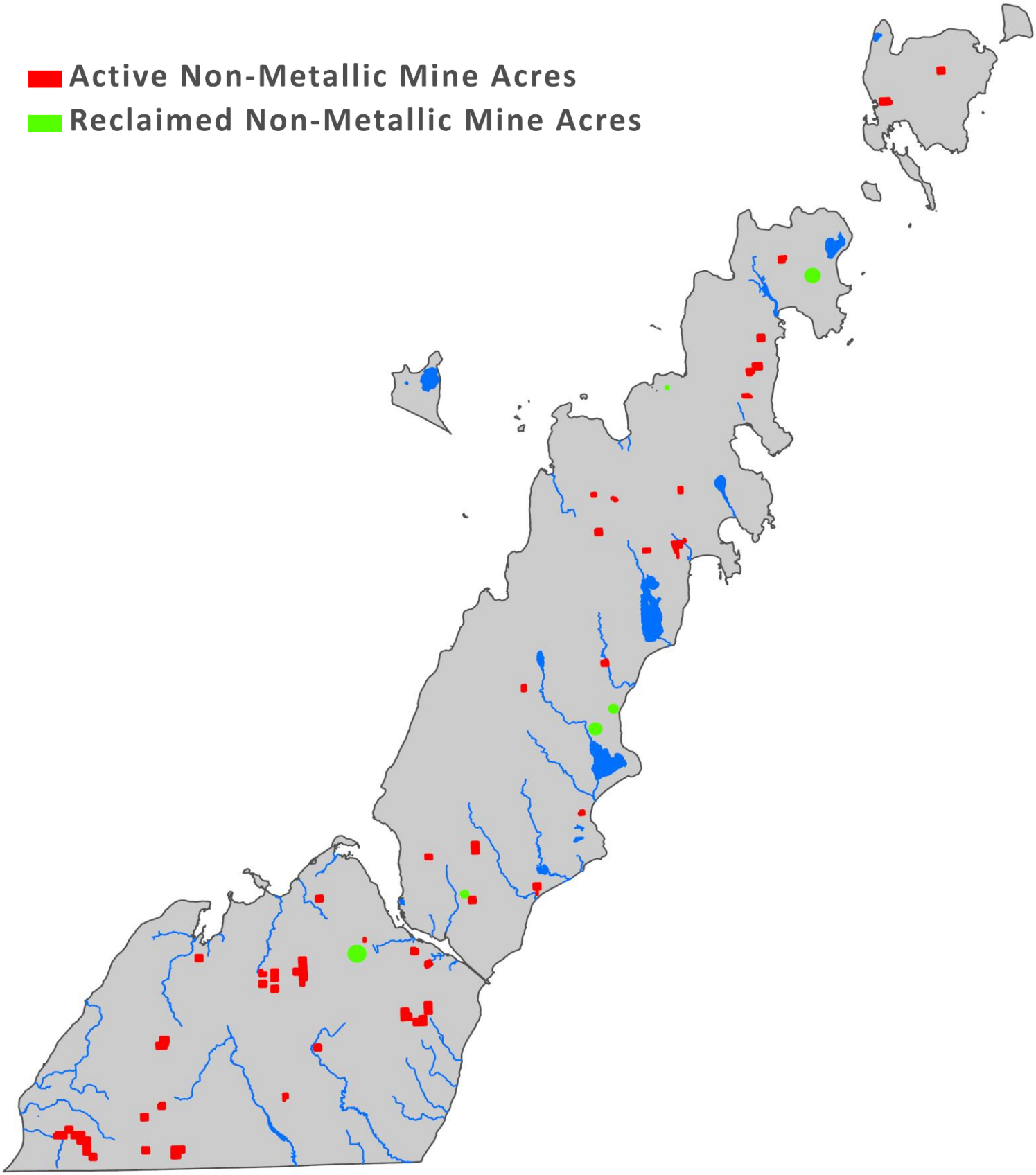


Figure 2-16. Location of Non-Metallic Mines in Door County.

Significant Habitat and Natural Areas

The following are brief descriptions of areas designated in a collective effort by individuals with the goal of preserving Door County's communities of plants and animals and their habitats. Please refer to the document A Guide to Significant Wildlife Habitat and Natural Areas or Door County, Wisconsin (2003) for a more in-depth analysis of each area. Figure 2-17 depicts the locations of these areas.

Ahnapee River Corridor

This corridor is approximately 5,200 acres and is comprised of a complex consisting of the Ahnapee River, Keyes Creek, Brussels Hill and Gardner Swamp. This corridor provides a continuous habitat passage from the Kewaunee County line north to the waters of Green Bay. Most of the surrounding land is woodlots or farmland. The greatest threats to this area are nonpoint source pollution from agriculture and development pressure along the Ahnapee River floodplain and the contiguous nature of the surrounding corridor.

Black Ash Swamp

The Black Ash Swamp is approximately 5,000 acres in Door and Kewaunee County with approximately 2,100 acres in Door County. This area is the largest contiguous block of forested land in southern Door County and represents an extremely significant ecological habitat. The land surrounding this area is primarily agriculture. Threats that exist for the Black Ash Swamp are poor logging practices threatening its ecological value, an increasing Gypsy Moth population and poor agricultural practices.

Delwiche-Sand Hill Pineries & Fabry Creek Complex

This significant area is a forest known for its large diameter native red pine and white pine trees. This, in conjunction with the 3.7-mile Fabry Creek, forms a 930-acre complex in southern Door County. On the western edge of the Niagara Escarpment, this complex forms a major north-south running wildlife corridor. The surrounding land use for this area is predominantly natural forest area with some agricultural cropland and pasture and some logged woodlots. Water samples have revealed a threat from agricultural practices leading to considerable contribution of nutrients, sediment and bacteria to Fabry Creek. This creek also lacks necessary buffers; as portions have been ditched and pastured and are in close proximity to feed lots.

Renard Swamp

Renard Swamp is a 1,570-acre wetland habitat near the bay of Green Bay in southern Door County. Three significant habitats comprise this complex; a southern hardwood swamp, mesic-wet beach ridges and Renard Creek. This area, with its mixed upland forest and creeks with their associated drainage ways, is a significant stand of intact southern hardwoods in relatively undisturbed condition. The surrounding land use is primarily woodlots with little cropland. Some sections of Renard Creek are primarily pasture and cropped land with little buffering. Threats that exist within this complex are poor logging practices, sedimentation and introduction of organic pollution to Renard Creek from agricultural practices and the spread of exotic plant species.

Stony Creek Wetlands Complex

The Stony Creek Wetlands Complex is situated in southeastern Door County and envelops approximately 6,370 acres. This complex is the largest creek system in southern Door County with Stony Creek and its associated wetlands and upland areas. Flooded hardwood swamps and perennial wetlands merge to form the main branch of Stony Creek that flows into large tracts of wetland and open emergent marshes and ultimately flows through a forested terrace with steep banks. This ecologically significant wetland system is thought to be the second most important wildlife heritage area in southern Door County. The land use throughout the Stony Creek Complex is a mix of second growth forest patches, active farmland and extensive wetlands. Threats to this area include encroachment from agriculture and residential development, contamination from nonpoint source pollution, susceptibility of groundwater due to shallow soils and fractured dolostone bedrock and the spread of aggressive exotic plant species.

Brussels Hill/Keyes Creek/Gardner Swamp Complex

This area features a prominent landmark in southern Door County in the Brussels Hill, an expression of the Upper Ordovician and Silurian bedrock that forms the Niagara Escarpment. Karst formations such as exposed creviced bedrock, sinkholes and pit caves are prominent in this area. The 7,215 acres comprised in this complex are largely contiguous tracts of forests, wetlands and dolostone karst features. The Gardner Swamp area is adjacent to the Brussels Hill and is comprised of 5 square miles of wetlands, sugar maple dominated forests, upland islands and lowland forests. 1.5 square miles of the swamp are designated as the Gardner Marsh State Wildlife Area. The Gardner Swamp area is dissected by Keyes Creek as it flows from the Brussels hill and outlets in the bay of Green Bay in Little Sturgeon Bay. Land use surrounding this area is primarily agriculture with some woodlots and residential areas. The threats to this area include pressures from increased residential and commercial development as a result of proximity to the cities of Sturgeon Bay and Green Bay, water quality degradation from substandard septic systems and agricultural sources and the decline of open spaces due to development.

Hungry Settlement Marsh

This area is a 375-acre association of bog, alder thicket and tamarack swamp located in south central Door County. This complex is mostly surrounded by upland forest and wetlands and appears to be an intact community well buffered and free of non-native species with little human disturbance. This marsh feeds part of Stony Creek via a small tributary. The land surrounding this complex is largely cropland and rural residential. Because of the bog nature of this area, there is little threat of development or road construction.

Southern Lake Michigan Shoreline

This region covers approximately 16 lineal miles along the Lake Michigan shoreline and comprises an area of approximately 16,200 square miles. This site is a diverse association of sand dunes and swale forests, open to forested wetlands, bedrock outcrops and upland mixed conifer hardwood forests. This extensive mix of forest, lakes, streams and shoreline is an ecologically significant holding with an impressive arrangement of biological diversity and natural landforms. Several natural areas have been designated within this area, most significantly Whitefish Dunes State Park and the Nature Conservancy's Shivering Sands project. The Shivering Sands area is a 4,000-acre complex of shoreline, sand ridge/swale forests, northern lowland conifer and conifer/hardwood forests, upland conifer forests, fens, marshes, bog-like wetlands, lakes and streams and dolostone cliff environments. Dunes Lake is the largest of

three lakes within the Shivering Sands area. This lake is 81 acres and is fed by Geisel Creek and several springs and outlets to Lake Michigan via Shivering Sands Creek. Two shallow embayment lakes; Schwartz (28 acres) and Arbter (16 acres) lie to the north of Dunes Lake. Lily Bay Creek is a 7-mile stream that runs through primarily agricultural lands and small woodlots before it discharges to Lake Michigan at Lily Bay. This area is comprised of low-forested swamps and upland sandy ridges. This corridor is an important ecological corridor connecting the lakeshore with interior portions of the peninsula. Kellner Fen is a 60-80-acre open wetland bounded by a sand ridge or dune and swale complex, a white cedar swamp and a conifer hardwood forest. The land surrounding this area is largely woodlots and other natural areas with some orchards, old fields and a landscape nursery. The Sturgeon Bay Ship Canal was constructed in the 1870s through an area of extensive ridges and swales. This area is a mix of dry sites containing pine, hemlock and birch and lowlands between the ridges with cedar, green ash and alder. Land use in this area is predominantly recreational in the heavily forested areas near the canal and more agriculture away from the shore. The Clay Banks area is a section of approximately 1.5 miles of relatively undeveloped shoreline. Mixed cedar and hardwoods cover this area as wetlands in lowland areas provide drainage to Lake Michigan via several small creeks. Land cover is mostly wooded along the shoreline with a few residential homes and some areas of recreational land. Inland areas consist of agricultural land. The threats to the Southern Lake Michigan Shoreline are largely pressures from development as well as invasion of exotic species and poor logging practices. Poor agricultural practices are a potential threat to wetland and surface water areas.

Sawyer Harbor/Lost Creek & Larson Creek Watersheds Complex

This complex is located in west central Door County and is approximately 4,590 acres. Together with the Stony Creek Wetlands Complex, this site provides a contiguous habitat corridor from the bay of Green Bay to Lake Michigan. This habitat corridor is essential for the protection of surface and groundwater quality. The large lowland cedar and ash swamps provide an important terrestrial habitat while the surface waters discharging to the bay of Green Bay at Sawyer Harbor and Sand Bay are important for that important fish spawning area of Green Bay. Sawyer Harbor is heavily influenced by recreational activity due to its sheltered nature and its close proximity to Potawatomi State Park. The surrounding land use for Sawyer Harbor is largely recreational with some residential areas. Lost Creek is a 2.5-mile stream with a 2.2 square mile watershed that is comprised mostly of cropland. A golf course and the county landfill are in close proximity to this stream. Larson Creek is a 4-mile intermittent stream that originates in Cunningham Swamp and flows through predominant cropland and pasture with some residential areas before discharging to the bay of Green Bay at Sand Bay. Larson Creek is part of an 8.9 square mile watershed. Threats to this complex are agricultural practices, residential growth from the City of Sturgeon Bay and sedimentation to wetlands. Sinkholes and other solution features in this complex pose a threat to water quality due to nonpoint sources of pollution.

West Branch Whitefish Bay Creek Corridor

The West Branch Whitefish Bay Creek Corridor is a 2,150-acre complex of upland forests and lowland swamps. The West Branch of Whitefish Bay Creek is 4.8 miles in length and originates from an area of natural springs and a small ephemeral pond and flows south to Whitefish Dunes State Park. This corridor is ecologically significant due to the contiguous nature of the riparian habitat as well as several intact forest types and wetlands in the headwaters and throughout the entire site. The surrounding land use for this corridor is predominantly cropland with some woodland and plantation forests. The primary

threats to this habitat are poor agricultural practices and contamination to the stream as well as residential development.

Bay Shore Bluff Lands

This area is located along the western shore of Door County on the bay of Green Bay and comprises approximately 3,250 acres. The prominent feature of this site is the Niagara Escarpment resulting in many karst features such as caves and sinkholes throughout the area. The Door County Land Trust owns a 124-acre tract of land along the bluffs that has been designated as a State Natural Area. This area lends itself to a large diversity of habitat types consisting of hardwood swamps, open cliff faces and dry mesic forests. The tracts at the base of the escarpment hold many seeps and areas on the north end consist of springs and ponds. These habitats also support a large number of rare or uncommon species. Land use surrounding this area is largely cropland, woodlots and orchards with some residential areas and recreational land. The Spring Lane Hardwood Swamp is a15- acre spring-fed swamp that is drained by several sinkholes. This area is predominantly wooded with fewer instances of residential, cropland and orchards. Threats to this area are predominantly related to development in the form of loss of forest cover, destruction of bedrock, filling of wetlands and karst features and increased impervious surfaces. Other threats include poor logging practices, invasive species, Gypsy Moth invasion and increased deer herbivory as subdivisions increase.

Logan Creek/Lost Lake Corridor

This corridor comprises approximately 4,950 acres that includes Logan Creek, a 5.4-mile Outstanding Water Resource and Lost Lake, a spring-fed, shallow, marl-bottomed seepage lake. The significance of this site is the quality of Lost Lake and the presence of several species that hold state significance. This corridor is made up of a diverse wetland complex north of Lost Lake and an extensive conifer forest along Logan Creek. The surrounding land use for this area is cropland, stump pasture, pasture and orchards. Threats to this corridor include runoff form agricultural practices and grazing of livestock near the creek as well as future residential expansion.

Bay to Lake Wildlife Corridor

This large corridor encompasses approximately 15,200 acres in north central Door County and covers an area from Peninsula State Park on the west shore and extends in two branches to the eastern shore. The first branch of this corridor includes the Fish Creek Watershed, including the 1.5-mile Fish Creek and forested wetlands with the prominent feature being the Niagara Escarpment; Thorp Pond, a 6.4-acre lake with no defined inlet or outlet and its associate wetlands that connect to the Fish Creek watershed; and Hibbards Creek, a 7.4-mile stream originating southeast of Thorp Pond as a series of springs and wetlands and outlets to Lake Michigan north of Jacksonport. Hibbards Creek drains a 21.9 square mile and its stream corridor consists of wetlands, conifer swamps, dry-mesic woodlands and ridge-swale complexes. Land use in this branch of the corridor ranges from woodlots, idle farmland, orchards and single-family residences on the west end to primarily agriculture and residential on the east shore.
The second branch of the Bay to Lake Wildlife Corridor consists of the Piel Creek-Kangaroo Lake system. This system lies in a shallow trough of the Niagara Escarpment that extends from Fish Creek to Lake Michigan. Piel Creek is a 2.5-mile stream originating in a large wetland complex and flows to the north end of Kangaroo Lake. Numerous springs discharge to the creek and several are present where it discharges to the lake. Kangaroo Lake is an embayment lake created by the sand deposition and dune

formation following recession of post-glacial lakes and regional post-glacial rebound. The lake is dissected by a causeway with three culverts connecting the north end with the south. Hines Creek, a one-mile stream draining through a ridge-swale complex, provides the outlet for Kangaroo Lake and connects it to Lake Michigan. Meridian Park is situated at the south end of Kangaroo Lake. The surrounding land use for this branch of the Bay to Lake Wildlife Corridor is largely woodlands in the Piel Creek corridor with extensive development along the shores of Kangaroo Lake. The north end of the lake remains undeveloped with much of the property owned by The Nature Conservancy and the Door County Land Trust. Threats to this corridor include poor agricultural practices in the corridor of Hibbards Creek with nonpoint runoff and pasturing near the stream being a concern, development near Thorp Pond and Kangaroo Lake, residential development and the associated road pressures in the Piel Creek corridor, poor logging practices, recreational vehicle use and invasion of exotic species.

Ephraim/Baileys Harbor Forest Corridor & North Bay Lowlands

This large complex comprises 11,100 acres in northeastern Door County and is a complex of natural area projects and preserves held by The University of Wisconsin-Green Bay, the Ridges Sanctuary, The Nature Conservancy, The Door County Land Trust and the Wisconsin Department of Natural Resources. This area is made up of cedar swamps, glacial landforms and a forest corridor with few roads. Ephraim Swamp is a lowland swamp that extends from the west shore of Door County at Eagle Harbor to the southeast towards Baileys Harbor. Hidden Springs Creek, an Exceptional Resource Water, originates in Ephraim Swamp and outlets to the bay of Green Bay. The Baileys Harbor Forest Corridor continues from the perimeter of Ephraim Swamp to the Lake Michigan shoreline. This area consists largely of lowland swamp species such as black spruce, tamarack and white cedar. Two creeks flow into this swamp; Hidden Brook Creek, which follows a ridge/swale system and an unnamed stream that flows into Mud Lake, a 155-acre drainage lake that empties into Lake Michigan at Moonlight Bay via Reibolts Creek. The North Bay Lowlands/Three Springs area comprises 4,700 acres and contains 8,500 feet of shoreline along North Bay in Lake Michigan, a very significant stretch of pristine shoreline in the county. This area contains several rare species including the federally endangered Hines emerald dragonfly. Land use in this corridor ranges from cropland, recreational public land and natural areas surrounding Ephraim Swamp to predominantly woodlots in the Baileys Harbor Forest Corridor and the Lake Michigan shoreline. Threats that exist to this large corridor include fragmentation of habitat from residential development, disruption of surface water and groundwater flow regimes, recreational vehicle use, poor logging practices and nonpoint sources of pollution from sewage, road maintenance and poor agricultural practices.

Mink River/Rowley's Bay System

This area comprises approximately 2,900 acres and contains the Mink River Estuary, an Outstanding Resource Water and State Natural Area, with much of the surrounding property owned by The Nature Conservancy. The upland segments of this system are scattered with abandoned cropland and orchards mixed with some scattered active agriculture and some low-density residential areas while the lower segments are largely undisturbed wetlands and marshes with sand ridges and swales near the Lake Michigan shoreline. Threats to this ecologically significant system include contamination to groundwater that supplies the system through failing septic systems or increased nutrient loading, invasive species and pressures resulting from development.

Europe Lake Forest Area

This system is made up of 1,700 acres of northern mesic forest and features Europe Lake, Wisconsin Bay and Table Bluff. Europe Lake is a 273-acre seepage lake separated from Lake Michigan by a dolostone ledge and sand dune topography. The southern edge of the forest area and the lake is bordered by Newport State Park, this with a portion designated as Europe Bay Woods State Natural Area creates a significant ecological habitat of forest, wetland and shoreline habitat. The land use surrounding this area is primarily natural areas with some idle cropland, orchards and residential lots. The predominant threat to this area is pressures from development including fragmentation.

Grand Traverse Islands

This system is made up of the collection of all major islands in the surrounding waters of Door County. Most of these 19 islands are underlain by Silurian dolostone which outcrops on the shoreline and occasionally in the interior. Washington Island contains areas designated as State Natural Areas: Jackson Harbor Ridges, Big Marsh, Little Marsh and Coffee Swamp as well as 850 acres of wetlands. Rock Island is a state park with a large portion, Rock Island Woods, designated as a State Natural Area. Collectively, these islands have been inventoried and found to contain 64 rare species of animals, invertebrates and plants among 18 natural community types. Threats that exist for these islands include forest management practices, deer herbivory, invasive species, domination by colonial water birds on some smaller islands and human pressures from development and recreation on some of the larger islands.

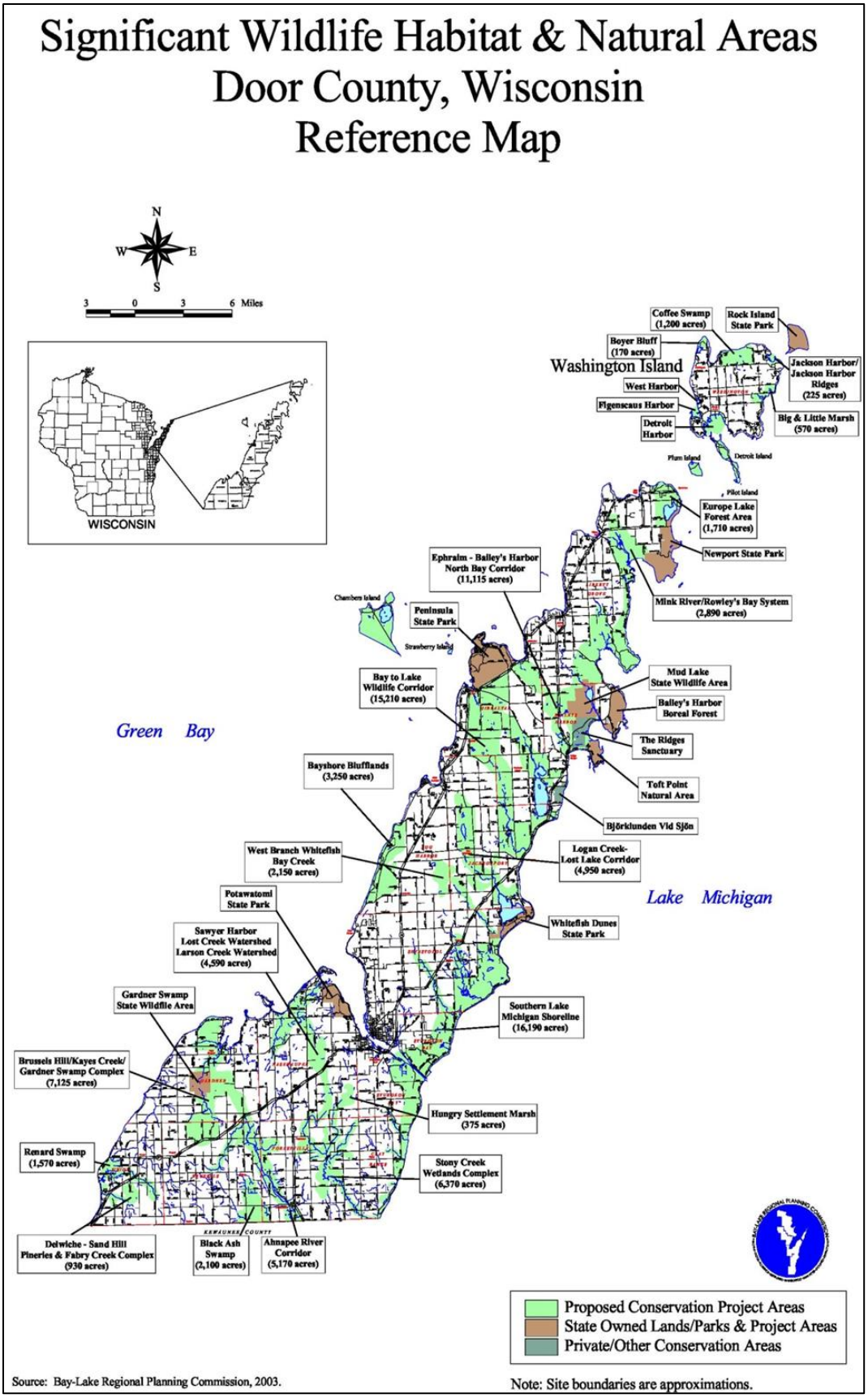


Figure 2-17. Significant Wildlife Habitat and Natural Areas.

Wisconsin Land Legacy Places

These areas have been identified by the Department of Natural Resources (DNR) as places critical to meet Wisconsin's conservation and outdoor recreation needs over the next 50 years. Over a three-year period, from 1999 to 2002, the DNR hosted numerous public and staff meetings to gather information, local knowledge and opinions about Wisconsin's land and water. The following places are those identified as meeting those criteria in Door County. Please refer to the document Wisconsin Land Legacy Report for a more in-depth analysis of each area and a more detailed discussion of the specific resource concerns.

Chambers Island

The forests on the island are excellent, extensive, second-growth mixed beech, hemlock, sugar maple, and red oak. Deer have been absent for approximately ten years, allowing for a flush of tree regeneration. The natural communities and plant species of this island would benefit from continued cooperation between the WDNR and the Chambers Island Landowners Association (CILA).

Colonial Waterbird Nesting Islands

Scattered in both Green Bay and along the Lake Michigan coast are many small islands that are utilized primarily by colonial waterbirds for nesting. Examples include Hat, Little Strawberry, Jack, Adventure, Spider, Gravel, Pilot, Hog, and Fish Islands. Some are currently owned by the US Coast Guard, but several are privately held.

Door Peninsula Hardwood Swamps

Scattered along the southern Door Peninsula are several large wetlands dominated by black ash and red maple. Examples include: Duvall, Gardner, Cunningham, May, Stony Creek, Maplewood, Black Ash, and Lipsk Swamps. These wetlands provide high quality, consistent flow to creeks and streams. Often found within agricultural settings, these wetlands also provide habitat for a variety of wildlife. Although these sites have limited recreation value (given their wet nature), protecting some lands surrounding these wetlands could provide a variety of trail opportunities.

Eagle Harbor to Toft Point Corridor

Running across Door County is a lowland corridor of predominantly wooded swamps. Ephraim Swamp and Baileys Harbor Swamp both contain extensive forested wetlands of
maple, ash, and cedar and act as an ecological corridor across the Door Peninsula. The federally-Endangered Hine's Emerald dragonfly occurs in the corridor. Given the wet nature of this corridor, recreation opportunities would be limited.

Grand Traverse Islands

The Grand Traverse Islands extend off the north end of the Door Peninsula and include Plum, Detroit, Washington, and Rock Islands, along with some other small outcroppings. With the exception of Washington Island, they are predominantly forested. The islands are generally very rocky and are subject to severe weather conditions. The islands are frequented by water birds during migration. Many rare natural communities occur on the islands including Great Lakes alkaline rock shore. Some islands support large deer populations. The largest of Lake Michigan's islands, Washington Island supports some agriculture, many fallow farm fields, forests and wetlands. On the island's northeast side, Jackson

Harbor Ridges State Natural Area contains an excellent assemblage of rare and uncommon vascular plants. The beach undulates with numerous areas of dry to wet sand and interdunal swales. These swales contain an unusual community that prefers wet calcareous soils. Coffee Swamp State Natural Area, located about ½ mile inland from the north coast, contains a high-quality fen with boreal components. Expanding protection efforts north to include part of the shoreline of Lake Michigan would increase the protection of this ecologically important site. Big Marsh is a complex of boreal rich fen, relatively high quality northern wet-mesic forest, and an unusual emergent aquatic community with large expanses of seasonally dry marl and dolostone gravel "pavement." Although much of the island's shoreline is developed with seasonal and permanent houses, some good quality sand dunes remain and are worthy of protection.

Kangaroo Lake

Kangaroo Lake was formed by a combination of dune deposition, receding lake levels, and regional post-glacial land rebound. The lake is shallow with a marl bottom and calcium rich water. Set within a matrix of agricultural, residential, and forest land, it harbors high quality natural communities and rare species at both its north and south ends. At the north end are plant species characteristic of fens, sedge meadows, marshes, and shrub-carrs. Plants that can tolerate high levels of calcium in the soil, such as shrubby cinquefoil, hoary and bog willow, twig-rush and wire-leaved sedges, are present. On the south end of Kangaroo Lake is a complex of old beach ridges and dunes, now wooded with hemlock, sugar maple, and yellow birch. Also present are beech, red maple, white cedar and a few super-canopy white pines. This mesic forest type —on a stabilized lake sand dune—is quite rare in Wisconsin.

Mink River Estuary-Newport State Park-Europe Lake

Considered by many to be the most pristine freshwater estuary in the country, the Mink River Estuary provides critical spawning habitat for Lake Michigan fish and is a very important migration site for many birds. Estuaries, areas where river water mixes with oceans or lakes large enough to experience tides, or "seiches," are highly productive ecosystems, yet very fragile and susceptible to disturbance. The Mink River originates in a series of hardwater springs and flows through lowland forest dominated by white cedar. After a short distance, it enters a large marsh and eventually empties into Rowley's Bay. The marsh, which includes both shallow and deep-water sections, is a mix of shrubs (willow, dogwood, and alder), sedges, and bulrushes. Not surprisingly, the changing lake levels play an important role in perpetuating the diverse and changing set of habitats —at times exposing mud flats and at other times flooding large areas of vegetation. More than 200 bird species typically pass through the estuary each year, including a wide variety of ducks, herons, gulls, bitterns, cormorants, and loons. Fishing is popular in the bay and throughout the estuary. As the temperature between the river and Lake Michigan differs throughout the year, steelhead, brown trout, bass, northern pike, and other fish make their way up the river and its tributaries. The many mammals, reptiles, amphibians, and invertebrates that make their home in the estuary take advantage of the changing conditions and nutrient-rich environment. Europe Lake was a bay of Lake Michigan at one time, but the action of waves and currents has formed a bar of gravel and sand across the mouth of the embayment, forming the lake. There is a forest of virgin red and white pine and old-growth beech-sugar maple mesic forest between Europe Lake and Lake Michigan. Swampy pockets of boreal forest occur east of Europe Lake, and this habitat supports many rare plants. A small portion of the site is now within Newport Beach State Park.

Niagara Escarpment

The Niagara Escarpment is a long dolostone ridge that in Wisconsin runs from the tip of Door County south along the east side of Lake Winnebago and then finally recedes underground in Dodge County. The Escarpment continues eastward through Michigan's Upper Peninsula, into Canada, and then resurfaces to form Niagara Falls. This linear, high ridge provides many of the state's most spectacular views and is the logical means to link many existing protected areas on and near the Escarpment. Ellison Bluff, Red Banks Alvar, Carlsville Bluff, High Cliff State Park, and Horicon Ledge are some of the best-known places along the Escarpment. Given its length and proximity to the Fox River Valley cities, it is one of the most frequently visited features in the state and there is considerable interest in protecting additional areas to meet conservation and recreation needs. Given the numerous rock outcrops, cliffs, and talus slopes, the Escarpment also harbors some very unusual habitats that in turn support many uncommon species. Pockets of ancient cedar trees, cold springs, and areas where cool air gently flows out of the rocky hillsides are scattered along the Escarpment. These fragile microhabitats support delicate ferns, flowers, and maybe most notably, a collection of extraordinarily rare snails. Areas along the Escarpment, particularly in Door County, have relatively thin soil deposits as a result of glacial scouring and little post-glacial deposition. These soil conditions, combined with the fractured nature of the dolostone, can lead to groundwater contamination problems.

North Bay to Bailey's Harbor

This shoreline, one of the highest quality, most ecologically valuable stretches of shoreline in the Midwest, features boreal forest, ridge-swale complexes, northern wet-mesic forest, sedge meadow, and cobble and bedrock beach. Along Bailey's Harbor lies the Ridges Sanctuary, which harbors a series of Lake Michigan beach ridges forested with black spruce, white spruce, balsam fir, and white pine, with wet swales between the ridges. Swamp conifers occupy some of the swales; others are filled with marsh and bog flora. Portions of the ridges are open, wet and calcareous and support an outstanding assemblage of rare and endangered plants. This site has the largest known population anywhere of the federally-Endangered Hine's emerald dragonfly. The peninsula between Bailey's Harbor and Moonlight Bay contains several plant communities within a relatively short distance. The vegetation of the eastern shoreline, influenced by the cooling effects of Lake Michigan, consists of a narrow strip of relict boreal forest dominated by balsam fir and white spruce. Along the point is a fine example of the rare cobble beach natural community. The remainder of this peninsula is a mesic forest of sugar maple, yellow birch, hemlock, and scattered white pine. To the north, along Moonlight Bay, is an extensive sedge meadow that grades into shrub-carr and wet-mesic forest. The wet-mesic forest is dominated by white cedar with occasional paper birch and black ash. The site, along with the adjacent Ridges Sanctuary, contains many area- sensitive bird species including seventeen species of nesting warblers. Inland from Moonlight Bay lies Mud Lake, a shallow, hard-water drainage lake surrounded by an extensive shrub and timber swamp. The bottom is predominantly marl, although dolostone bedrock is found in some areas. There are many old snags present. Water levels fluctuate with seasonal precipitation. Aquatic plants are most diverse in the outlet stream and include burreed, coontail, pondweeds and wild rice. In the lake are softstem bulrush, yellow water lily, giant reed, and cattail. The plants under the old snags are sweet gale, dogwood, and willow. Reibolts Creek, which runs from Mud Lake to Lake Michigan, has been stocked with trout and supports a trout spawning run. Waterfowl use is occasionally heavy. Migratory shorebirds and waterfowl are attracted to this stretch of Lake Michigan

shoreline, and this site is one of the few known nesting sites in Wisconsin for the common goldeneye. Inland communities also support a wide variety of Neotropical birds, including species associated with northern boreal forests and wetland communities. Baileys Harbor, Moonlight Bay, and North Bay also provide nearly the entire suitable spawning habitat for the Lake Michigan whitefish population.

Peninsula State Park

Peninsula State Park, established in 1909, is a 3,770-acre state treasure on Wisconsin's Door County peninsula. Nearly seven miles of Lake Michigan's Green Bay shoreline wrap around a landscape of forests, meadows and wetlands. Rocky bluffs ascend over 150 feet above the lake. Considered by many to be Wisconsin's most complete park, Peninsula is also the most popular camping destination in the state. Visitors can hike, bike, boat, golf, and swim during spring, summer and fall. Winter offers cross country skiing, snowshoeing, sledding, and snowmobiling. Camping, nature programs, and sightseeing are offered year-round.

Peninsula State Park to Jacksonport Corridor

This north-south corridor across Door County, follows a series of upland forests and grasslands from the park to the headwaters of Hibbard Creek and then follows the creek valley down to Jacksonport. This predominantly upland corridor acts as an ecological connection across the Door Peninsula and could provide various trail opportunities. This corridor is a complement to the nearby Eagle Harbor-Toft Point linkage.

Red Hill Woods-Brussels Grassland

Brussels Township contains a mosaic of hay and small grain farm fields interspersed with open grasslands. This combination of agricultural fields and grasslands supports many grassland birds including upland sandpipers. North of this large open area lies Red Hill, which contains the largest remaining maple-beech forest in this ecological landscape. Together, this area forms a valuable corridor between Gardner and Black Ash Swamps.

Shivering Sands

Running from Cave Point County Park to Rocky Point south of the Sturgeon Bay Canal, the shore and near shore areas here support high quality dunes, wetlands and forests. Whitefish Dunes State Park contains both active dunes dominated by shifting sands and herbaceous plants as well as stabilized dunes supporting American beech, hemlock and sugar maple. Further south is a large white cedar swamp surrounding three undeveloped lakes. Here orchids flower amidst mosses and downed trees. The open fen communities found on the lake edges harbor such rare species as tussock bulrush and coast sedge. Dwarf lake iris blooms in the dolostone-based upland conifer forest east of the central cedar swamp. Near the ship canal are more large wetland complexes, including some high-quality cedar swamp and northern fens. The entire area supports an impressive suite of mammals including fisher, otter, black bear, snowshoe hare, porcupine, and mink. The site is also home to many breeding birds. All three accipiters known to occur in Wisconsin (Cooper's hawk, goshawk, and sharp-shinned hawk) have been found here during their breeding season. Black terns as well as sandhill cranes are regular breeders on Dune's Lake, and the ridge and swale forest is home to large numbers of Canada warblers and northern water thrushes, among others. A total of 110 species of birds have been recorded on breeding bird surveys from the area.

Invasive Species

The Wisconsin State statute defines an invasive species as a “nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health”. Once established, invasive species are extremely difficult, costly to control/eradicate, and their ecological effects are often irreversible. Invasive species are a growing environmental and economic threat to Wisconsin and more applicably Door County.

Wisconsin recognized the potential and realized negative impacts invasive species have on the environment and economy, and passed Chapter NR 40 in 2009. Wisconsin's Invasive Species Identification, Classification and Control Rule, NR 40, separated invasive species into two categories “prohibited” & “restricted”. The rule was updated in 2014 with the addition of 85 new species and the delisting of 2 species to reflect the changing collective knowledge of invasive species.

As an effort to manage invasive species in Door County, SWCD along with non-profits, dedicated citizens, municipalities, and various agencies, created the Door County Invasive Species Team (DCIST), in 2001. DCIST is a collaborative effort pooling information, tools, and skills to tackle invasive species threatening Door County, through education and control efforts.

Historically, Door County has focused on four main species: Common Reed (*Phragmites australis*), Wild Parsnip (*Pastinaca sativa*), Common & Cut leaf Teasel Species (*Dipsacus spp*.), and Japanese Knotweed (*Reynoutria japonica*) (See Figure 2-18). These species are listed by WDNR under the NR 40 rule and were chosen based on presence and impacts to human, ecological, and economic health of the county. According to the 2019 Door County invasive species inventory, Door County has 92 acres of common reed, 20 acres of wild parsnip, 10 acres of cut-leaf & common teasel, and 1.6 acres of Japanese knotweed (See Figure 2-19).

Figure 2-18. Invasive Species of Focus in Door County.

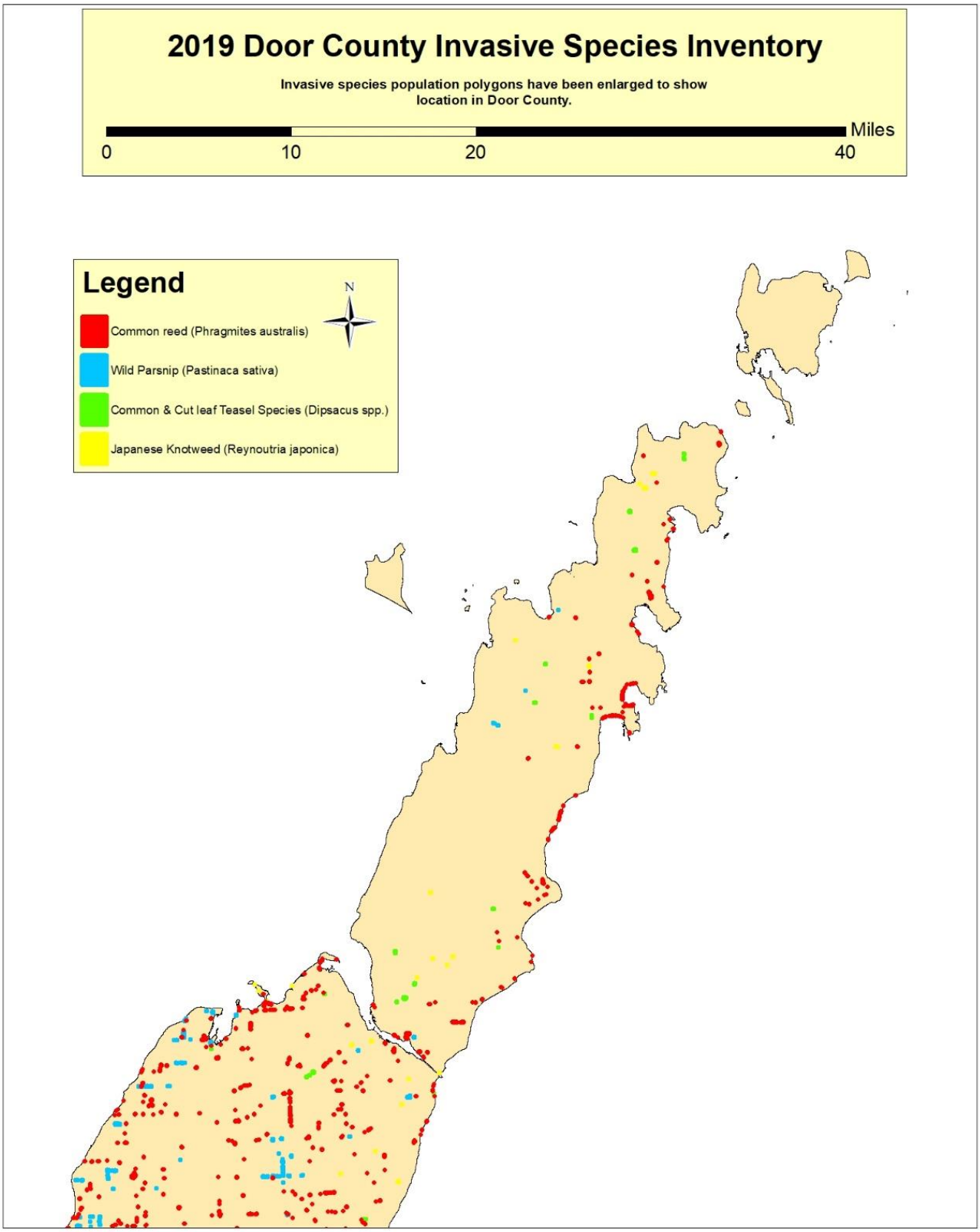


Figure 2-19. Inventory of Invasive Species of Focus in Door County.

Surface Water Resources

Watersheds are a major focus of surface water studies. Although watersheds are not specific water resources, they represent the drainage basin that encompasses all of the surrounding landscape that drains to a central point, such as a stream, river or lake. Watershed delineation allows for the prediction of the volume of water flowing over a given area into a surface water resource. It also assists in identifying surrounding land use or activities that might impact the waterbody. Because of this natural grouping and organization of resources, the following sections are organized by major watersheds (See Figure 2-20) encompassing key surface water resources.

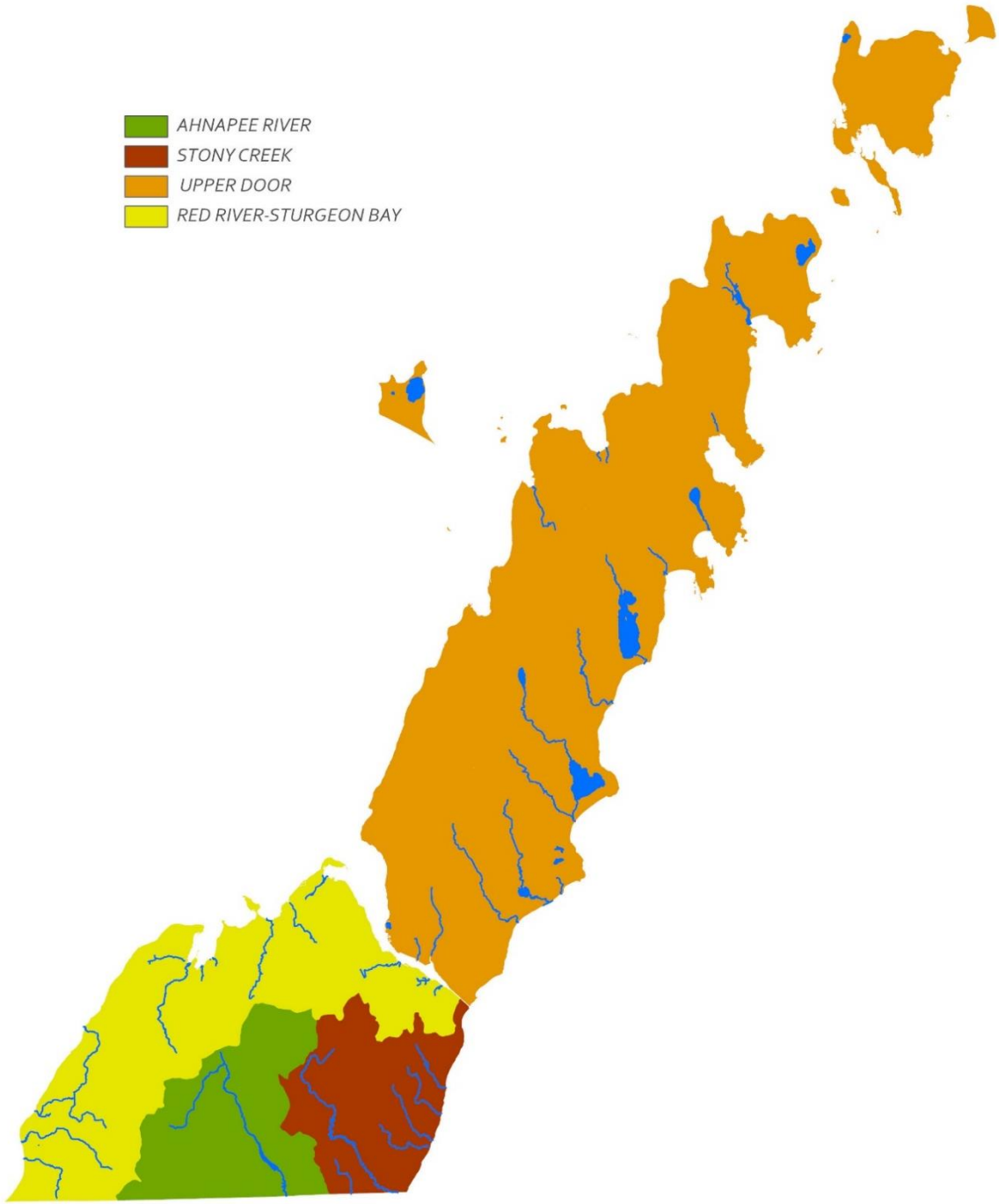


Figure 2-20. Major Door County Watersheds.

Streams, Creeks and Rivers

There are 38 named streams throughout Door County, and the majority of all streams are relatively short (less than six miles in length) and many have limited intermittent flow. For a complete description of Door County lakes and ponds, please refer to the *Surface Water Inventory of Door County* prepared by the SWCD in December of 2000.

Included within each of the watershed sections is a summary of recent water quality monitoring data collected by Door County Soil & Water Conservation Department staff and/or partners including the University of Wisconsin – Oshkosh and the Wisconsin Department of Natural Resources as part of larger projects. Other water quality data exists for some of these streams and the results presented here are an overview of general conditions, not an exhaustive inventory of available data. Appendix A contains a description of each parameter to help readers not familiar with water quality data.

Major Watersheds

Red River/Sturgeon Bay Watershed

The Red River/Sturgeon Bay Watershed was designated as a priority watershed under the DNR's Wisconsin Nonpoint Source (NPS) Water Pollution Abatement Program and administered and implemented by the SWCD from 1992 through 2008. The Red River/Sturgeon Bay Watershed approximately 89,200 acres (139 mi^2) and is made comprised of several creeks that flow to Green Bay.

This watershed lies within the counties of Door (78%), Kewaunee (13%) and Brown (9%) and is primarily agricultural with approximately 60% of the watershed comprised of cropland, farmsteads/pastures, and conservation reserve land; the largest business associated with agricultural land use is dairy farming. This watershed has historically been ranked medium for nonpoint source issues affecting streams and high for nonpoint source issues affecting groundwater. Table 2-5 summarizes characteristics and Figure 2-21 illustrates the locations of creeks located in the Red River/Sturgeon Bay Watershed.

Creek	Length (Miles)	Width (Feet)	Gradient (ft/mi)	Flow	Substrate	Watershed (mi^2)
Fabry	3.7	4	43	Intermittent	Rock/Cobble, Sand, Gravel	2.7
Renard	6	6	35	Continuous	Gravel, Silt	7.2
Silver	2.5	6	32	Intermittent	Gravel	2.5
Sugar	9	9	17.8	Continuous/Intermittent	Rock/Cobble	11.6
Twin Harbor	2		20	Intermittent	Rock/Cobble	3.3
Kayes	9.8	4	8	Continuous	Sand, Gravel	17
Malvitz	2.2	6	17.4	Intermittent	Rock/Cobble	1
Krueger	2.7		20	Intermittent	Rock/Cobble	5.6
May	5		14.6	Intermittent	Rock/Cobble, Silt	5.3
Larson	4	6.3	46.5	Intermittent	Sand, Gravel	8.9
Lost	2.5		8	Intermittent	Silt	2.2
Unnamed #2	2.7		10	Intermittent	Silt	3.3
Samuelson	1.25		24	Intermittent	Rock/Cobble	3.7
Unnamed #1	1		120	Intermittent	Silt	1.6
Strawberry	1.6	12	12.5	Continuous	Sand	4.4

Table 2-5. Characteristics of Streams in the Red River/Sturgeon Bay Watershed.

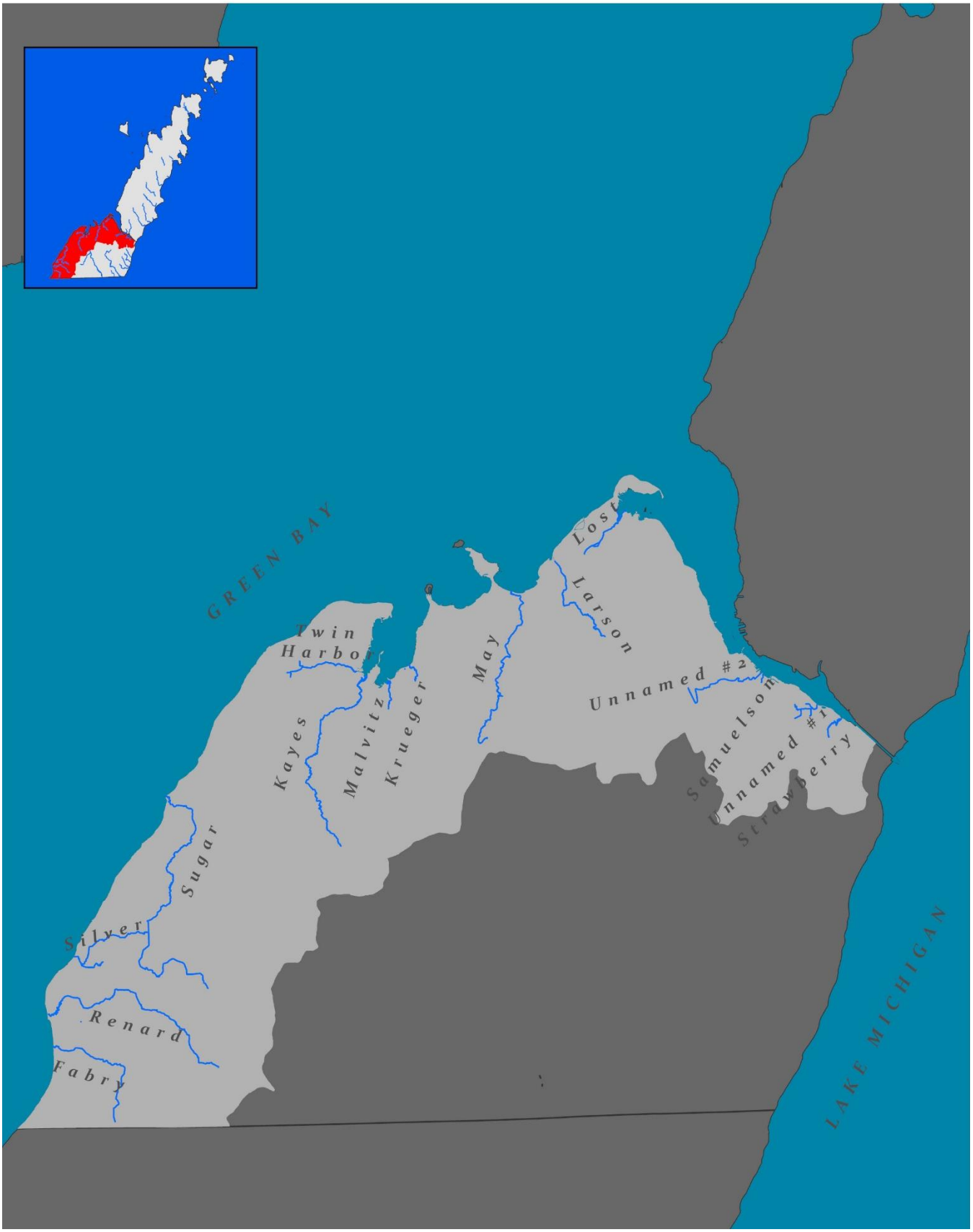


Figure 2-21. Locations of Streams in the Red River/Sturgeon Bay Watershed.

Water Quality of Streams in Red River/Sturgeon Bay Watershed

SWCD staff collaborated with University of Wisconsin – Oshkosh to monitor Sugar Creek, Silver Creek (Union) and Renard Creek in 2017 and 2018 as part of a project targeting resources towards phosphorus reduction in these watersheds. Water quality results confirm the need for continued efforts to reduce phosphorus loading to Sugar and Silver (Union) Creeks. Additional monitoring of Sugar and Silver Creeks continued through 2019 as part of the Wisconsin Department of Natural Resources Water Action Volunteers (WAV) program.

Total Phosphorus results for Sugar Creek exceeded the threshold of 0.75 mg/L in 15 of the 18 samples near the outlet to Green Bay taken during the field seasons of 2017 – 2019. Silver Creek (Union) yielded results that exceed 0.75 mg/L in all of the 18 samples taken during that same period. Renard Creek samples exceeded the 0.75 mg/L threshold in 3 of 12 samples taken in 2017 and 2018. Macroinvertebrate indices identified impacts of poor water quality in all three creeks in 2017 and 2018. The lowest score was "severe" impact in Silver Creek in 2018, with all other samples falling within "slight" and "moderate" impact range for both the Hilsenhoff Biotic Index and EPT Richness Index. Charts A-1 through A-5 in Appendix A show total phosphorus and macroinvertebrate data for these streams.

SWCD staff initiated a second watershed project in the Kayes and Larson Creek Watersheds in 2019. Stream monitoring in these watersheds is part of an ongoing effort, from 2019 to 2021, to target resources to reduce total phosphorus in these watersheds. Twin Harbor Creek, Kayes Creek, Malvitz Creek, Krueger Creek, May Creek and Larson Creek are all within these larger watershed areas and are being monitored for water chemistry parameters and three of those are also being sampled for macroinvertebrate populations.

Although there has only been one field season (2019) of water samples taken, the results of six-monthly samples (May through October) for total phosphorus and total suspended solids concentrations are summarized in Table 2-6. A Macroinvertebrate Index of Biotic Integrity (M-IBI) was determined for fall 2019 samples collected from Kayes, Malvitz and Larson Creeks and condition for each was identified as "fair". Sampling is projected to continue in 2020 and 2021 to better characterize conditions in these streams. Total phosphorus and M-IBI data and shown in Charts A-6 through A-12 in Appendix A.

Years	Stream	TP (mg/L) Min - Max	Average TP (mg/L)	TSS (mg/L) Min – Max	Average TSS (mg/L)
2017 - 2018	Sugar	0.02 – 0.31	0.13	2 – 58	14
	Silver (Union)	0.09 – 0.74	0.27	3 – 70	12
	Renard	0.05 – 0.32	0.09	No Detect – 39	10
2019 - 2021	Twin Harbor	0.03 – 0.14	0.09	No Detect – 11	6
	Kayes	0.15 – 0.15	0.05	No Detect – 8	5
	Malvitz	0.01 – 0.03	0.03	No Detect – 8	5
	Krueger	0.05 – 0.14	0.09	3 – 14	7
	May	0.03 – 0.07	0.05	4 – 14	7
	Larson	0.05 – 0.10	0.79	6 – 12	8

Table 2-6. Summary of Total Phosphorus (TP) and Total Suspended Solids (TSS) data for streams in the Red River/Sturgeon Bay Watershed.

Ahnapee River Watershed

The Ahnapee River is 14.7-miles in length. It originates in southern Door County and flows southeast through Kewaunee County and enters Lake Michigan at the City of Algoma. The Door County portion of the Ahnapee River is approximately 8.5 miles in length and averages approximately 25-feet in width. The Ahnapee originates in a wetland and spring complex and is fed by several tributaries along its course. There is one named tributary to the Ahnapee River, Silver Creek, in the Town of Brussels that drains a landscape that is primarily agriculture and its confluence is near the headwaters. The Door County portion of the Ahnapee River enters the Forestville Millpond, a 94-acre impoundment created by a dam constructed in 1877. Table 2-7 summarizes characteristics and Figure 2-22 illustrates the locations of the Ahnapee River, Silver Creek and the Forestville Millpond.

The Ahnapee River and its tributaries encompass a watershed of approximately 31,200 acres. Analysis of the land use in the Ahnapee River Watershed results in approximately 53% agricultural activities. Recent modeling and analysis identify agricultural sources as the primary source of sediment and nutrients within the watershed.

Creek/River	Length (Miles)	Width (Feet)	Gradient (ft/mi)	Flow	Substrate	Watershed (mi^2)
Silver (Brussels)	5.25	8	5.3	Continuous	Sand, Silt	7.6
Ahnapee River	8.5 (in Door County)	25	7.7	Continuous	Rock/Cobble, Sand, Gravel	4.8

Table 2-7. Characteristics of Streams in the Ahnapee River Watershed.

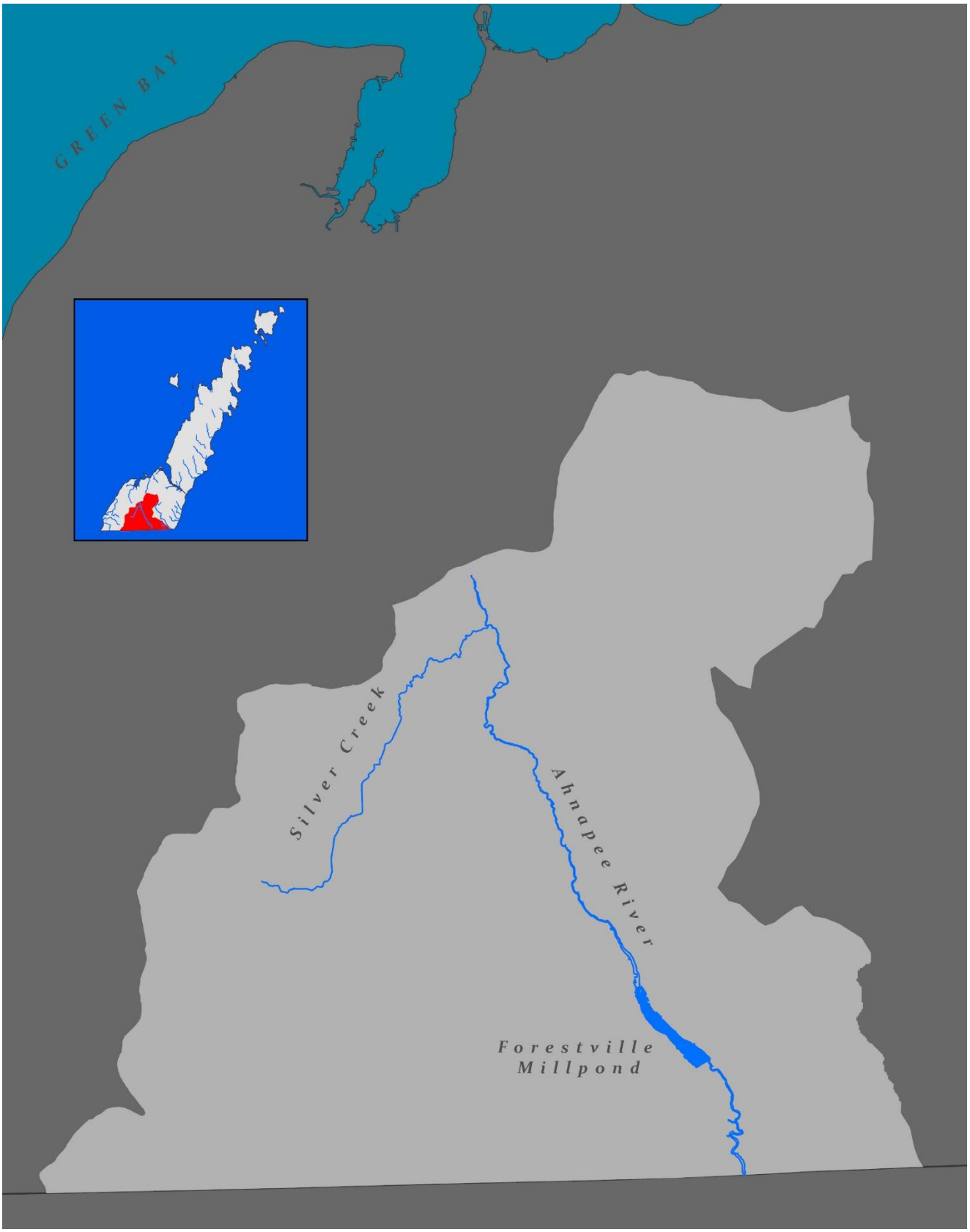


Figure 2-22. Locations of Streams in the Ahnapee River Watershed.

Water Quality of the Ahnapee River and Forestville Millpond

The Ahnapee River and the Forestville Millpond have been the subject of studies from 2017 – 2020 that included comprehensive inventory, modeling and monitoring. Two documents: *The Final Report for Comprehensive Lake Management Planning Grant Project #LPL162317, Forestville Millpond* (June 2018) and *the Analysis and Management Plan for The Upper Ahnapee River Watershed* (January 2020) with detailed results are available online at www.co.door.wi.gov.

The most consistent, and longest duration of, sampling of the Ahnapee River has been at the crossing of the main branch at County H through the Wisconsin DNR Wadeable Trend Reference Site program. In a set of sampling results spanning 2010 – 2019, measurements exceeded the 0.075 mg/L threshold in 6 of 26 samples. The Macroinvertebrate Index of Biotic Integrity (M-IBI) in samples collected at this same location in 2010 – 2018 identify "fair" conditions in 3 of 9 years and "good" conditions in 6 of 9 years. The Ahnapee River was also monitored briefly in 2019 by the Wisconsin DNR at County J and did not exceed the 0.075 mg/L threshold for total phosphorus in any of the samples collected. Silver Creek (Brussels) exceeded the threshold in one of six samples. Total phosphorus and M-IBI data are shown in Charts A-13 through A-16 in Appendix A.

The Forestville Millpond is a shallow, eutrophic waterbody with a high concentration of phosphorus accumulated in the sediment based on data collected in 2017. Total phosphorus samples of water exceeded 0.020 mg/L, the concentration at which algal blooms commonly appear. Two of the three samples exceeded the 0.040 mg/L threshold designated for waterbodies similar to the Forestville Millpond. The average summer Chlorophyll concentration was determined to be 50.4 µg/L and the overall Trophic State Index (TSI) was 64; ranking the Forestville Millpond as eutrophic in 2017. Six sediment cores were analyzed at three separate depths to determine the makeup of the accumulated sediment within the Forestville Millpond. Total phosphorus concentrations ranged from 764 mg/kg to 1,870 mg/kg; the Limit of Detection for phosphorus is 39.8 mg/kg and the Limit of Quantification is 119 mg/kg.

In 2017 dissolved oxygen concentrations measured in the Forestville Millpond were below the 5 mg/L threshold at various depths in the July sample and all depths in the August sample, suggesting oxygen depletion during summer months based on the limited numbers of samples collected. Oxygen was above 5 mg/L in September samples. Total phosphorus for water and sediment samples, and dissolved oxygen concentrations are shown in Charts A-17 through A-19 in Appendix A.

An analysis of cropland soil erosion potential in the Ahnapee River Watershed was done in April 2020 by the Wisconsin DNR, using the Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) model. The results of this analysis are illustrated in Figure A-5 of Appendix A and will assist in prioritization of practices to reduce sediment and nutrient loading in the watershed.

The SWCD estimated 2018 phosphorus (26,847 lb/year) and sediment (3,833 tons/year) loads in the Upper Ahnapee Watershed using the STEPL model. A full description of the area included and model assumptions and limitations are available in the *Analysis and Management Plan for The Upper Ahnapee River Watershed* (January 2020) at www.co.door.wi.gov. Reductions of 35% for phosphorus and 24% for sediment were estimated to result from the conservation practices proposed within the watershed plan. These will need to be updated once the WDNR completes the TMDL analysis for the watershed.

Stony Creek Watershed

The Stony Creek Watershed is approximately 34,500 acres and consists of Stony Creek with two named tributaries, and five smaller creeks that drain to Lake Michigan. Stony Creek is a 13.6-mile, relatively low gradient creek that has been ditched in some sections, that originates in Door County and outlets to Lake Michigan in the northeast corner of Kewaunee County. The upper 11 miles of the Stony are classified as a Warm Water Fish Forage community while the lower 5 miles are classified as Cold Class II water. Approximately 61% of the land use in the Stony Creek Watershed is comprised of agricultural activities. Improper handling storage and disposal of animal waste has historically been considered a serious potential source of nonpoint pollution.

The Stony Creek watershed was historically given a high groundwater ranking for selection as a priority watershed project through the Wisconsin NPS Water Pollution Abatement Program, but not selected before that program ended. Habitat loss as a result of impacts from sedimentation has resulted in a high nonpoint source ranking. Table 2-8 summarizes characteristics and Figure 2-23 illustrates the locations of creeks located in the Stony Creek Watershed.

Creek	Length (Miles)	Width (Feet)	Gradient (ft/mi)	Flow	Substrate	Watershed (mi^2)
Clay Banks		6	10.5	Intermittent	Sand	2.9
Woodard	4.7	5.5	44	Continuous/ Intermittent	Rock/Cobble, Silt	2.8
Schuyler	4	6.6	12.7	Continuous/ Intermittent	Rock/Cobble	4.4
Bear	4	5.9	33.3	Continuous/ Intermittent	Rock/Cobble	4.9
Kolstad	3	23	0.2	Intermittent	Silt	4.3
Kramer	2	10.5	14	Intermittent	Sand	3.7
Stony	13.6	16	8.5	Continuous/ Intermittent	Rock/Cobble	16.2
Silver (Forestville)	2 (in Door County)	8.9	16	Intermittent	Rock/Cobble	4

Table 2-8. Characteristics of Streams in the Stony Creek Watershed.

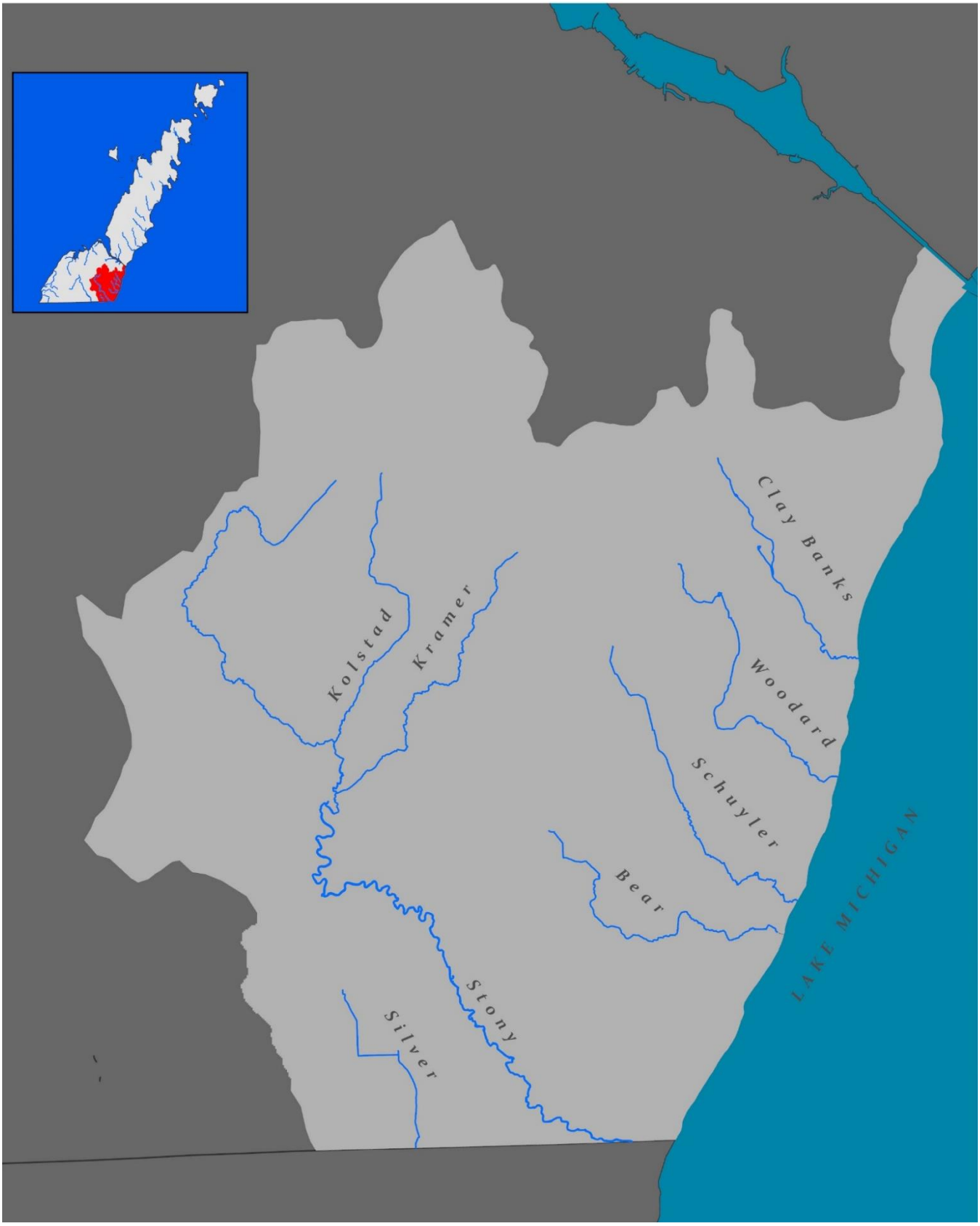


Figure 2-23. Locations of Streams in the Stony Creek Watershed.

Water Quality of the Stony Creek Watershed

Recent monitoring in the Stony Creek Watershed has primarily occurred through the Wisconsin Water Action Volunteers program (2014-2019) as well as to collect preliminary data for the Wisconsin DNR Northeast Lakeshore Total Maximum Daily Load (TMDL) effort in 2019.

There have been two consistent sampling locations on Stony Creek, at the County H crossing and the Rosewood Road crossing. The sampling site at County H yielded total phosphorus results that exceeded 0.075 mg/L in 14 of 18 samples, while the site at Rosewood Road exceeded the threshold in 7 of 23 samples. Limited, but recent sampling has occurred in other streams within the watershed and is summarized in Table 2-9. Macroinvertebrate Index of Biotic Integrity results from 2014 indicated "fair" conditions in three locations of Stony Creek. Total phosphorus and M-IBI data are shown in Charts A-20 through A-24 in Appendix A.

Stream	TP (mg/L) Min – Max	TP (mg/L) Average	TSS (units) Min - Max	TSS (units) Average
Stony @ County H	0.04 – 0.22	0.10	---	---
Stony @ Rosewood Rd	0.03 – 0.17	0.07	No Detect - 7	2
Bear	0.01 – 0.10	0.03	No Detect – 14	3
Woodard	0.02 – 0.10	0.05	No Detect - 4	3
Schuyler	0.02 – 0.07	0.05	No Detect - 4	2
Silver (Forestville)	0.03 – 0.12	0.06	---	---

Table 2-9. Summary of Total Phosphorus (TP) and Total Suspended Solids (TSS) data for streams in the Stony Creek Watershed.

Upper Door Watershed

The Upper Door Watershed was selected as a priority watershed under the DNR's Wisconsin Nonpoint Source Water Pollution (NPS) Abatement Program and was administrated and implemented by the SWCD from 1984 to 1996. The Upper Door Watershed includes all land north of the Sturgeon Bay shipping canal including Washington and Chambers Islands and comprises approximately 184,000 acres.

The southern portion of the watershed, an area from the canal north to a line drawn approximately from Fish Creek to Baileys Harbor, is predominantly agricultural. Agriculture exists to a lesser degree north of this line. This project was the first largescale watershed in the state selected to primarily address the impacts of nonpoint source pollution on groundwater quality.

The most common groundwater pollutants determined for the Upper Door Watershed project were bacteria and nitrates. Sources for nonpoint pollution were partly thought to be derived from the improper handling, storage and disposal of animal waste. Other suspected nonpoint sources in the watershed were septic systems and the associated land spreading sites and landfills. Table 2-10 summarizes characteristics and Figure 2-24 illustrates the named rivers and creeks that are located in the Upper Door Watershed.

Creek/River	Length (Miles)	Width (Feet)	Gradient (ft/mi)	Flow	Substrate	Watershed (mi^2)
Little						3.6
Big	13.0	4.5				
Lily Bay	3.4	5	19.1	Continuous/ Intermittent	Silt, Sand	13
Geisel	3.6	20	9.7	Continuous	Rock/Cobble, Gravel	9.8
Shivering Sands	1.1	27	12.5	Continuous		
Fischer	2.0					
Whitefish Bay	1.1	28		Continuous		
Logan	5.4	8	17.7	Continuous	Rock/Cobble, Gravel, Silt	12.0
Hibbard	7.4	15	7.6	Continuous	Rock/Cobble, Gravel	17.0
Fish	1.5	8	15	Intermittent	Rock/Cobble, Gravel, Silt	2.0
Peil	2.5	16.4	6.3	Continuous	Silt	
Heins	2.9	14	7.8	Continuous		
Ephraim	1.5	9	15	Intermittent	Rock/Cobble	3.9
Hidden Brook						
Rieboldt	5.4		5	Continuous		
Hidden Springs	1.0			Intermittent		
Three Springs	2.3	4	10.9	Intermittent	Gravel, Silt	5.0
Mink River	1.4					

Table 2-10. Characteristics of Streams in the Upper Door Watershed.

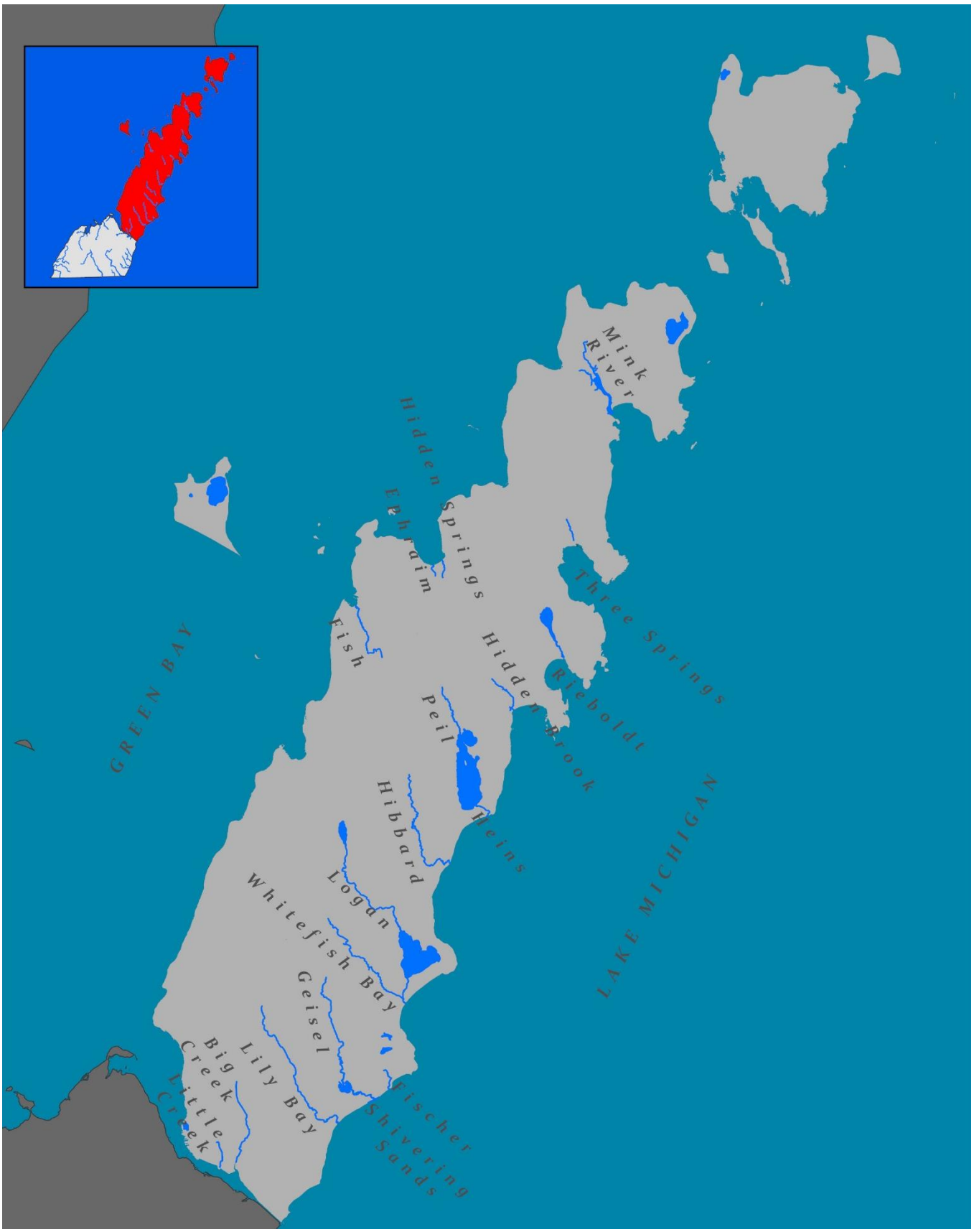


Figure 2-24. Locations of Streams in the Upper Door Watershed.

Water Quality of the Upper Door Watershed

Recent monitoring of streams in the Upper Door Watershed has primarily occurred through the Wisconsin Water Action Volunteers program effort at six locations in 2015. The majority of streams have consistently low phosphorus concentrations that do not approach the 0.075 threshold (see Table 2-11). Only Fish Creek and Geisel Creek exceeded the threshold, with Geisel approaching the limit more frequently than any of the other monitored creeks.

Long-term trends have been tracked in Geisel Creek as part of comprehensive study of Dunes Lake titled: Water Quality Evaluation and Planning for the Dunes Lake Watershed, Door County, WI 2008-2012 Report. The five-year watershed study identified all sources of nutrients impacting Dunes Lake. The entire report and reference materials can be viewed through the following link: https://www.co.door.wi.gov/DocumentCenter/View/830/Water-Quality-Evaluation-and-Planning-for-the-Dunes-Lake-Watershed-2012-PDF?bidId= The study was initiated when the SWCD and other conservation partners documented signs of unnatural and rapid eutrophication within Geisel Creek and Dunes Lake. Specifically, filamentous algae covered the rocky substrate within the creek, more frequent algal blooms, more expansive aquatic plant growth, and aggressive expansion of the invasive narrow leaf cattail population to a point where the cattails have now completely encompassed the inner lake area over a span of only four decades. Results of the study showed significant phosphorus loading via ground and surface waters from point and nonpoint sources. One of the key findings was the phosphorus monitoring indicated 23% originated from the discharge of waste water from the Sevastopol Sanitary District and 77% was attributed to Agriculture and Private Onsite Waste Systems for individual households. This study also identified legacy deposits of phosphorus contained within the organic sediments of Dunes Lake.

Macroinvertebrate Index of Biotic Integrity (M-IBI) samples collected in Lily Bay Creek and Whitefish Bay Creek, indicate "good" conditions while samples collected in Three Springs Creek and at two locations in Geisel Creek indicate "fair" conditions. Total phosphorus and M-IBI data are shown in Charts A-25 through A-28 in Appendix A.

Stream	Total Phosphorus (mg/L) Min – Max	TP (mg/L) (Average)
Logan	0.01 – 0.01	0.01
Peil	0.01 – 0.02	0.01
Reiboldt (upstream of Mud Lake)	0.01 – 0.02	0.02
Reiboldt (out to Lake Michigan)	0.01 – 0.02	0.02
Three Springs	No Detect – 0.02	0.01
Fish	0.02 – 0.08	0.05
Geisel	0.02 – 0.18	0.05

Table 2-11. Summary of Total Phosphorus (TP) for streams in the Upper Door Watershed.

Lakes

There are 25 named lakes and ponds in Door County, with most of the lakes located in the northern half of the county. For a complete description of Door County lakes and ponds, please refer to the *Surface Water Inventory of Door County* prepared by the SWCD in December of 2000. Figure 2-25 illustrates the some of the major lakes and ponds located throughout the county and Table 2-12 summarizes some of the characteristics.

Lake Types

The following are categories that are used in the classification of lakes regarding their source.

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.

Riverine Impoundment - also known as reservoirs, artificially created standing water bodies, produced by dams on streams or rivers. Because of the diverse nature of streams, rivers, and dams, these waterbodies can vary greatly in size, configuration, flow patterns, water chemistry, and biota.

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).

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.

Trophic Status

The trophic status of a lake is a classification of the level of biological activity, or productivity, as measured by metrics such as the phosphorous content, algae abundance, and depth of light penetration. Varying trophic status is a way of describing the process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen, or eutrophication. The range of trophic statuses are as follows:

Oligotrophic – Low nutrient levels. Low populations of aquatic plants, animals and algae.

Mesotrophic – Moderate nutrient levels. Healthy and diverse populations of aquatic plants, fish and algae.

Eutrophic – High nutrient levels. Large populations of aquatic plants, fish and algae. Plants and algae populations often grow to nuisance levels. Fish species tolerant of warm temperatures and low dissolved oxygen concentrations.

Hypereutrophic – Very high nutrient levels. Often exhibit large algae blooms. Fish populations are dominated by carp and other species that tolerate warm temperatures and low dissolved oxygen concentrations.

Lake	Surface Area (Acres)	Maximum Depth (Feet)	Lake Type	Bottom Type	Trophic Status
Arbter	16	2	Drainage	Muck	Eutrophic
Bradley	19	7	Seepage	Sand	Eutrophic
Clark	868	25	Drainage	Marl, Rock, Sand	Oligotrophic
Dunes	80	1	Drainage	Marl, Muck, Silt	Eutrophic
Europe	273	10	Seepage	Marl, Gravel, Silt	Oligotrophic
Forestville Millpond	94	6	Riverine Impoundment	Silt, Muck	Eutrophic
Kangaroo	1,123	12	Drainage	Marl, Rock, Gravel, Sand	Mesotrophic
Krause	4	24	Spring	Muck	Mesotrophic
Little	24	6	Spring	Muck, Rock, Gravel	Eutrophic
Lost	91	5	Seepage	Muck, Silt	Hypereutrophic
Mackaysee	347	27	Spring	Sand, Rock, Gravel, Silt	Mesotrophic
Mink River Lake	101	13	Spring	Sand, Muck	Eutrophic
Mud	155	5	Drainage	Marl	Eutrophic
Schwartz	30	4	Seepage	Muck	Eutrophic

Table 2-12. Characteristics of Major Lakes and Pond in Door County.

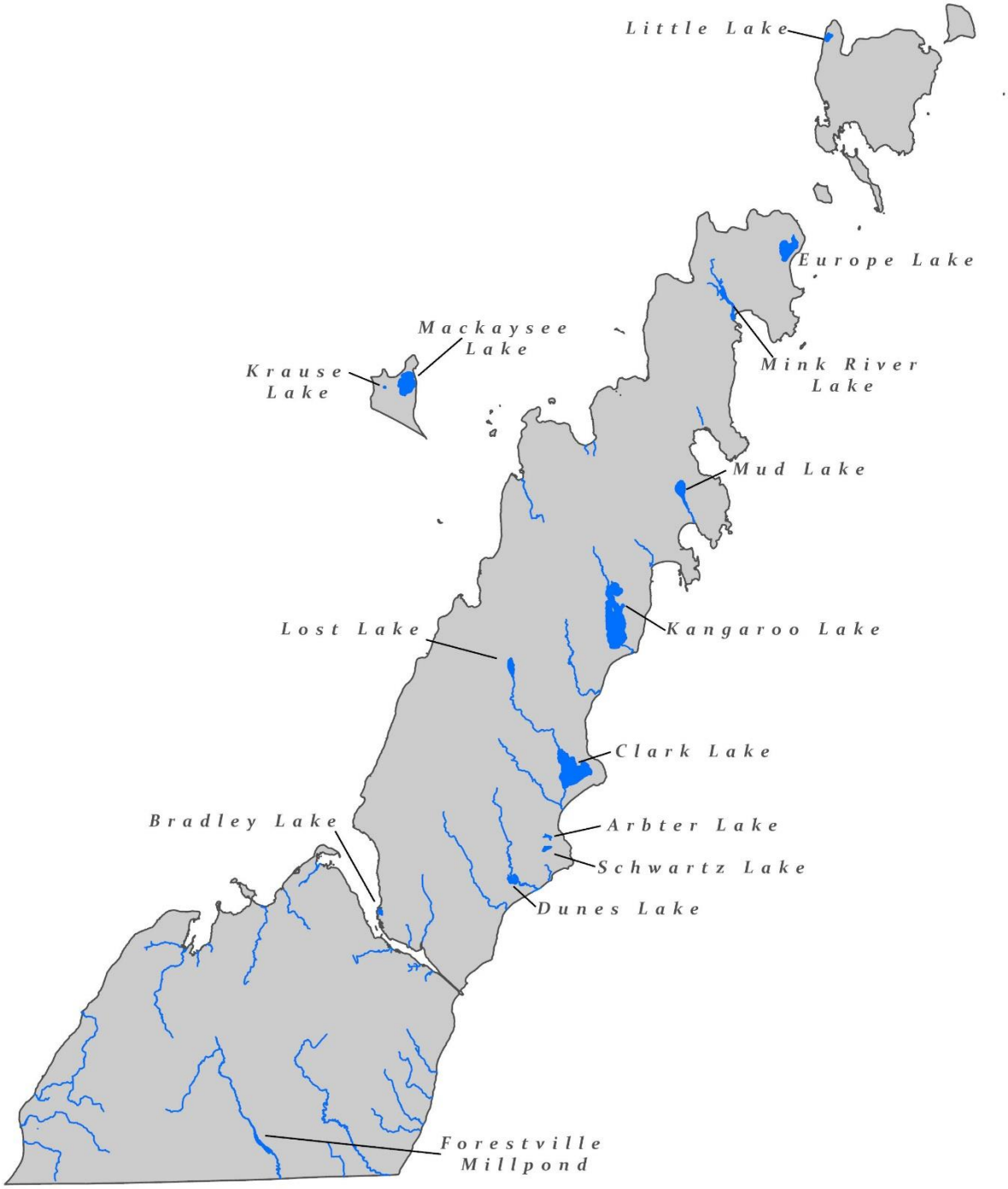


Figure 2-25. Location of Major Lakes in Door County.

Existing Classifications

Trout Streams

Class I

These streams are high-quality streams where populations of wild trout are sustained by natural reproduction and require stocking of hatchery trout. There are three streams, or portions of streams, in Door County that are considered Class I Trout Streams:

- Hidden Springs Creek
- Kayes Creek, miles 7.6 – 9.8
- Logan Creek, 0.2 miles at the mouth to Clark Lake.

Class II

These streams have some natural reproduction, but not enough to utilize available food and space in the habitat. Stocking is necessary to maintain a desirable fishery. There are seven streams, or portions of streams in Door County that meet the requirements to be considered Class II Trout Streams:

- Ephraim Creek
- Heins Creek
- Hibbard Creek, 5.32 miles from the mouth at Lake Michigan
- Kayes Creek, miles 6.1 – 7.6
- Lily Bay Creek, 1.76 miles from the mouth at Lake Michigan
- Logan Creek, miles 0.2 – 1.84
- Whitefish Bay Creek

Outstanding and Exceptional Resource Waters

Wisconsin has designated high quality waters as "Outstanding Resource Waters" and "Exceptional Resource Waters" in Chapter NR 102, Wisconsin Administrative Code. These are surface waters that provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. These waters warrant additional protection from the effects of pollution to prevent any lowering of water quality.

Outstanding Resource Waters typically do not have any point sources discharging pollutants directly to the water but may receive runoff from nonpoint sources. New discharges may be permitted only if their effluent does not increase pollutant levels in that waterbody. The following waters are designated as Outstanding Resource Waters:

- Logan Creek (0.2 miles at the mouth to Clark Lake)
- Mink River (mile 0 – 1.6)
- Mink River Lake

Exceptional Resource Waters may be affected by point source pollution or have the potential for future discharge from a small sewer community provided that dischargers maintain the high-quality resource values. The following water are designated as Exceptional Resource Waters:

- Kayes Creek (mile 7.6 – 8.03)
- Unnamed tributary to Kayes Creek (mile 0 - 1.1, adjacent to County K)
- Hidden Springs Creek (mile 0 - 0.73)

Impaired Waters

Every two years, Section 303(d) of the 1972 Clean Water Act requires each state to publish a list of all waters that *do not meet* established water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on new information or changes in water quality status. The following water bodies are listed on the 2018 303(d) Impaired Waters list:

- Sugar Creek – The full 9 miles of Sugar Creek was listed in 2014 for pollutant Total Phosphorus with an unspecified impairment.
- Ahnapee River – The full length of the Ahnapee River in Door and Kewaunee Counties (mile 0 – 14.71) was listed in 1998 for PCB contaminated fish tissue. Similarly, the length of the Lake Michigan Shoreline was listed in 1998 for PCB contaminated fish tissue.
- Ahnapee River – The Ahnapee River below the dam in Forestville in Door and Kewaunee Counties (mile 0 – 7.86) was listed in 2014 for pollutant Total Phosphorus, impairment degraded biological community.
- Stony Creek – The lower 8.3 Miles of Stony Creek was listed in 1998 for exceedance of Total Suspended Solids and degraded habitat from sediment loading. The upper 7.8 miles was listed in 2018 for pollutant Total Phosphorus with an unspecified impairment.
- Mackaysee Lake – Currently listed since 1998 for contaminated fish tissue from atmospheric deposition of mercury, Mackaysee Lake is proposed for delisting during the next cycle based on updated fish consumption advisories.

The Wisconsin Department of Natural Resources has initiated a Total Maximum Daily Load (TMDL) process along the Northeast Lakeshore of Lake Michigan. This TMDL is focused on addressing surface water quality impairments from phosphorus and total suspended solids, and includes both the Ahnapee River and Stony Creek. The WI legislature supported TMDL development in 2017 and stream monitoring continued through 2019. Additional steps taken by WDNR in the process include an inventory of WPDES permit holders and effluent monitoring data (2019), collection of agricultural management data (2020), analysis and watershed model development (2020) and stakeholder outreach throughout the TMDL development process. Anticipated to be completed in 2022, the TMDL will identify sources of impairments and necessary reductions in pollutant loads to meet water quality standards. Additional information is available at https://dnr.wi.gov/topic/TMDLs/NELakeshore.html .

Lake Michigan Water Levels and Precipitation Trends

Because there are nearly 300 miles of shoreline around Door County, fluctuations of the water levels of Lake Michigan and Green Bay have a significant impact on land use and land features along those shorelines. Over the last 100 years the Lake Michigan long-term annual mean water level was 578.84 feet, IGLD 1985 (See Chart 2-6). After approximately fifteen years of below average water levels from 1999-2014, the lake rose over five feet to record high monthly levels in the winter of 2020. The all-time record low was 576.02 feet in January 2013 and the reported monthly mean for March 2020 was 581.43 feet.

Lake Michigan water levels have been above the monthly mean every month since November 2014. Future projections include additional months of record high water levels throughout spring and summer of 2020. These high water levels are the result of several months and years of persistent wet conditions in the region that resulted in higher than average net water supply to the Great Lakes (US ACOE 2019). Additional US Army Corps of Engineers water level data and forecasts are available at: https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/

Locally, northeast Wisconsin has also experienced persistent wet conditions in recent years. Sturgeon Bay's wettest year on record was 2019. Green Bay's long-term precipitation records identify four of the top ten wettest years as occurring since 2010. Normal annual precipitation in Green Bay is 29.52 inches, with annual precipitation amounts of 37.45 inches in 2018 and 48.63 inches in 2019 setting back to back annual records (NOAA 2019). These exceptionally wet years have not only contributed to surface flooding but also elevated groundwater levels above what is considered typical in portions of Door County.

Beyond record annual precipitation there is a perception among observers that rainfall intensity and/or the amount of rainfall in any given storm has increased in recent years. Local data supporting this observation is not readily available, however analysis of rainfall events in Wisconsin shows that both the frequency and magnitude of heavy rainfall events have been increasing in past decades (WICCI 2011). Forecasted trends related to Wisconsin's changing climate include a 75% probability that annual average precipitation will increase. Climate models also project a "fair level of confidence that spring and fall precipitation will increase, and total rainfall and intense rainfall events are projected to increase significantly during the winter and spring months from December to April" (WICCI 2011). These changes are projected for coming decades and must be considered when planning best practices to protect natural resources.

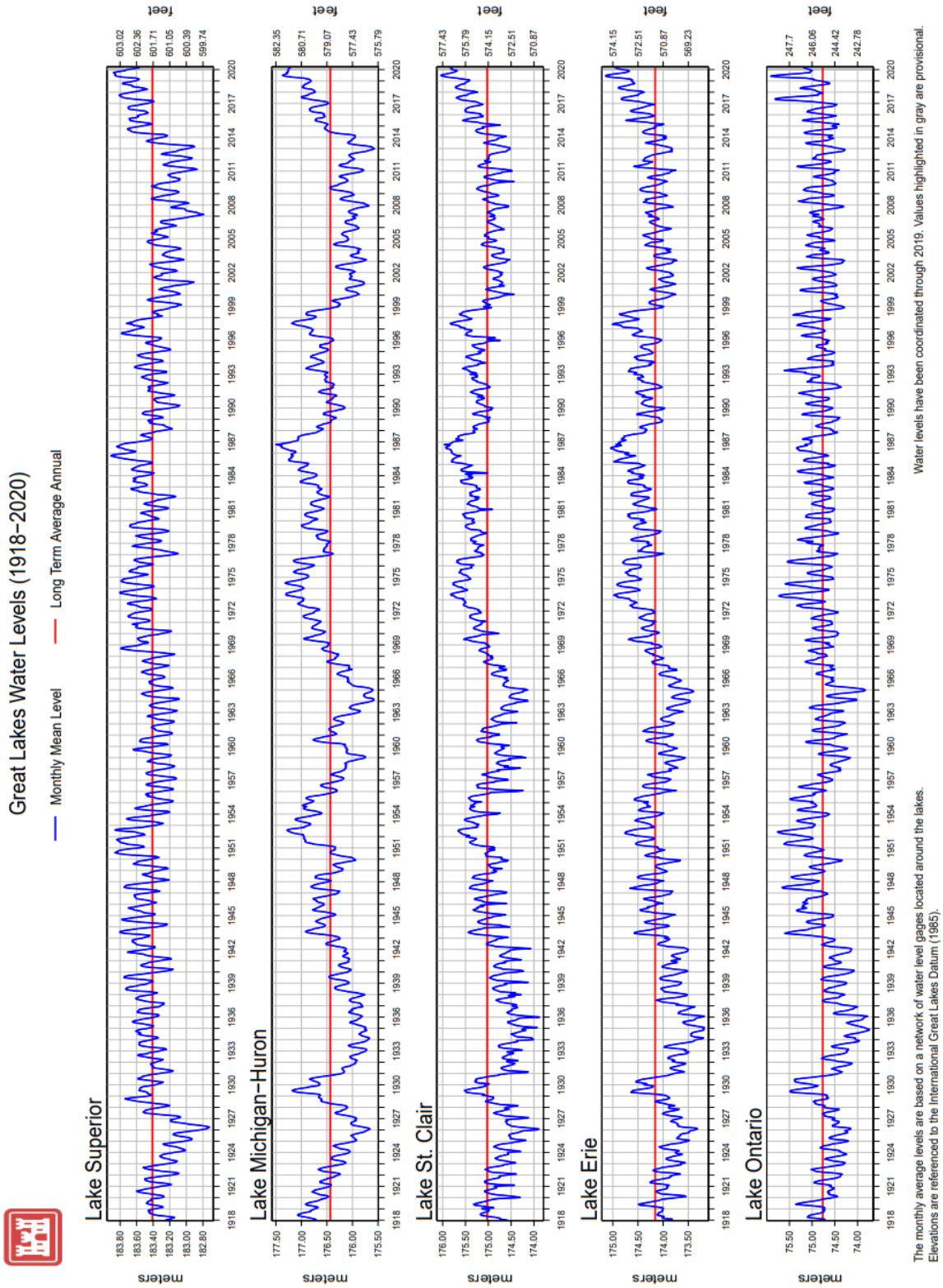


Chart 2-6. US Army Corps of Engineers Great Lakes Water Levels (1918 – 2020).

Wetlands

Wetlands can be defined as," an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions" [s. 23.32(1), Wis. Stats.]. Wetlands in Door County, and throughout Wisconsin, play an important role in both preservation of critical habitat and protecting both water quality and quantity. Because of the connectivity that exists between ground and surface water in much of Door County, wetlands many times exist as the groundwater expresses itself upon the surface. This role underscores the importance of protection of these sensitive landscapes, not only as needed habitat, but also as the interface of groundwater with surface activities. Wetlands are largely distributed throughout the county in coastal lowland areas and ridge and swale habitats and along stream corridors that lie in historic drainage paths. There are several broad wetland classifications and combinations found throughout Door County. The location and distribution of wetland classes can be reviewed in Figure 2-26. For more information regarding wetland classification and/or types, please visit:
https://www.wisconsinwetlands.org/learn/about-wetlands/wetland-types or
https://dnr.wi.gov/topic/wetlands/types.html

Wetland Classifications

Upland Areas – These are areas surrounded by wetlands or areas that are generally segregated from wetlands, or may be on the boundary of wetland conditions, where the water table is not close enough to the surface to satisfy the requirements of other wetland complex types. These sites can many times be characterized by raised hummocks resulting from shallow rooting in response to saturated soil conditions. Plant species in upland areas are typically those found in non-wetlands, but can be found there occasionally.

Forested – Often referred to as swamps, this wetland type is dominated by trees. Common types of forested wetlands are coniferous swamps, lowland hardwood swamps, and floodplain forests. Soils in forested wetlands are typically wet in spring and early summer, but may dry up later in the year. Forested ephemeral ponds are important systems that are generally small, shallow, poorly-drained basins that provide critical habitat within wetland systems. This wetland type can include bogs/fens and forested floodplain complexes comprised of species such as tamarack, white cedar, black spruce, elm, black ash, green ash and silver maple.

Scrub/Shrub – Dominated by woody vegetation that ranges from true shrubs and young trees to small trees and shrubs that may have been stunted due to their growing conditions. These types of wetlands can demonstrate a phase of succession, leading to a Forested Wetland, or they can represent a relatively stable community. Scrub/shrub wetlands can include bogs/fens and alder thickets that are characterized by woody shrubs and small trees such as tag alder, bog birch, willow and dogwood.

Emergent/Wet Meadow – These wetlands are generally typified by frequent of continuous inundation and are dominated by plants that are typically rooted underwater and emerge into the air. Vegetation in an emergent wetland is typically present for most of the growing season in an average year. If there is not standing water present, these systems will at least maintain saturated soil conditions. Sedges, grasses and reeds often dominate these systems and they can also be home to blue flag iris, marsh milkweed, mint and various species of goldenrod and aster.

Aquatic Bed – Areas with plants growing entirely on or in a water body no deeper than 6 feet. Plants may include pondweed, duckweed, lotus and water–lilies. These include wetlands and deep-water habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years. Water regimes include subtidal, irregularly exposed, regularly flooded, permanently flooded, intermittently exposed, semi permanently flooded, and seasonally flooded.

Open Water – These areas are characterized by lakes, ponds and unvegetated river sloughs that are six feet or less in depth. Open water settings are generally absent of aquatic emergent and terrestrial vegetation species but are dominated by plants that grow principally on or below the surface of the water. Species found in this setting often include pondweed, duckweed, lotus and water lilies.

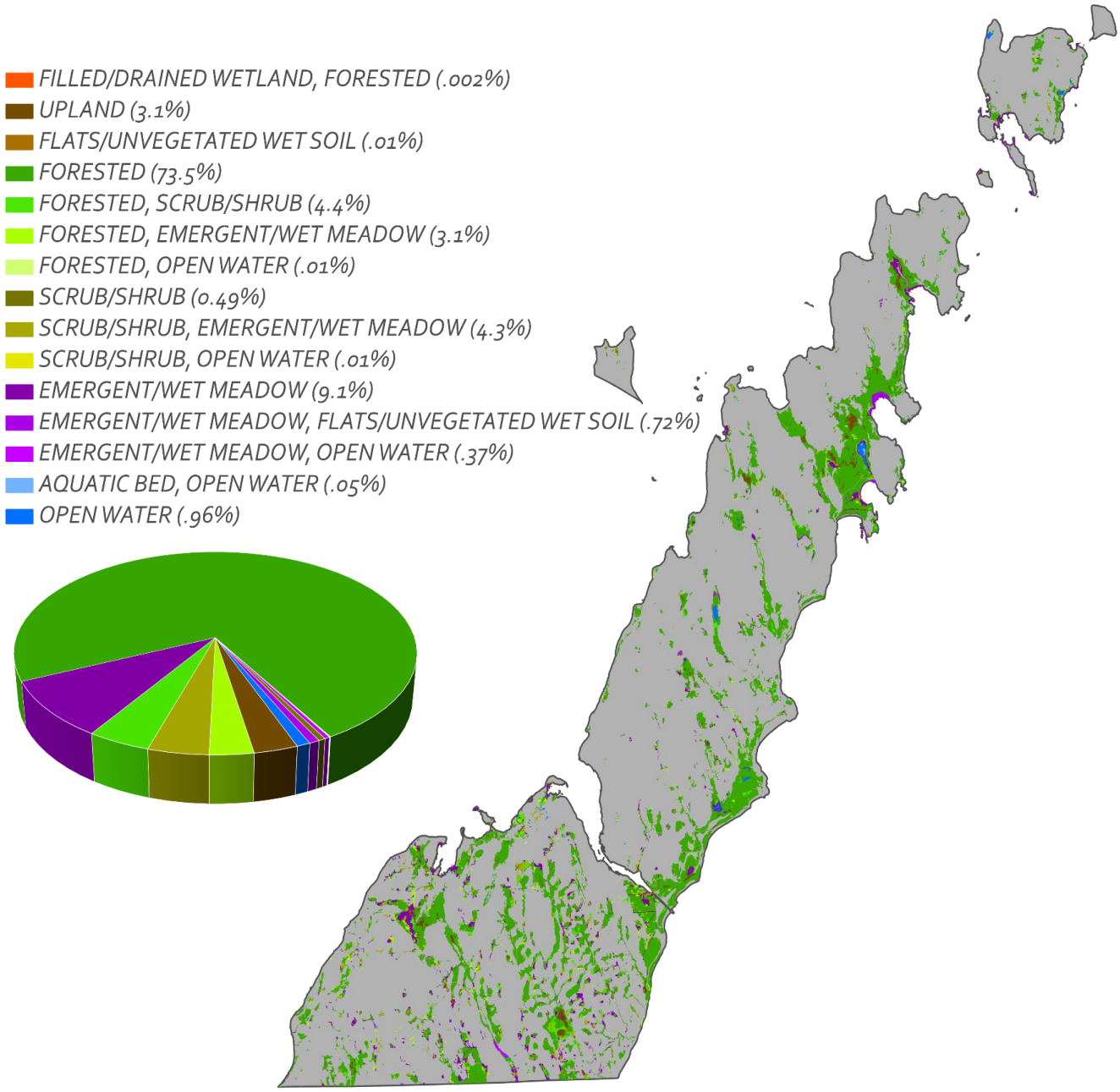


Figure 2-26. Location and Distribution of Wetland Classes in Door County.

Door Peninsula Coastal Wetlands Ramsar Site

In 1971, a worldwide treaty was signed based on concern by countries and non-governmental organizations about the increasing loss and degradation of wetland habitat worldwide. The treaty was signed and adopted in the city of Ramsar, Iran, at the Convention on Wetlands of International Importance. This was an integral step in recognizing significant wetlands around the globe and establishing a mechanism for the conservation and sustainable use of those areas identified as significant international wetlands of distinction. A Ramsar wetland is a wetland placed under protection due to its international and ecological significance. There are currently 2,389 sites designated worldwide, 40 in the United States and four in the State of Wisconsin (See Figure 2-27).

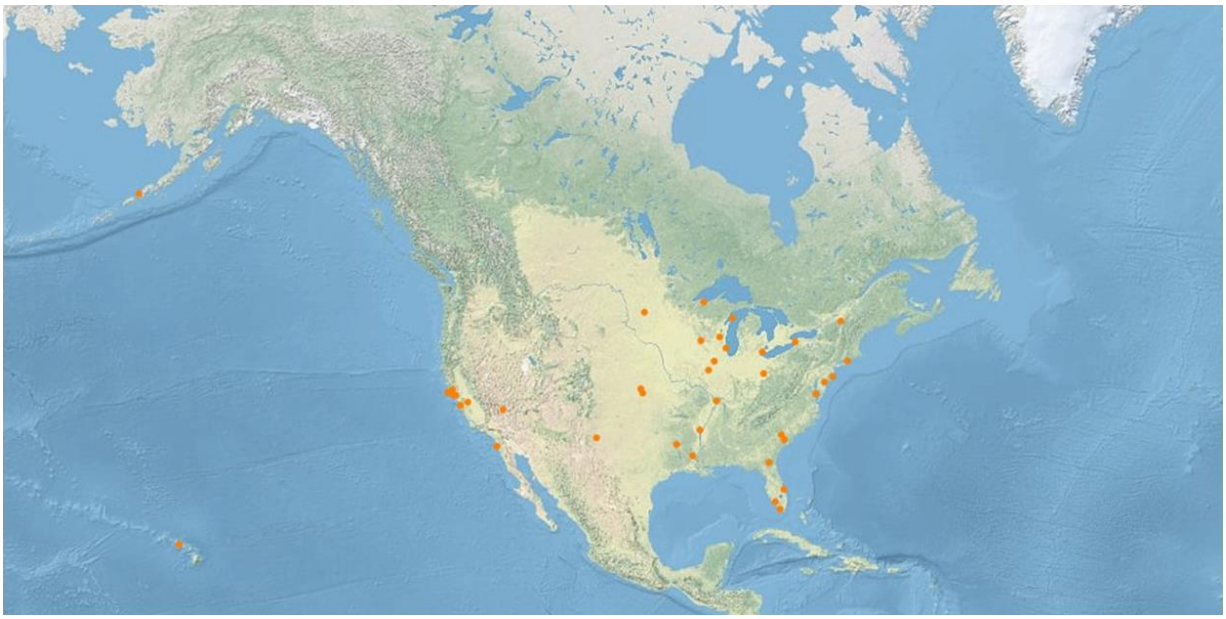


Figure 2-27. Ramsar Designated Sites in the United States (Source: www.ramsar.org).

In 2014, the Door Peninsula Coastal Wetlands area comprising approximately 11,500 acres, was designated as a Ramsar Site. This site was the first designated on Lake Michigan and occupies a major section of the Eastern Lake Michigan shoreline in northern Door County (See Figure 2-28). This span of wetlands is a diverse example of regionally and globally significant wetland communities, including interdunal wetlands and northern wet-mesic forest. It supports numerous species of fauna and flora including the rare dwarf lake iris (Iris lacustris) and over 150 species of birds that use the site for nesting or as staging areas during autumn and spring migrations. It also hosts the largest known population of the federally-endangered Hine's emerald dragonfly (Somatochlora hineana). Areas of groundwater recharge are a critical habitat component for the Hine's emerald dragonfly. Threats to this significant habitat include invasive species such as giant reed grass (Phragmites australis), urban development, and increasing recreational vehicle use. Climate change has also been identified as a potential threat, as it could lead to changes in levels of the groundwater and of Lake Michigan, changes in water pH and declines in species richness and diversity.

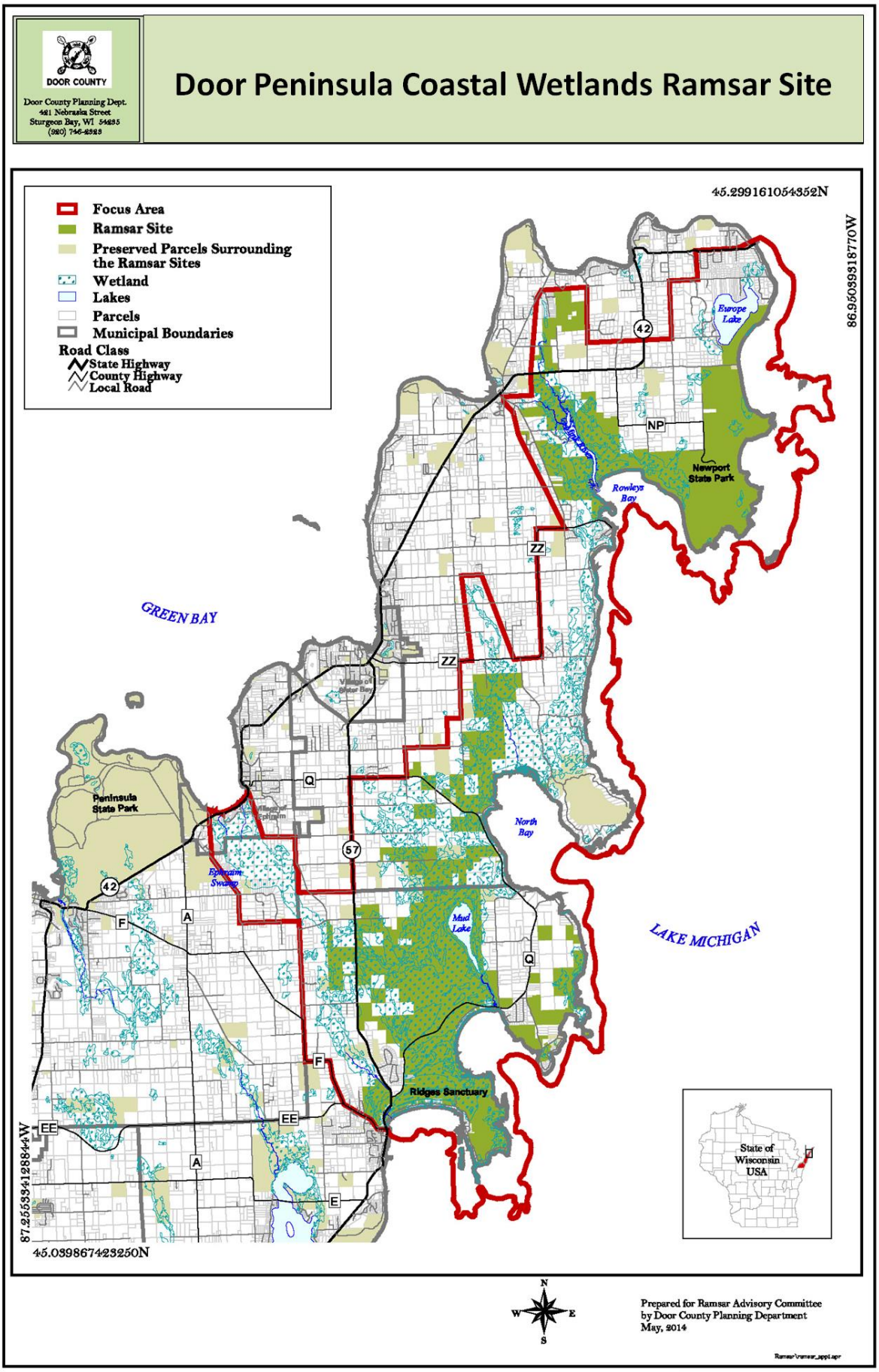


Figure 2-28. Door Peninsula Coastal Wetlands Ramsar Site.

Potentially Restorable Wetlands

The Wisconsin DNR has generated records of Potentially Restorable Wetlands (PRW), and they have been designated as a layer that identifies areas across the state of Wisconsin that could potentially be restored to wetland. PRWs are areas that are not currently mapped as wetland, but soil and water pooling data indicate it may be possible to restore them to wetland. Because this process utilizes existing data sets of varying currency and quality, field verification of mapped PRWs is highly recommended before firm land use decisions can be made. Four categories have been established in this process:

Potentially Restorable Wetlands (PRW): Areas of hydric soil, not currently mapped as a wetland, with a land use compatible with restoration techniques. There are 10,616 acres of PRWs identified in Door County.

Less Than 0.5 Acres: Locales that meet the characteristics of a PRW, but occupy an area less than 0.5 acres. Door County has 416 acres of PRWs less than 0.5 acres.

Contributing Areas: Non-hydric soil units immediately adjacent to existing wetlands or PRWs with high moisture content. There are 13,675 acres classified as contributing areas to PRWs in Door County.

Urbanized: PRWs that are urban areas, roads and active railroad corridors. There are 1,482 acres of urbanized PRWs identified throughout Door County.

Figure 2-29 displays the PRWs located throughout Door County, identified in a dataset provided by the Wisconsin DNR.

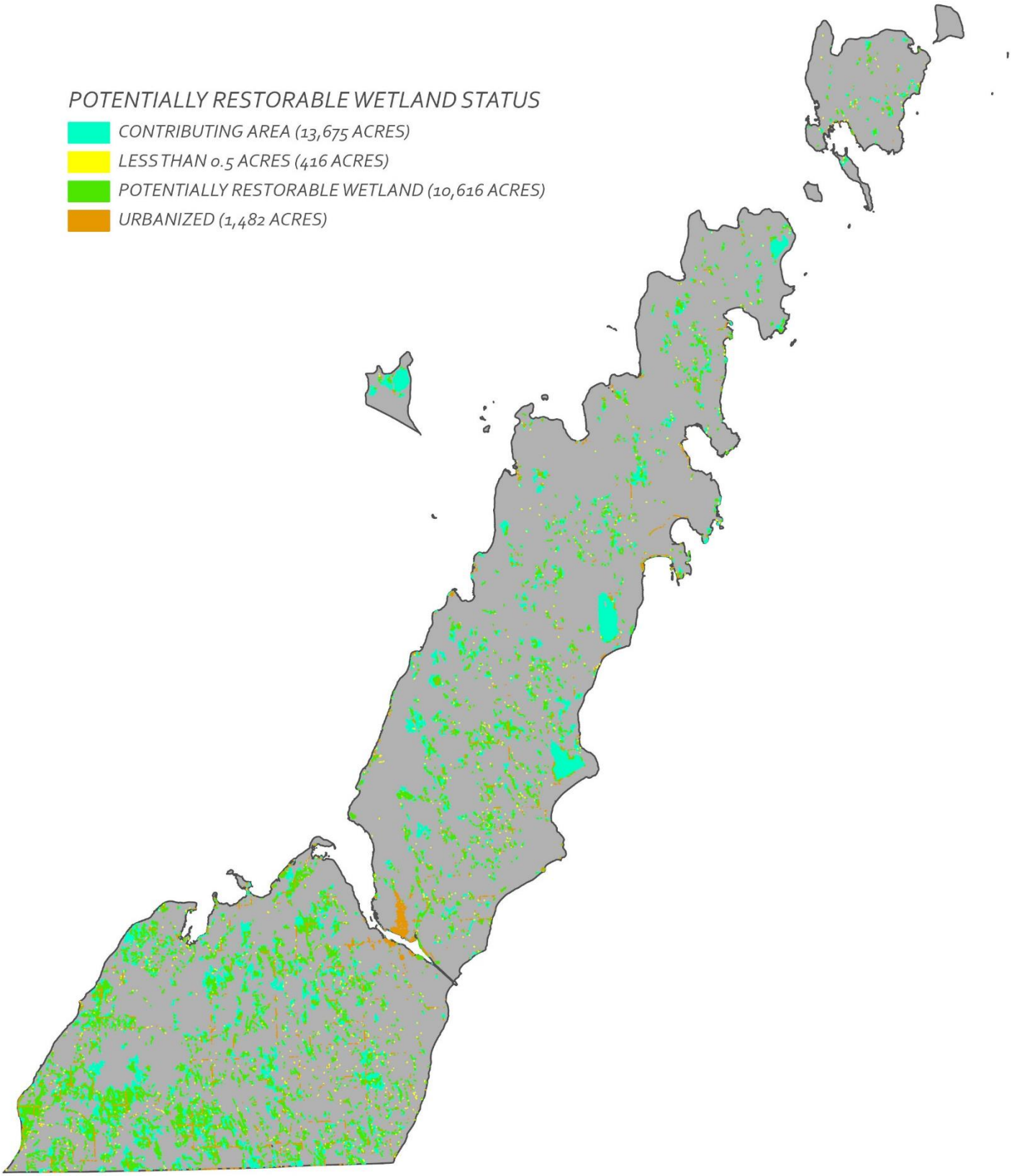


Figure 2-29. Potentially Restorable Wetlands in Door County.

Groundwater Resources

Although Door County is surrounded by the waters of Lake Michigan and Green Bay, the primary source of drinking water for nearly all county residents and visitors is groundwater. This resource impacts a large majority of the county population. In addition to recharge of the county's drinking water aquifers, groundwater resources are vital to wetlands, as well as providing input to surface water resources through connectivity in any ground/surface water systems.

Groundwater Contamination Susceptibility

Groundwater, due to the geology of the county, is readily impacted by surface activities and surface waters. Land use, thin soils over fractured bedrock, soils with high permeability rates, solution features and closed depressions all contribute to the high potential for groundwater contamination (Figure 2-30). These factors are also the primary reasons for the rapid movement of the groundwater giving Door County aquifers an extremely quick recharge time. As a result, the quality of the groundwater is a significant concern to the people of Door County. The sensitivity of this resource is highlighted throughout plan.

Contaminants

A contaminant in drinking water is described as any physical, chemical, biological, or radiological substance or matter in water. The goal of safe drinking water is to maintain a system free from any contaminant. Two common contaminants in Wisconsin with serious, immediate health effects, are bacteria and nitrates.

Bacteria

Coliform bacteria live in soil, on vegetation and in surface water. Water from a properly constructed well is typically free from coliform bacteria as bacteria washed into the ground by rainwater or snowmelt are usually filtered out as the water moves through soil. However, coliform bacteria sometimes enter water supplies through poorly maintained wells, solution features or rapid flow through soils with little attenuation. Coliform bacteria are generally not harmful themselves, but their presence in drinking water is used as an indicator of a risk of more serious contamination. *E. coli* is a type of bacteria found in the intestines and feces of warm-blooded animals. The presence of *E. coli* in well water identifies contamination from sewage or animal wastes and indicates potential contamination by other pathogenic bacteria, viruses and parasites that can cause disease. The health standard for coliform bacteria and E. coli bacteria is zero.

Nitrates

Nitrate is very soluble in water and is easily transported via surface water and overland runoff into groundwater aquifers. Nitrate forms when nitrogen from fertilizers, animal wastes, septic systems, municipal sewage sludge, decaying plants and other sources combines with oxygenated water. In infants under six months of age, nitrate exposure can cause a serious condition called methemoglobinemia or "blue-baby syndrome." Infants with this condition need immediate medical care because it can lead to coma and death. Nitrate taken in by pregnant women may reduce the amount of oxygen available to the growing fetus. Nitrate in drinking water may also increase the risk of thyroid disease or colon cancer. The health standard for the concentration of nitrate in a private well is 10 mg/L.

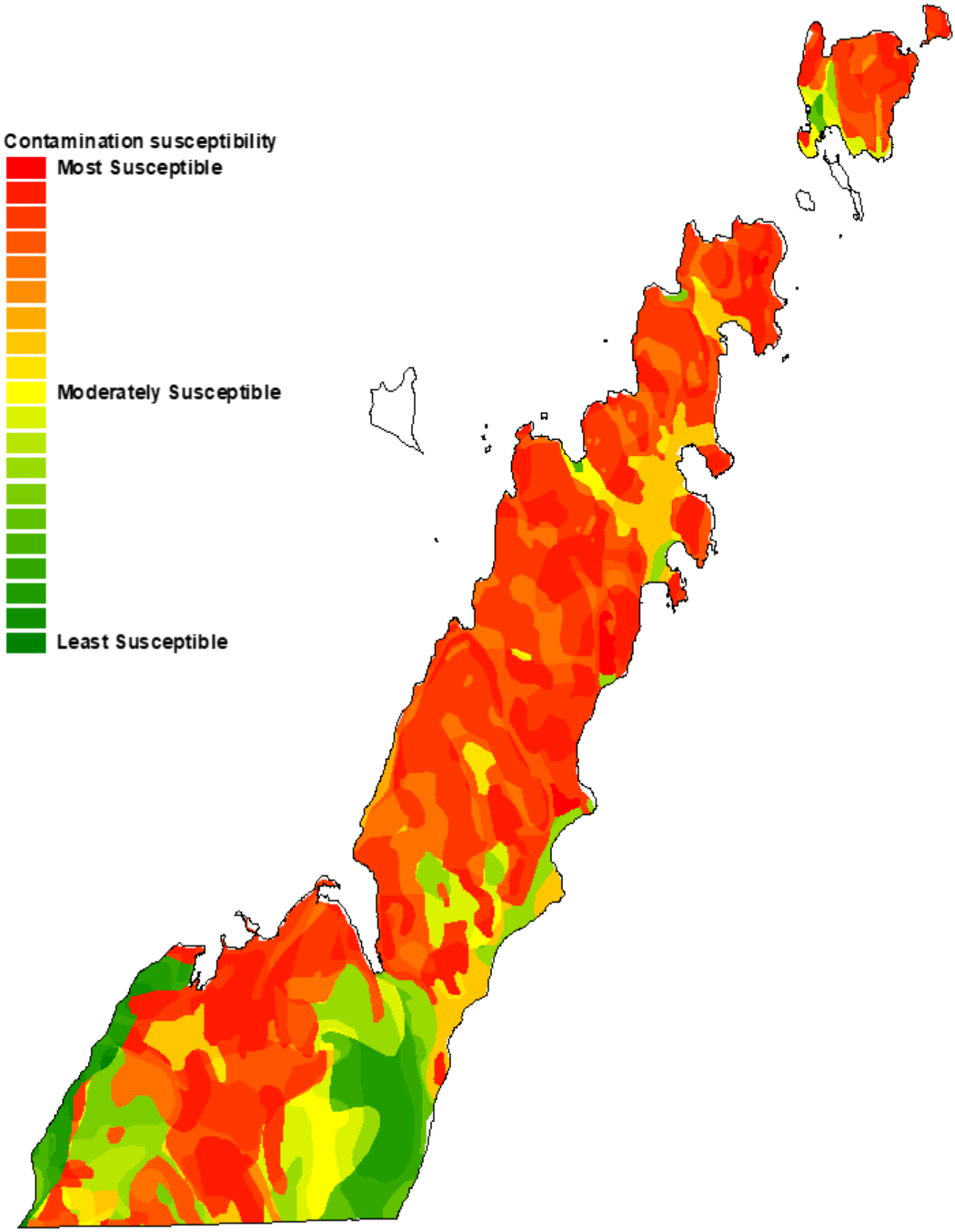


Figure 2-30. Groundwater Susceptibility in Door County. Map Source: Schmidt, R.R, 1987.

Private Wells

There are approximately 8,000 private wells in Door County, with potentially more that are not in use or without records due to their age. Information about the status of groundwater in Door County is relatively inconsistent and primarily based on accounts of historic groundwater contamination events. A five-year study done by the Wisconsin Geological and Natural History Survey incorporated sampling from domestic wells and two groundwater springs. Results from this study revealed that Coliform bacteria was the most frequently detected contaminant in the study area, with the average well yielding a positive coliform detection over 35% of the times it was sampled. Of all of the wells sampled, Nitrate values ranged from non-detectable to 267 mg/L with a sample mean value of 7.4 mg/L (Bradbury and Muldoon 1992). A long history of contamination is still evident in the concerns of residents about the safety of their drinking water supply.

Data from the Wisconsin Department of Health Services shows that in a period from 1988 to 2017, the State average percentage of private wells exceeding 10 mg/L is 10%, and those with a positive detect of Coliform bacteria is 16%.

Recent private well testing initiatives in Door County are summarized in Table 2-13. Voluntary sampling programs were conducted by University of Wisconsin Stevens Point (2011-2015) and University of Wisconsin Oshkosh (2015 & 2016). In 2019, Door County collaborated with the University of Wisconsin Oshkosh to target sampling effort across the county to improve spatial distribution of well testing results. This effort will be continued in future years, as funding allows.

Years	Number Wells Sampled	Total Coliform (presence)	E. Coli (presence)	Average Nitrate (mg/L)	Nitrate (greater than 10 mg/L)
2011 – 2015	557	21 %	10 %	1.3	1 %
2015	477	12 %	1 %	2.2	3 %
2016	392	22 %	2 %	1.9	2 %
2019	148	16 %	0 %	1.7	2 %

Table 2–13. Summary of Door County Private Well Sampling Program Results.

Bacteria and nitrate data can also be viewed on the UW-Stevens Point Groundwater Center's Groundwater Quality Viewer (https://gissrv3.uwsp.edu/webapps/gwc/pri_wells/#).
This data is a compilation of private well testing across the State of Wisconsin, but the information is limited to what is voluntarily provided and should not be extrapolated to a specific well. Figure 2-31 and Figure 2-32 depict bacteria and nitrate testing in Door County. A caveat to this data is that the data shown is an average of all results for each one square-mile section, with some sections containing more data than others.

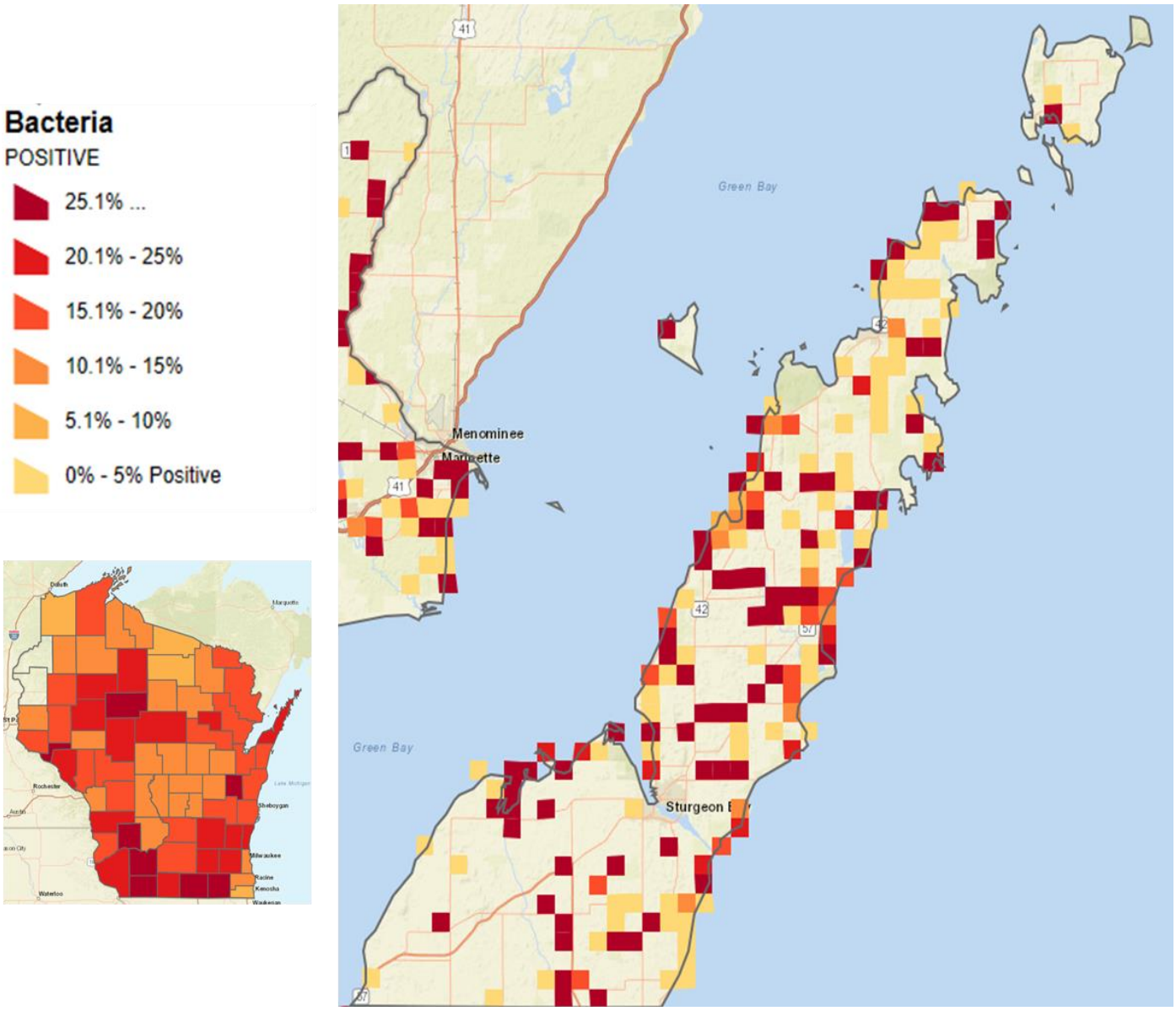


Figure 2-31. Percentage of Coliform Bacteria Detect per Section (Fall 2019) – Data Courtesy of UW-Stevens Point

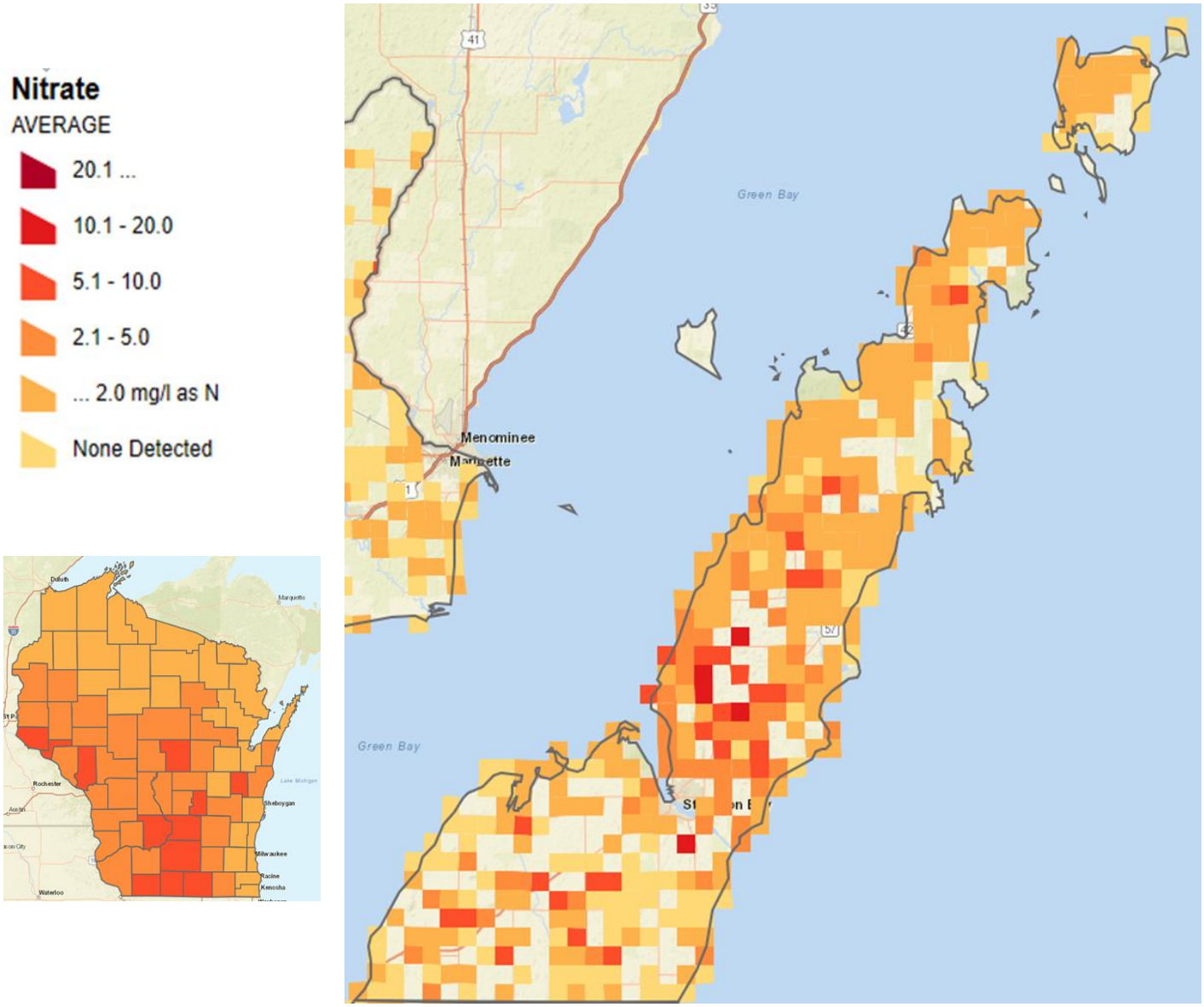


Figure 2-32. Average Nitrate Level per Section (Fall 2019) – Data Courtesy of UW-Stevens Point

Nitrate in Public Wells

Samples for nitrate are generally collected at least annually from public water systems and are required to be reported to the Wisconsin Department of Natural Resources.

Municipal Community (MC) - water systems with 15 or more service connections, or serve a community of at least 25 residents for at least 6 months of the year. MC systems are owned by a city, town, village, or other government entity.
Other-than-municipal community (OTM) - water systems have 15 or more service connections, or serve a community of at least 25 residents for at least 6 months of the year, but are not owned by municipalities. OTM systems include mobile home parks, subdivisions, apartment buildings and condominium complexes.
Transient Non-Community Wells (TN) - systems serve at least 25 people, but not necessarily the same people, for 60 days a year or more. TN systems include motels, restaurants, taverns, campgrounds, parks and gas stations.
Non-transient non-community (NN) - water systems serve at least 25 of the same people for at least 6 months of the year. NN systems include schools, day care centers, factories, or businesses with 25 or more employees.

Data is publicly available and has been aggregated by the University of Wisconsin Stevens Point in the following section to better visualize nitrate levels and long-term nitrate trends in Door County's groundwater (See Table 2-14 and Figures 2-33, 2-34). The Groundwater Retrieval Network represents data from all known wells, including wells that may no longer be in use. To ensure that data is representative of current conditions, wells without a sample collected in the past 6 years are excluded from analysis

Some public water supply systems are sampled more than once per year. Others may also have treated samples represented in the original data. To account for these issues, only the maximum nitrate value for each calendar year was selected for use in the trend analysis and county average.

While this data provides a long-term dataset, it is important to consider that public water wells are often not as representative of groundwater quality in rural areas. In addition, municipal wells may be drilled deeper and often are not reflective of nitrate concentrations in shallow groundwater.

Number of Wells	Mean Nitrate Level (mg/L)	Significant Decrease	Slight Decrease	No Significant Change	Slight Increase	Significant Increase
438	1.24	1	15	406	13	3

Table 2-14. Nitrate Level Trend in Public Wells. Data Courtesy of UW Stevens Point.

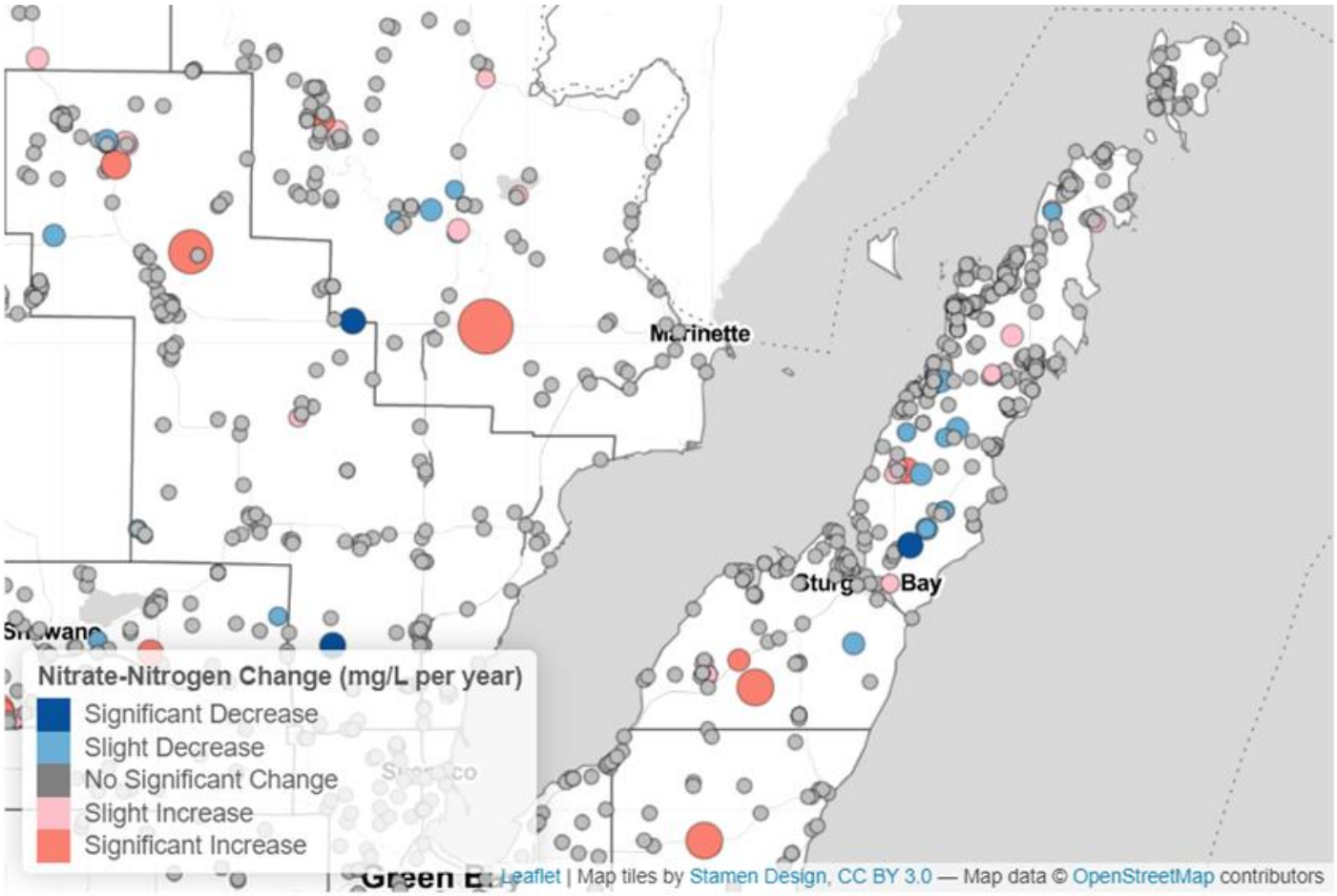


Figure 2-33. Nitrate Level Trend in Public Wells. Data Courtesy of UW Stevens Point.

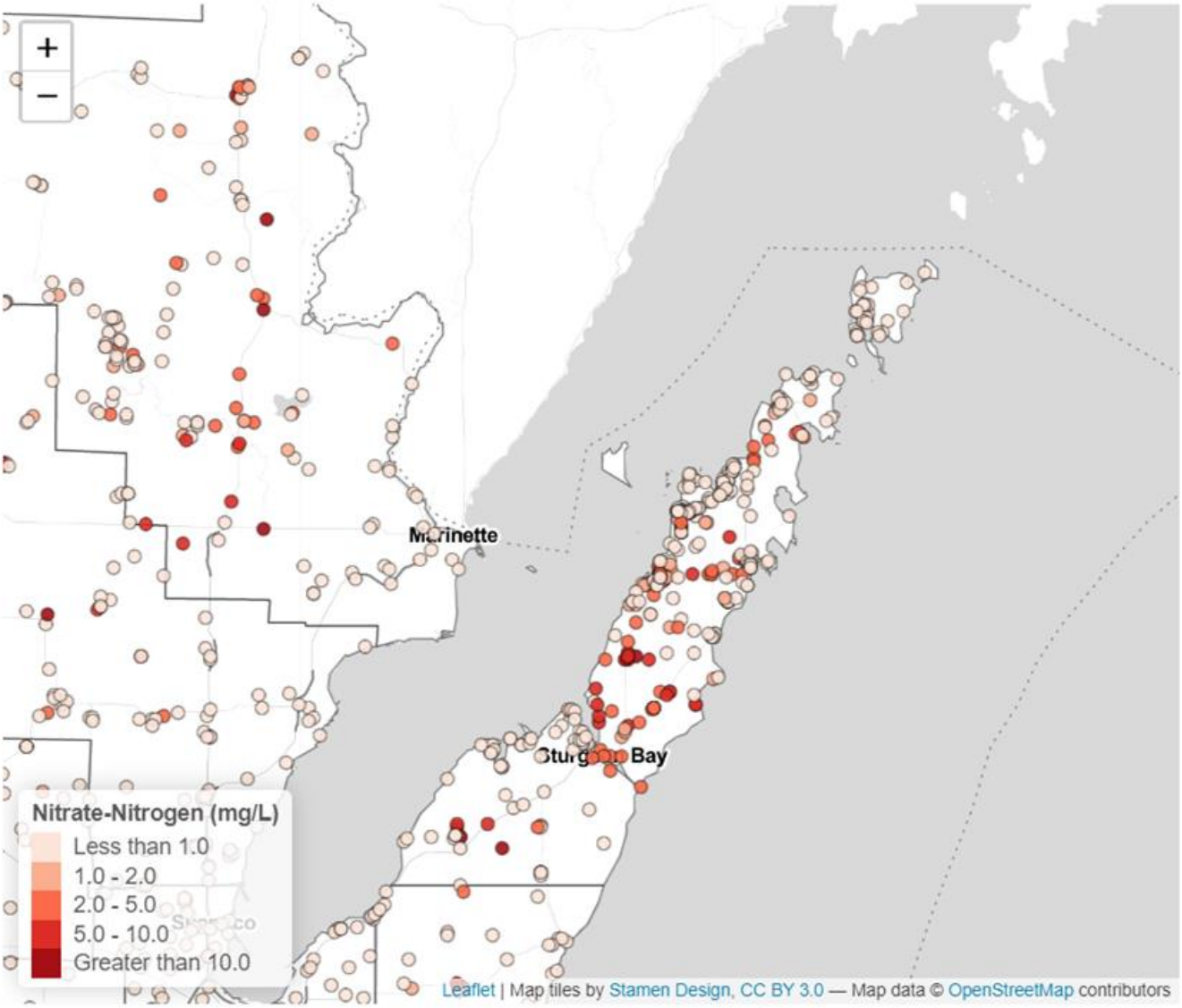


Figure 2-34. Nitrate Levels in Public Wells. Data Courtesy of UW Stevens Point.

Municipal Wells

City of Sturgeon Bay

There are currently five active wells supplying drinking water for the City of Sturgeon Bay. Historical evidence of well water contamination and degradation, as well as being the drinking water source for the largest concentrated population in the county, has enhanced the need for the protection of the aquifers that supply the City of Sturgeon Bay. Nine of eleven municipal wells in the city have had bacterial contamination, six of which were abandoned. Currently, all water from the five active wells is chlorinated and fluoridated before entering the distribution system. In addition, the source water at three of the five wells has sporadically tested positive for total coliform bacteria, additional treatment is provided at these locations, with ozonation as the initial chosen method. However, equipment has aged, treatment has been updated to a combination of ultraviolet light and chlorination.

The Wisconsin Geological and Natural History Survey completed a study to research the boundaries of the Sturgeon Bay Municipal Wellhead Zone of Contribution (ZOC) in 1996 with funding and assistance from the Sturgeon Bay Utilities, the Wisconsin Department of Natural Resources, and the SWCD. This study delineated the land surface area where precipitation and surface waters infiltrate and contribute to the groundwater supplying the five municipal wells. The study also determined the travel times of the groundwater from the point at which it was infiltrated until it reached any one of the five wells. Due to the unique fractured bedrock aquifer, maximum travel times were a remarkable 2 years with mean travel times of approximately 3 months. In comparison to sand and gravel aquifers, the city of Madison, Wisconsin may have mean travel times of 50 to 100‘s of years to its municipal wells. This comparison is evidence to one of the primary risks of groundwater pollution in Door County. The lobes of groundwater traveling to the Sturgeon Bay municipal wells encompasses much of the central part of the county (See Figure 2-35).

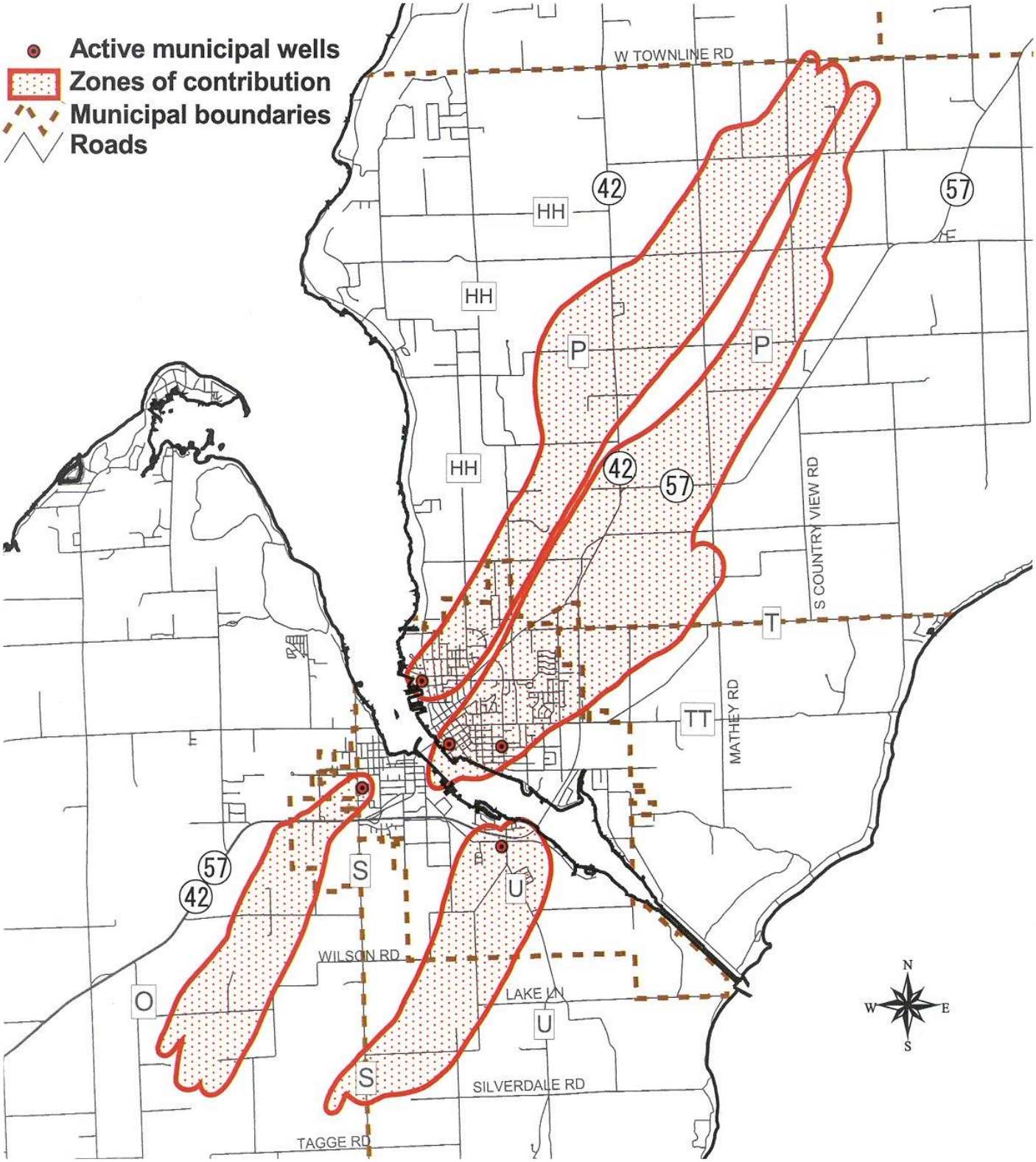


Figure 2-35. Location and Zones of Contribution for the City of Sturgeon Bay Municipal Wells. Map Source: Wellhead Protection Plan – Sturgeon Bay Municipal Wells, 2003

Village of Sister Bay

There are three wells that supply drinking water to the Village of Sister Bay. The village established a Zoning Ordinance in 1973 which includes requirements to control and prevent pollution of water. Additionally, the Village of Sister Bay passed a Wellhead Protection Ordinance in May 1997 to protect the portions of the Zones of Contribution to the two operating wells that lie within the village limits. Well #3 is located outside the village limits, and operated by the Town of Liberty Grove Sanitary district. At this time the two municipalities, the Village of Sister Bay and the Town of Liberty Grove, are working toward the establishment of a wellhead protection plan that addresses all portions of the zones of contribution. The Village municipal code was updated in 2010 to incorporate management zones and create overlays for the village zoning map (See Figure 2-36).

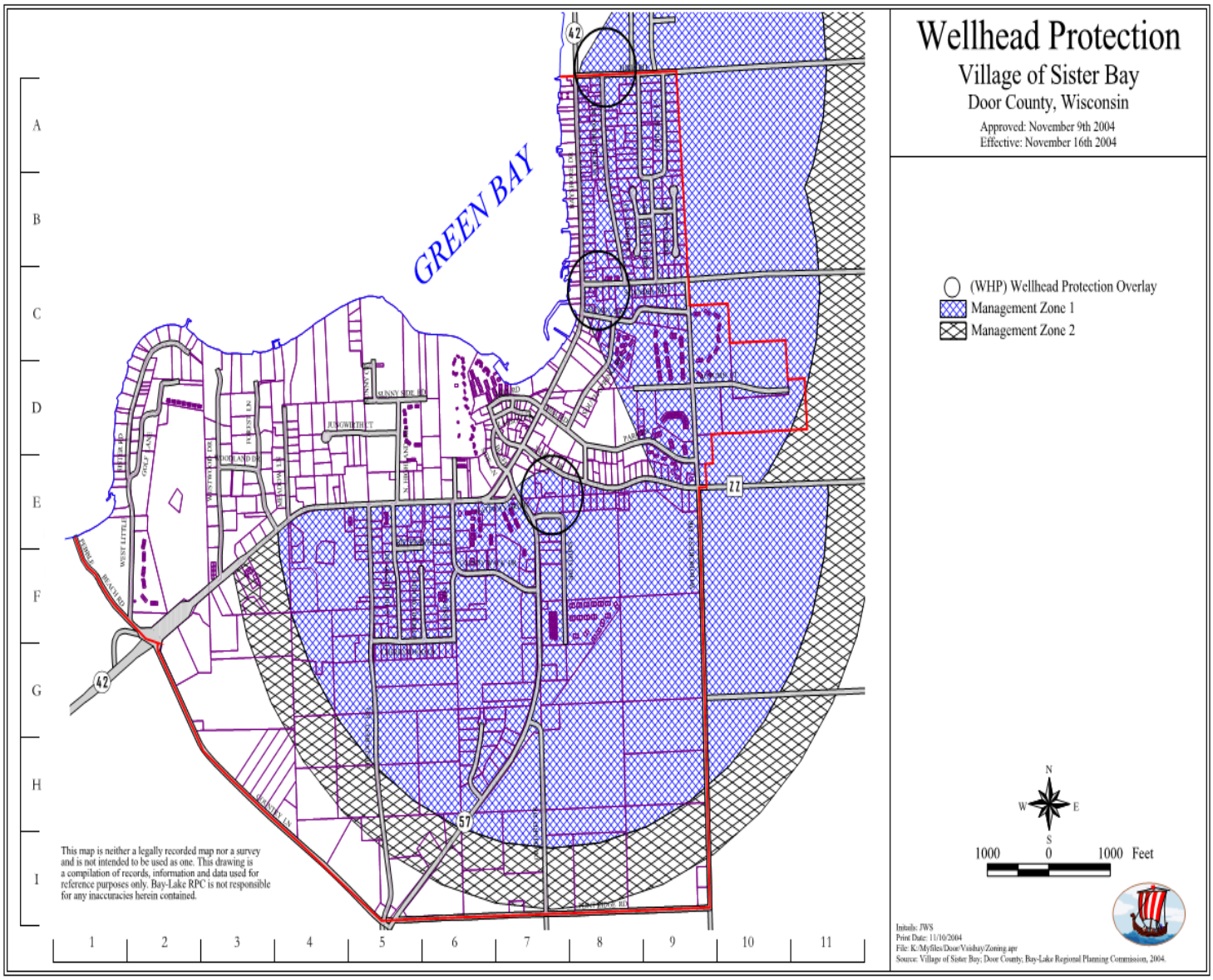


Figure 2-36. Wellhead Protection Areas for the Village of Sister Bay Municipal Wells.

Maplewood

There is a municipal water supply for the unincorporated area of Maplewood, in the Town of Forestville. There is currently not a formal zone of contribution or wellhead protection plan established for this system that supplies drinking water to 44 residential and 6 commercial areas, comprising approximately 120 people. Much of the contributing area for this system lies within the Ahnapee River Watershed.

2.2 Strategic Planning and Public Comment

Previous Land and Water Resource Management Plan Efforts

The original Door County Land and Water Resource Management Plan was developed in 1999. Strategic planning meetings, facilitated by the University of Wisconsin-Extension Community Development Educator and the SWCD, were used to identify and address the concerns and needs of Door County's resources. Six meetings were held to ask "What are the most important soil, water and other natural resource issues facing Door County over the next decade?" of representatives including: members of the public nominated by County Board members, non-profit organizations; partner agencies and elected officials. Detailed results and their rankings can be reviewed in the 1999 Land and Water Resource Management Plan.

To update the original Land and Water Resource Management Plan in 2005 the SWCD surveyed the same group of representatives to determine their opinion of the current status of Door County's resource concerns. The results of the survey and the associated rankings can be found in Appendix B of the 2011-2020 Land and Water Resource Management Plan. The top nine resource concerns in the 2005 survey were the same as those in established in 1999.

In 2010, the Land and Water Resource Management Plan was again revised. For the update the SWCD reviewed recent planning documents that had included extensive input from the public, agency officials, non-profit groups and county staff. These included the Door County Comprehensive and Farmland Preservation Plan – 2035, Door County Citizen Survey Report (2009), and Door County Greenprint Project (2008-2009). The results showed a strong correlation to the existing goals in previous Land and Water Resource Management Plans.

In 2010 SWCD provided the results from the above-listed studies along with past plan priorities to the Citizens Advisory Committee established for previous versions of the plan. The group provided unanimous feedback to maintain the same prioritized goals used in previous versions of the plan. Additionally, some of the responses from previous surveys were added to the list to create a more comprehensive documentation of the natural resource issues present in Door County.

Each of the planning documents reviewed in 2010 contains goals that are relevant to the 2021-2030 Land and Water Resource Management Plan. The Door County Farmland Preservation Plan was integrated into the Door County Comprehensive Plan in 2014, creating the Door County Comprehensive and Farmland Preservation Plan 2035. Brief summaries of plans and goals reviewed in preparation of this Land and Water Resource Management Plan are included in the following sections.

Door County Comprehensive and Farmland Preservation Plan 2035

Smart Growth legislation was signed into law on October 27, 1999 and detailed a comprehensive plan and numerous land use regulations and programs that needed to be consistent with a comprehensive plan by January 1, 2010. The Door County Planning Department coordinated the development of the Comprehensive Plan with the county's nineteen municipalities. In addition to the municipalities, development of the plan included efforts from several county departments and committees and work groups comprised of local experts and residents.

Farmland preservation planning law requires consideration of the same topics as the comprehensive planning law, and both laws have the same public participation, hearing, notification, and adoption requirements. Door County adopted an updated Comprehensive Plan and Farmland Preservation Plan in 2014 after an extensive planning and public review process. Details are available here: https://www.co.door.wi.gov/492/Planning

The overall goals developed for the Door County Comprehensive and Farmland Preservation Plan 2035 are:

GOAL 1. Improve communication and knowledge regarding land use issues between all levels of government and residents, and support or initiate cooperative efforts on issues requiring multijurisdictional coordination.

GOAL 2. Preserve and protect the county's surface water, groundwater, wildlife habitats, and natural features.

GOAL 3. Protect existing agriculture and promote sustainable agricultural operations.

GOAL 4. Maintain, preserve, and enhance the community's rural atmosphere and agricultural heritage.

GOAL 5. Preserve historic sites and community character, and support, as appropriate, cultural and historical festivals, events, and activities.

GOAL 6. Encourage quality affordable housing and economic opportunities for the current and future population.

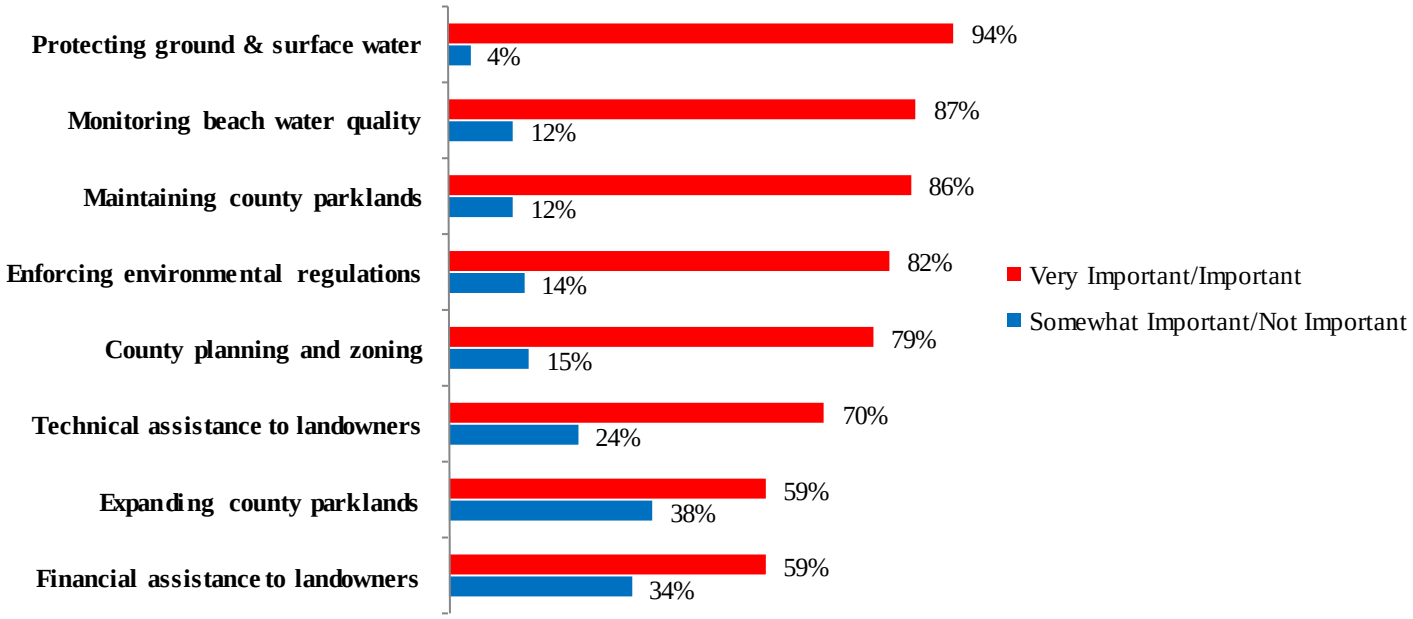
GOAL 7. Support the development, maintenance, and up-grading of utilities, community facilities, and services in an efficient, coordinated, and cost-effective manner to service the current and future needs of the community's residential and commercial uses.

GOAL 8. Support the development - at the lowest possible environmental and social cost - of a transportation system that is safe, economical, efficient, integrated, inter-modal, and interconnected, and adaptable to changes in demand and technology.

Door County Citizen Survey Report

In May of 2009, the Survey Research Center at the University of Wisconsin - River Falls mailed surveys to 1,123 Door County residences to gather opinions about priorities for Door County government. The response rate to the survey was 45 percent, resulting in accuracy of plus or minus 4.4 percent with 95 percent confidence.

Respondents gave high levels of importance to county operations and services relating to protection of natural resources and the environment. Water quality topics topped the ranking with more than nine out of ten respondents acknowledging protection of ground and surface water quality as very important or important.



When presented with a list of thirty county services and operations, respondents tended to rate many as very important or important. When analyzing only the very important results, twelve of thirty services and operations were considered as such and are listed in rank order below:

1. Protecting ground and surface water quality
2. Countywide ambulance service
3. Responding to public safety concerns
4. Maintaining roads and bridges
5. Recording and maintaining vital records
6. Prosecuting criminal cases
7. Enforcing child support orders
8. Conducting elections
9. Monitoring beach water quality
10. Enforcing environmental rules and regulations
11. Collecting property taxes
12. Providing public health services

Door County Greenprint Project

The planning for the Greenprint project began with an analysis of existing plans developed by county, state and federal agencies as well as information held by nonprofit groups regarding the status of the natural resources and the efforts to protect those resources. Following the analysis of the existing plans, the participants worked as groups to establish goals for the county that could be supported by regionally relevant and scientifically defensible data.

The goals established by the Greenprint Project that were determined to be the most significant in the protection of the county's resources are as follows:

- Protect Groundwater Quality
- Protect Surface Water Quality
- Protect Habitat for Native Plants and Animals
- Restore Landscape Connectivity

Door County Invasive Species Strategy 2018-2023

The Door County Invasive Species Strategy was developed by the Door County Invasive Species Team (DCIST) and the SWCD in 2018. It identifies four primary areas needed to provide a coordinated approach to managing invasive species throughout Door County and serves as the Door County's intended approach towards invasive species management.

Overall goals established in the Door County Invasive Species Strategy are as follows:

<u>Prevention:</u>

- Limit the number of invasive species introduced to Door County and slow the spread of those invasive species already present within the county.

<u>Early Detection and Monitoring:</u>

- Increase the likelihood that invasive species in Door County will be identified and reported to DCIST.
- Develop and enhance the capacity of the DCIST partnership address early detection species with emphasis on priority EDRR species and those listed as prohibited under Wisconsin's NR-40 Administrative Rule.
- Coordinate data collection and management throughout the DCIST partnership and ensure that data collected in Door County is compatible with technology information systems within the State and region.

<u>Control and Management:</u>

- Maintain *Phragmites australis* as the county's focal species until fewer than 10 acres remains throughout the county and its shorelines.
- Determine next highest priority species for management and control in Door County and use an integrated pest management approach to make recommendations to the public and conduct control activities.
- Foster municipal invasive species programs.
- Seek funding to continue large-scale control initiatives for priority species within the county.

- Coordinate data collection and management throughout the DCIST partnership and ensure that data collected in Door County is compatible with technology information systems within the State and region.

Communication:

- Expand the public's awareness of and involvement in DCIST and invasive species efforts. Build both financial and volunteer support for these efforts. Maintain organizational integrity of the DCIST partnership.

2021-2030 Land and Water Resource Management Plan Efforts

To prepare for the 2020 update of the Door County Land and Water Resource Management Plan the SWCD worked with the UW-Madison Extension to conduct public input sessions similar to those held in 1999 for the original plan development. Members of the public were invited to participate in one of three sessions held in February 2020 in Sturgeon Bay, Egg Harbor, and Brussels. At each session the SWCD gave a presentation with information on land, water and natural resources in Door County. The UW-Madison Extension then facilitated an exercise wherein small groups of participants answered the question "What are the most important soil, water and other natural resource issues facing Door County over the next decade?". Each group recorded their issues and then presented their list to all present. Participants were provided an opportunity to vote on their top three priorities out of all the issues generated by the group. Appendix B contains the results of each session with the vote tallies for each issue.

In January 2020 the Door County Board of Supervisors appointed a Local Advisory Committee following ATCP 50.12, Wisconsin Administrative Code, to reflect a broad spectrum of public interests and perspectives and provide recommendations to the Door County Land Conservation Committee. Appendix C lists the representatives and affiliations of those appointed to the committee. The Local Advisory Committee met twice in late winter/spring of 2020 to review the list of Specific Land & Water Resource Needs, Resource Goals and draft sections of the Land and Water Resource Management Plan.

2.3 Identification of Specific Land & Water Resource Needs

An important component of the Land and Water Resource Management Plan is the identification of specific land and water resource needs of Door County to inform the development of goals and actions to address those needs. The previously discussed planning and public participation efforts were integral to the development of the prior plans as well as the 2021-2030 update to the Land and Water Resource Management Plan. Based on the input collected through this process the top resource concerns have remained virtually the same through all of the Land and Water Resource Management Plans. Additions to the 2021-2030 list reflect additional concerns about human impacts on natural resources, changing climate and lake levels, and the need for civil discussion and information sharing.

The resource needs are listed in order of priority, however many of the concerns are interconnected and can be addressed concurrently. Groundwater protection and improvement is an immediate and apparent concern based on the unique geology of the County. The protection of the groundwater resource can impact nearly all surface land use activities. Other resource needs, can be categorized into biological concerns as threats to habitats and species.

The identification of the resource needs of Door County is the basis for the SWCD programs that are to address the corresponding resource need. The prioritized list has and will continue to provide guidance to SWCD program direction but does not include all the resource needs of Door County.

The prioritized major land and water resource needs of Door County are:

1. Groundwater protection and improvement
2. Surface water protection and improvement
3. Impacts of human use and development on natural resources
4. Changing climate and lake levels
5. Human waste management
6. Animal waste management
7. Stormwater management
8. Soil erosion control; agricultural and construction site
9. Invasive species control
10. Education and awareness of environmental issues and sustainable farming practices
11. Fertilizer and chemical use
12. Natural Resources information sharing
13. Non-Metallic mine reclamation
14. Agricultural sustainability and land protection

2.4 Resource Goals

The purpose of the Door County Land and Water Resource Management Plan is to address concerns for the protection of the natural resources of the county. The directions taken by the SWCD will be using a series of goals to be implemented through existing and future programs as well as through assistance to both voluntary and regulated landowners. This implementation will primarily involve the execution of practices and conservation measures that will provide the greatest benefit to the land and water resources of Door County.

Because it is often not possible to link a specific cause and effect for concerns relating to Door County's resource needs, it is the intent of the SWCD to use the best judgment, most current technology and technical assistance available to install as many practices and conservation measures as possible to remediate and/or protect the county's land and water resources. An example of the difficulty of specific cause and effect would be an attempt to determine the specific pollutant source location for a specific contaminated well.

The resource goals of the Door County LWRMP are broad topics that reflect the identified land and water resource needs of the county. A prioritized list of these major land and water resource needs and their associated goals are as follows:

1. Groundwater protection and improvement
   Goal: Protect or improve, when and where necessary, groundwater resources to applicable State standards.

2. Surface water protection and improvement
   Goal: Protect or improve, when and where necessary, surface water resources to applicable State standards.

   Goal: Protect surface water resources through identification and abatement of beach contamination sources.

3. Impacts of human use and development on natural resources
   Goal: Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).

4. Changing Climate and Lake Levels
   Goal: Collaborate with partners (e.g. other County Departments, NOAA, WDNR, and others) to develop climate adaptation best practices to protect natural resources and support development of long-term climate resilient mitigation practices for agriculture and other land uses.

5. Human waste management
   Goal: Reduce the risks to water quality through proper repair/replacement of failing septic systems.

6. Animal waste management
   Goal: Reduce the risks to water quality through proper storage, handling and disposal of animal waste.

7. Stormwater management
   Goal: Reduce the risk to water quality and prevent flooding through proper stormwater runoff management.

8. Soil Erosion Control; agricultural and construction site
   Goal: Reduce soil erosion rates on agricultural fields through proper soil conservation practices.

   Goal: Reduce soil erosion from construction sites through proper soil erosion control measures.

9. Invasive species control
   Goal: Protect the habitat and biodiversity of native fauna and flora through the control of aggressive, invasive non-indigenous species.

10. Education and awareness of environmental issues and sustainable farming practices
    Goal: Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

11. Fertilizer and chemical use
    Goal: Reduce the risks to water quality through proper storage and handling of fertilizer and chemicals.

12. Natural resources information sharing
    Goal: Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

13. Non-metallic mine reclamation
    Goal: Reduce the impacts to water quality and other natural resources from nonmetallic mines through proper operation and/or reclamation procedures.

14. Agricultural sustainability and land protection
    Goal: Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.

Part 3 of this Land and Water Resource Management Plan describes the SWCD programs that are the primary vehicles for working toward the overall goals to protect Door County's land and water resources.

Part 4 gives additional details of the programs and associated activities and aligns each program with the overarching Land and Water Resource Management Plan Resource Goals listed above.

Part 3

Plan of Implementation Addressing Land, Water & Related Resource Needs

Contents

3.1 Agricultural Implementation
3.2 Urban and Rural Non-Agricultural Implementation
3.3 Additional Groundwater Protection Programs
3.4 Invasive Species
3.5 Technical Assistance & Information and Education

The following sections contain descriptions of the SWCD programs that are used to meet the overarching Land and Water Resource Management Plan Resource Goals listed in Part 2. Each section also includes specific program goals and associated priority actions.

Part 4 gives breaks down program activities into short-term and long-term tasks and shows the connection between each program and the overarching Land and Water Resource Management Plan Resource Goals listed in Part 2.

3.1 Agricultural Implementation

Overarching Resource Goals

- Protect or improve, when and where necessary, the groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Reduce the risks to water quality through proper storage, handling and disposal of animal waste.
- Reduce soil erosion rates on agricultural fields through proper soil conservation practices.
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Reduce the risks to water quality through proper storage and handling of fertilizer and chemicals.
- Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.

Agricultural Implementation Program Goals

Protect water quality and address land and water resource needs though implementation of the agricultural performance standards and prohibitions in Chapter 23, Door County Code.

Promote conservation practices that protect water quality and enable proper resource management by landowners.

Chapter 23: Agricultural Performance Standards and Animal Waste Storage Ordinance

To improve the protection of water resources from nonpoint source pollution, 1997 Wisconsin Act 27 modified Sections 92 and 281 of Wisconsin Statutes to require the development of performance standards for agricultural and non-agricultural nonpoint source water pollution. The statewide standards and any county-developed standards must address the Animal Waste Advisory Committee Prohibitions (281.16(3)). The Door County Land and Water Resource Management Plan is designed to follow the guidelines outlined in the statewide performance standards and prohibitions.

The SWCD completed an Agricultural Performance Standards and Animal Waste Storage Ordinance in the fall of 2004. This comprehensive ordinance was created to address the Statewide Agricultural Performance Standards and Manure Management Prohibitions in Chapter NR 151, Wisconsin Administrative Code, and was adopted by the Door County Board of Supervisors on August 24, 2004 and codified as Door County Code Chapter 23.

Chapter 23 also included a revision of the 1987 Animal Waste Storage Ordinance. This update assured that all activities relating to animal waste storage and transfer comply with agricultural performance standards and technical standards necessary for the SWCD to ensure sound construction and repair practices consistent with the water quality goals of Door County.

Chapter 23 has since been revised each time the state of Wisconsin has revised the Agricultural Performance Standards in Chapter NR 151, Wisconsin Administrative Code, and when updated technical standards related to animal waste storage are identified in Chapter ATCP 50, Wisconsin Administrative Code. This enables the SWCD to consistently enforce the most up-to-date standards at the local level.

The following agricultural performance standards and prohibitions are contained within Chapter 23:

Agricultural Performance Standards	**Effective Date***
Sheet, rill and wind erosion	October 1, 2002
Clean water diversion	
Manure storage, closure and existing facilities	
Manure storage, new construction and alterations	January 1, 2011
Nutrient management	Varies (10-01-2003, 01-01-2005 and 01-01-2008)
Tillage setback	January 1, 2011
Phosphorus index (PI)	
Process wastewater handling	
Silurian bedrock (areas with 20 feet or less of soil over Silurian bedrock)	July 1, 2018
Manure Management Prohibitions	
No overflow of manure storage facilities	October 1, 2002
No unconfined manure pile in a Water Quality Management Area (WQMA)	
No direct runoff from a feedlot or stored manure into waters of the state	
No unlimited access by livestock to waters of the state	

* Effective date listed in Ch. NR 151, Wisconsin Administrative Code, and important for identifying cost share requirements

Chapter 23 outlines the implementation requirements for the Agricultural Performance Standards and Manure Management Prohibitions. These include a specific process by which the SWCD makes a compliance determination for each standard and prohibition, classifies cropland or livestock operation

noncompliance as “new” or “existing” relative to the effective date of the standard or prohibition, identifies if cost share is required to be offered, and formally notifies the landowner and operator of these determinations and the associated compliance period.

Landowners that are found to be noncompliant are required to either change management or install best management practices (BMPs) to meet the agricultural performance standards and manure management prohibitions, provided that a bona-fide offer of cost share has been made when there are eligible costs. Appendix D contains a list of BMPs commonly installed and cost shared by SWCD.

To ensure that continual cost share is not required into the future, Chapter 23 includes:

> *Once a landowner or operator achieves compliance with a cropland/livestock performance standard or prohibition, compliance with the standard or prohibition shall be maintained by the existing landowner or operator and heirs or subsequent owners, regardless of cost sharing.*

This allows landowners and operators to receive the technical and financial assistance they need to bring their cropland and livestock operations into compliance with the standards and prohibitions while providing some assurance that water quality protection and BMPs endure over time.

SWCD implementation activities for the agricultural performance standards and prohibitions include the following:

- Information and Education
  - Landowner and operator contacts
  - Informational brochures
  - Speaking engagements
- Inventory and Assessment for Compliance Status
  - Identification of priority livestock operations and cropland
  - Site visits, data collection, discussions with owner/operator
- Tracking
  - Documentation (assistance notes, photos)
  - GIS tracking by parcel of compliance status of inventoried property
  - Access database by parcel of compliance notifications, status, and deadlines
  - Financial, conservation planning, and design records for installed BMPs
- Notification and Enforcement (Sections 1.33 and 1.34 of Chapter 23, Door County Code)
  - Comprehensive inventory of all parcels associated with owner/operator
  - Office review of all pertinent records related to site such as: installed BMPs, prior determinations and notifications, history of discussions with landowner
  - Notification letter generated following procedures in Chapter 23
  - Discussion with owner/operator
  - Notification letter sent via certified mail or hand delivery (with affidavit)
  - Technical assistance to propose necessary BMPs and site management to achieve compliance
  - Financial assistance secured from a variety of grant sources to offer cost share to install BMPs (when available and/or required)
  - Formal offer of cost-sharing (when available and/or required)
  - Compliance period established

- Cost share agreements developed with landowners/operators and technical assistance provided to install BMPs to achieve compliance, LCC approval of cost share agreements
- Annual report of notification letters and status to LCC
- Site returned to compliance: notification letter with obligation to maintain in future
- Persistent non-compliance after compliance period has ended referred to Corporation Counsel for elevated enforcement

A decision made in writing by the SWCD may be filed by the person aggrieved by the decision or a person with adverse impacts to substantial interests. The appeal must be filed and the appeal fee must be paid within 30 days of the issuance of the decision. After the review, the Board of Adjustment must provide its written determination within 45 days. A chart depicting the appeal process can be found in Appendix E of this document.

The current status of Chapter 23 inventories and compliance notifications to landowners and operators through June 1, 2020, is listed below. Individual notifications have principally included all parcels owned and/or operated by the recipient of the notification. It's noteworthy that this covers both livestock operations and cropland which may have been inventoried prior to adoption of the 2011 performance standards (tillage setback, phosphorus index, process wastewater) and the 2018 Silurian bedrock performance standard. In that case, those parcels may be listed as "currently compliant", where in reality additional determinations need to be made to assess the compliance status of performance standards that have been promulgated after the issuance of those notifications. Figure 3-1 illustrates the location of parcels included in notifications to date, and indicates their current compliance status.

912 Notifications:

- 113 are currently noncompliant
  - 87 eligible for cost share
  - 73 were offered cost share, 62 accepted the cost share offer
- 799 are currently compliant (653 have been determined to be compliant for all items)
  - 200 were compliant in the first notification
  - 599 achieved compliance following notification
    - 519 were eligible for cost share
    - 514 were offered cost share, 439 accepted the cost share offer
    - 160 addressed without c/s

In order to effectively implement the requirements of the agricultural performance standards and prohibitions listed above the adoption of ordinances designed to protect the quality of Door County's land and water resources is necessary. While Chapter 23 is a comprehensive document, it will be necessary to continuously monitor its adequacy at meeting future concerns that are considered as potential threats to Door County's resources. The intent of the LCC in the development and adoption of ordinance(s) will be to invite all interested parties to voice their input and concerns. Interested parties include farm groups, environmental groups, other agencies, resource professionals, other potentially impacted entities and private citizens. Public input and LCC guidance will be used by the SWCD in drafting any applicable ordinance(s).

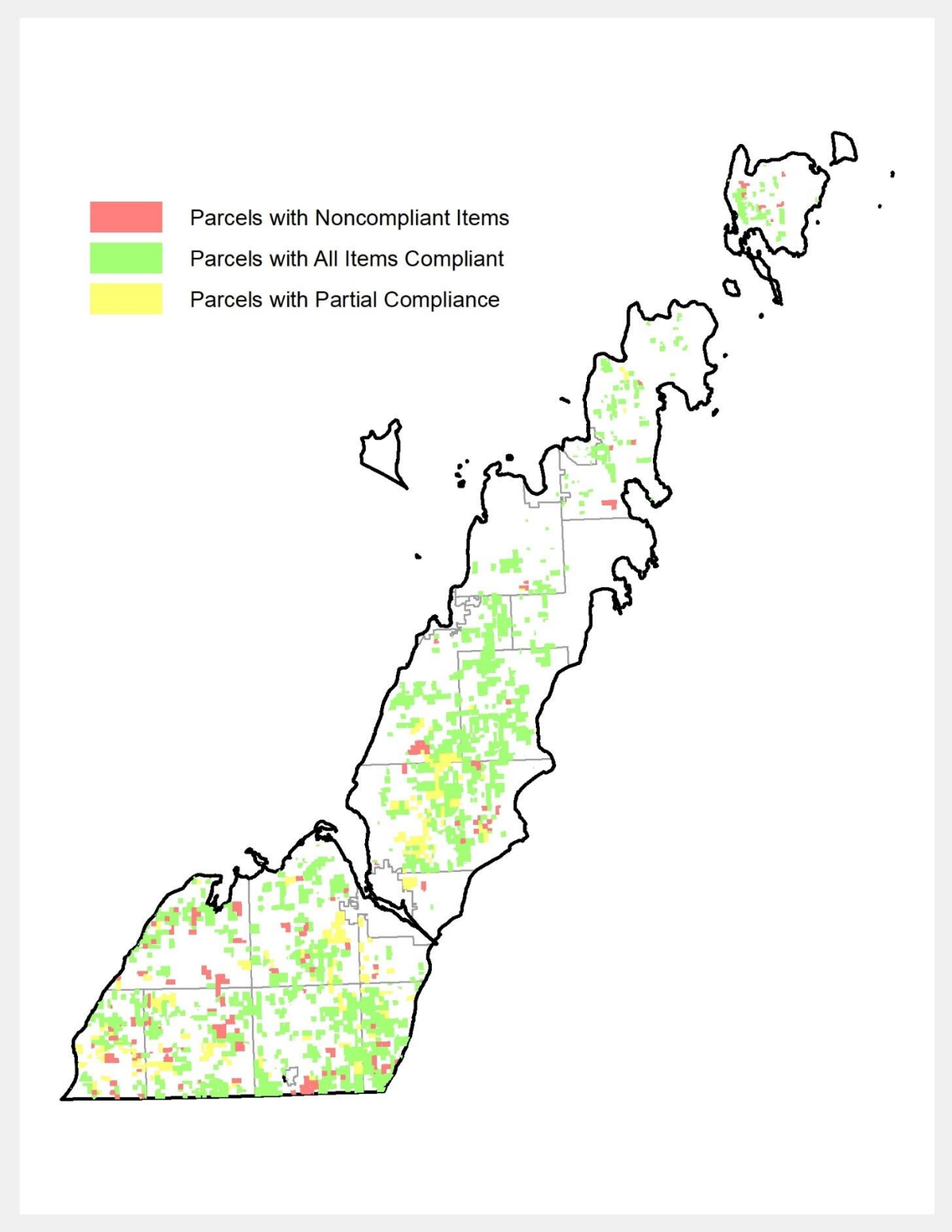


Figure 3-1: Locations of parcels that have been inventoried and notified of compliance status under Chapter 23.

Implementation Strategy for Agricultural Standards and Prohibitions

To ensure effective implementation of this plan the SWCD follows an established strategy to help landowners comply with the agricultural performance standards and manure management prohibitions. Program emphasis has shifted over time from large, comprehensive projects in defined geographic areas known as "Priority Watershed Projects" (from the mid 1980s – 2000s) to a focus on implementation of the agricultural standards and prohibitions at individual sites. In recent years smaller scale watershed projects have again emerged as a priority. No matter the scale, implementation of the required agricultural performance standards and prohibitions will continue through the combined efforts in the following categories:

1. Voluntary Participation
   Regardless of location in the county, landowners that voluntarily seek compliance without previous designation by the SWCD will be prioritized for technical and financial assistance. This will remain the preferred approach for implementing best management practices in Door County. Technical and financial assistance for voluntary conservation projects will not be restricted to the boundaries of a large geographic area-based comprehensive project or plan. Assistance to landowners through established programs as well as non-traditional avenues is necessary to provide a complete approach to protecting the natural resources of Door County and achieving compliance with agricultural performance standards and manure management prohibitions.

2. Required Landowners and/or Operators
   Landowners with livestock operations that are new or significantly expanded since the effective date of the relevant performance standard or prohibition are required to comply regardless of cost sharing availability. Likewise, landowners who have previously achieved compliance with a standard or prohibition are required to maintain compliance without further cost share offer. The SWCD will continue to provide technical assistance to such landowners and only rarely will be able to provide cost share for eligible BMPs. Landowners receiving a Notice of Intent or Notice of Discharge from the WDNR are required to comply, provided cost share is offered for eligible expenses. The SWCD will provide technical assistance and seek funding, when necessary, to assist these landowners.

3. Review of Previously Installed Best Management Practices (BMPs)
   A majority of farms have installed some BMPs through prior cost share programs, some of which are now over thirty years old. The operation and maintenance period and life expectancy of these projects has been exceeded and the associated technical standards have changed significantly in the intervening time. The SWCD will coordinate a safety and environmental review of installed BMPs at livestock operations to identify those in need of repair, upgrade, and/or abandonment if the practice is a health or safety hazard. The SWCD will also review and promote re-establishment of cropland BMPs such as sediment basins and grassed waterways which have a typical lifespan of ten to fifteen years and will have filled with sediment if they fulfilled the original intent.

4. Farmland Preservation Program
   The goal of the Farmland Preservation Program is to preserve current and future agricultural uses of land by providing tax credits to those within an exclusive agricultural zoning district or with signed Farmland Preservation Agreements. In Door County only one town, Clay Banks, adopted the exclusive agriculture zoning district. Landowners claiming tax credits are required to comply with

the agricultural performance standards and prohibitions and verifying compliance for these parcels is a priority for the SWCD. SWCD conducts spot checks on 25% of enrolled acres each year and tracks participation using excel spreadsheets. Identified noncompliance is discussed with landowners and a schedule of compliance established; cost share is rarely available to resolve compliance issues for these sites. In 2019 twenty-three landowners claimed the tax credit for 2,311 cropland acres while two landowners were ineligible for the tax credit due to unresolved notices of noncompliance.

5. Targeted Watershed Projects
   WDNR has renewed interest in watershed planning and implementation at the HUC-12 (subwatershed) scale following the US Environmental Protection Agency "9 Key Elements" framework for watershed plans. The goal is to holistically improve water quality by assessing the contributing causes and sources of nonpoint source pollution, involving key stakeholders and prioritizing restoration and protection strategies to address water quality problems. The SWCD has an approved nine element plan for the Upper Ahnapee Watershed in Door County. Within the last four years the SWCD has also targeted efforts to identify nonpoint sources of pollutants in the Sugar-Silver-Renard Watersheds and the Kayes-Larson Watersheds. The SWCD has prioritized landowners within these targeted watersheds for technical and financial assistance.

6. Geographic Prioritization
   In addition to the efforts outlined above, and as time and resources permit, the SWCD identifies priority sites using a geographic prioritization based on six factors: depth to bedrock, depth to water table, soil attenuation potential, existence of a surface water quality management area, existence of a high-priority watershed and existence of a closed depression. Each of these factors was given equal weight in a formula to generate a number for each livestock parcel in the county, the higher numbers being more critical and zero being the least (Figure 3-2). All of the parcels in the county were ranked according to the model and given a numeric value. Identification of priority farms and cropland and implementation of the standards and prohibitions has occurred incrementally, starting with the most critical and moving systematically through the ranked list (Figure 3-3).

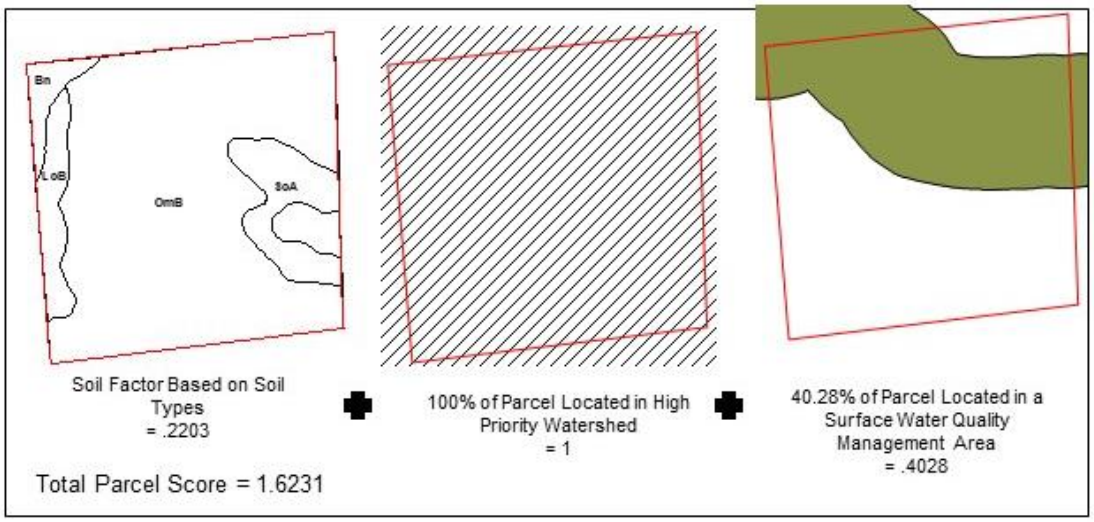


Figure 3-2: Example of parcel ranking for geographic prioritization.

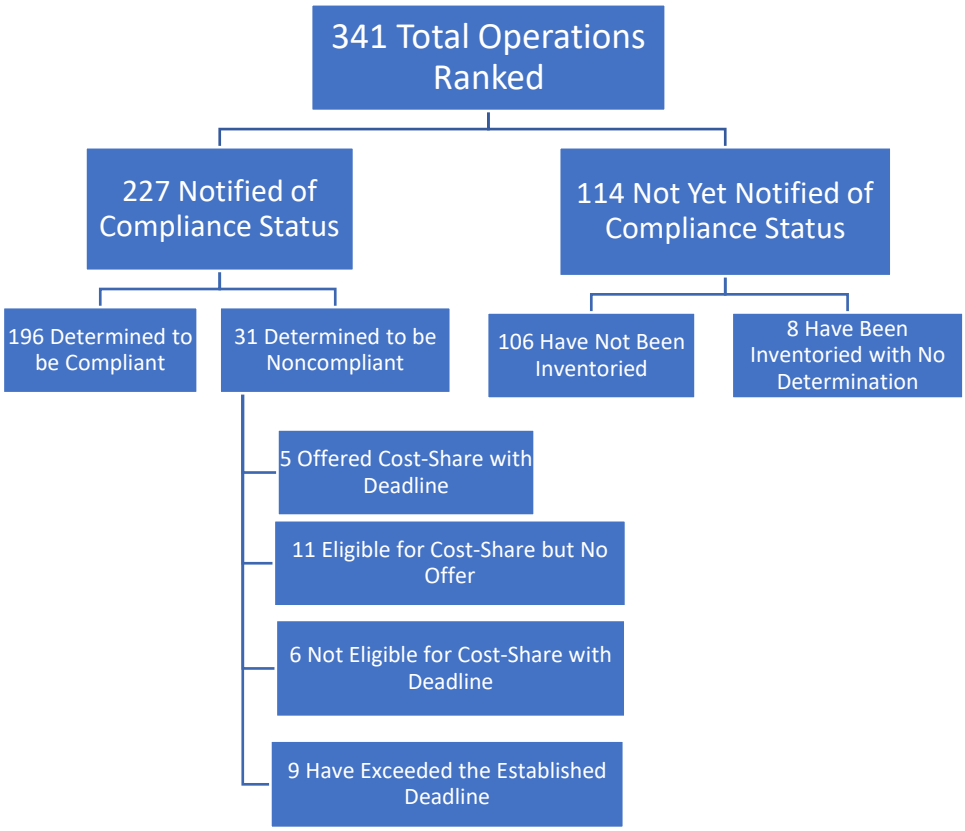


Figure 3-3 Status of notifications to livestock operations ranked using geographic prioritization.

Refinement of Geographic Prioritization

When selecting priority farms the SWCD seeks the areas with the greatest need for protection and greatest potential for pollutant reduction. The geographic prioritization removes personal, political and social biases and instead concentrates on the land and water resource needs. Within these considerations the SWCD also recognizes that there are additional factors that are not quantifiable in a model or the established categories. In these situations, the SWCD will analyze the ranked list based on additional criteria to move a selection up or down to most wisely use limited resources. Criteria that may be considered are:

- Number of animal units
- Condition of existing manure storage and barnyard facilities
- Cropland suitable for winter application of manure
- Management ability
- Historic water quality concerns or complaints
- Viability of operation
- Long-term pollution potential

As a method of checks-and-balances, any deviation from the ranked prioritization list will need the approval of the County Conservationist prior to initiation of investigation of compliance with the performance standards and manure management prohibitions.

Nutrient Management

The purpose of nutrient management is identified in NRCS Conservation Practice Standard 590 (2015) as:

> *To budget, supply, and conserve nutrients for plant production. To minimize the risk of agricultural nonpoint source pollution of surface and groundwater resources. To properly utilize manure or organic by-products as a plant nutrient source. To protect air quality by reducing odors and reactive nitrogen emissions (ammonia, inorganic oxidized forms, and organic compounds). To maintain or improve the physical, chemical, and biological condition of the soil.*

This standard outlines the requirements for nutrient management plans which are required both as a standalone performance standard, as well as to demonstrate compliance with the sheet, rill and wind erosion and phosphorus index and Silurian bedrock performance standards for cropland.

The total amount of harvested cropland in Door County comprises approximately 86,500 acres and is largely concentrated in the land base spanning south of Sturgeon Bay to approximately an imaginary line spanning from Baileys Harbor to Egg Harbor (See Figure 2-13). The SWCD began a comprehensive nutrient management program in the spring of 1994. Since then, the program has received a high level of acceptance with a steady increase in numbers of planned acres through the 2000s. Over 80% of Door County's cropland has been included in nutrient management plans since 2013 (Figure 3-4). The SWCD has received sufficient funding to offer the required cost share for nutrient management to nearly all eligible parcels.

Despite the high level of nutrient management coverage within the county, challenges remain to minimize the impacts of nutrient applications on surface water and groundwater within the County. The SWCD has prioritized efforts to ensure plans are prepared accurately and implemented as written in the field through detailed office review of submitted plans, communication with landowners and operators, and inspection of manure applications. Plan reviews focus on compliance and/or deficiencies in meeting "T" tolerable soil loss, identification of high phosphorus fields, channels in need of vegetation, and whether or not the plan meets requirements of the 590 standard. The SWCD also provides nutrient management plan assistance to landowners in the form of collaborative training sessions and assistance for small operators who lack technical skills and/or internet access.

To be successful at protecting water quality nutrient management planning must be broader than just identifying nutrient applications (NPK). The SWCD needs to expand programming to promote concepts such as: soil health, building organic matter, reducing excessive phosphorus levels in soils, stabilizing concentrated flow channel and other conservation practices to reduce soil erosion, increased setbacks from streams beyond the minimal five-foot requirement, reduced tillage and adjustments to crop rotations. This may be achieved through continued professional development for SWCD staff, cooperative efforts with partners who have similar goals, and engagement with landowners through conservation planning.

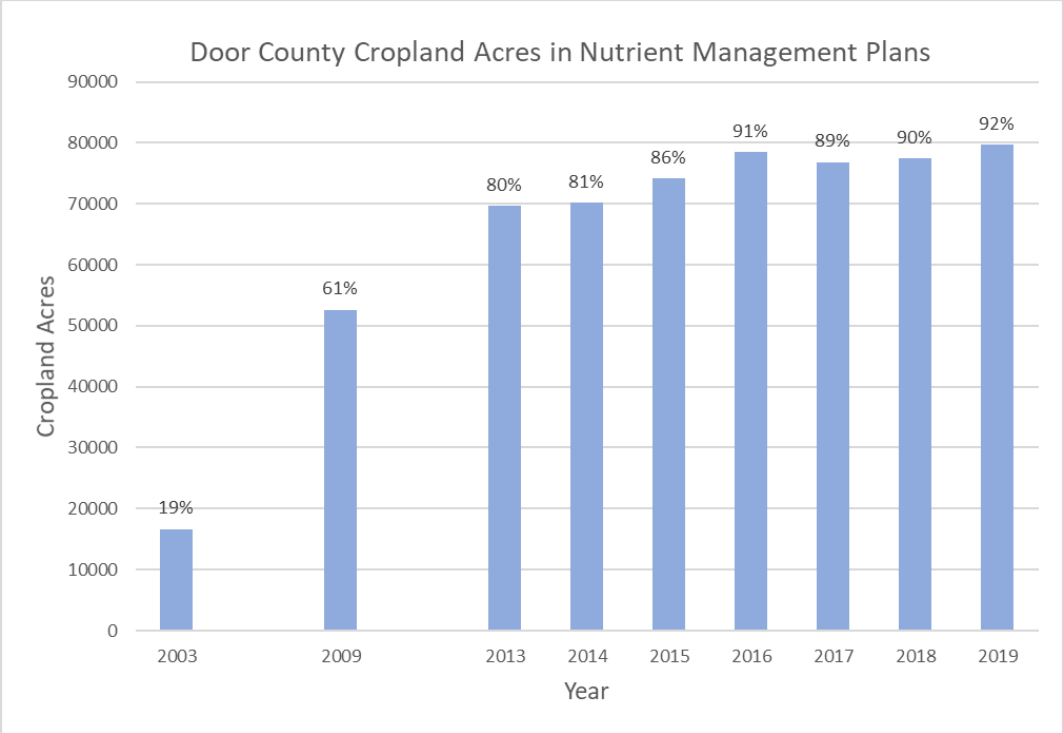


Figure 3-4: Number of acres and percentage of harvested cropland acres included in nutrient management plans submitted to the SWCD from 2003 through 2019.

Chapter NR 243 – WPDES Concentrated Animal Feeding Operations (CAFOs)

The Wisconsin Pollutant Discharge Elimination System (WPDES) Program was established in Chapter 283, Wisconsin Statutes, to address point sources of water pollution to waters of the state. The WDNR regulates the discharge of pollutants through wastewater permits issued for a five-year term that contain monitoring, reporting, and compliance schedule requirements. Large Concentrated Animal Feeding Operations (CAFOs) are permitted by WDNR under Chapter NR 243, Wisconsin Administrative Code. CAFOs are required to follow the agricultural performance standards and prohibitions as well as additional permit requirements, such as zero discharge of pollutants from the production site area, beyond those that apply to small and medium operations without a WDNR permit.

There are currently two CAFO operations in Door County with WPDES permits. One large CAFO operation has a permit expiring March 31, 2022 that allows for expansion up to 10,000 animal units over the permit term. The second is a medium-sized operation that was formally designated as a CAFO by WDNR due to discharges to waters of the state. Cropland acreage owned and/or operated by these two operations, as well as CAFOs located in other counties, comprises approximately 16,600 acres (20%) of all Door County cropland (See Figure 2-13).

The SWCD continues to provide technical assistance to CAFO operations to meet the agricultural performance standards and prohibitions and animal waste permit conditions. Enforcement of these standards remains the responsibility of the SWCD as well as providing technical assistance for permits through the Door County Land Use Services Department. For these reasons the SWCD takes an active role in reviewing all plans submitted for approval, no matter the size of the operation. The SWCD helps the WDNR identify landowners that are potentially approaching the maximum number of animal units

before a permit is required and facilitates landowner compliance with permit conditions and protection of Door County's natural resources.

Sources of Funding to Assist with Best Management Practice Installation

Installation of Best Management Practices (BMPs) is a primary means of addressing the land and water resource needs at agricultural sites. Additionally, a required component of implementing the agricultural performance standards and prohibitions is making a bona-fide offer of cost share for eligible costs to install BMPs. It has been nearly twenty years since the first agricultural performance standards and prohibitions were created in 2002 in ch. NR 151, Wisconsin Administrative Code, and most livestock operations in Door County have installed BMPs through a variety of cost share programs.

Compliance determinations and associated offers of cost share have been complicated by the additional performance standards promulgated in 2011 and 2018. For example, the SWCD may have worked with a livestock operation to install BMPs such as manure storage in 2010 and brought the site fully into compliance at that time. However, a new offer of cost share is now required to address process wastewater issues at the same site since that standard later came into effect. Site changes, such as expansion of numbers of animals, may also impact cost share eligibility and requirements. Over time the technical standards have been strengthened to be more protective of water quality which increases the overall cost to install BMPs, at times well beyond what is typically available through traditional cost share grant programs. So while cost share is necessary to assist landowners and operators with the financial viability of their sites, it has made compliance determinations and enforcement of the agricultural performance standards and prohibitions difficult.

The SWCD has long prioritized seeking cost share funding to offer landowners and operators to address the water quality and natural resource issues at their sites. The SWCD has a history of successful implementation of projects including:

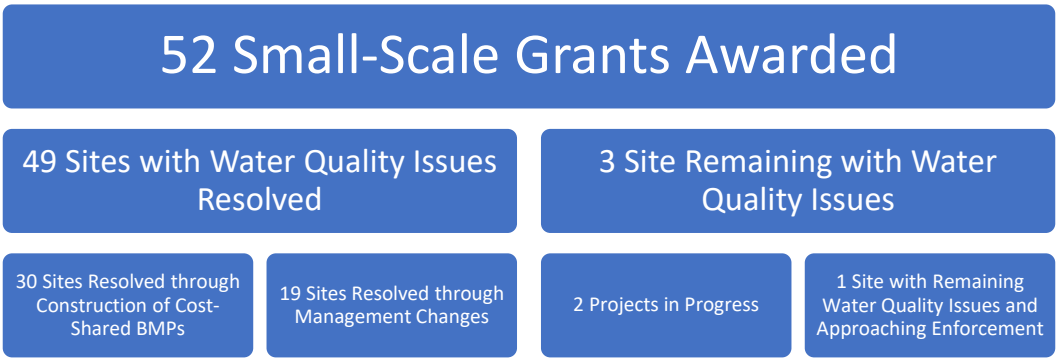
- Priority Watersheds:
  Although the Priority Watershed program is no longer active in Wisconsin, it is important to recognize this significant prior investment in reducing nonpoint sources of pollution in Door County.

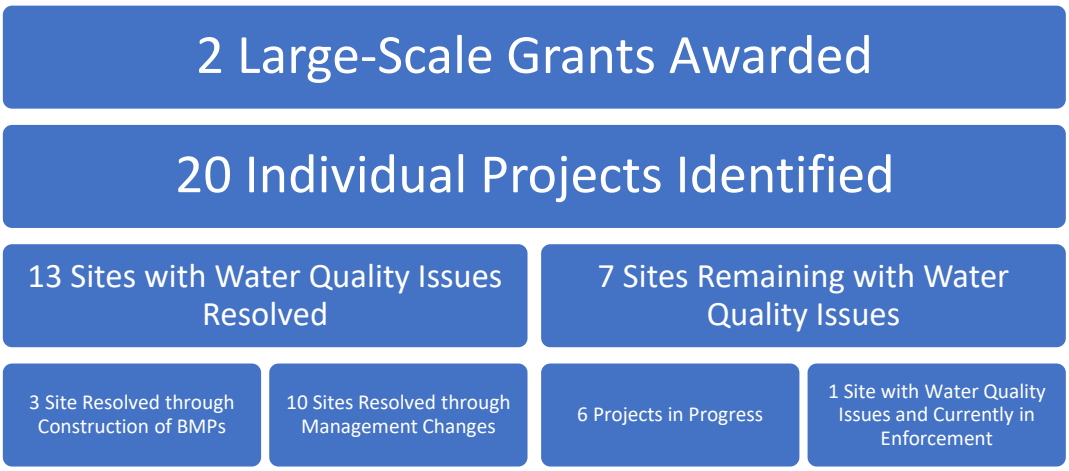
  The Upper Door Watershed was selected as a priority watershed under WDNR's Nonpoint Source Water Pollution (NPS) Abatement Program and administered by the SWCD from 1984 to 1996. This project was the first large-scale watershed in the state selected to primarily address the impacts of nonpoint source pollution on groundwater quality. This project successfully installed BMPs as well as heightened awareness of other groundwater quality issues. Economic conditions in the late 1980's hindered some landowner participation and illustrated that without adequate financial assistance animal waste practices to protect groundwater are expensive and difficult for landowners to install.

  The Red River/Sturgeon Bay Watershed was selected as a priority watershed under the same program in 1992 and implemented by the SWCD through 2008. Objectives of the project were to improve water quality and safeguard wells by reducing nutrients, sediment and bacteria loading from a variety of sources. Over its duration the project successfully executed 258 cost share agreements and overcame uncertainties about long-term funding by the state.

The SWCD continues to engage with landowners who participated in both priority watershed projects so that BMPs installed through the program are properly operated and maintained, as well as providing additional technical and financial assistance where necessary.

- Targeted Runoff Management Program:
  The WDNR provides competitive funding to counties to cost share installation of BMPs to meet the Agricultural Performance Standards and Prohibitions through the Targeted Runoff Management (TRM) program. Since the end of the Priority Watershed Program the SWCD has relied on TRM as the primary source of funding for installing BMPs and enforcing Chapter 23. Since 2002 the SWCD has been awarded 52 small-scale TRM grants and two large-scale TRM grants to offer cost share for 20 additional projects. The chart below provides details of the outcome of that funding. TRM has been, and will continue to be, an important tool for providing cost share assistance for projects that most likely would not have happened cooperatively without financial assistance.





- Chapter 243 Notice of Discharge Program:
  Notice of Discharge (NOD) projects are grants provided to the SWCD from the WDNR or DATCP to provide cost share to agricultural sites that have received a notice from WDNR under Chapter 243 Wisconsin Administrative Code. The SWCD identifies suitable sites for this program to the WDNR, applies for grant funding, and provides technical assistance to landowners in the design and implementation of BMPs to remediate the discharge sources. The benefit of this program is that funding is made available more quickly than other grants so that significant impacts and threats to ground and/or surface water can be addressed. Since 2011 the SWCD has assisted 2 landowners and provided $191,000 of cost share for BMPs through this program.

- Conservation Reserve Enhancement Program:
  The Conservation Reserve Enhancement Program (CREP) pays landowners to establish vegetation on land along waterways or return continually flooded fields to wetlands. Enrollment may be either a 15-year agreement or a perpetual easement. Landowners receive a combination of state and federal payments per acre enrolled which vary depending on soil type and previous land use. The SWCD works with the local Farm Service Agency office to determine landowner eligibility for the program, administers the state portion of the program, and monitors compliance with the program conditions. Over the lifetime of the program (2002-2019) the SWCD has helped landowners enroll in 57 fifteen-year agreements with 355 acres protected, and nine perpetual easements with 85 acres protected.

- Additional Sources of Funding:
  In addition to the programs listed above, the SWCD relies on other sources of funding and partners for assistance in BMP installations. The USDA Natural Resources Conservation Service (NRCS) provides significant amounts of funding for practices in Door County through the Environmental Quality Incentives Program. DATCP annually provides funding to the SWCD through the Soil and Water Resource Management Program to implement the priorities outlined within this Land and Water Resource Management plan. Over the last ten years DATCP has allocated an average of $32,000 for cropland or 'soft practices' and $48,000 for livestock or 'hard practices' each year.

- County Water Pollution Abatement Cost-share Program:
  First adopted in 1980, the *Door County Water Pollution Abatement Cost Share Program Policy* was designed to provide cost share to landowners who install BMPs to abate nonpoint sources of pollution. Door County allocates $10,000 annually to the program which is generally used to provide additional incentives to landowners installing BMPs, make grant applications more competitive for funding, and allow for non-traditional, lower-cost projects to be installed. This program is also the primary source of funding for well abandonments described later in this section.

Priority Agricultural Implementation Actions:

- Administer Chapter 23 using established strategy to identify priority sites for inventory, tracking and notification/enforcement of SWCD findings
- Review Animal Waste Storage permit applications to ensure compliance with standards and prohibitions and resource protection goals
- Seek a variety of funding sources to provide financial assistance and cost share offers, where necessary and appropriate, for operations to install BMPs to address water quality issues

- Monitor the adequacy of Chapter 23, Door County Code to meet Door County's resource needs and update as necessary to reflect changes and maintain consistency with state statutes and agricultural performance standards and manure management prohibitions.
- Continue site visits to inspect installed BMPs, ensure continued compliance, and provide technical assistance for updating BMPs when necessary
- Health and safety review of BMPs that have exceeded life expectancy, with emphasis on comprehensive Slurrystore manure storage inspection by representative of Harvestore company and abandonment of BMPs at non-active farms that are deemed a hazard
- Promote proper implementation of nutrient management plans and cropping practices, such as high residue management and cover cropping, to reduce soil erosion
- Provide technical assistance to landowners to address land and water resource needs
- Implement the Farmland Preservation Program to promote agricultural use on agricultural land and compliance with agricultural performance standards
- Collaborate with partners to provide nutrient management training for landowners that prepare their own nutrient management plans
- Eliminate winter spreading of manure in high hazard or environmentally sensitive areas; Support efforts that eliminate any application of liquid manure during frozen or snow-covered conditions
- Evaluate feasibility of, and promote where reasonable, alternative methods of waste handling and/or storage to reduce proportion of water in manure and process wastewater. Alternative methods should meet or exceed current environmental protections
- Assist WDNR with identification of operations approaching the CAFO permit threshold size and with compliance related to permit and agricultural performance standards and prohibitions
- Expand technical expertise of SWCD staff in best management practices and conservation planning through continued professional development

3.2 Urban and Rural Non-Agricultural Implementation

Overarching Resource Goals

- Protect or improve, when and where necessary, the groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Protect surface water resources through identification and abatement of beach contamination sources.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Reduce the risk to water quality and prevent flooding through proper stormwater runoff management.
- Reduce soil erosion from construction sites through proper soil erosion control measures.
- Reduce the impacts to water quality and other natural resources from nonmetallic mines through proper operation and/or reclamation procedures.

Urban and Rural Non-Agricultural Implementation Program Goals

Protect groundwater and surface water resources through proper erosion control and storm water runoff management.

Protect groundwater and surface water resources and control of the negative impacts of development through proper reclamation of nonmetallic mines.

Protect and improve beach water quality through continued monitoring, evaluation of installed practices so that sources of beach contamination are identified and abated.

Help Door County cropland owners address wildlife damage issues through the Wildlife Damage Abatement and Claims Program.

Work with natural resources partners to implement watershed restoration projects to maintain and restore high quality and functional habitats.

Voluntary Implementation

As with the agricultural program, the SWCD prioritizes voluntary conservation measures for urban and rural non-agricultural activities. Priority is given to landowners, contractors and other agencies that want to address natural resources needs of their property and implement best management practices. The key to this strategy is providing technical and financial assistance, where available, to plan, design and install appropriate conservation measures. It is imperative that voluntary landowner needs are

addressed to provide a more complete approach to protecting the natural resources of Door County. This service will be provided on a call-in, walk-in, or agency referral basis.

Storm Water Runoff Management and Construction Site Erosion Control

Storm water runoff contains pollutants from roads, parking lots, construction sites, industrial storage yards and lawns. The WDNR Storm Water Program regulates storm water discharges from construction sites, industrial facilities and some municipalities through the Wisconsin Pollutant Discharge Elimination System (WPDES) program through Chapter NR 216, Wisconsin Administrative Code. Subchapter III of NR 151, Wisconsin Administrative Code, includes non-agricultural performance standards to limit nonpoint runoff pollution from non-agricultural facilities and nonpoint practices.

The Door County Zoning Ordinance and Land Division Ordinance regulate various land use activities including those portions of the county governed under the ordinances. Projects can be required to implement plans for both construction site erosion and storm water runoff control measures. These activities are site specific and have requirements established by the Door County Resource Planning Committee, Board of Adjustment, Land Use Services and/or SWCD. The SWCD works with contractors, realtors and all interested parties in both the private and public sectors to promote proper construction site erosion and stormwater runoff control. The SWCD has been delegated responsibility for technical review of submitted plans and inspection of best management practices identified in those plans. An inter-departmental agreement between Land Use Services and the SWCD clarifies department roles and responsibilities.

The SWCD *Storm Water Runoff Control Design Criteria Procedural Policy* was adopted by the LCC in 2006. The policy establishes the minimum criteria for storm water runoff control plans prepared, or reviewed, by the SWCD. This policy considers runoff quantity and quality impact in the preparation of storm water runoff control plans and the design of detention and retention basins. Availability and/or adequacy of the downstream drainage system and outlet are also considered in design. On April 5, 2018 Wisconsin Act 243 became effective requiring local governments to strictly conform with uniform statewide standards. This restricts the SWCD in requiring storm water controls beyond those established by the State unless they are to address existing flooding or to prevent future flooding problems.

The SWCD also provides occasional technical assistance to the Village of Ephraim for site plans submitted under the Village Storm Water / Construction Site Erosion Control Ordinance. The ordinance requires that construction sites form a plan to control storm water runoff and construction site erosion. The LCC approved SWCD's role in implementing the ordinance at the time it was adopted and the SWCD will continue to provide that assistance to the Village as requested.

Recent Lake Michigan water level increases have created additional concerns with shoreline erosion, damage to personal property and damage to local government infrastructure. The SWCD will continue to work with the Land Use Services Department, contractors, landowners, and engineers to streamline permitting and proper shoreline protection efforts.

Nonmetallic Mining and Reclamation

Door County has active and inactive nonmetallic mines found scattered throughout the county in both zoned and non-zoned areas. Active nonmetallic mines provide topsoil, clay, sand, gravel and aggregate for concrete, asphalt, construction and road building as well as dimensional stone for shoreland protection, landscaping, building and decorative use. There are currently fifty permitted sites in Door County (See Figure 2-16) comprising approximately 1,684 acres approved for mining, of which 869 acres are considered active.

Prior to laws and zoning that implemented requirements for mining operations, mines were developed and abandoned without regard to their potential adverse impacts and final restoration of the site. Abandoned rock, gravel, and sand quarries were left void of topsoil and vegetation, which can compromise ground and surface water quality. Additionally, many abandoned mines were left with unstable and unsafe high walls that border property lines. All abandoned mines, regardless of zoning, are not required to institute reclamation efforts to stabilize the site if mining activity ceased prior to August 1, 2001. There have been 5 sites that have completed reclamation efforts on 75 acres since the adoption of Chapter 36.

Chapter 36, Door County Code, is the Nonmetallic Mining Reclamation Ordinance adopted by the Door County Board of Supervisors on May 22, 2001 and amended in 2007. The SWCD regulates all mining reclamation activity in all Door County municipalities with some exceptions including: sites less than one acre, sites for the owner's domestic or farm use, Department of Transportation borrow sites, and those sites regulated by WDNR under Chapter 30 and subject to NR 340. Operators of all nonmetallic mining sites that operate on or after August 1, 2001 are required to apply for a reclamation permit.

The SWCD works with mine operators through Chapter 36 on reclamation plan approvals and modifications, compliance checks, and verifies the necessary financial assurance is secured to ensure satisfactory reclamation in the future.

Beach Contamination – Source Identification and Reduction

The SWCD has worked cooperatively with partners including the Door County Public Health Division, the UW-Oshkosh, Door County Parks, and local municipalities to develop a comprehensive beach monitoring and pollution abatement program for Door County. Door County Public Health leads the beach monitoring program, with 31 beaches tested throughout the recreational season for *E. coli* as an indicator of contamination through Federal Beach Act funds (see Figure 2-14). Results of advisories and closures are made available to the public online at www.wibeaches.us

Following an outbreak of gastrointestinal illness in swimmers at a beach in 2002, the SWCD initiated a comprehensive review of sources of contamination at all monitored beaches with Door County Public Health and the UW-Oshkosh. Data was collected from 2003 – 2007 using funding provided by the Wisconsin Coastal Management Program. Eleven beaches were identified as having elevated E. coli levels following 0.25" rain events in the previous 24 hours indicating storm water discharge during and after rain events as a source of pollutants. Potential pollutants from various land uses are transported to near shore beach waters by storm water pipes, runoff over paved surfaces, and streams. Using this data, the SWCD worked with an engineering firm and nine municipalities to design best management practices to reduce pollutants at each beach. Federal funding totaling $837,377.38 was spent on twelve remediation projects for best management practices with project installations beginning in 2009 and

concluding in 2014. A total of 7 municipalities and 2 county parks participated receiving cost share for the beach contamination reduction program. Beaches that have installed improvements to date are listed on page 23 of Part 2.

This program was successful at installing best management practices at the beaches given the limited regulations and funding available to address storm water runoff impacts on beach water quality. Smaller municipalities commonly do not have the resources in terms of expertise or funding to address this complex issue and the SWCD was able to provide technical and financial support for implementation of practices to reduce bacterial contamination on those beaches. Future efforts will focus on continued monitoring of beaches, including analysis and follow up at beaches where practices were installed. An assessment of the impacts of record high Lake Michigan water levels on installed practices and development of contingency plans for highly impacted beaches will also be necessary.

Watershed Restoration Projects

The SWCD works cooperatively with a wide range of partners to protect and improve watersheds within the county. Restoration efforts are a combination of focused effort through existing programs and additional programs specific to the needs of the target watershed.

Ahnapee River Watershed

The SWCD completed comprehensive inventory, modeling and monitoring of the Upper Ahnapee River Watershed resulting in a *Final Report for Comprehensive Lake Management Planning Grant Project #LPL162317, Forestville Millpond* (June 2018) and *Analysis and Management Plan for The Upper Ahnapee River Watershed* (January 2020). Both reports are available online at www.co.door.wi.gov. The WDNR also completed analysis of erosion potential in the watershed (Figure A-5 of Appendix A) to assist in prioritization of practices to reduce sediment and nutrient loading in the watershed. The SWCD continues to work with landowners to implement conservation practices to reduce nonpoint loading within the watershed, and will use the aforementioned reports to help prioritize those efforts.

In November of 2019 Door County initiated a two-year drawdown of water levels in the Forestville Millpond. The SWCD continues to assist the Facilities and Parks Department with the drawdown as requested. The SWCD will seek additional funding in future years to evaluate the impacts of the drawdown on conditions in the Forestville Millpond and to fully implement the approved 9 element watershed plan for the Upper Ahnapee Watershed.

Dunes Lake

The Dunes Lake project was started to investigate the causes of eutrophication of the Geisel Creek - Dunes Lake - Shivering Sands Creek system. Watershed sources of phosphorus have been addressed by the SWCD securing cost share grants for farmers so that all cropland in the watershed is covered under a nutrient management plan and all farm sites certified as compliant with the Agricultural Performance Standards and Prohibitions. In addition, the Door County Sanitarians have verified that all existing POWTS (private onsite wastewater treatment systems) were in compliance. Efforts related to the classification of Geisel Creek have been initiated to enable future phosphorus limitations on the Sevastopol Sanitary District wastewater discharge and thus permanently reduce point sources of phosphorus to entire system.

Once the watershed nonpoint sources of nutrients were addressed the partnership between Ducks Unlimited, The Nature Conservancy, WDNR, the SWCD and Doorland Preserve landowners focused on

restoration efforts to remove organic sediments containing legacy phosphorus and to control invasive cattail populations impacting fish passage. This partnership has maintained an aggressive and strategic plan to restore Dunes Lake and is committed to maintain this unique habitat after restoration efforts are completed. Previous integrated efforts included the completion of a 2-acre pilot dredge, 32 acres of invasive narrow leaf cattail treatments, and the installation of a public parking lot on property owned by the Town of Sevastopol. Approximately $1.1 million in funding, through several funding sources, has been secured by project partners to complete restoration dredging of approximate 18 acres in 2020. Continuing invasive species monitoring and treatment are also planned for 2020.

Kayes and Larson Creek Watersheds; Silver, Sugar, and Renard Creek Watersheds

Since 2017 the SWCD has targeted conservation activities within the Silver, Sugar, and Renard Creek Watersheds in southern Door County that drain to the Bay of Green Bay. The purpose is to reduce phosphorus loading to the Bay, increase conservation practice adoption to reduce nonpoint loading to the streams and Bay, and monitor stream conditions in those watersheds. Two years of initial contacts led to the SWCD seeking additional funding for installation of best management practices at agricultural sites within those watersheds. Since 2019 the SWCD has undertaken a similar inventory and monitoring effort in the Kayes and Larson Creek Watersheds, with an expectation of seeking additional funding to implement conservation practices in these watersheds in future years.

Watershed Approaches for Wetland Protection and Restoration

Wetland protection and restoration is yet another conservation tool available to the SWCD. The SWCD provides technical assistance to individual landowners about the importance of protecting and preserving the function of existing wetlands as part of other conservation projects. Continued cooperation with other departments, agencies, and partners will be necessary to advocate for and ensure protection of existing wetlands continues. Updated mapping may be necessary to ensure all wetland types are identified and protected, including ephemeral ponds that may only exist during the wettest of years. The WDNR is currently updating the Wisconsin Wetland Inventory and a review of the adequacy of wetland mapping would be appropriate after that project has been completed.

Restoring the functional values of impacted wetlands can also help meet watershed goals and advance the priorities outlined in the Land and Water Resource Management Plan. There are a variety of tools available to prioritize wetland efforts including the "Wetlands by Design Watershed Approach" developed by the Nature Conservancy and WDNR. The Explorer tool is available at https://maps.freshwaternetwork.org/wisconsin/ and is designed to inform watershed planning and help narrow potential restoration options to a manageable number based on specific functional values.

Wildlife Damage Abatement and Claims

The State of Wisconsin wildlife damage abatement and claims program is administered through the SWCD. Landowners voluntarily report crop damage and loss from four species: goose, deer, bear and turkey and the SWCD provides them with information about techniques for abatement. When abatement practices are not effective, the SWCD estimates the financial crop loss which makes the landowner/operator eligible for compensation. Approval is based upon available state funds and landowner compliance with their abatement plan.

For wildlife species not eligible under the program, the SWCD provides information on the species and how to remedy the loss however, financial assistance is not available. The most common of the ineligible species in Door County are raccoon and gulls.

Nearly 90% of time in the program is devoted to damage caused by Door County's large deer population. An increasing number of land owners are also reporting turkey damage but there have not been any well documented cases of extensive turkey damage yet. The success of the venison donation portion of the program has continued to increase over the past five years. The SWCD also works closely with the Conservation Congress members to include options on all aspects of wildlife control and other issues.

The agricultural and ecological damage that some species can cause is a concern for the county. Other assistance through the program will be enhanced by working in conjunction with other cooperating agency representatives to inform more landowners of the options available if damage occurs.

Priority Urban and Rural Non-Agricultural Implementation Actions:

- Promote proper storm water runoff and construction site erosion control to public and private professional sectors through by providing information about the impacts of nonpoint runoff, requirements, and effective use of BMPs.
- Initiate cooperative efforts between agencies to review polices and program implementation to establish a more thorough and uniform storm water runoff management and construction site erosion control program in Door County.
- Implement Chapter 36, Door County Code, Nonmetallic Mining Reclamation Ordinance by reviewing plans, checking compliance of active mines with plan requirements, and requiring guarantee of financial assurance to facilitate proper resources for reclamation.
- Follow up monitoring at beaches and evaluation of impact of high Lake Michigan lake levels on practices installed to abate storm water runoff. Continued collaboration with Door County Public Health and UW-Oshkosh for monitoring.
- Annual review of beach advisory and closures to identify beaches where increased investigation and protection may be necessary.
- Implement and revise Upper Ahnapee Watershed plan to incorporate results of WDNR Total Maximum Daily Load Analysis
- Assist with drawdown of the Forestville Millpond, seek funding, and complete follow-up sampling
- Evaluate opportunities to protect existing wetlands and restore functional wetlands to meet watershed goals, prioritizing effort based on available tools such as the "Wetlands by Design Watershed Approach"
- Ensure up-to-date wetland maps are available and used; evaluate if additional wetland inventory is necessary to identify and protect ephemeral ponds
- Work with natural resources partners to implement watershed restoration projects to maintain and restore high quality and functional habitats, such as Dunes Lake and others.
- Continue focused efforts to promote conservation practices and monitor streams in targeted watersheds to reduce nonpoint source loads using available grant funding
- Provide assistance to landowners impacted by wildlife damage.

3.3 Additional Groundwater Protection Programs

Overarching Resource Goals

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

Additional Groundwater Protection Program Goals

Groundwater protection through proper abandonment of unused wells.

Protect Door County's municipal drinking water supplies by promoting planning and practices to protect groundwater from contamination in zones of contribution to municipal wells.

Groundwater protection from the adverse effects of historic contamination at former orchard sites.

Well Abandonment

The SWCD relies on staff, WDNR, and private landowners to report unused wells or drillholes that need to be properly abandoned. Properly sealing unused wells prevents contaminants from using the well as a direct route to groundwater, thereby protecting groundwater quality and the health and safety of users of Door County's drinking water. Many well drillers and licensed plumbers in the area are aware of the program and refer landowners to the SWCD so that their clients can properly abandon unused wells without the concern of additional costs. Participation in the program is voluntary and illustrates the County's initiative to protect its residents while providing a service to the public.

County cost share provides an incentive by reducing the cost to the landowner through reimbursement of a determined percentage of eligible costs. Landowners are eligible for the incentive if they are not otherwise required to abandon the well. Over the last ten years 58 wells were abandoned using $24,067 in cost share funds.

Information about well abandonment is incorporated into all SWCD water quality educational programs. The SWCD also identifies wells to be abandoned through conservation planning for other programs. Wells that are an immediate threat to groundwater and have uncooperative owners are referred to the WDNR Drinking Water Specialist for follow-up.

Municipal Wellhead Zone of Contribution Protection

Wellhead protection programs are a crucial aspect of municipal planning in Wisconsin, especially in Door County, as the most significant natural resource issue facing the residents and visitors of Door County is a safe drinking water supply. Door County wells have a high incidence of bacteria, nitrate and, in some portions of the county, lead contamination.

The sensitivity of Door County's aquifer well documented and the risk to public health is of great concern. The aquifer providing most of Door County's drinking water is made up of highly fractured Silurian dolostone. Vertical fractures as well as horizontal bedding planes provide the primary pathway for a relatively rapid flow of groundwater through this aquifer. The soils that overlie this bedrock are generally shallow and provide limited attenuation of pollutants in the surface water as it recharges the aquifer. This condition is exacerbated by the presence of karst features, which pertains to the dissolution of the bedrock to form conduits that allow surface water to flow directly to groundwater.

Door County's groundwater resources are recharged from water that infiltrates through the land surface and not from waters of Lake Michigan or the bay of Green Bay. Therefore, activities on the land surface have a large impact on the groundwater quality of Door County. Efforts to protect the Zones of Contribution (ZOC) for municipal wells are necessary to reduce the chance of contamination of Door County's municipal water supplies.

The Door SWCD, in cooperation with Sturgeon Bay Utilities, developed the *Wellhead Protection Plan for Sturgeon Bay Utilities Municipal Wells* in later winter of 2003. This plan was adopted by the Door County Board of Supervisors and is available at:
https://www.co.door.wi.gov/DocumentCenter/View/569/Wellhead-Protection-Plan-PDF

The Village of Sister Bay's municipal water distribution system consists of three wells that provide a water supply for the village of Sister Bay, as well as the Liberty Grove Sanitary District No. 1. In 1995 Robert E. Lee & Associates, Inc. examined the history of Sister Bay's water use, projected future usage, and delineated zones of contribution for the municipal wells that include portions of the Village of Sister Bay and the Town of Liberty Grove. This formed the basis of a Wellhead Protection Plan for the village of Sister Bay.

There is also a public water system for a portion of the unincorporated Village of Maplewood, which is administered by the Maplewood Sanitary District #1, and provides a water supply to approximately 120 people. A zone of contribution has not been delineated for either of the two wells nor has a Wellhead Protection Plan been developed. It is as important for individuals to have a Wellhead Protection Plan in smaller water systems as it is in large municipal water systems. The SWCD could assist with connecting the Village of Maplewood with the Wisconsin Rural Water Association and WDNR and help evaluate if additional resources are available to advance their wellhead protection efforts.

Challenges associated with municipal wellhead protection programs for these municipal wells are due to the zone of contribution extending outside of the city/village limits, into portions of neighboring Towns. Since the zones of contribution cover a large land area and there are numerous types of land use practices that make these municipal wells vulnerable to contamination. Cooperation between County, Village and Town officials is necessary to most efficiently protect the drinking water supplies. It is critical that the communities implement the wellhead protection plans to protect the aquifers that supply their water.

Lead and Arsenic Contaminated Sites

Since the late 1800s, Door County orchards have been major producers of apples and cherries. During peak production in the 1940s and 1950s, the area consisted of approximately 10,000 acres of cherry orchards and 2,000 acres of apple orchards. In the last several decades, orchard acreage, and likewise processing operations, has substantially decreased.

In the early 1900s until the 1940s, lead arsenate was the primary insecticide used. Starting in the 1940s lead arsenate use was alternated with the use of DDT. The widespread use of lead arsenate ended by 1960; but, it was still sporadically applied until the early 1970s. During its use, lead arsenate was brought to mixing stations in powder form and mixed with water to produce a lead arsenate solution for spray application on the fruit trees in the orchard.

Elevated levels of lead and arsenic in soils at abandoned mixing sites, orchards, and fruit processing plant wastewater discharge points are a cause for concern. Lead and arsenic levels are highest at the mixing sites and the processing plant wastewater discharge points, which comprise smaller areas resulting in higher concentrations. Spillage that occurred at these sites also contributed to elevated concentration in the soils. Concentrations in orchards are lower but the larger area creates a more widespread contamination problem. Wastewater drainage areas also pose a contamination threat because of lead and arsenic residue that remained on the cherries as they were processed at the plant. Contamination at the various sites and the orchards poses both a threat to drinking water supplies and a direct contact concern.

The SWCD made an effort to remediate contaminated lead and arsenic sites. Some of the more significant, but a small percentage of the total number, abandoned mixing sites were remediated in the late 1980s and early 1990s in a cooperative effort between the state of Wisconsin and Door County. The SWCD maintains records of these efforts and has maps available to identify sites of concern and where remediation occurred. As such, the SWCD provides information to property sellers and buyers, realtors, and financial institutions about the sites, completed remediation, and potential remaining concerns.

Priority Additional Groundwater Protection Actions:

- Incorporate education about well abandonment program into water quality presentations and conservation planning for other SWCD programs.
- Cost share voluntary well abandonments as they are received.
- Refer uncooperative owners of wells that are an immediate threat to groundwater to WDNR.
- Provide Information and Education to the public and municipalities about wellhead protection and the impact of activities within the ZOC. Explore additional protection programs within municipal wellhead zones of contribution, such as green space easements, identify potential sources of contamination and additional protective actions.
- Assist with the implementation of Wellhead Protection Plans for the City of Sturgeon Bay and Village of Sister Bay and offer assistance to the Village of Maplewood.
- Provide information about location of prior orchard contamination sites and related potential health concerns to property sellers/buyers, realtors and financial institutions.

3.4 Invasive Species

Overarching Resource Goals

- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

Invasive Species Program Goal

Protect Door County's natural communities from the threat of invasive species by supporting DCIST efforts and continuing with education, outreach, control, and municipal programs.

Door County Invasive Species Team (DCIST)

The presence of invasive species represents one of the highest threats to Door County's exceptional number of rare species and natural communities. A variety of invasive species able to inhabit a range of habitats are currently present in the county and numerous other invasive species are threatening to increase their range and spread into the county. These species looming on the fringes of Wisconsin and Door County's boarders include Asian Carp and wooly adelgid along with many others that are not as well known.

In 2000, a coalition of conservation groups and government agencies recognized the urgent need to protect these irreplaceable sites from the threat of invasive species. This coalition developed into the Door County Invasive Species Team (DCIST). The first step was to develop a system that could locate infestations, validate and store the locations, control infestations at high priority sites, monitor control results, educate the public about invasive species and serve as a model for other communities. DCIST continues to meet and be a clearing house of information for the public, and provide joint invasive species control efforts throughout the county. SWCD continues to be an active member of DCIST, provides partial funding for the coordinator position, and serves as the fiscal agent for the partnership.

Public interest, collective knowledge, and federal and state recognition of invasive species is constantly increasing, reflecting the importance and need for continuing the Door County Invasive Species Team (DCIST) and invasive species control and education efforts. The SWCD & DCIST aim to expand programing, outreach & control efforts, and participation in collective learning opportunities. Currently, the SWCD participates in programs to manage invasive species, including DCIST, WDNR AIS programing, educational outreach, and control efforts. For current DCIST/SWCD invasive species activities please visit the DCIST website: https://doorinvasives.org/ for additional information on Door County's Invasive

Species Strategy Plan please visit: https://www.co.door.wi.gov/DocumentCenter/View/753/Door-County-Invasive-Species-Strategic-Plan-PDF?bidId=

Aquatic Invasive Species

Populations of phragmites, purple loosestrife, zebra mussels, quagga mussels, and Eurasian water milfoil are already present in the county at varying levels and present threats to Door County's aquatic habitats. To address these species and other aquatic invasive species the SWCD with funding provided from the WDNR has implemented an aquatic invasive species (AIS) program. The program includes educational outreach & control efforts such as Clean Boats Clean Waters boat launch water craft inspections, Drain Campaign, Landing Blitz, tournament engagement, Bridge snapshot days, and participating in WDNR AIS data collection. To help implement this program, the SWCD has partnered with Door County Parks to install two boat decontamination stations at two of the county's most popular boat launches.

Education and Outreach

DCIST and SWCD efforts historically focused on prevention through education and outreach paired with control efforts. Education and outreach provide a context to discuss invasive species and arms the public with the tools to succeed in monitoring and controlling these populations. Continuing with previous efforts, the SWCD will support education and outreach through generating materials, hosting and participating in events, engaging the public through media platforms, and engaging various stakeholders. DCIST partners and the SWCD have installed boot-brush stations on various trails throughout Door County, aiding in invasive species prevention efforts. In the future the SWCD and DCSIT aim to continue with education and outreach efforts and to increase programing to a larger audience.

Control

Historically, Door county has focused on controlling and inventorying four main species; Common Reed (*Phragmites australis*), Wild Parsnip (*Pastinaca sativa*), Common & Cut leaf Teasel species (*Dipsacus spp*.), and Knotweed species (*Fallopia Spp.*). These species were targeted due to their presence in the county and were identified as species of primary concern based on impacts to the environment, human health and economy. Continuing with these efforts are critical in controlling and potentially eradicating these species from Door County. These efforts have expanded to include early detection "prohibited" species since these species have not established substantial populations in Door. Looking to the future, SWCD aims to expand programs to address additional species helping preserve Door County's natural resources.

Municipal Outreach

Through previous outreach and control efforts municipalities have looked to support invasive species control efforts through the adoption of noxious weed ordinances and participating in municipal cost share programs. Municipal involvement is necessary to provide assurances that current level of invasive species control can be maintained if grant funding becomes limiting. The SWCD has actively promoted ordinance development and implementation. Currently 11 municipalities have adopted noxious weed ordinances and 5 municipalities (the program's limit) signed up to participate in the invasive species cost share program in 2019. SWCD aims to expand these efforts by increasing ordinance adoption and providing implementation support to municipalities.

Priority Invasive Species Actions:

- Maintain and seek additional funding as necessary to support DCIST and SWCD invasive species outreach & education and control activities.
- Generate public interest in invasive species via volunteer events, establishing friends' groups, media platforms and website, participating in and hosting events.
- Continue to emphasize control of Door County's four priority species while also expanding to include additional invasive species such as early detection "prohibited" species.
- Encourage municipalities to adopt noxious weed ordinances and support their implementation through technical and financial assistance.

3.5 Technical Assistance & Information and Education

Overarching Resource Goals

ALL Goals with particular emphasis on:

- Collaborate with partners (e.g. other County Departments, NOAA, WDNR, and others) to develop climate adaptation best practices to protect natural resources and support development of long-term climate resilient mitigation practices for agriculture and other land uses.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

Technical Assistance & Information and Education Program Goals

Maintain personnel with diverse knowledge, skills, and expertise in natural resources to provide technical assistance to the public, municipalities, agencies, and other partners.

Increase Door County residents and visitors' awareness of current conservation issues and to increase the number of participants in conservation programs.

General Resource Management Assistance

The SWCD provides technical assistance to a variety of partners including the general public, municipalities within Door County, other natural resources agencies and partners. This is an important tool for achieving proper resource management in Door County and represents a substantial staff effort not readily attributable to other specific programs.

Assistance to the general public takes a variety of forms including:

- Planning and design of practices
- Advice to landowners with general resource concerns
- Sharing information from aerial photos, topographic maps, and soil maps
- Providing tutorials of available resources on Door County's webmap
- Referral to other agencies

Assistance to other municipalities may include:

- Survey and design of storm water runoff management practices
- Construction site erosion control
- Identification of culvert locations
- Advice on drainage issues

Providing technical assistance is a high priority and a valuable service provided by the SWCD. It is important that the SWCD maintain a personnel resource base of diverse knowledge and expertise in natural resources and a network of other resource professionals for referrals to other departments and agencies. Technical assistance to the general public will continue as long as SWCD resources are available and where the service will provide an environmental or conservation benefit. Long term commitments to municipalities, such as inclusion in an ordinance with a specified role, requires approval of the LCC prior to entering into an agreement.

Research Assistance Pertaining to Door County's Natural Resources

The SWCD has provided research assistance to the Universities of Wisconsin, graduate research students, Wisconsin Geologic and Natural History Survey, the WDNR, and other agencies. Assistance has ranged from basic local support to active participatory roles in joint proposals and project implementation. Cooperation on projects fosters valuable working relationships with other natural resource professionals and provides valuable information about Door County's Natural Resources. Research assistance will continue to be an important method of increasing available information and fostering partnerships to promote information exchange.

Information and Education

By participating in general information and education activities the SWCD provides current information about conservation issues and programs in the county to a range of audiences such as the general public, schools, and interested organizations. General information and education activities include presentations, training sessions, public hearings, news releases, website information, and publications on various conservation topics such as: groundwater quality and protection, geology and soils, storm water pollutant reduction, stream and lake water quality monitoring, beach contamination issues and remediation, watershed mapping, Best Management Practices in watersheds, wetland protections, invasive species identification and control, nutrient management, compliance with agricultural standards and prohibitions, and other general water quality conservation topics.

The SWCD also integrates outreach activities into specific programs so that efforts further the goals of that program. This targeting of outreach with specific project allow for the strategy to focus on the appropriate audience. For example, to increase landowner understanding and adoption of nutrient management plans, the SWCD works with partners to have training classes in Sturgeon Bay. The invasive species control program has the most visible outreach program of the various SWCD programs with grant funding to support those efforts. The SWCD also partners with others such as the UW-Madison Extension, local conservation organizations, and other agencies to cooperatively share relevant information.

Priority Actions:

- Assist the general public, municipalities, and others where that assistance provides an environmental or conservation benefit.
- Develop partnerships, identify research priorities, seek funding cooperatively with partners, and promote information exchange.
- Expand technical expertise of SWCD staff in best management practices, conservation planning, and mitigating the impacts of changing climate through continued professional development.
- Offer conservation education programs to schools as requested and coordinate with school science teachers and/or ecology clubs to recruit student volunteers for conservation projects.

- Offer workshops, training sessions for general public on issues of interest to landowners (nutrient management, invasive species control, surface and ground water monitoring, practices to reduce storm water runoff in urban areas).
- Informational mailings and website updates to reach the mass public on seasonal conservation issues (i.e. recharge of groundwater, best times for fertilizing, cropland best management practices such as tillage and residue management).
- Cooperative efforts with other agencies and/or public groups to provide education on conservation and environmental protection to landowners.

Part 4

Summary of Work Plan and Fiscal Management

Contents

4.1 Work Plan
4.2 Fiscal Management
4.3 Progress Assessment

4.1 Work Plan

The work plan to meet the goals of this Land and Water Resource Management Plan is listed in the tables on the following pages that are organized by program. Each program table includes a list of the Overarching Land and Water Resource Management Plan Resource Goals, corresponding Program Goals, and a series of short-term and long-term activities.

The identified activities will require phased implementation so that they can be accomplished within available resources of the SWCD. Generally short-term activities are those that are completed annually by the SWCD and/or those that may be accomplished within two to three years given existing SWCD staff resources. Long-term work tasks correspond with more complete implementation of conservation and environmental protection programs to accomplish the goals of the Land & Water Resource Management Plan and are considered to be ten-year work tasks. Projections beyond ten years are unrealistic considering the ever-changing nature of conservation programs and threats to Door County's natural resources. It can also be expected that changing resource needs will require revision to these work tasks and their implementation schedule within the next ten years.

The actual implementation schedule for the activities on the following pages is contingent on available funding to support the proposed activities. Funding limitations will require a longer time to implement the identified activities. Likewise, should additional resources be made available implementation of these tasks could occur more completely and/or long-term activities could be expedited. More discussion of fiscal management for the SWCD is included in Section 4.2.

Chapter 23 Agricultural Performance Standards and Prohibitions Implementation

Program Goals:

- Protect water quality and address land and water resource needs though implementation of the agricultural performance standards and prohibitions in Chapter 23, Door County Code.
- Promote conservation practices that protect water quality and enable proper resource management by landowners.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Reduce the risks to water quality through proper storage, handling and disposal of animal waste.
- Reduce soil erosion rates on agricultural fields through proper soil conservation practices.
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Reduce the risks to water quality through proper storage and handling of fertilizer and chemicals.
- Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.

Priority Actions	Short-term Activity	Long-term Activity
Chapter 23 – Agricultural Performance Standards	Administer Chapter 23 using established strategy to identify priority sites for inventory, tracking and notification/enforcement of findings: • Target compliance status reviews using implementation strategy • Maintain detailed tracking records by parcel • Seek a variety of funding sources to provide financial assistance and cost share offers, where necessary and appropriate, for operations to install BMPs to address water quality issues • Address all resource concerns at a site	• Monitor the adequacy of Chapter 23, Door County Code, to meet Door County's resource needs and update as necessary to reflect changes and maintain consistency with state statutes and agricultural performance standards and manure management prohibitions
Chapter 23 – Animal Waste Storage Permits	• Review Animal Waste Storage permit applications to ensure compliance with standards and prohibitions and resource protection goals	• Monitor the adequacy of Chapter 23, Door County Code, and update as necessary to reflect changes in technical standards

Chapter 23 Agricultural Performance Standards and Prohibitions Implementation		
Priority Actions	**Short-term Activity**	**Long-term Activity**
Operation & Maintenance Reviews	• Continue site visits to inspect installed BMPs, ensure continued compliance, and provide technical assistance for updating BMPs when necessary	• Ensure continued proper resource management after prescribed operation and maintenance periods have expired. • Health and safety review of BMPs that have exceeded life expectancy, with emphasis on comprehensive Slurrystore manure storage inspection and abandonment of BMPs at non-active farms that are deemed a hazard • Provide technical assistance to upgrade or replace aging manure storage structures to reduce human and environmental safety concerns
Nutrient Management	• Promote proper implementation of nutrient management plans and conservation cropping practices, such as high residue management and cover cropping to reduce soil erosion • Collaborate with partners to provide nutrient management training for landowners that prepare their own nutrient management plans and outreach related to best management practices • Office review of plans to identify common errors and share findings with producers, cropland owners, and consultants • Audits of manure applications • Hold cropland owners responsible for continued compliance and promote sample lease agreement • Promote mapping of tile lines, inlets, and outlets to ensure proper nutrient applications	• GIS tracking of fields under nutrient management to ensure program participation rates continue at current levels • Maintain sustained efforts to reduce soil erosion rates on agricultural fields through cropland practices that promote soil health. Partner with other agencies with similar goals • Evaluate feasibility of, and promote where reasonable, alternative methods of waste handling and/or storage to reduce proportion of water in manure and process wastewater. Alternative methods should meet or exceed current environmental protections. • Identify opportunities for nutrient reduction at tile outlets and associated conservation practices • Identify high hazard and environmentally sensitive areas. Eliminate winter spreading of manure in high hazard or environmentally sensitive areas • Support efforts that eliminate any application of liquid manure during frozen or snow-covered conditions

Chapter 23 Agricultural Performance Standards and Prohibitions Implementation		
Priority Actions	**Short-term Activity**	**Long-term Activity**
Farmland Preservation Program (FPP)	• Implement the Farmland Preservation Program to promote agricultural use of agricultural lands and compliance with agricultural performance standards, through annual compliance certification for participants claiming tax credits	• Assist Land Use Services with update of existing Farmland Preservation Plan if necessary to accommodate state program revisions
NR 243 - WDNR Notices and CAFOs	• Seek cost sharing (as appropriate) and provide technical assistance to resolve notices of discharge issued by WDNR to priority small and medium livestock operations • Provide technical assistance to inform landowners of, and ensure compliance with, WDNR CAFO permit requirements • Identify operations approaching the WDNR CAFO permit threshold size, discuss requirements with those operations and refer them to WDNR	• Ensure all participants comply with applicable standards • Advocate for additional conservation practices to address all resource concerns at a site

Storm Water Runoff Management and Construction Site Erosion Control

Program Goal: Protect groundwater and surface water resources through proper erosion control and storm water runoff management.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Reduce the risk to water quality and prevent flooding through proper stormwater runoff management.
- Reduce soil erosion from construction sites through proper soil erosion control measures.

Priority Actions	Short-term Activity	Long-term Activity
Technical Assistance	• Promote proper storm water runoff and construction site erosion control to public and private professional sectors through by providing information about the impacts of nonpoint runoff, requirements, and effective use of BMPs • Review storm water plans submitted to Land Use Services Department	• Initiate cooperative efforts between agencies to review polices and program implementation to establish a more thorough and uniform storm water runoff management and construction site erosion control program in Door County • Ensure up-to-date wetland maps are available and used; evaluate if additional wetland inventory is necessary to identify and protect ephemeral ponds

Nonmetallic Mining Management and Reclamation

Program Goal: Protect groundwater and surface water resources and control of the negative impacts of development through proper reclamation of nonmetallic mines.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Reduce the impacts to water quality and other natural resources from nonmetallic mines through proper operation and/or reclamation procedures.

Priority Actions	Short-term Activity	Long-Term Activity
Chapter 36 – Nonmetallic Mining Reclamation	• Check compliance of active mines with requirements of approved plans and permits • Ensure new permit applications meet requirements in Chapter 36 • Ensure adequate financial assurance for implementation of approved reclamation plans	Review effectiveness of Chapter 36 and update if necessary and/or permissible

Beach Contamination – Source Identification and Reduction

Program Goal: Protect and improve beach water quality through continued monitoring, evaluation of installed practices so that sources of beach contamination are identified and abated.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Protect surface water resources through identification and abatement of beach contamination sources.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

Priority Actions	Short-term Activity	Long-Term Activity
Beach Contamination Reduction	• Monitor installed practices • Information and education efforts on runoff impacts to beaches and reduction practices	• Identify retrofits and/or repairs necessary to practices to mitigate impacts of Lake Michigan water levels • Collaborate with other agencies on sampling protocols, best practices, evaluation of effectiveness of installed practices • Seek funding for identification and remediation projects (based on identified issues) at other public access locations

Watershed Restoration

Program Goal: Work with natural resources partners to implement watershed restoration projects to maintain and restore high quality and functional habitats.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Protect or improve, when and where necessary, surface water resources to applicable State standards.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

Priority Actions	Short-term Activity	Long-Term Activity
Ahnapee River Watershed	• Implement relevant portions of the approved 9 element watershed plan for the Upper Ahnapee Watershed, dependent on available funding • As requested, assist the Facilities and Parks Department with the drawdown of the Forestville Millpond • Seek funding for follow-up sampling	• Continue to implement and revise Upper Ahnapee Watershed plan to incorporate results of WDNR Total Maximum Daily Load Analysis and follow-up sampling from Forestville Millpond draw down • Evaluate opportunities to protect existing wetlands and restore functional wetlands to meet watershed goals, prioritizing effort based on available tools such as the "Wetlands by Design Watershed Approach" • Seek additional funding to implement plan
Dunes Lake	• Support 2020 monitoring, dredging, and invasive species control efforts using available grant funding	• Maintain and support established partnership to further restoration efforts, seek additional funding where necessary

Priority Actions	Short-term Activity	Long-Term Activity
Kayes and Larson Creek Watersheds; Silver, Sugar, and Renard Creek Watersheds; and Other Watersheds identified as a priority	• Continued monitoring of water quality using available grant funding for Kayes and Larson Creeks • Participate in WDNR WAV monitoring program • Promote installation of best management practices to reduce nonpoint source loads using available grant funding	• Seek funding to install best management practices to address identified areas of concern • Evaluate opportunities to protect existing wetlands and restore functional wetlands to meet watershed goals, prioritizing effort based on available tools such as the "Wetlands by Design Watershed Approach" • Seek funding to continue watershed monitoring

Wildlife Damage Abatement and Claims

Program Goal: Help Door County cropland owners address wildlife damage issues through the Wildlife Damage Abatement and Claims Program.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

Priority Actions	Short-term Activity	Long-Term Activity
	Provide assistance to landowners impacted by wildlife damage	Provide assistance to landowners impacted by wildlife damage

Additional Groundwater Protection Programs

Program Goals:

- Groundwater protection through proper abandonment of unused wells.
- Protect Door County's municipal drinking water supplies by promoting planning and practices to protect groundwater from contamination in zones of contribution to municipal wells.
- Groundwater protection from the adverse effects of historic contamination at former orchard sites.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Protect or improve, when and where necessary, groundwater resources to applicable State standards.
- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

Priority Actions	Short-term Activity	Long-Term Activity
Well Abandonment	• Incorporate education about well abandonment program into water quality presentations and conservation planning for other SWCD programs • Cost share voluntary well abandonments as they are received	• Refer uncooperative owners of wells that are an immediate threat to groundwater to WDNR

Priority Action	Short-term Activity	Long-Term Activity
Municipal Wellhead Zone of Contribution Protection Programs	• Assist municipalities (Sturgeon Bay, Sister Bay) with their wellhead protection programs	• Provide Information and Education to the public and municipalities about wellhead protection and the impact of activities within the ZOC • Explore additional protection programs within municipal wellhead zones of contribution, such as green space easements, identify potential sources of contamination and additional protective actions. • Offer assistance to the Village of Maplewood to delineate wellhead zone of contribution and wellhead protection plan
Lead and Arsenic Contaminated Sites	• Provide information about location of prior orchard contamination sites and related potential health concerns to property sellers/buyers, realtors and financial institutions.	

Program: Invasive Species

Program Goal: Protect Door County's natural communities from the threat of invasive species by supporting DCIST efforts and continuing with education, outreach, control, and municipal programs.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:

- Minimize the adverse effects of increased human use, fragmentation, urban sprawl, construction site erosion, increased impervious areas and other development pressures to protect land and water resources (including but not limited to the waters, soils, wetlands, forests and significant or critical biodiversity).
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.

Priority Actions	Short-term Activity	Long-Term Activity
Aquatic Invasive Species / Education and Outreach	• Generate public interest in invasive species via volunteer events, establishing friends' groups, media platforms and website, participating in and hosting events.	• Maintain and seek additional funding as necessary to support DCIST and SWCD invasive species outreach & education activities. •
Control	• Continue to emphasize control of Door County's four priority species while also expanding to include additional invasive species such as early detection "prohibited" species.	• Maintain and seek additional funding as necessary to support DCIST and SWCD invasive species control activities.
Municipal Outreach	• Encourage municipalities to adopt noxious weed ordinances and support their implementation through technical and financial assistance.	• Encourage municipalities to adopt noxious weed ordinances and support their implementation through technical and financial assistance.

Technical Assistance & Information and Education

Program Goal: Maintain personnel with diverse knowledge, skills, and expertise in natural resources to provide technical assistance to the public, municipalities, agencies, and other partners.

Overarching Land and Water Resource Management Plan Resource Goals Addressed:
ALL, with particular emphasis on

- Collaborate with partners (e.g. other County Departments, NOAA, WDNR, and others) to develop climate adaptation best practices to protect natural resources and support development of long-term climate resilient mitigation practices for agriculture and other land uses.
- Develop and maintain collaborative relationships with local, state and federal agencies and other relevant partners to share information, partner on research, seek funding and implement projects to protect and improve land and water resources.
- Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.

Priority Actions	Short-term and Long-Term Activities
Technical assistance	• Assist the general public, municipalities, and others where that assistance provides an environmental or conservation benefit • Assist Land Use Services Department Sanitarians as requested and within available resources
Research Assistance	• Develop partnerships, identify research priorities, seek funding cooperatively with partners, and promote information exchange
Staff Development	• Expand technical expertise of SWCD staff in best management practices, conservation planning, and mitigating the impacts of changing climate through continued professional development
Information and Education	• Offer conservation education programs to schools as requested and coordinate with school science teachers and/or ecology clubs to recruit student volunteers for conservation projects. • Offer workshops, training sessions for general public on issues of interest to landowners (nutrient management, invasive species control, surface and ground water monitoring, practices to reduce storm water runoff in urban areas). • Informational mailings and website updates to reach the mass public on seasonal conservation issues (i.e. recharge of groundwater, best times for fertilizing, cropland best management practices such as tillage and residue management). • Cooperative efforts with other agencies and/or public groups to provide education on conservation and environmental protection to landowners.

4.2 Fiscal Management

In 2020 the SWCD operating budget is comprised of approximately 33% county appropriations and 67% outside grant funds. The 2020 SWCD budget is $1,422,225 with anticipated revenue of $948,384 from a variety of state, federal and other funds.

County appropriations support the SWCD core operations. A combination of long-term and annual grants provides additional support for staff and program implementation which includes the range of conservation and environmental protection efforts described in this plan. Historically the majority of the funds included in the SWCD budget were cost share funds to provide financial assistance directly to landowners for the installation of conservation best management practices. Over time the SWCD has transitioned from a program dominated by construction of agricultural "hard" practices, such as manure storage, to include "soft" cropland practices and other conservation initiatives. However, cost share funds still represent a third of the overall budget in 2020 and have held relatively consistent in recent years.

The SWCD budget in future years will need to continue to rely on a combination of county appropriations, state staffing and cost share support, and a variety of additional competitive grants. The SWCD actively seeks as much funding as possible through grants that advance program priorities and support implementation to meet the goals of this plan. In preparing annual budgets, the SWCD uses all available funding sources to maintain the staffing, cost sharing and operating costs necessary to address the goals and objectives of its programs vital to protection of Door County's natural resources.

Required SWCD Budget 2021-2025 to Maintain Current Operations

	2020	2021	2022	2023	2024	2025
Personnel	721,493	746,487	768,882	791,948	815,707	840,178
Cost Share	442,466	442,466	328,990	328,990	328,990	328,990
Program/Operating	258,266	158,266	163,014	167,904	173,942	178,130
Total Budget	1,422,225	1,347,219	1,260,886	1,288,842	1,317,638	1,347,297

The "Required SWCD Budget 2021-2025 to Maintain Current Operations" in the table above is based on the existing budget for the SWCD for the year 2020. The figures represented in the Table are projections beyond 2020 based on the current budget to establish what would be required to maintain existing staffing and capabilities in future years. The source of the funds for the budget projections is unknown and projections should not be confused with anticipated budgets for programs. Unknown future state funding and restricted county tax levy support due to limitations placed upon the county taxing ability make actual budget projections beyond 2020 tenuous, if not impossible.

Personnel

In 2020 the SWCD has a staff of seven full-time professional Conservationists, one Administrative Assistant, and two limited term Invasive Species employees totaling available annual hours of 18,487. The SWCD also annually contracts with Independent Contractors to complete short-term and/or specialized tasks. It is anticipated that the current available staff hours will be constant through 2025, provided that sufficient funding can be obtained.

In addition to county appropriations the SWCD relies on an annual staffing and support grant from DATCP to maintain current staffing levels. In 2020 DATCP allocated $143,964 to Door County for staff and support out of a total personnel cost of $721,493 for 2020. Wisconsin State Statute s. 92.14(6)(b) states that the State of Wisconsin:

> *shall attempt to provide funding under this section for an average of 3 staff persons per county with full funding for the first staff person, 70 percent funding for the 2nd staff person and 50 percent funding for any additional staff persons and to provide an average of $100,000 per county for cost-sharing grants.*

The SWCD staffing allocation in 2020 equates to full funding of the first position and 50% of the second position, with no additional funding for the other six full-time positions. Nor has the SWCD received the statutory staffing funding goal from the state in any of the last ten years. Instead the SWCD has used county appropriations and the DATCP staffing grant as match to other competitive grants to cover the shortage and maintain existing staffing levels. In 2020 SWCD staff are supported by a variety of competitive grants including the National Fish and Wildlife Foundation Conservation Partners and Sustain our Great Lakes Programs, WDNR Targeted Runoff Management and Invasive Species grants (both Education and Control), US Forest Service Cooperative Weed Management Area grant, as well as other fees and revenue sources.

No significant staffing budget modifications in expenditures or revenue from 2020 are known or anticipated for future years. Expanding programs to address long-term priorities (such as expanding conservation assistance to promote cropland conservation practices, fully implementing the Upper Ahnapee Watershed 9 element plan, or providing additional technical and financial assistance to more fully implement the agricultural performance standards) will require additional Conservationist hours to accommodate the full range of tasks needed to meet the goals established within this plan. Additional administrative support has not been identified as a need in 2020 or the foreseeable future provided that the existing level of administrative support is maintained.

Cost Share

In 2020 the SWCD has $442,466 available to offer as cost share to help landowners offset the cost of installing best management practices on their property. The SWCD obtains cost share through competitive TRM and/or NOD grants from the WDNR for agricultural practices in specific watersheds ($353,476), an annual allocation from DATCP ($78,990), and an annual allocation from Door County ($10,000). Annual allocations from DATCP and Door County are anticipated to continue into the foreseeable future, however funding from WDNR is competitive and cannot be counted on in future years as program eligibility requirements restrict future ability to secure these funds.

Cost share funding remains a significant need in future years in order to effectively implement the agricultural performance standards and manure management prohibitions. Landowners that have operations in existence prior to the effective date of the performance standards cannot be required to meet the standards and prohibitions unless cost-share funds are available to defray their costs. Construction of best management practices can also be costly and not easily accommodated by voluntary landowners without financial assistance. Accordingly, implementation success and concurrent protection of natural resources relies on the availability of supportive cost share funding. It is anticipated that the cost share needs will not be addressed by one source of funds, but rather by a combination of sources that will be dynamic and change from year to year. It will be a challenge to

provide adequate cost share to effectively implement the agricultural performance standards and prohibitions countywide with the condition that the landowner/operator need not comply unless such funds are available.

Program/Operating

Adequate personnel and cost share funds are not SWCD's only fiscal need to implement the goals and objectives of this plan. Program and operating costs (such as equipment, supplies, training, travel and contractual support for specific projects) support the programs and technical assistance for natural resource management on private lands through voluntary and/or regulatory programs. Presently, and for the foreseeable future, the funding for the programmatic costs associated with the conservation and environmental goals and programs of the plan will draw upon a variety of sources including both county appropriations and grant funding. Revenue sources will necessarily be dynamic and change from year to year, dependent on available grants and the nature of the projects to be implemented. As with both personnel and cost share, the SWCD will continue to seek competitive grant funding to sustain program and operating costs to meet the goals and activities outlined within this plan.

4.3 Progress Assessment

This section describes the SWCD strategy and measures to be used for monitoring progress at implementing this Land and Water Resource Management Plan. The success at meeting the short-term program goals and activities will be assessed annually through the annual reports and workplans submitted to DATCP. Long-term assessments will be more comprehensive as there are program updates and revisions to the Land and Water Resource Management Plan. Because program accomplishments do not always lend themselves to specific, measurable results the SWCD will at minimum assess the items listed below annually, and use the results combined with the workplan tables in the prior section to measure success.

Agricultural Implementation

- Annual operation and maintenance compliance site visits
- Contracts entered into with landowners to install conservation best management practices
- Conservation practices installed with assistance from the SWCD
- Financial assistance provided to landowners and/or operators to install conservation practices
- Notification letters issued to landowners
- Compliance checks / certificates of compliance issued to landowners participating in the Farmland Preservation Program
- Cropland acres covered under nutrient management
- Farmer education training for nutrient management offered in Door County
- Technical assistance provided to landowners to meet WDNR Notice of Intent, Notice of Discharge, and WPDES CAFO permit requirements
- Agricultural waste storage permits issued

Urban and Rural Non-Agricultural Implementation

- Storm water / erosion control plans referred from the Land Use Services department reviewed
- Nonmetallic mining permit applications reviewed
- Inspection of nonmetallic mines and review of financial assurance
- Inspection of installed best management practices of beaches
- Funding obtained for watershed restoration projects
- Stream monitoring and practices installed to further watershed restoration projects
- Assistance to landowners through wildlife damage program

Additional Groundwater Protection Programs

- Wells properly abandoned
- Assistance to municipalities for wellhead protection programs
- Assistance to landowners about location of prior orchard contamination sites

Invasive Species

- Invasive species coordination with DCIST partners
- Funding obtained for invasive species information & education and control efforts
- Assistance to municipalities for their noxious weed ordinances

Technical Assistance & Information and Education

- Technical and research assistance to general public, municipalities, and other partners for projects with an environmental or conservation benefit
- Educational programs, workshops, training, and other informational sessions offered

This Land and Water Resource Management Plan is designed with an understanding that program changes will require revisions to the plan in the future. The intended timeline for plan review is in five years so that changes in county resource needs and programs can be evaluated and updated if necessary.

Part 5

Plan Adoption Process

The original Door County Land and Water Resource Management Plan was developed over several months of 1999. The process involved input gathered from a series of planning meetings that included representatives of interested parties including: community members from each County Board Supervisory District; elected officials from the county's municipalities; county, state and federal agency professionals; and private organizations. The 2005 and 2010 updates surveyed the same group of representatives to establish if the priorities that were deemed to be the most significant for the county had changed. Each time feedback from the group revealed that the resource concerns remained constant. Results of prior county planning efforts were also analyzed to ensure that the resource concerns were sound and reflect the concerns of the citizens of Door County.

In 2020 the SWCD gathered input from the general public, a Local Advisory Committee, staff and the Land Conservation Committee to develop a draft plan. A public hearing was held to receive additional public input then a final draft, approved by the LCC, was sent to DATCP for review and presentation to the state Land and Water Conservation Board.

The following is a chronological history of the plan update:

- December, 2019 – SWCD Staff review plan and timeline for update.
- January 9, 2020 – Land Conservation Committee review of existing plan, public input process, and timeline for plan development and approval.
- January 28, 2020 – Local Advisory Committee appointed by the Door County Board of Supervisors.
- February 17,19 and 20, 2020 – Public Input Sessions in Sturgeon Bay, Egg Harbor and Brussels.
- February 25 and June 10 – Local Advisory Committee Meetings to review elements of draft plan.
- June 11, 2020 – Land Conservation Committee review of elements of draft plan.
- June - July 2020 – Draft to WDNR & DATCP, revisions of draft to incorporate comments received.
- July 9, 2020 – Land Conservation Committee review of draft plan and comments received from WDNR and DATCP.
- July 29, 2020 – First Class II Notice published for August 13, 2020 Public Hearing
- August 5, 2020 – Second Class II Notice published for August 13, 2020 Public Hearing
- August 13, 2020 – Public Hearing for draft of Land and Water Resource Management Plan
- August 13, 2020 – Land Conservation Committee approval of final draft
- August 18, 2020 – Complete Plan submitted to DATCP
- October 6, 2020 – Door County Land and Water Resource Management Plan presented to the Wisconsin Land and Water Conservation Board, Board recommendation for approval
- December 2020 – Door County Board of Supervisors approval of plan

Following the Door County Board of Supervisors approval of the plan DATCP reviews the recommendation of the Land and Water Conservation Board and notifies the County of its decision.

Appendices

Appendix A
Water Quality Data Referenced in Section 2 - Resource Assessment

Total Phosphorus

Phosphorus is an essential nutrient in plants and animals, and is also a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. Phosphorus exists in water in either a particulate phase or a dissolved phase. Particulate matter includes living and dead plankton, precipitates of phosphorus, phosphorus adsorbed to particulates, and amorphous phosphorus. The dissolved phase includes inorganic phosphorus and organic phosphorus. Total phosphorus (TP) is a measure of all the forms of phosphorus, dissolved or particulate, that are found in a sample. A disproportionate level of Phosphorus in waterbodies is the major nutrient contributor to excessive aquatic plant growth, including algae blooms. Eutrophication is a natural process that results from accumulation of nutrients in lakes or other water bodies, but it is often accelerated by human activities that increase the rate and the amount of nutrients entering the water body. If excessive amounts of nutrients are added to a water body, algae and aquatic plants can grow in large quantities. As plants die, they are decomposed by bacteria, which use dissolved oxygen. Dissolved oxygen concentrations can drop too low for fish to breathe, leading to fish kills. Excessive amounts of algae grow into scum on the water surface, decreasing recreational value and clogging water-intake pipes. Rapid decomposition of dense algae scums with associated organisms can give rise to foul odors. Accumulated sediments act as a sink where legacy phosphorus can be stored, and also as an ongoing source of phosphorus for the overlying water. Recycling of phosphorus from the underlying sediments that have been enriched by years of high nutrient inputs can cause a lake to remain eutrophic well after external inputs of phosphorus have been decreased.

The State of Wisconsin has established the maximum threshold for Phosphorus levels in surface waters throughout the state. As outlined in NR 102.06(3)(b), the maximum threshold criterion for streams is 75 micrograms per liter (µg/L) or .075 milligrams per liter (mg/L). As outlined in NR 102 (4)(b)3, the maximum threshold criterion for lakes is 40 micrograms per liter (µg/L) or .040 milligrams per liter (mg/L). Algal blooms in surface waters are likely to occur at phosphorus levels greater that 20 micrograms per liter (µg/L) or 0.020 milligrams per liter (mg/L).

Index of Biotic Integrity

The Index of Biotic Integrity (IBI) is a tool used to assign a value to a waterbody based biological activity in a water body reflected by the ecological complexity based on statistical analysis. The IBI is used to identify and classify water pollution issues.

An assessment of biological integrity was done in 2019 and will be repeated in 2020 and 2021 in Kayes, Malvitz and Larson Creeks. The method used is the Macroinvertebrate Index of Biotic Integrity (M-IBI), in which the scoring system is used to measure disturbance of aquatic communities from human impacts

or pollution. The scoring is based on sampling of benthic macroinvertebrates and reflects the stream conditions; as the rate of stream degradation increases, a corresponding decrease in the number of environmentally-sensitive species and an increase in environmentally tolerant species are observed. These changes in aquatic community composition are scored relative to a reference or "least-impacted" condition, and are placed in a condition category based on the resulting score. The condition categories are excellent, good, fair and poor.

Dissolved Oxygen

Dissolved oxygen is the amount of gaseous oxygen dissolved in the water; this is a result of direct absorption from the atmosphere, aeration through rapid movement or a byproduct of photosynthesis by aquatic plants. The amount of dissolved oxygen in a waterbody represents the amount of oxygen available to aquatic organisms including, fish, invertebrates and bacteria. As the concentration of dissolved oxygen in a waterbody drops, it will result in changes in the types and amounts of aquatic organisms that can survive there. Oxygen is removed from the water through chemical reactions that occur during the decay process and respiration of aquatic organisms. Temperature of the water, atmospheric pressure, light penetration and water turbulence can all impact the concentration of dissolved oxygen in a waterbody. Dissolved oxygen levels can be drastically reduced by the introduction of excessive amounts of organic matter such as sewage, manure or decaying plant matter. Introduction of warm water, excess nutrients and erosion from cropland and urban sources can also drastically impact dissolved oxygen concentrations. The State of Wisconsin has established the minimum concentration of dissolved oxygen content to support fish and aquatic life to be 5 milligrams per liter (mg/L).

Red River/Sturgeon Bay Watershed Water Quality Data

The following charts support the narrative of the water quality data in Section 2. Figure A-1 depicts the sample locations.

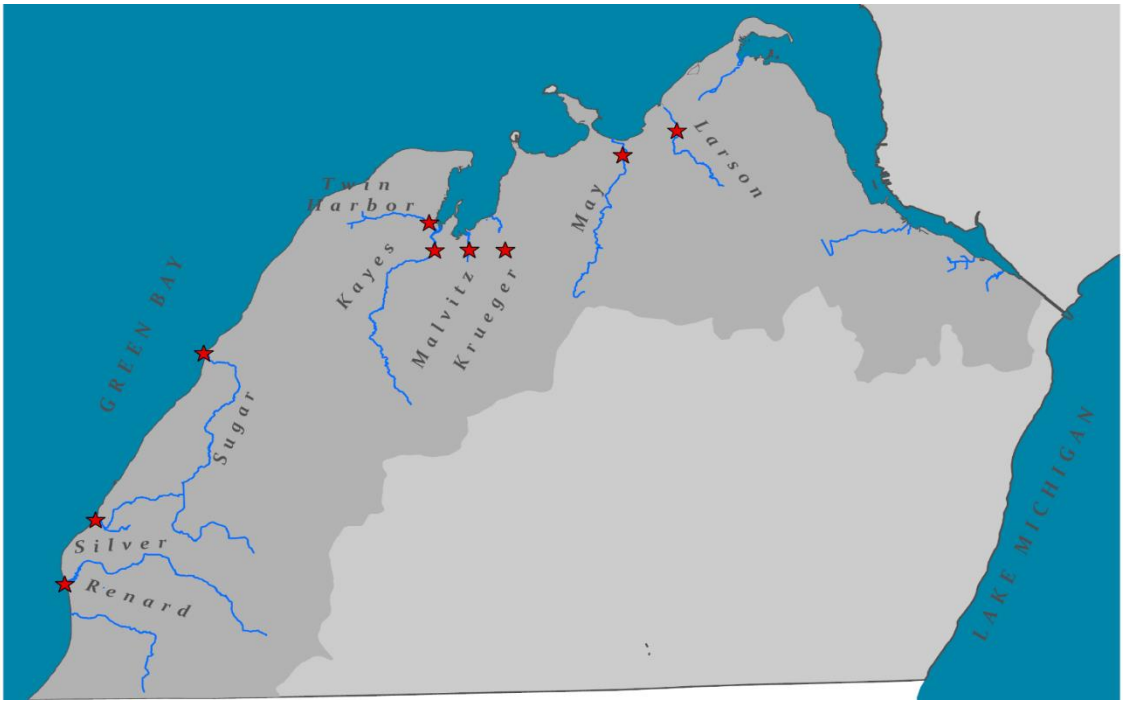


Figure A-1. Sample Locations in the Red River/Sturgeon Bay Watershed.

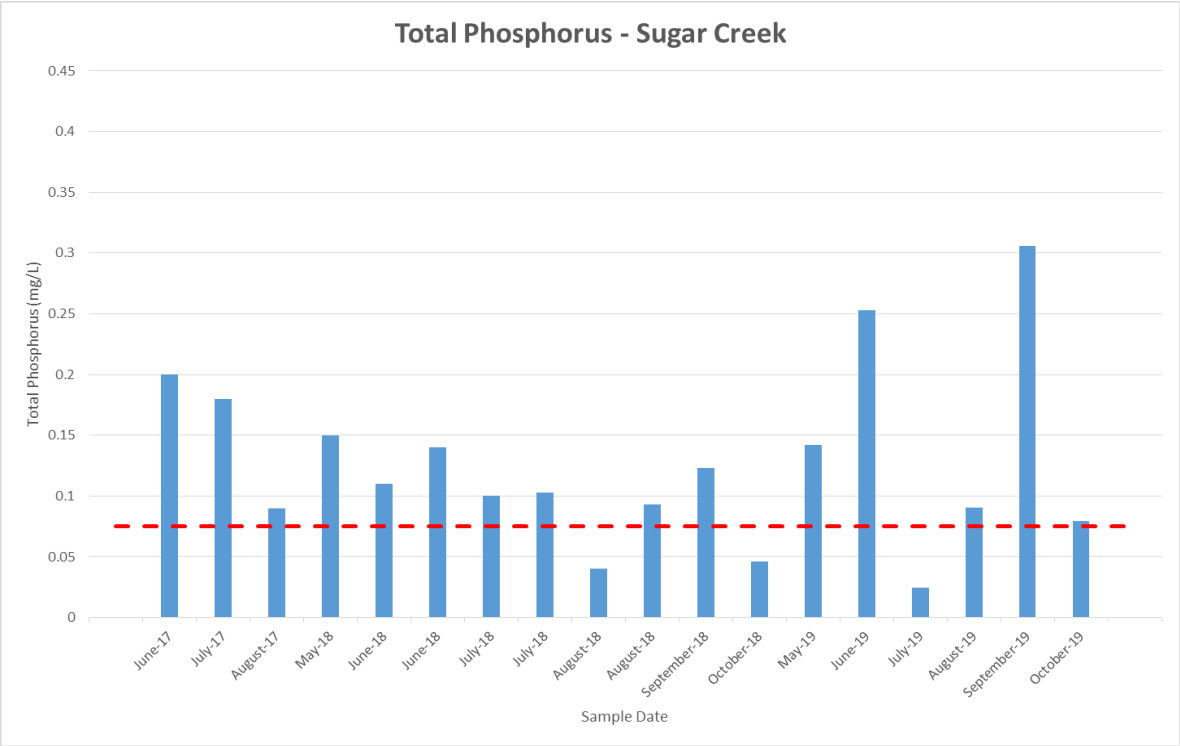


Chart A-1. Total Phosphorus Measurements in Sugar Creek

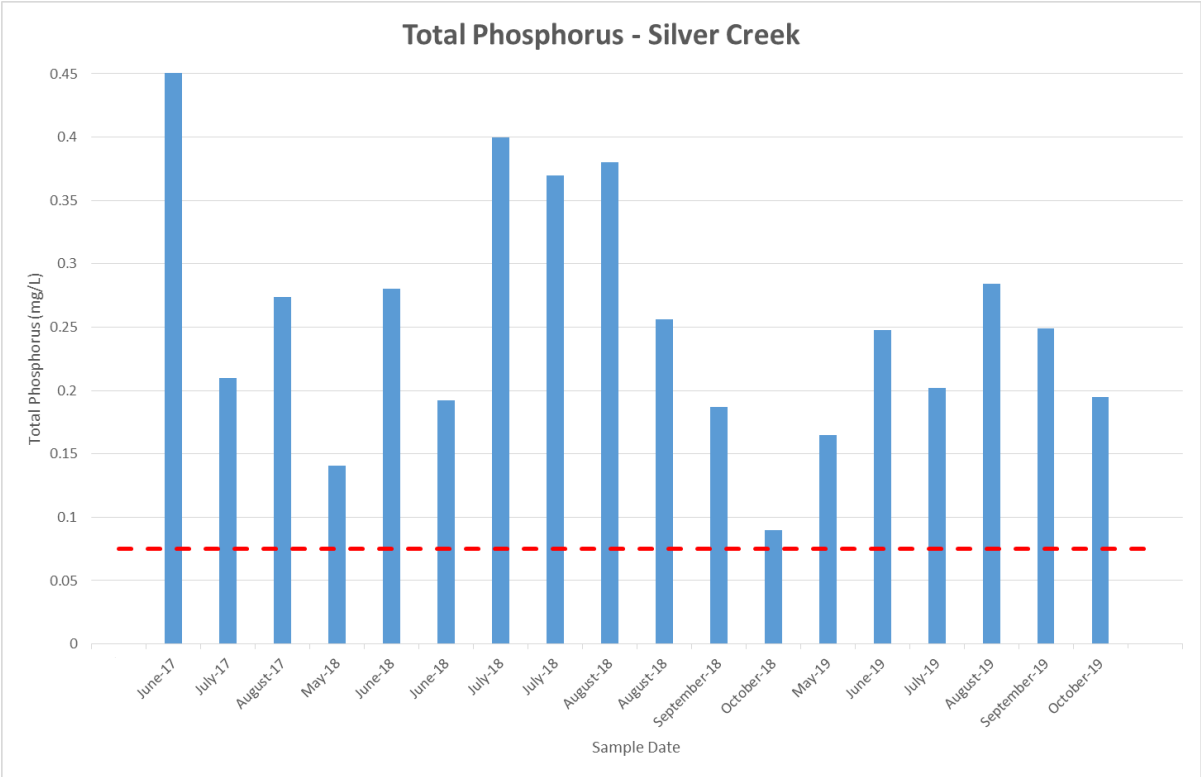


Chart A-2. Total Phosphorus Measurements in Silver Creek (Union).

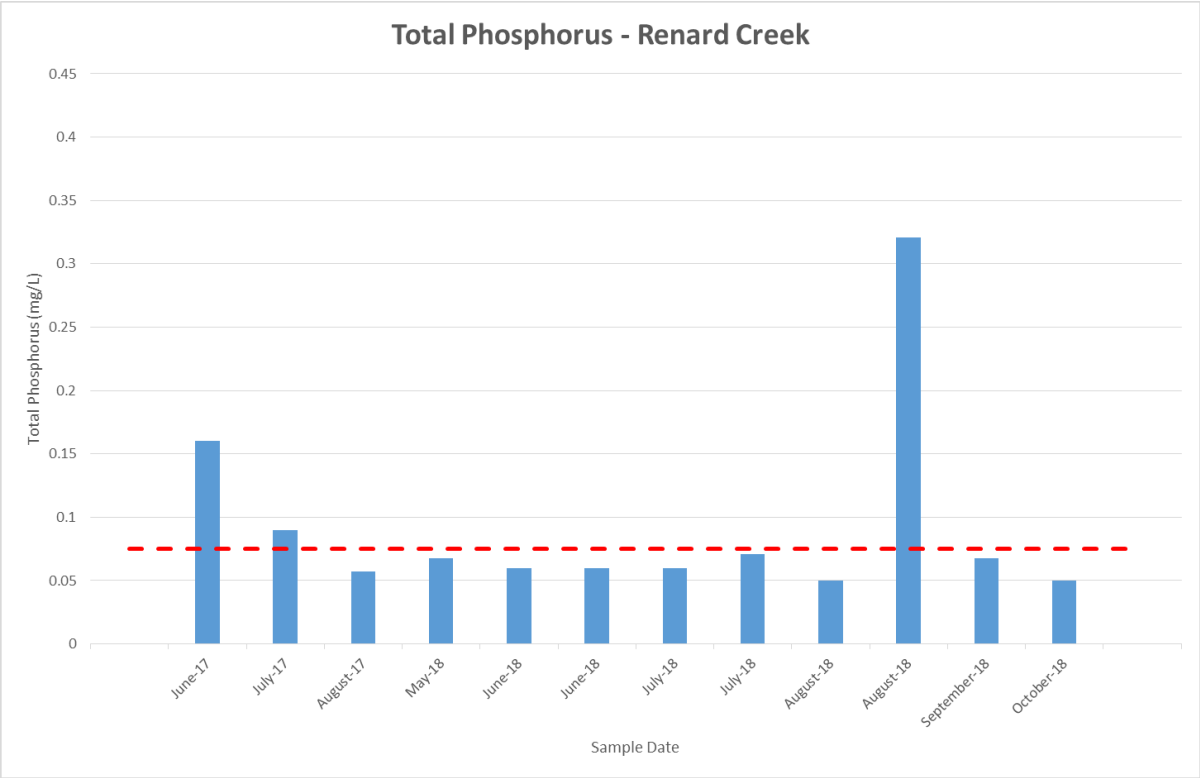


Chart A-3. Total Phosphorus Measurements in Renard Creek.

The Hilsenhoff Biotic Index is a statistical analysis to estimate the overall tolerance of a biotic community, weighted by the relative abundance of each taxonomic group. Organisms are assigned a tolerance number from 0 to 10 with regard to their sensitivity to pollutants, 0 being the most sensitive and 10 being the most tolerant.

The EPT Richness Index is a method to estimate water quality based on the abundance of three major orders of stream insects that exhibit a low tolerance to water pollution A percentage of Ephemeroptera, Plecoptera andTricoptera (EPT) to the total taxa found is used to develop the EPT Richness Index; values that fall between 0 – 100%, with lower percentages representing more sever impacts to the water body and higher percentages representing less impact.

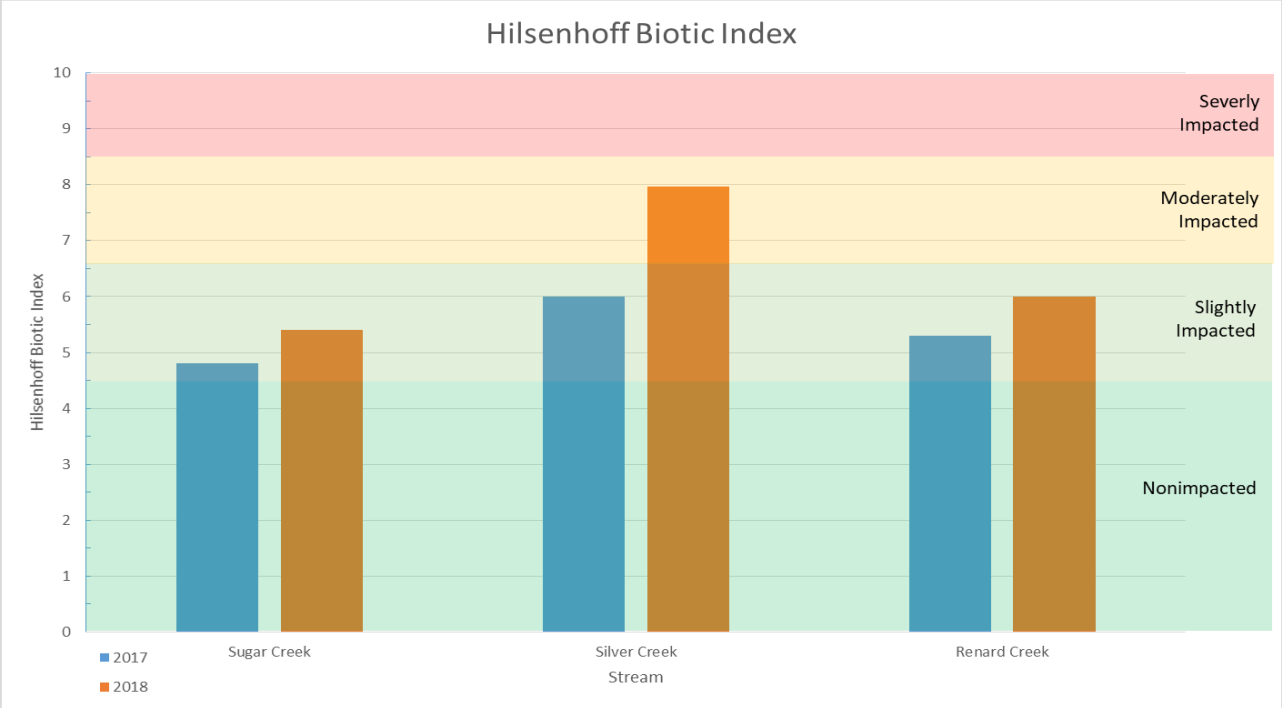


Chart A-4. HBI Values for Sugar, Silver and Renard Creeks.

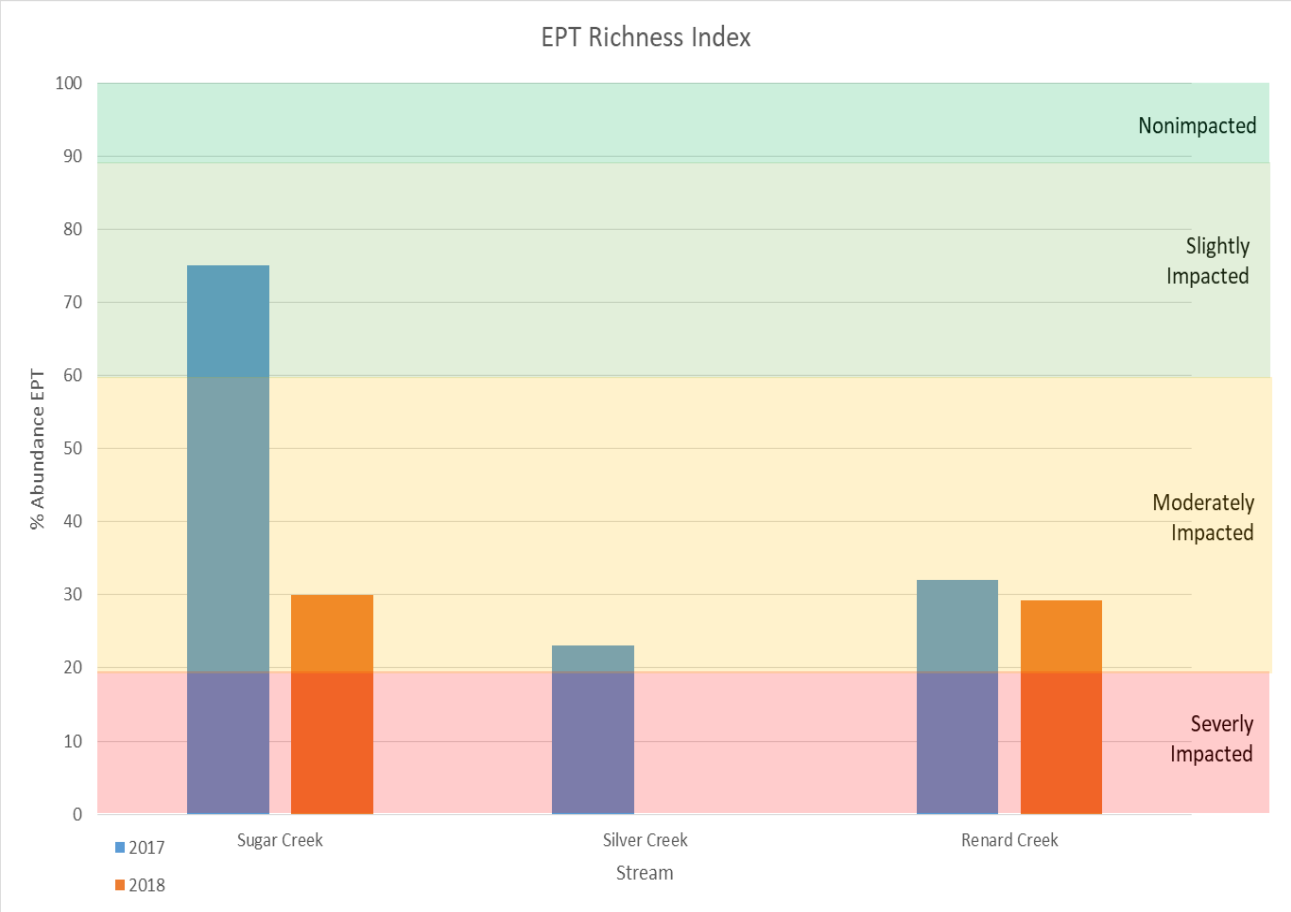


Chart A-5. EPT Richness Values for Sugar, Silver and Renard Creeks.

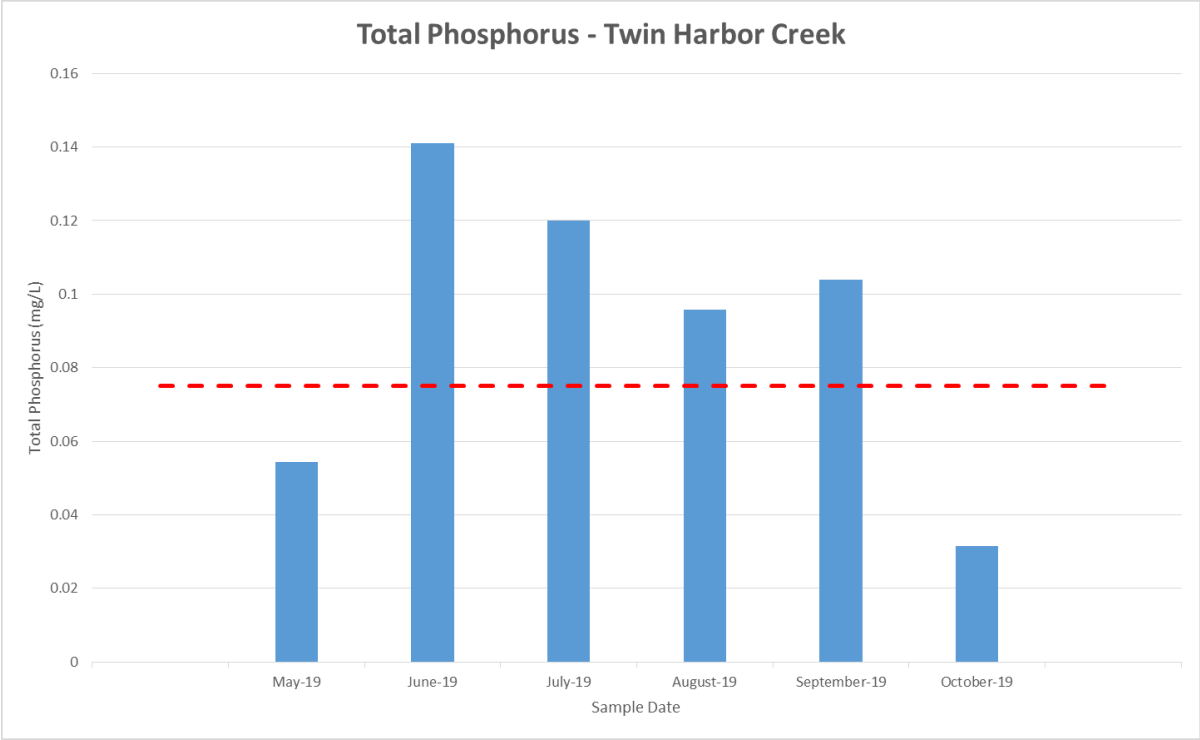


Chart A-6. Total Phosphorus Measurements in Twin Harbor Creek.

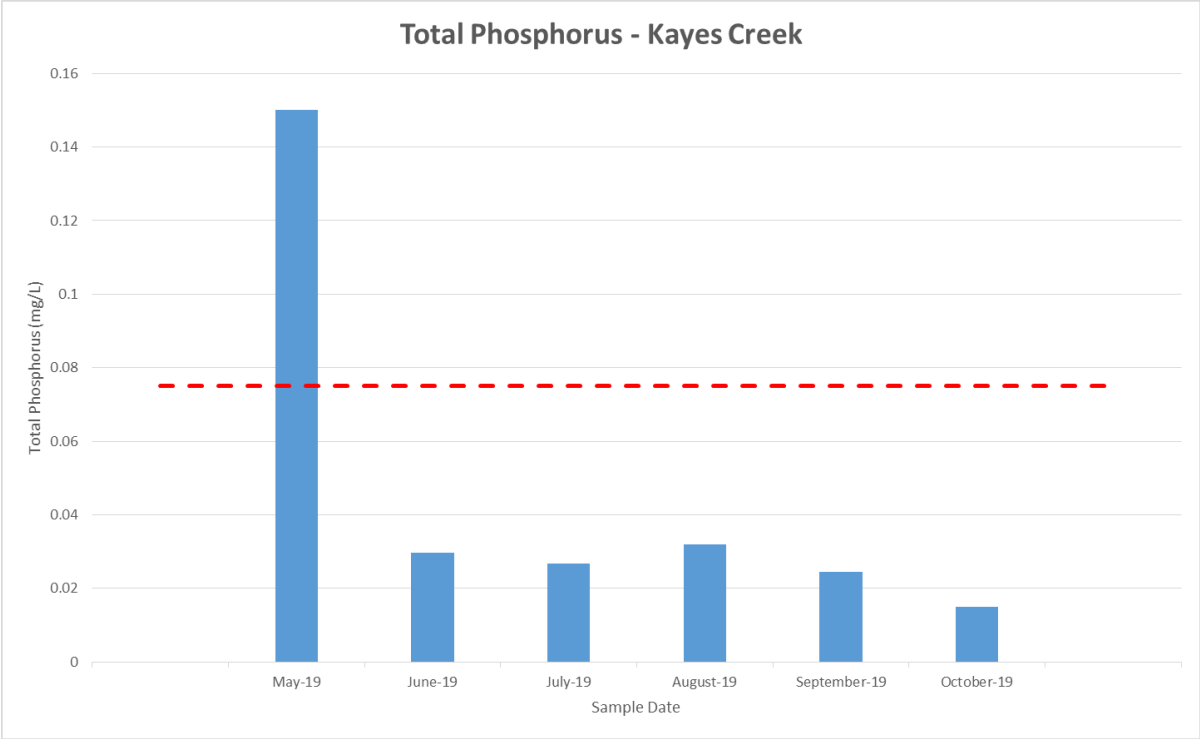


Chart A-7. Total Phosphorus Measurements in Kayes Creek.

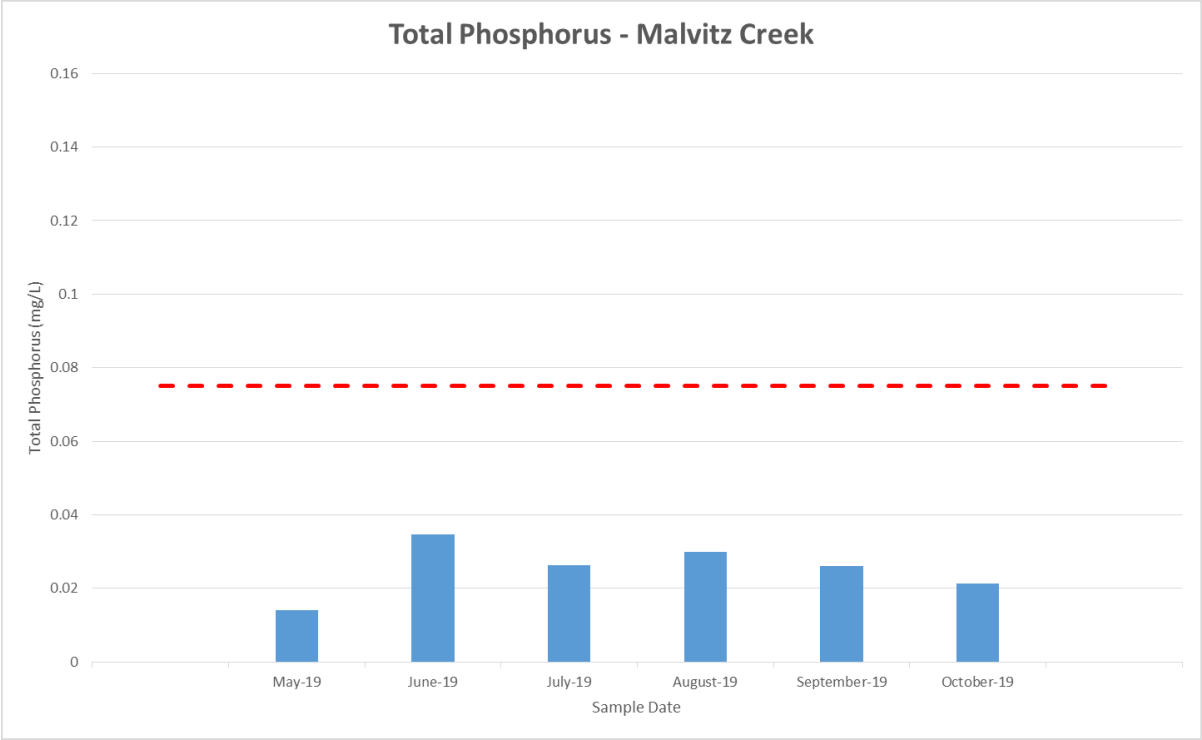


Chart A-8. Total Phosphorus Measurements in Malvitz Creek.

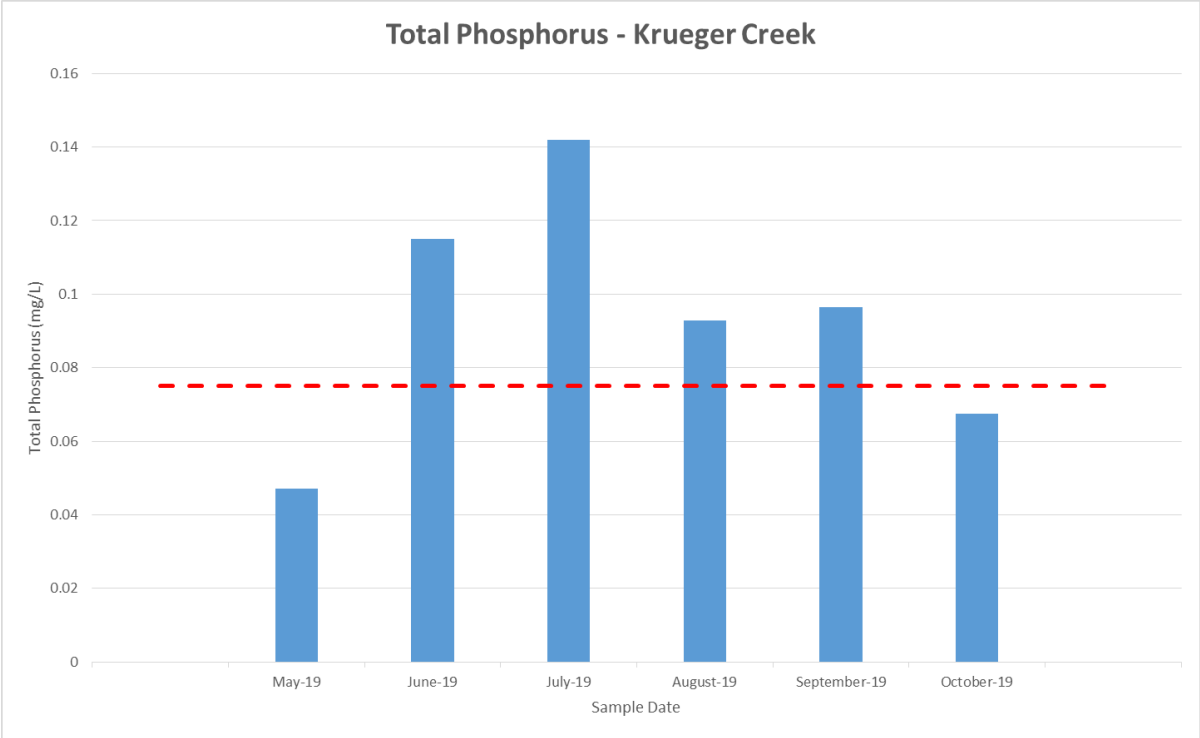


Chart A-9. Total Phosphorus Measurements in Krueger Creek.

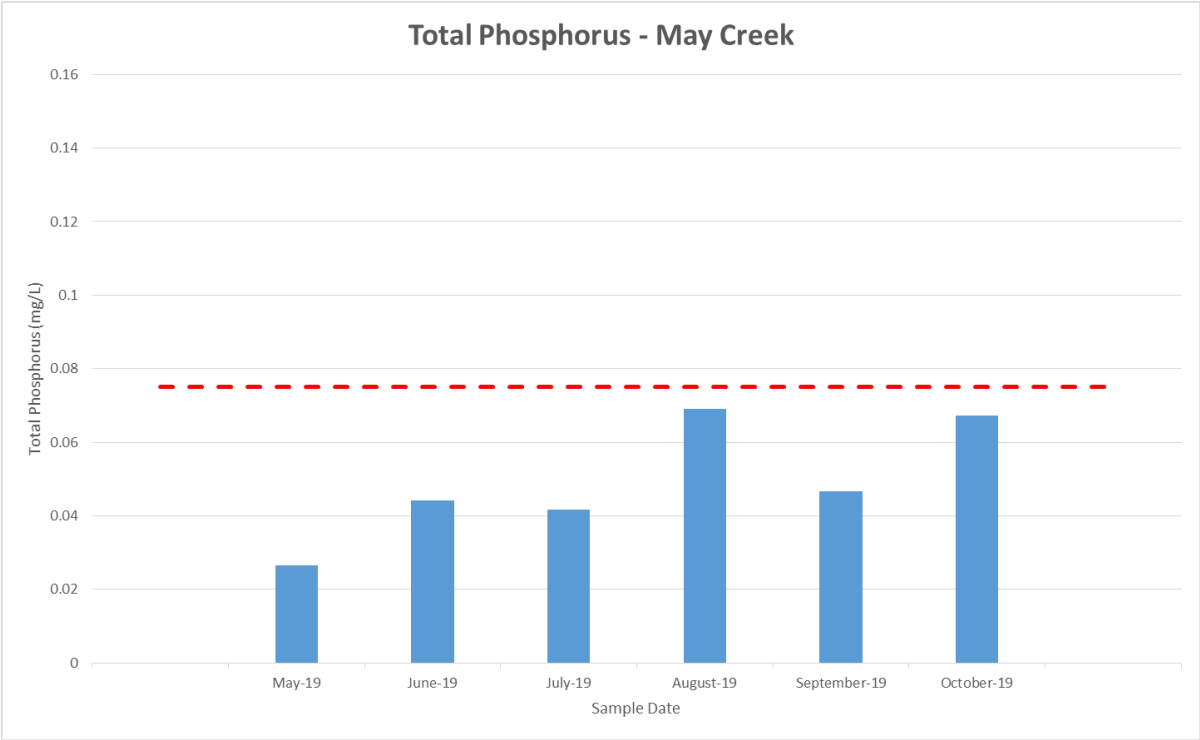


Chart A-10. Total Phosphorus Measurements in May Creek

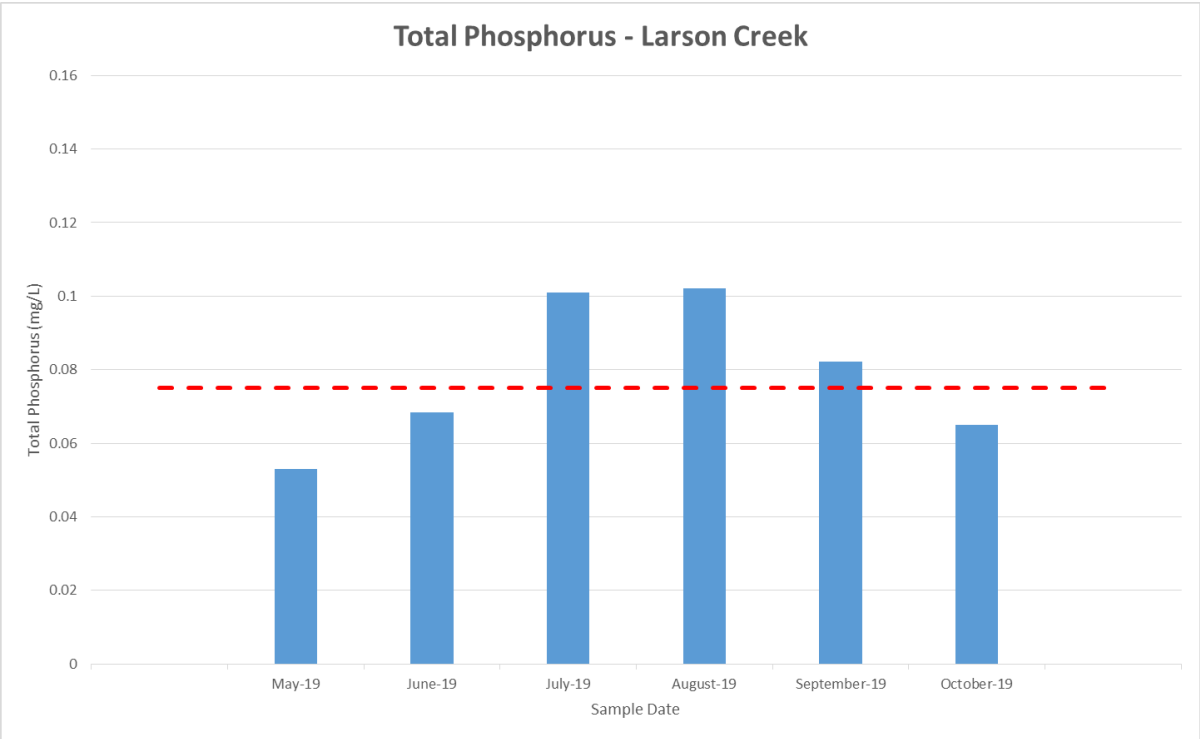


Chart A-11. Total Phosphorus Measurements in Larson Creek.

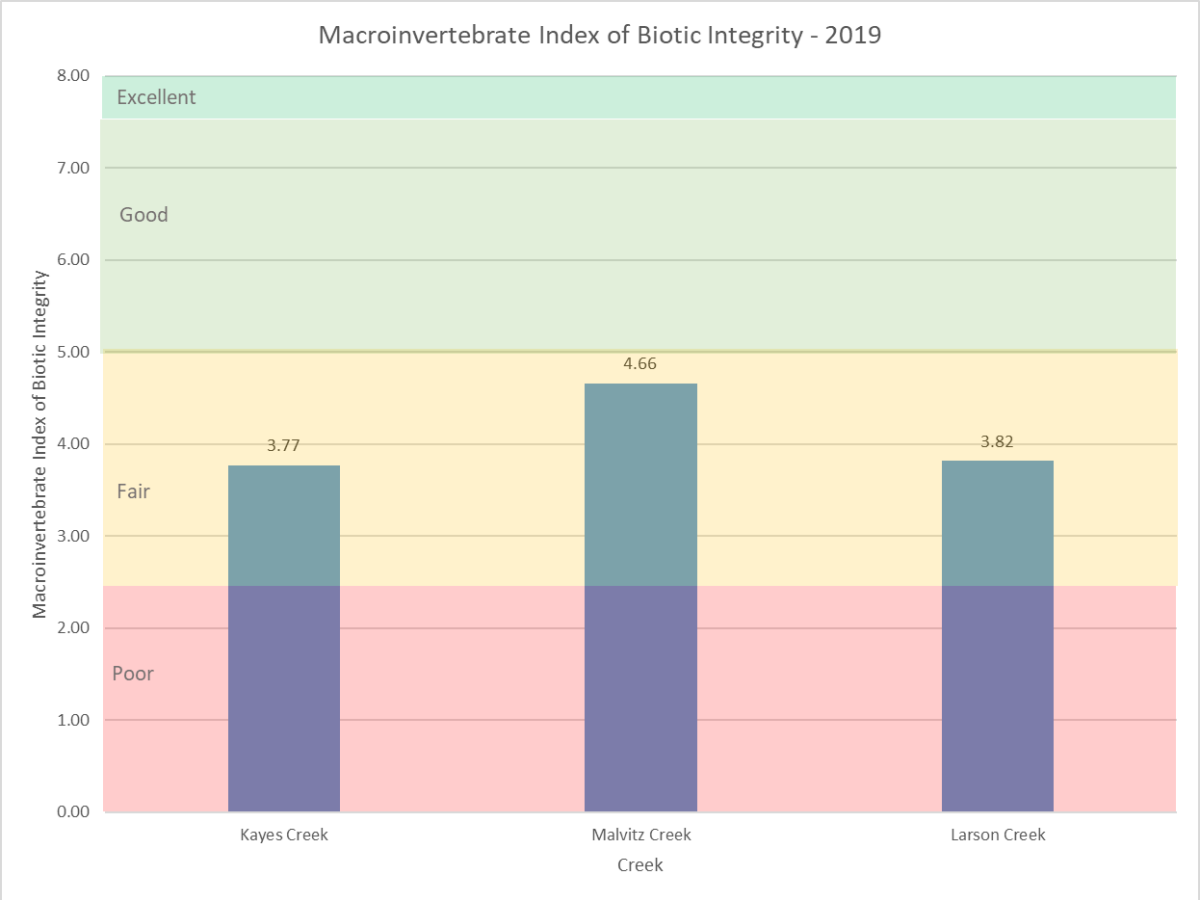


Chart A-12. M-IBI Values for Kayes, Malvitz and Larson Creeks.

Ahnapee River Watershed Water Quality Data

The following charts support the narrative of the water quality data in Section 2. Figure A-2 depicts the sample locations.

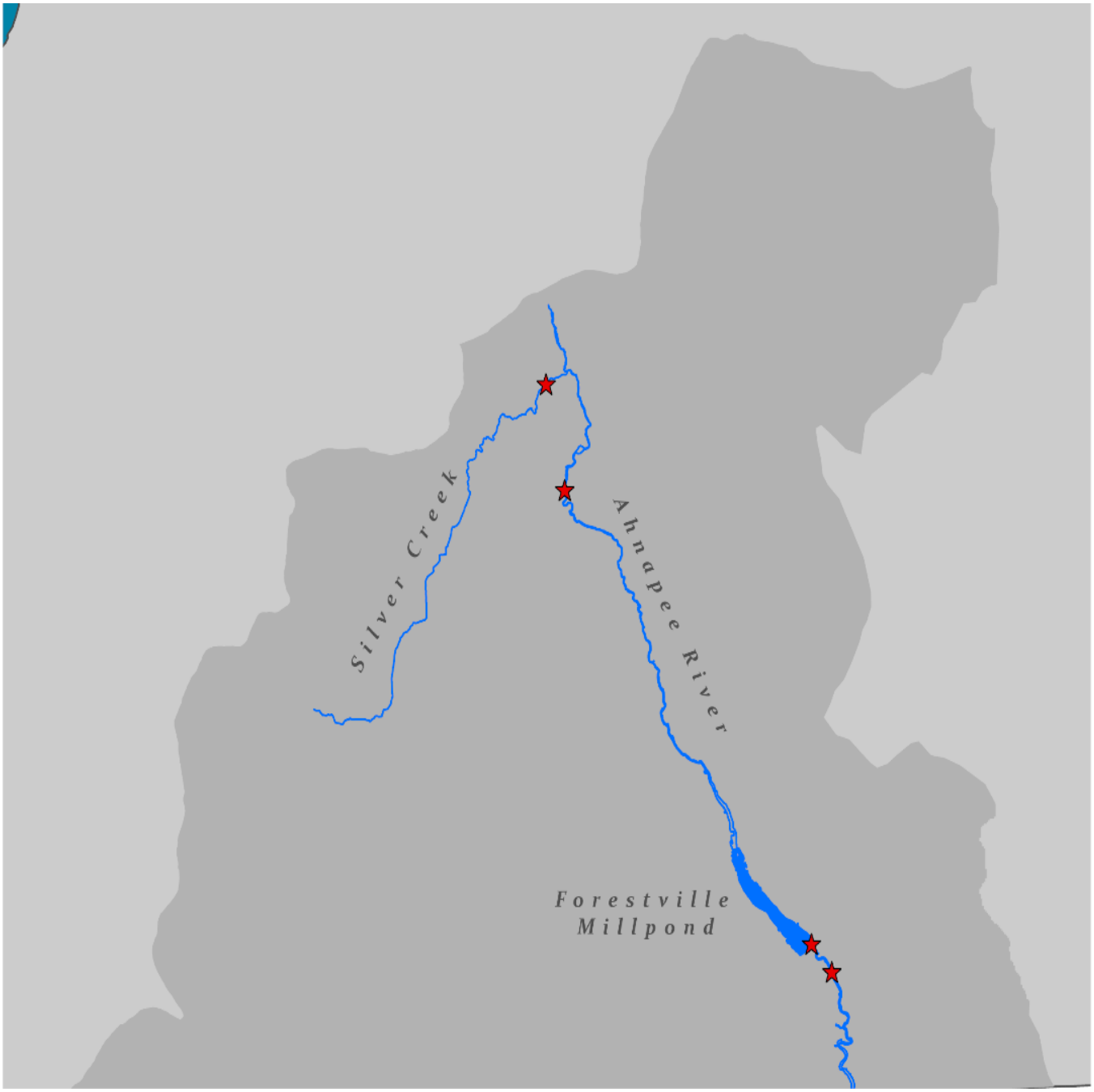


Figure A-2. Sample Locations in the Ahnapee River Watershed

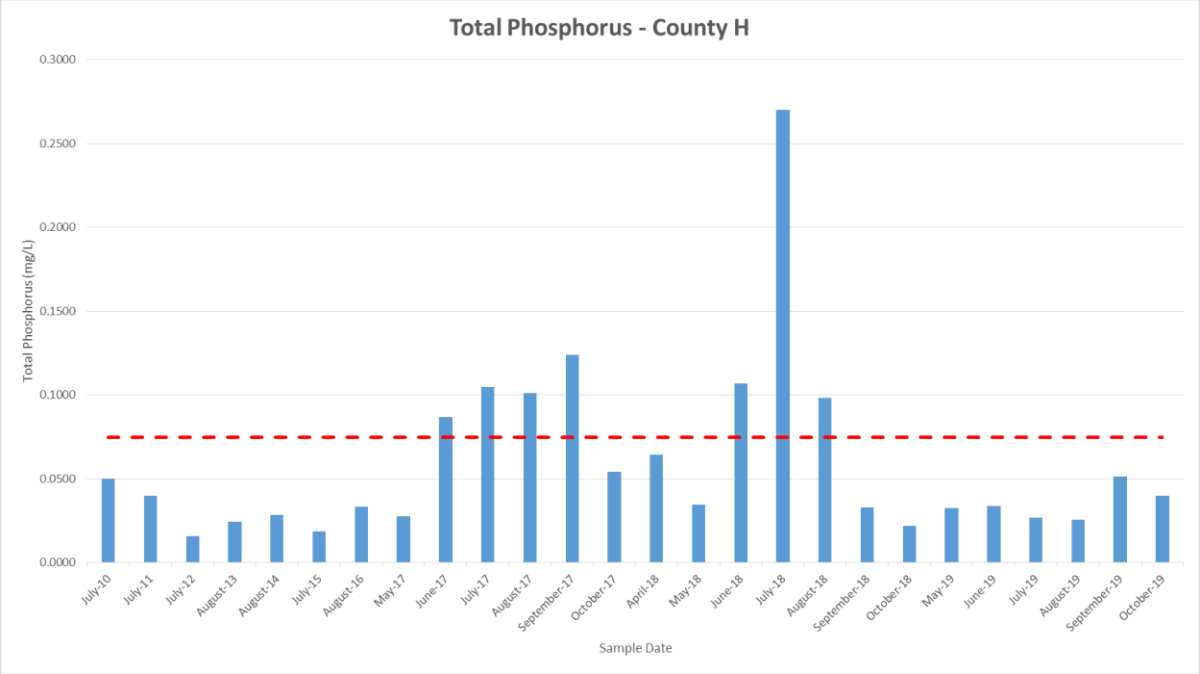


Chart A-13. Total Phosphorus Measurements in the Ahnapee River at County H.

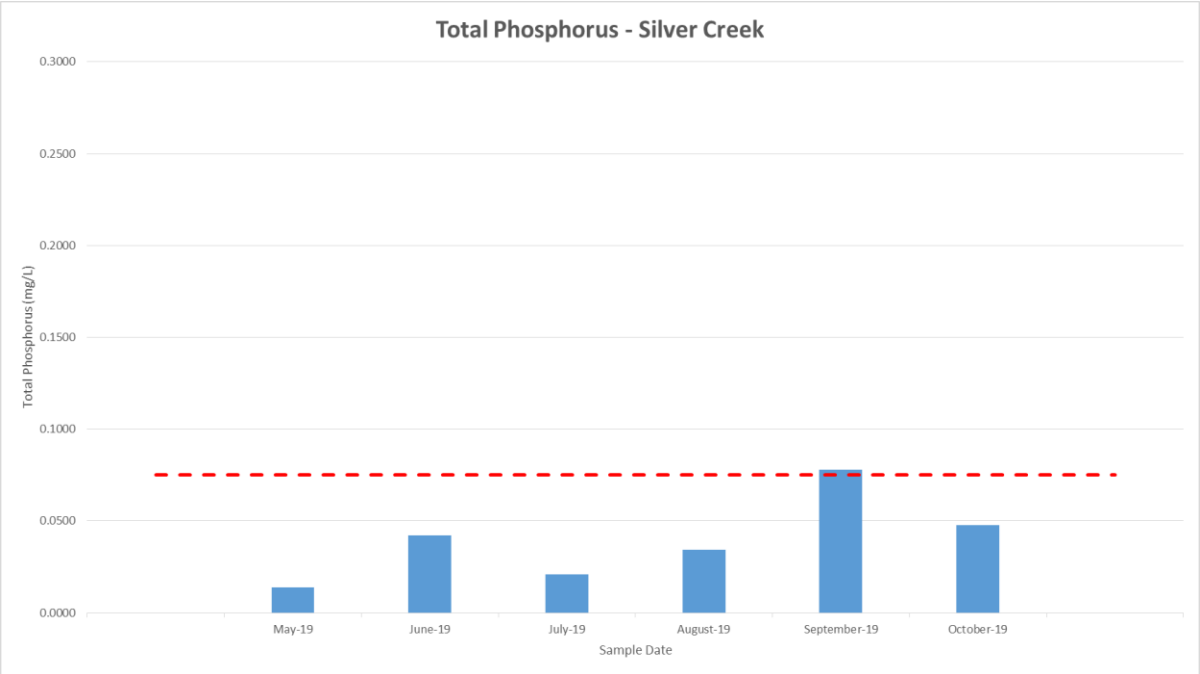


Chart A-14. Total Phosphorus Measurements in Silver Creek (Brussels).

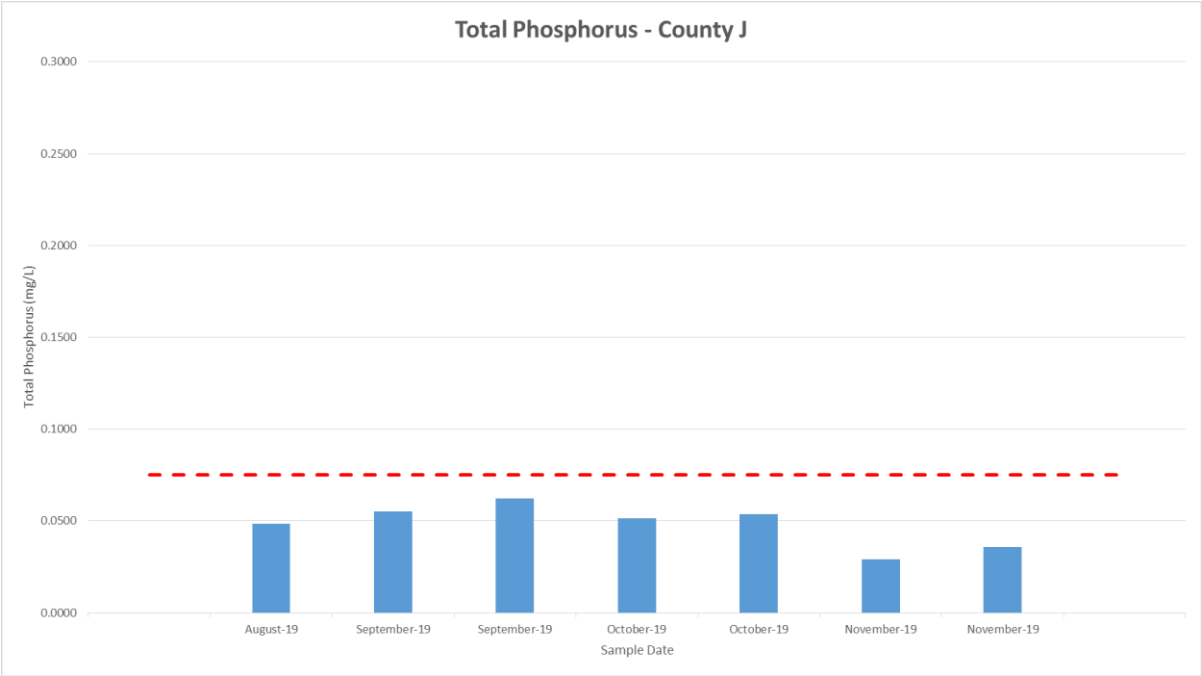


Chart A-15. Total Phosphorus Measurements in the Ahnapee River at County J.

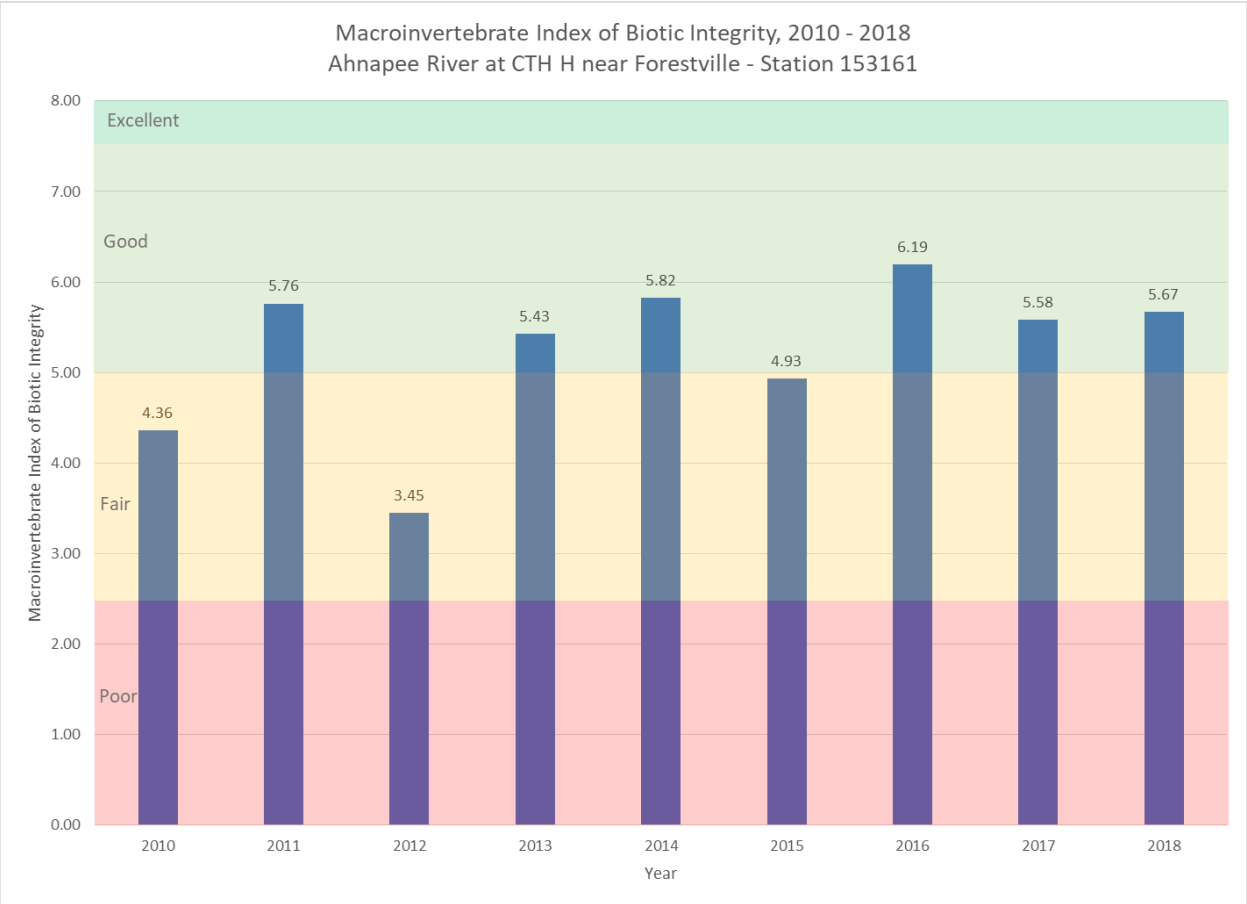


Chart A-16. M-IBI Values for the Ahnapee River at County H.

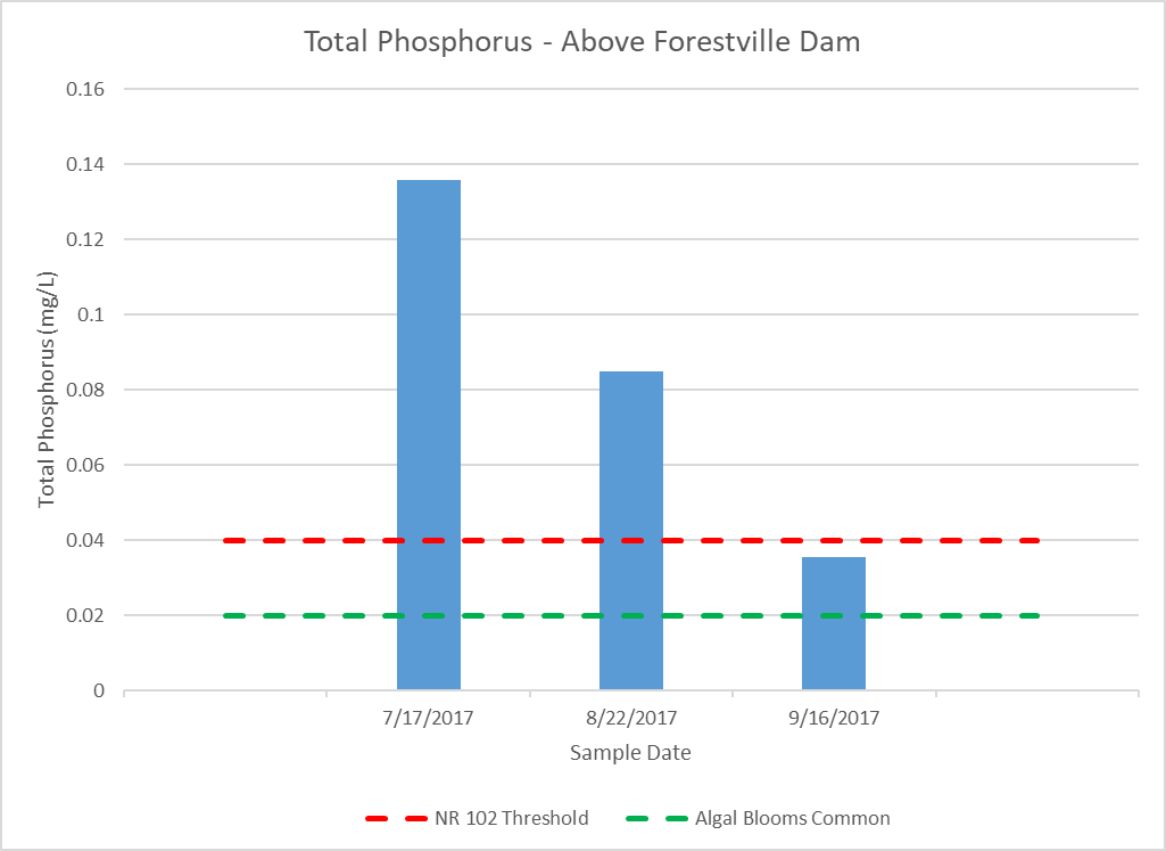


Chart A-17. Total Phosphorus Measurements Above the Forestville Dam

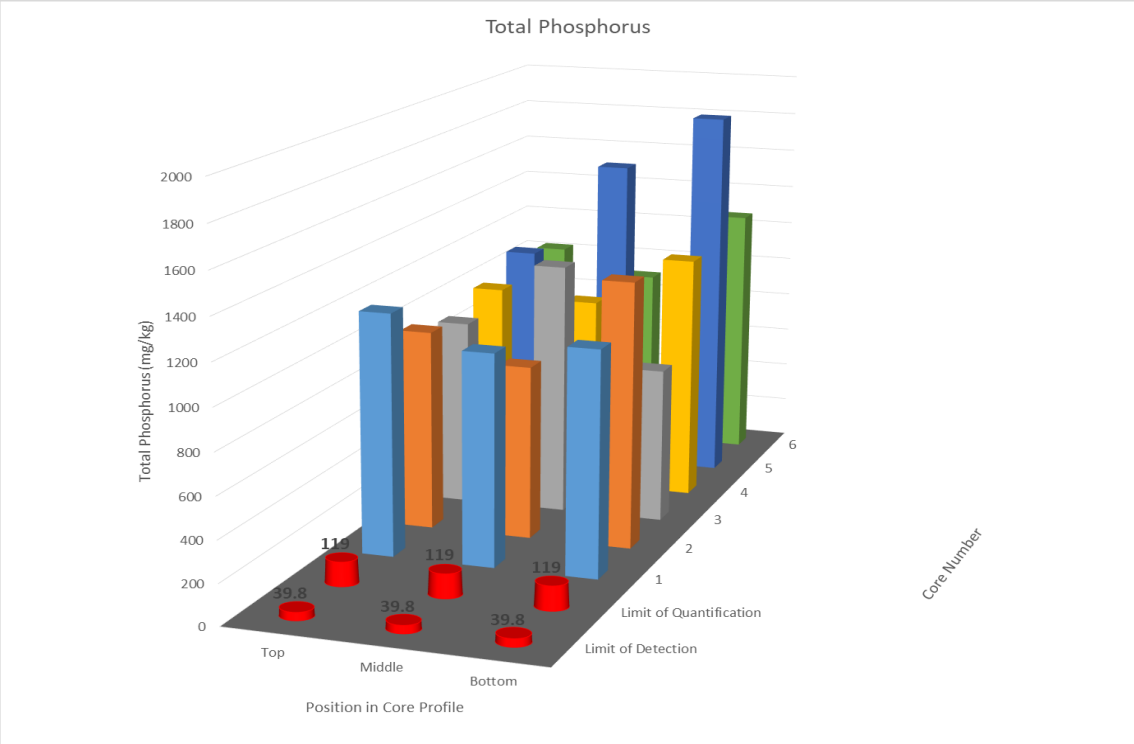


Chart A-18. Total Phosphorus Measurements in the Forestville Millpond Sediment Cores.

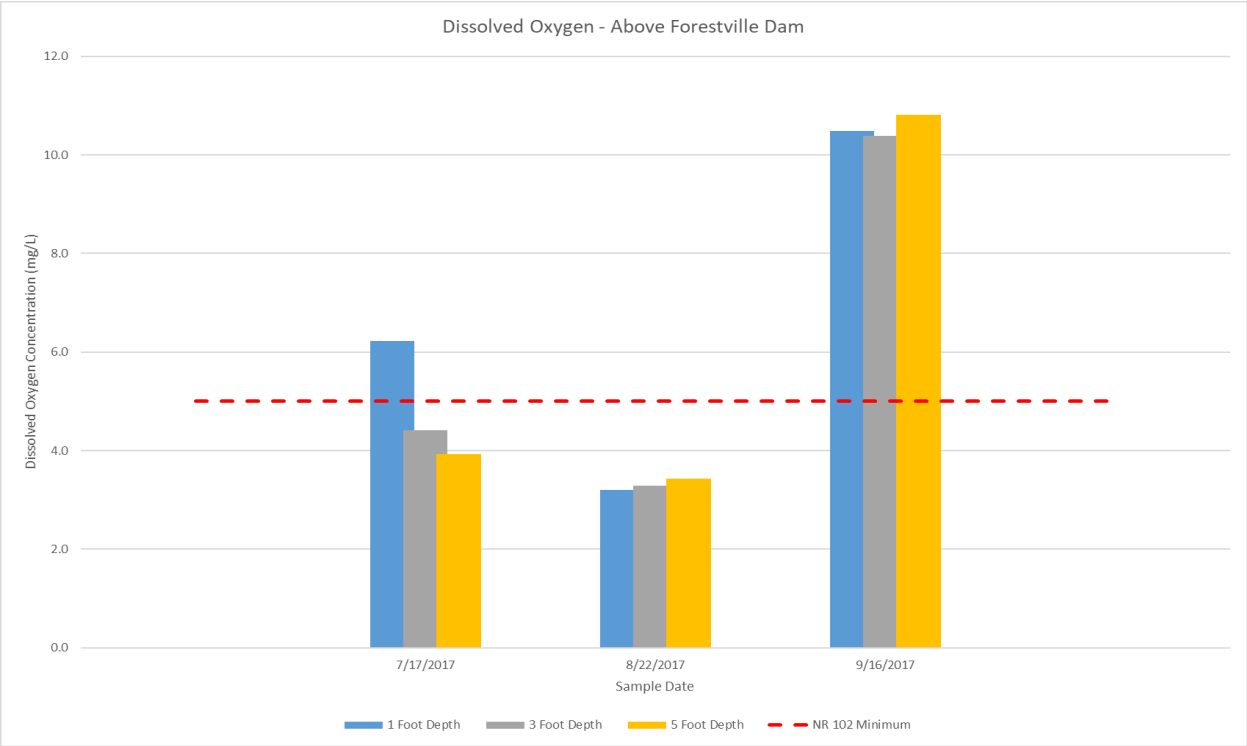


Chart A-19. Dissolved Oxygen Measurements Above the Forestville Dam.

Stony Creek Watershed Water Quality Data

The following charts support the narrative of the water quality data in Section 2. Figure A-3 depicts the sample locations.

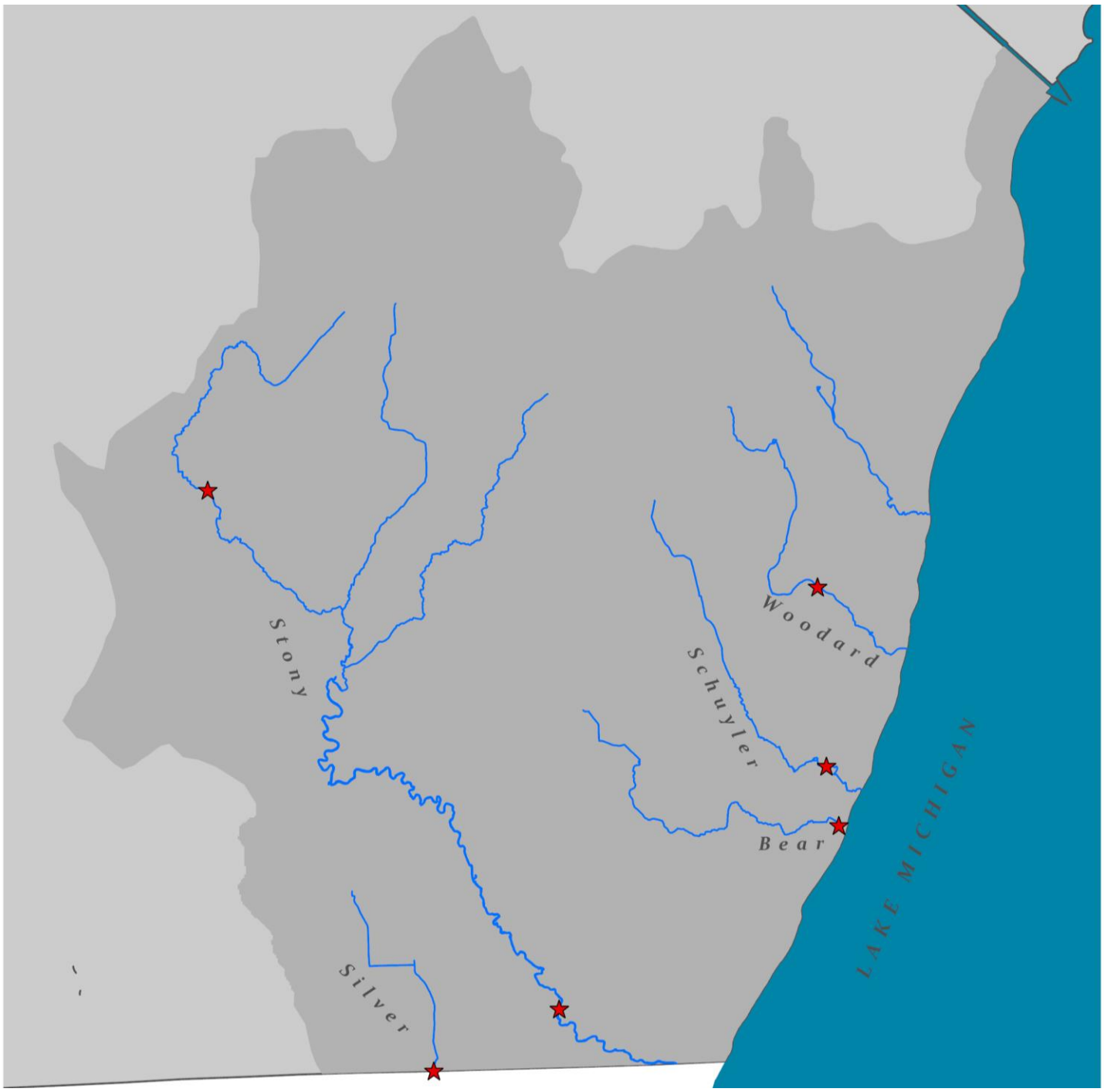


Figure A-3. Sample Locations in the Stony Creek Watershed.

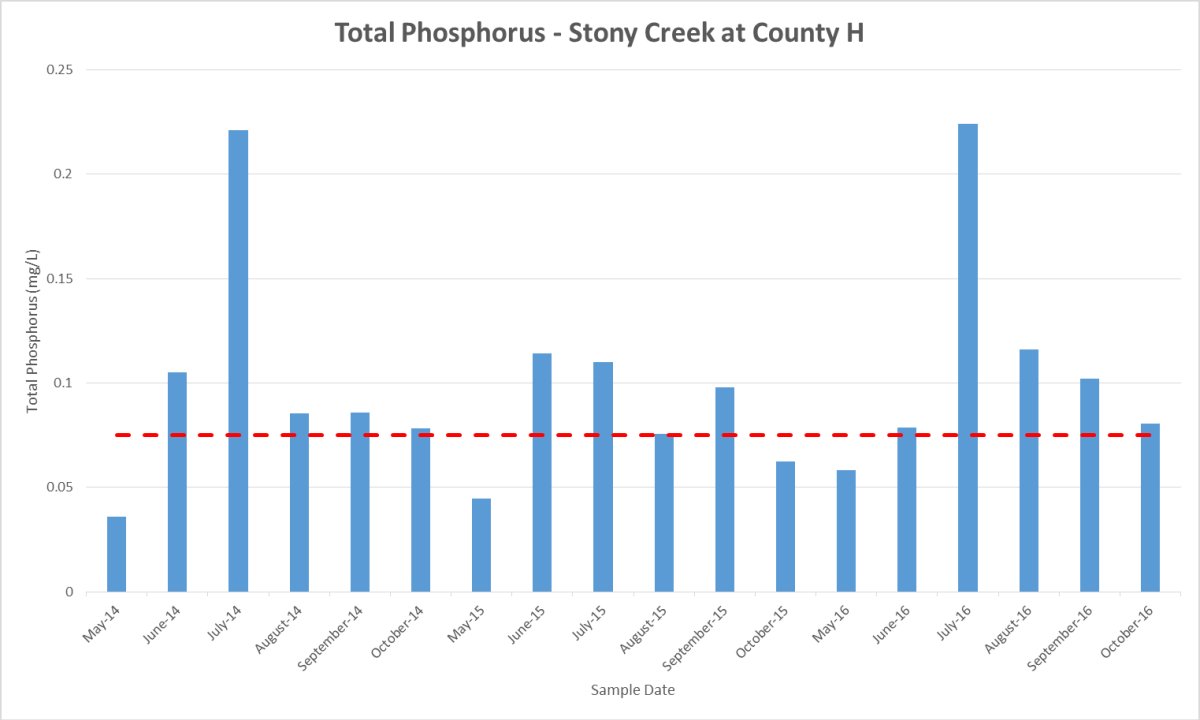


Chart A-20. Total Phosphorus Measurements in Stony Creek at County H.

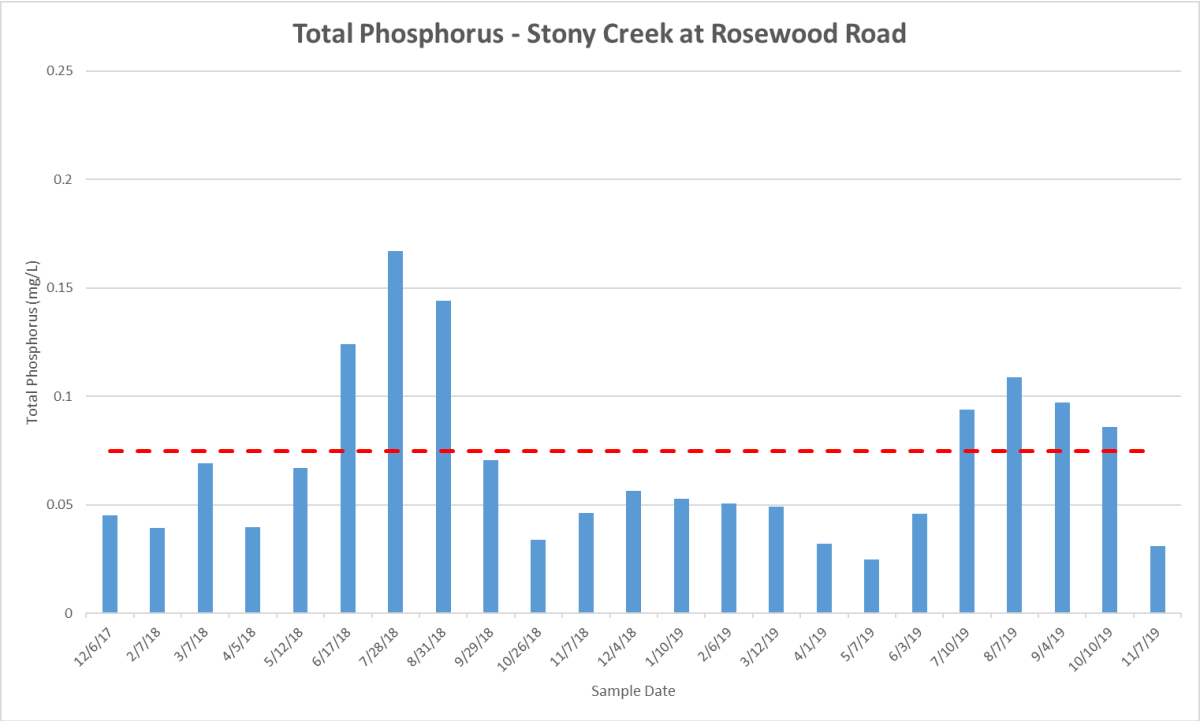


Chart A-21. Total Phosphorus Measurements in Stony Creek at Rosewood Road.

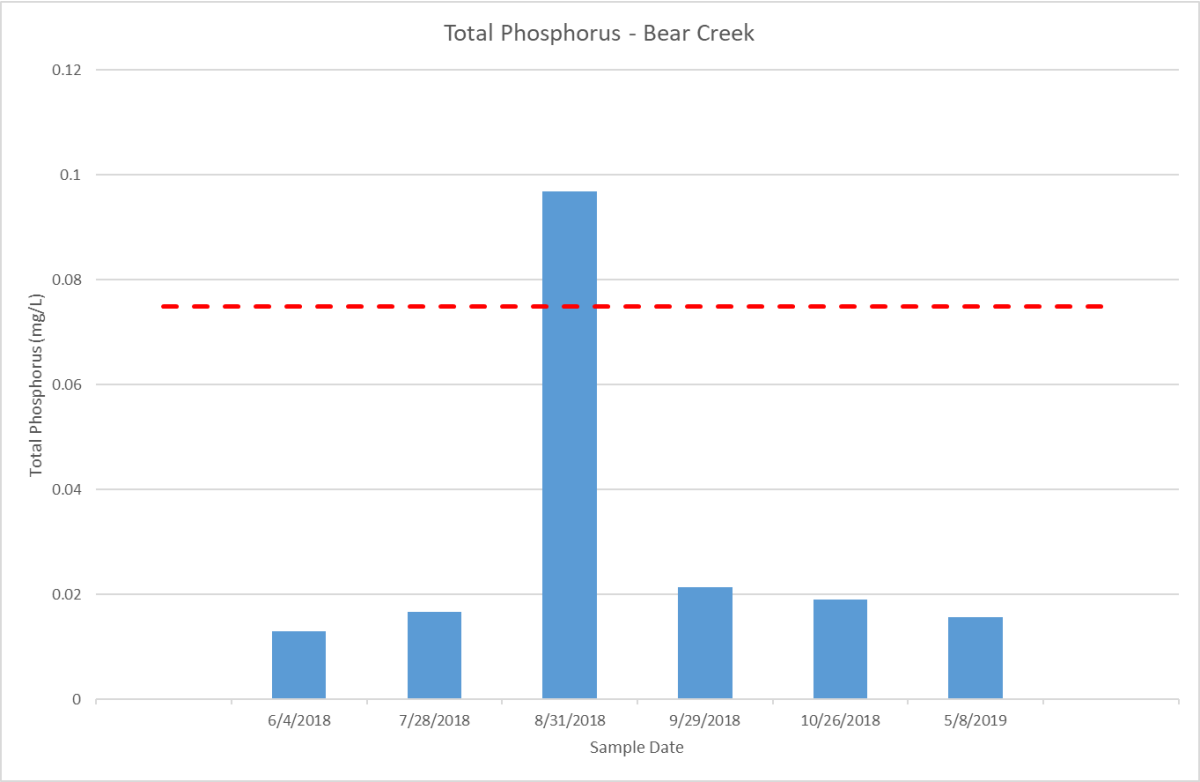


Chart A-22. Total Phosphorus Measurements in Bear Creek.

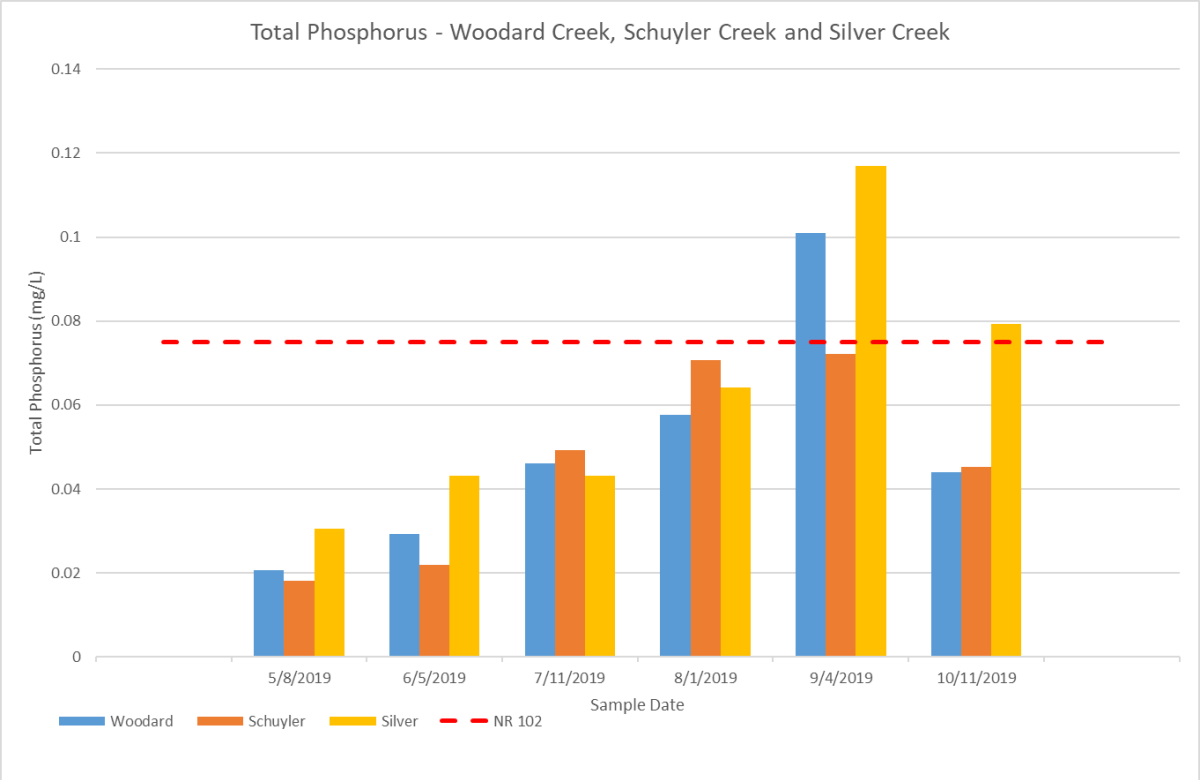


Chart A-23. Total Phosphorus Measurements in Woodard, Schuyler and Silver (Forestville) Creeks.

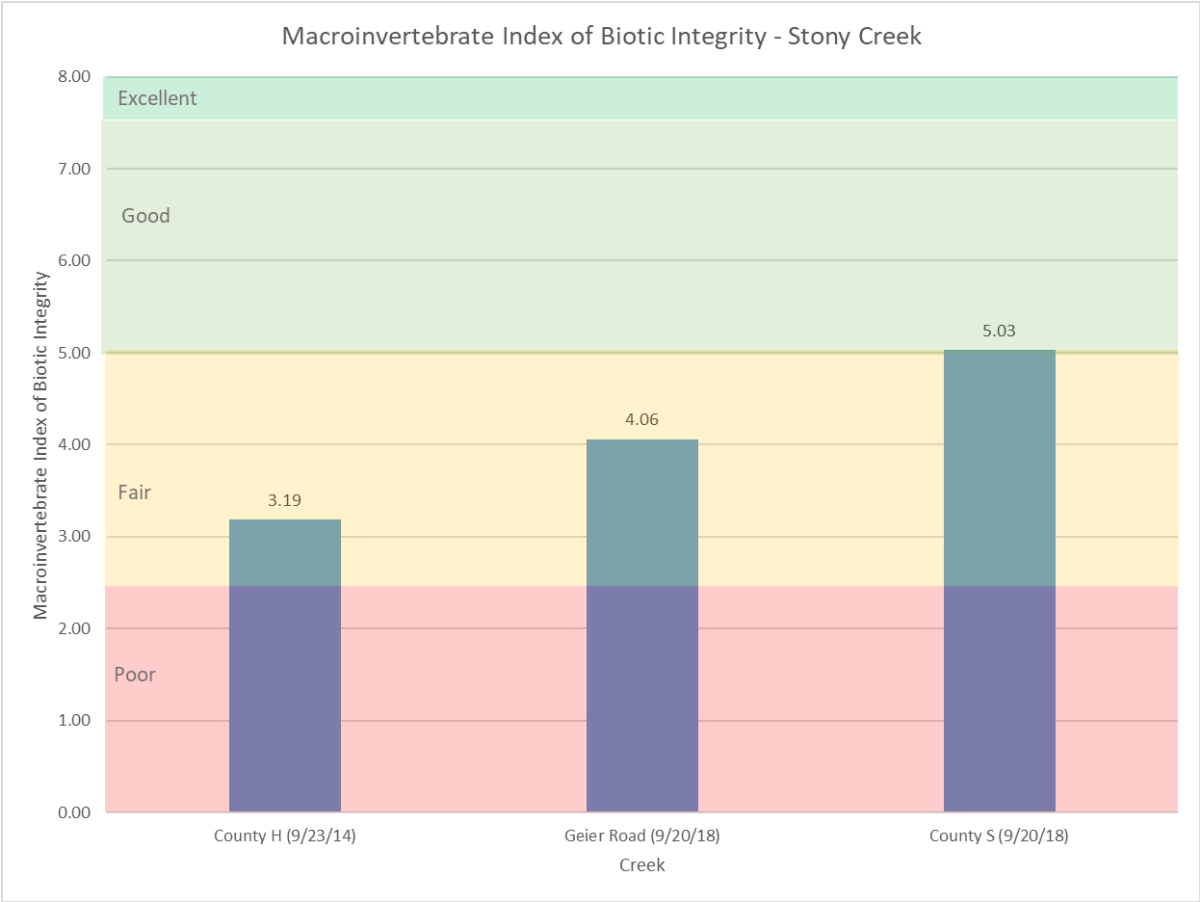


Chart A-24. M-IBI Values for Stony Creek at Three Locations.

Upper Door Watershed Water Quality Data

The following charts support the narrative of the water quality data in Section 2. Figure A-4 depicts the sample locations.

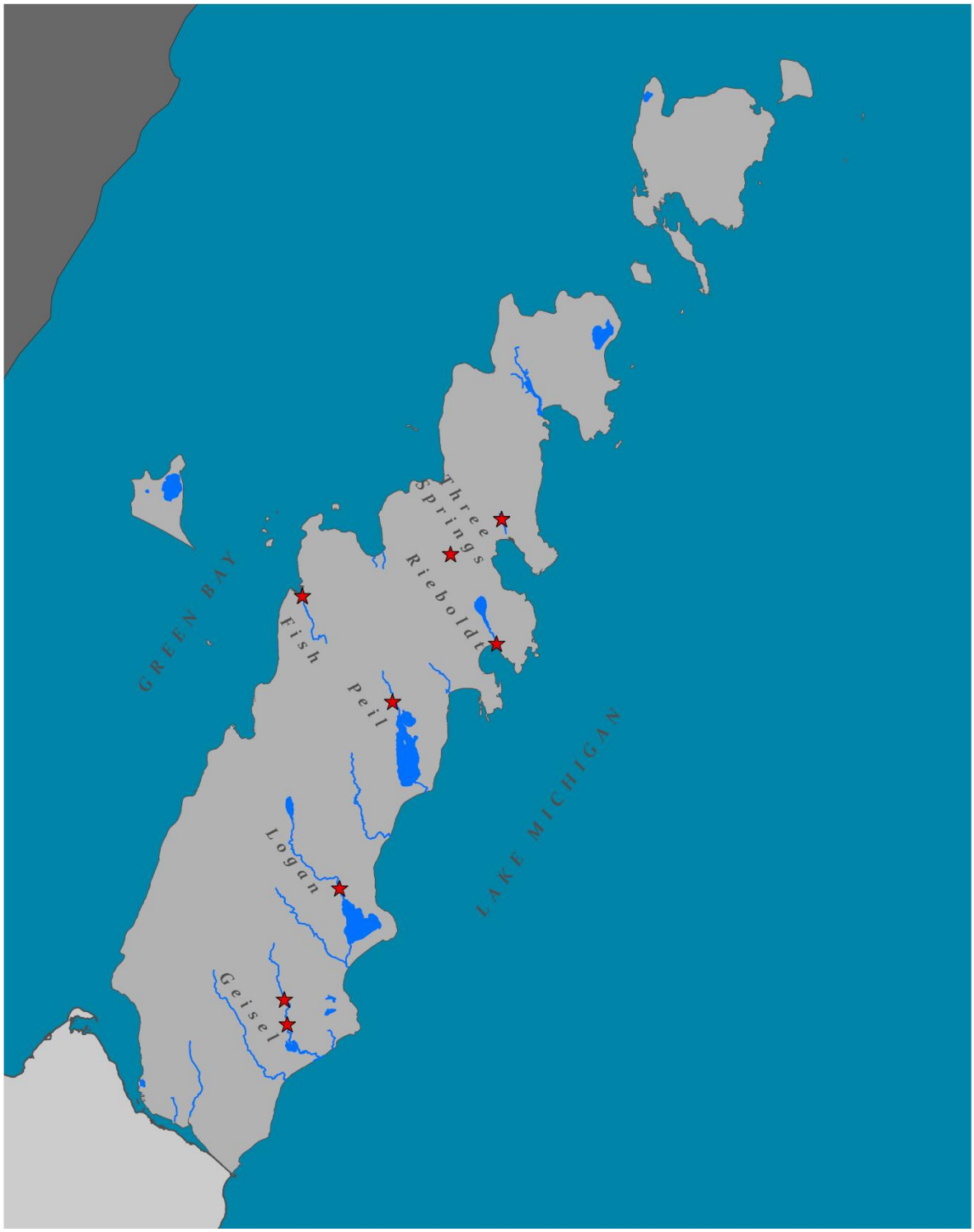


Figure A-4. Sample Locations in the Upper Door Watershed

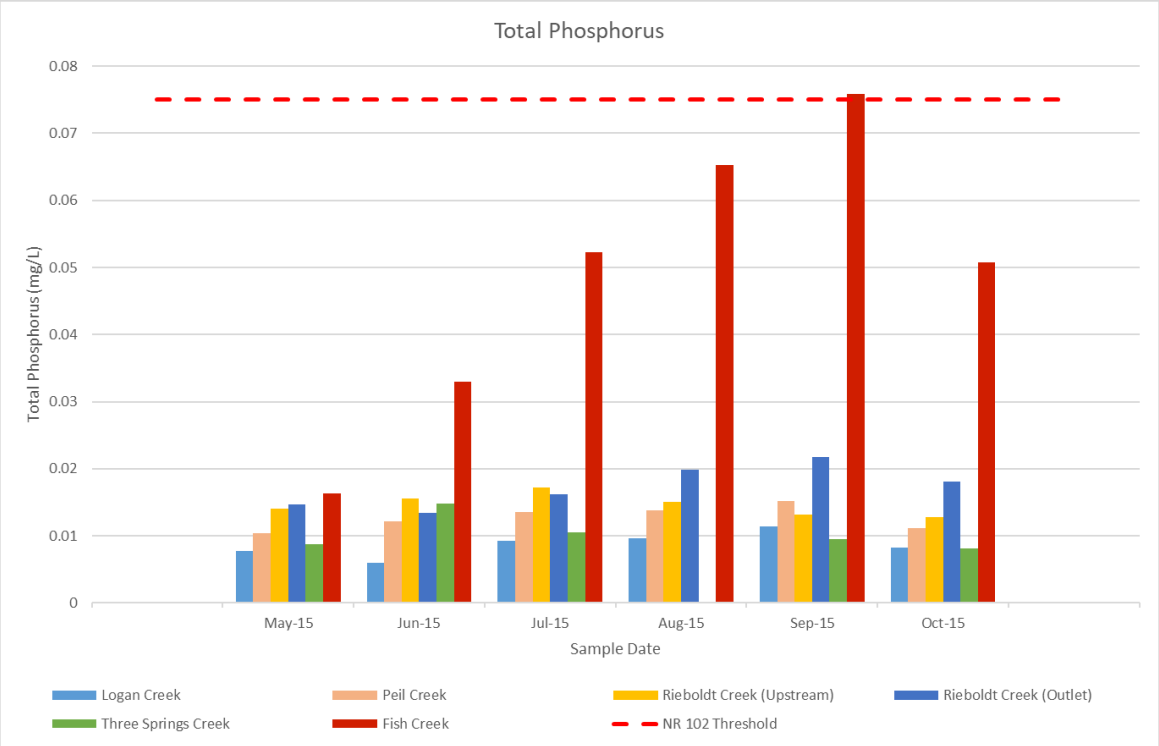


Chart A-25. Total Phosphorus Measurements in Upper Door Watershed Streams.

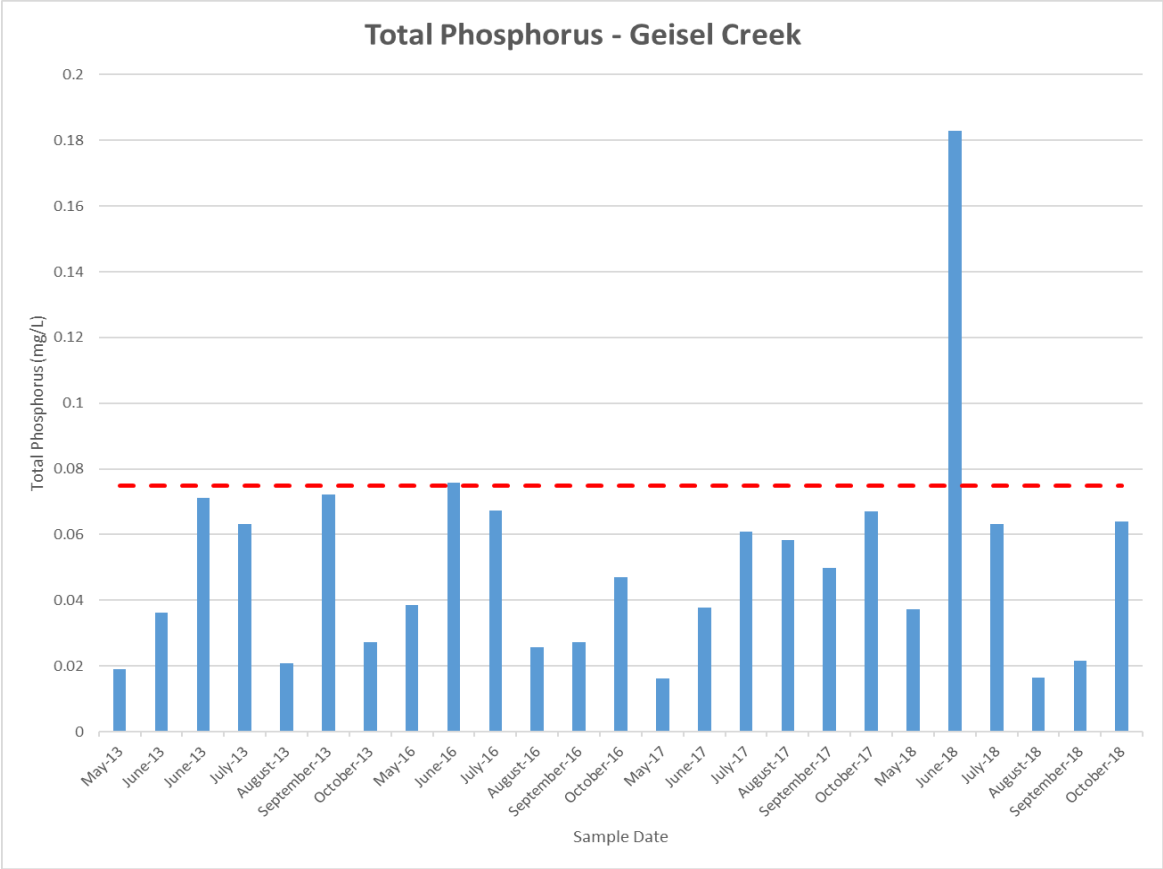


Chart A-26. Total Phosphorus Measurements in Geisel Creek at Haberli Road.

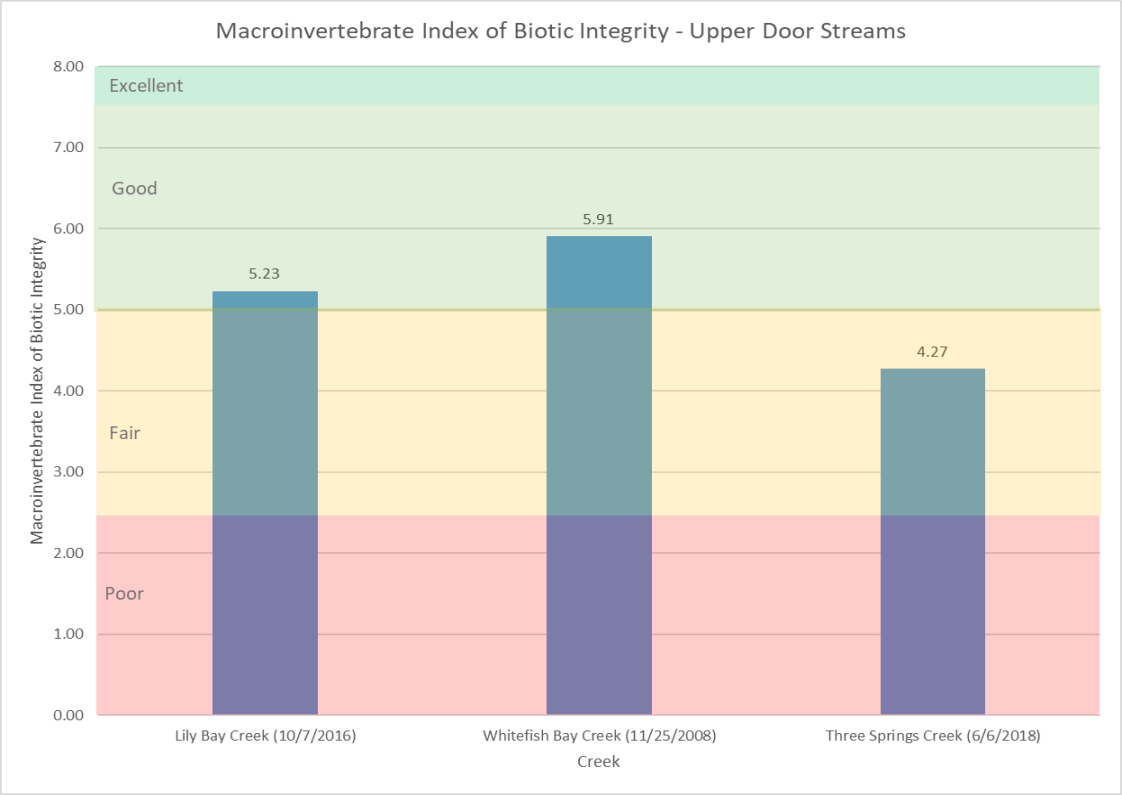


Chart A-27. M-IBI Values for Lily Bay, Whitefish Bay and Three Springs Creeks.

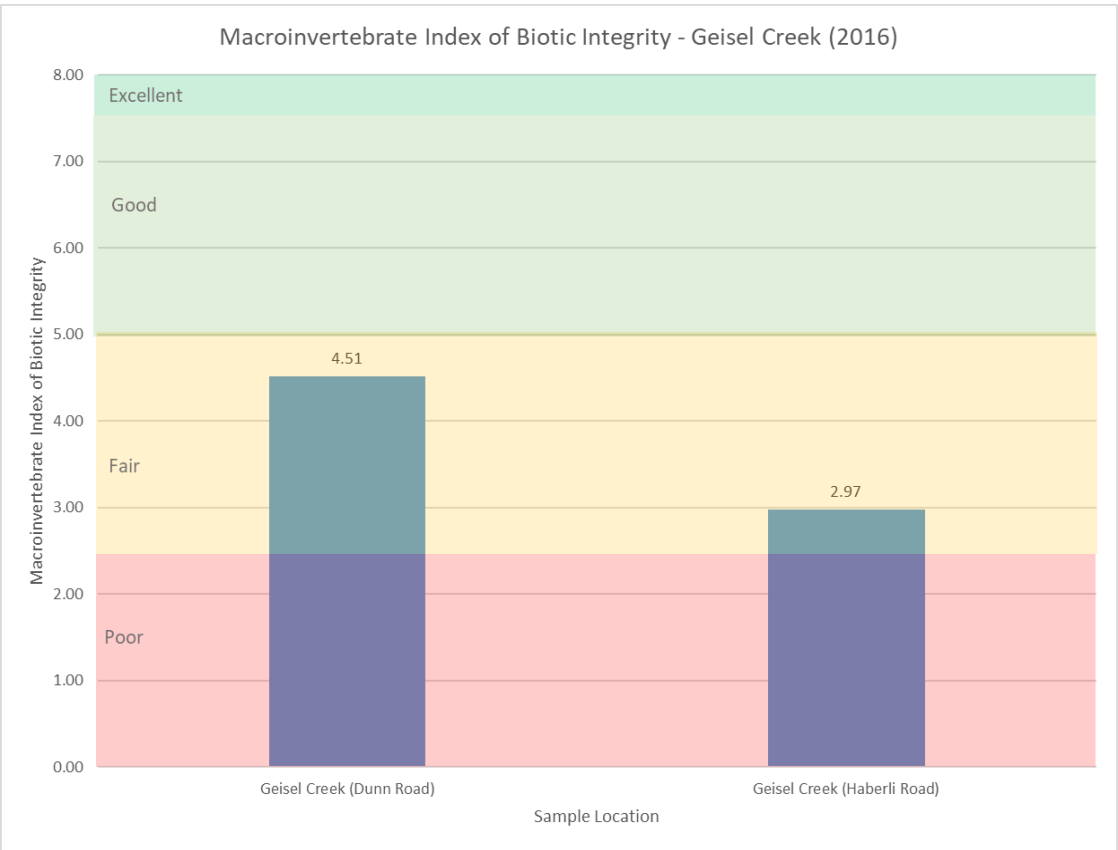


Chart A-28. M-IBI Values for Locations in Geisel Creek.

Soil Erosion Data Referenced in Section 2 - Resource Assessment

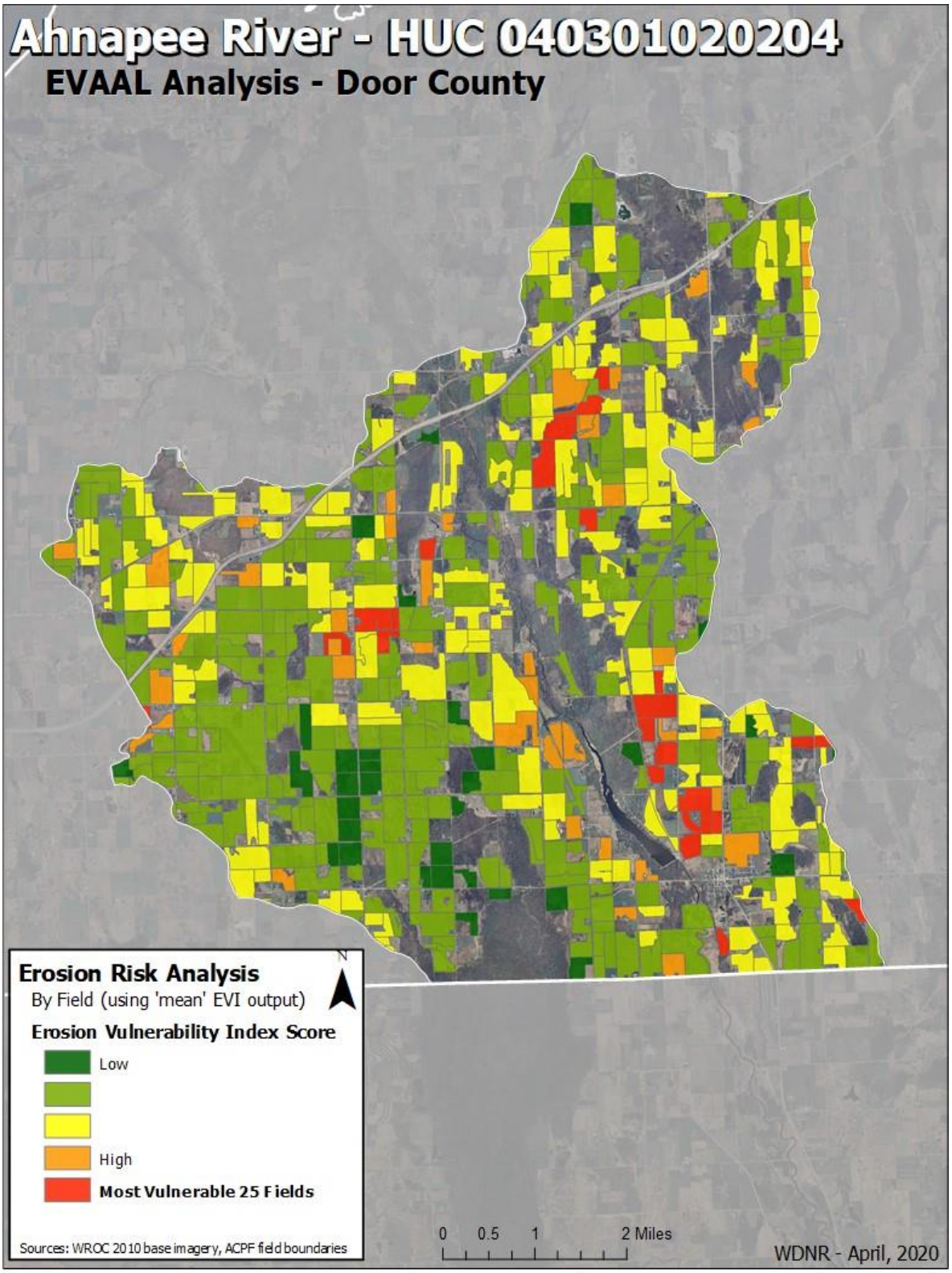


Figure A-5. Ahnapee River Watershed EVAAL Analysis

Appendix B
Results of Public Input Sessions to Identify Land and Water Resource Needs

Sturgeon Bay, February 17, 2020

Resource Needs	Votes
All items on 2010 plan, increase emphasis on #12 to: get more info to public (urban/rural) = more involvement/participation. Move to sustainable practices.	12
Karst geography - groundwater: all possible sources of contamination & which are most threatening	9
Agricultural runoff: Manure Spreading, Enforcement, Nutrient Management Plan Yield, Verifiable Milestone in Plan, Water that meets drinking standard reliable every day	9
Loss of contiguous forest land	7
High cap. wells (CAFO & golf)	3
Siloed access of data between County Depts/County - State - Fed levels/agencies	3
Herbicides, pesticides, etc. limits	3
Invasives, plants, insects with nonnative landscapes	2
Civil communication: ag education	2
Rising Lake Levels: impacting shoreline (erosion)	2
Erosion (soil)	1
High water mitigation	1
High water - erosion - beaches, roads, etc.	1
Loss of hedge rows	1
Beaches - closures, Tourist & Locals	
Groundwater - better intergovernmental coordination e.g. protection of city wells	
Human pathogens (water)	
Loss of certain bird insect eating species	
Loved to death	
Manage for climate change (recom. replace)	
Nitrates (water)	
Protect unique features	
Rising Lake Levels: high groundwater impact (lawn treatments impact to surface & groundwater)	
Rising Lake Levels: homeowner actions on the lakeshore	
Sprawl	
Toxins pesticides (soil)	
Urban/Residential homeowner land fertilizer/pesticides treatment controls - take in consideration soils/depth to bedrock - hold to same standards/schedules as ag.	

Egg Harbor, February 19, 2020

Resource Needs	Votes
Reliable safe drinking water	5
Golf course nutrient management	4
Remove bulls eye from farmers	4
Impact of climate change - Protection of wetlands	4
Groundwater protect & improvement: Expansion of public water system	3
Drinking H2O	2
Reduce chemicals on land (farm, lawn) & air (mosquitoes)	2
Groundwater protect & improvement: Increase/tighten manure spreading regulations (Kewaunee Cty's more stringent than Door, which is an extra incentive to export to Door)	2
Groundwater protect & improvement: Impact of new developments	2
Sturgeon Bay Zone of Contribution - revisit	1
I ♥ Poop ☺	1
Robust, reproducible testing of wells	1
Storm water management/monitor	1
Groundwater protect & improvement: Enhanced verifiable milestones	1
Control/regulate all wastes: human, animal, industry/factory	
Dead zone in Bay	
Encourage & monitor wildlife corridors	
Groundwater protect & improvement: Downstream education	
Groundwater protect & improvement: Drinking water quality	
Groundwater protect & improvement: Enforcement of existing regulations	
Groundwater protect & improvement: Prevention of manure storage overflow regardless of weather - risk management	
Groundwater protect & improvement: Protection from rising water levels	
Groundwater protect & improvement: Source research & I.D.	
High H2O Levels	
Impact of climate change - Cycolonic "Bombs" - runoff/flooding	
Natural buffer zone - keep	
Share water quality data	

Brussels, February 20, 2020

Resource Needs	Votes
Waste Management: human waste, industrial waste, agricultural waste, residential waste. Point & nonpoint sources of pollution. Solution: Reduce/remove H2O from waste management systems.	14
Lack of education on and awareness of environmental issues and sustainable farming practices	9
Animal waste - not liquid/liquid out	3
Wind - water - erosion - destruction	3
Groundwater & Surface water - need clean drinking H2O long term.	3
Overuse of resources: seasonal influx (tourism), weather dependent, budgetary restraints (infrastructure upgrades, ie Kewaunee, Maplewood), Staffing restrictions	3
Impact of development on natural resources	2
Invasive species	2
Can infrastructure handle influx of people to Door County? Overload of sewage system, garbage	2
Groundwater quality	1
Beach contamination (public perception state/nation)	
Human waste	
Plus rest of 2010 plan	
Surface water protection	

Appendix C
Local Advisory Committee

Organization	Representative
Brey Cycle Farm / Demonstration Farms Network	Tony Brey, Co-owner
Door County Cooperative	Caleb Cornell, Agronomist
Door County Economic Development Corporation	Tom Strong, Business Development Specialist
Door County Environmental Council	Mike Bahrke, President
Door County Land Trust	Tom Clay, Executive Director
Door County Land Use Services	Mariah Goode, Director
Door County Visitor Bureau	Michelle Rasmusson, Director of Marketing & Sales
Olson Family Farm	Rich Olson, Owner
The Nature Conservancy	Mike Grimm, Conservation Ecologist
U.S. Natural Resource Conservation Service	Joe Johnson, District Conservationist
University of Wisconsin – Oshkosh	Greg Kleinheinz, Chair, Dept. of Engineering Technology
UW Madison Peninsular Research Station	Matt Stasiak, Emeritus Fruit & Ag. Research Specialist
Wisconsin Department of Natural Resources	Erin Carviou, Nonpoint Source Coordinator
Wisconsin Geological and Natural History Survey	David Hart, Hydrogeologist/Geophysicist

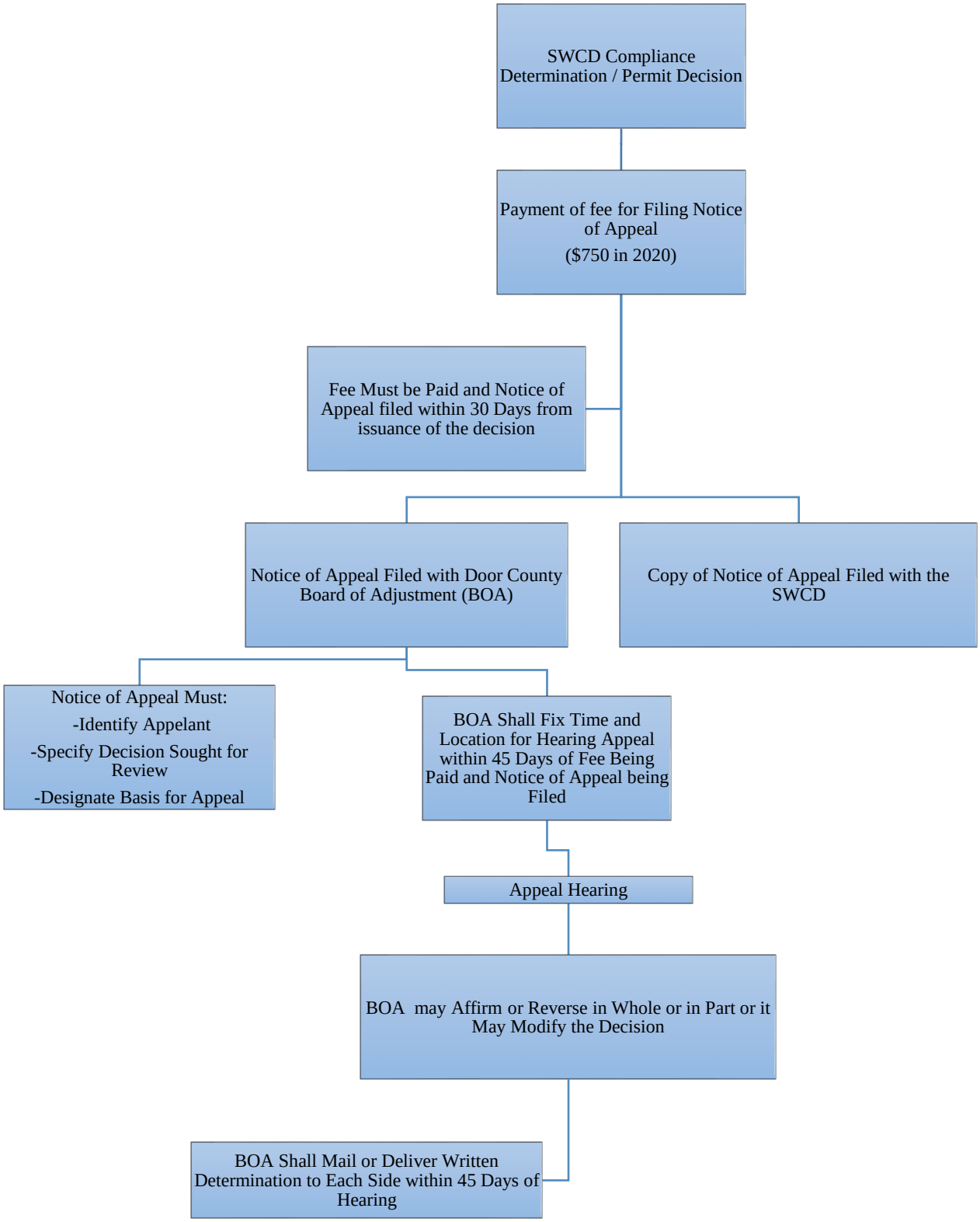
Appendix D

Agricultural Performance Standards and Manure Management Prohibitions and Conservation Practices to Address Them

Agricultural Performance Standard or Prohibition	Effective Date	Conservation Practices
Sheet, Rill and Wind Erosion Cropland soil erosion must meet tolerable soil loss (T) calculated by RUSLE 2 and Wind Erosion Equation.	October 1, 2002; applies to pastures beginning July 1, 2012	Install contour buffer systems, crop rotation, conservation tillage, no-till planting, contour strip cropping, and contour farming. Related practices: grade stabilization structures, grassed waterways, critical area stabilization, and lined waterways.
Tillage Setback Tillage operations may not be conducted within five feet of the top of surface water channels, negatively impact stream bank integrity or deposit soil directly in surface waters. Setbacks greater than 5 feet but no more than 20 feet may be required to meet the standard.	January 1, 2011	Adjust tillage operations to maintain appropriately-sized area of sod or self-sustaining vegetative cover adjacent to surface waters. Related practices: critical area stabilization, streambank or shoreline protection.
Phosphorus Index All cropland, pastures and winter grazing areas shall average a phosphorus index of 6 or less over the accounting period and may not exceed a phosphorus index of 12 in any individual year.	January 1, 2011	Nutrient Management. Adjust nutrient management planning to alter timing, placement and rates of all phosphorus sources applied to cropland and pasture areas. Adjust crop rotations to incorporate crops that have higher phosphorus demand to reduce soil phosphorus levels.
Nutrient Management The application of manure, commercial fertilizer and other nutrients shall conform with a Nutrient Management Plan.	Effective: 2003 for new operations 2005 for land within high priority watersheds 2008 for all cropland	Develop and implement annual nutrient management plan for applying all nutrients. All soil tests must be completed by DATCP approved lab. Apply nutrients according to UWEXA-2809 publication. Install conservation practices to reduce runoff and nutrient loading. Where feasible install alternative technologies and/or innovative practices at livestock operations to reduce the water content of manure applied to cropped fields.
Silurian Bedrock Manure that is mechanically applied to cropland or pasture areas where Silurian bedrock is within a depth of twenty feet from the soil surface must comply with the requirements identified in § NR 151.075, Wis. Adm. Code	July 1, 2018	Adjust nutrient management planning to alter timing, placement and rates of manure mechanically applied to cropland and pasture areas in Silurian bedrock areas.

Agricultural Performance Standard or Prohibition	Effective Date	Conservation Practices
Manure Storage Facilities Construct, maintain and proper closure of manure storage facilities to prevent animal waste overflows and leakage.	October 1, 2002. New or altered facilities on or after January 1, 2011 must be designed and operated to store runoff and precipitation resulting from a 25-year, 24-hour storm	Follow NRCS standards for construction, maintenance and closure using technical standards: for Waste Storage Facility (313) and Pond Sealing or Lining Compacted Soil Treatment (520), Geomembrane or Geosynthetic Clay Liner (521), and Concrete (522); and additional Technical Standards, including, but not limited to, Critical Area Planting (342), Fence (382), Roof Runoff Structure (558), Nutrient Management (590), and Manure Transfer (634) and Closure of waste impoundments (360) where they apply.
Manure Management Prohibitions a. No overflow from manure storage facilities. b. No unconfined manure stacks with Water Quality Management Areas. c. No direct runoff from feedlots and manure storage facilities to waters of the state. d. No unlimited access of livestock to waters of the state where that prevents maintenance of adequate sod or self-sustaining vegetative cover.	October 1, 2002	Design and construct facilities to technical standards, maintain existing facilities, repair or replace facilities, as needed. a. Relocate manure stacks to more environmentally safe areas. Construct storage facility. b. Install barnyard runoff control systems, roof runoff management systems, wastewater treatment strips, relocate animal feeding facilities. c. Install access roads and cattle crossings, watering facilities, livestock fencing, riparian buffers, prescribed grazing, stream bank protection.
Clean Water Diversions Runoff shall be diverted away from contacting feedlots, manure storage areas and barnyard areas within a Water Quality Management Area.	October 1, 2002	Install roof runoff management systems, earthen diversion and underground outlets
Process Wastewater Handling There may be no significant discharge of process wastewater to waters of the state.	January 1, 2011	Installation of collection, transfer and storage systems according to appropriate technical standards. Where appropriate, installation of properly designed vegetative treatment area.

Appendix E
Appeal Process



Appendix F
Notice of Public Hearing

Door County Advocate

STATE OF WISCONSIN
BROWN COUNTY

DOOR CO SOIL AND WATER

421 NEBRASKA ST

STURGEON BAY WI 542352225

Being duly sworn, doth depose and say that she/he is an authorized representative of the Door County Advocate, a newspaper published in Door County, Wisconsin, and that an advertisement of which the annexed is a true copy, taken from said paper, which was published therein on:

Account Number: GWM-DCSW67
Order Number: 0004297420
Total Ad Cost: $147.87
Published Dates: 07/29/2020, 08/05/2020

Legal Clerk

State of Wisconsin
County of Brown
Subscribed and sworn to before on August 5, 2020

Nancy Heyrman

Notary Public State of Wisconsin, County of Brown

5.15.23

My Commission Expires

# of Affidavits 1
This is not an invoice

NANCY HEYRMAN
Notary Public
State of Wisconsin

NOTICE OF PUBLIC HEARING
BEFORE
THE DOOR COUNTY LAND
CONSERVATION COMMITTEE

DOOR COUNTY GOVERNMENT
CENTER
421 NEBRASKA ST.
STURGEON BAY, WI 54235

In response to the public health emergency in connection with the COVID-19 pandemic, the public hearing to be held by the Door County Land Conservation Committee on Thursday, August 13, 2020 at 8:30 a.m. will be virtual only. The committee will be assisted in conducting the hearing by staff who will be located in the Door County Government Center County Board Room (C101, 1st Floor) at 421 Nebraska St., Sturgeon Bay, WI. "Virtual only" is exactly what the name implies: the hearings will be conducted by means of remote communication (i.e., teleconference or video conference).

The hearing will begin at 8:30 a.m., to consider the Door County Land and Water Resource Management Plan 2021 – 2030. The plan identifies Door County's land and water resource concerns and identifies goals that guide the Soil & Water Conservation Department programs to protect those resources. Staff will provide a brief summary of the plan at the start of the hearing, followed by virtual testimony by members of the public. Public input is invited and copies of the proposed Door County Land and Water Resource Management Plan 2021 – 2030 are available online: https://www.co.door.wi.gov/188/Soil-and-Water-Conservation.

A regular meeting of the Land Conservation Committee will be held immediately subsequent to the hearing. The meeting will also be conducted by teleconference or video conference only. Persons who intend to participate in the hearing and meeting are advised to be familiar with the Land Conservation Committee Guidelines for Virtual Hearings. The Guidelines, which include information on how to register to testify, may be found in the LCC public hearing agenda packet at: https://www.co.door.wi.gov/AgendaCenter.

To join the hearing and meeting via computer, click on the following link, https://doorcounty.webex.com/doorcounty/onstage/g.php?MTID=e41f16b6169a9aa29e27629b89e0b1d6f, enter your name and e-mail address when prompted (the password is entered for you), and then click "join."

Alternatively, using the free smartphone app "Cisco WebEx Meetings," click "join" a meeting and then enter the meeting number/access code (146 924 2036) and password (Aug13lcc2020).

You may also simply call (408) 418-9388 and enter the meeting number/access code.

All interested parties are urged to view the hearing and/or give oral testimony remotely via the free software application WebEx. In-person attendance and testimony will not be permitted. Anyone wishing to offer oral testimony needs to register in advance with the Door County Soil & Water Conservation Department.

Written testimony will be accepted on 8 1/2" x 11" paper only and must be received by 12:00 p.m. the day before the hearing. Anonymous correspondence will not be accepted. Letters may be made available for public inspection upon request filed with the Soil & Water Conservation Dept. Letters will be entered into the hearing record, but individual letters will not be read aloud.

Those who cannot participate remotely should call (920) 746-2214 or e-mail swcd@co.door.wi.us so we may endeavor to facilitate reasonable access for you. Likewise, if on the day of the hearing/meeting itself you have issues with meeting "entry" methods, please call (920) 746-2214 so we may assist you in entering the virtual meeting.

Kenneth Fisher, Chair
Door County Land Conservation Committee
c/o Door County Soil & Water Conservation Department
Door County Government Center
421 Nebraska St.
Sturgeon Bay, WI 54235
Phone: (920) 746-2214
FAX: (920) 746-2369

Publication Dates: July 29, 2020 and August 5, 2020
07/23/2020
EH/BH
Run July 29, Aug 5, 2020 WNAXLP

DOOR CO SOIL AND WATER
Re: Plan 2021 – 2030

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GREEN BAY, WI 54305-3430

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Glossary

Aquifer: A geologic deposit that yields economic supplies of water to wells or springs as a result of its porosity or permeability. Examples include a zone of sandstone, unconsolidated gravel, or jointed limestone.

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

Best Management Practice (BMP): The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

Buffer Strip: Strips of grass or other erosion-resisting vegetation between disturbed area and a stream or lake.

Clean Water Act (Public Law 92-500): The federal law that sets national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all dischargers of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

Conservation Tillage: Also referred Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease to as High Residue Management.

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

Critical Site: A major source of polluted runoff in a watershed project for which best management practices are available but are not currently being used. The watershed plan for a particular project contains the description and the means of identifying critical sites for different pollution sources. Critical sites are so important to the overall success of the priority watershed project that the state has been given authority to require site owners to install and/or use BMP's at identified critical sites.

Cuesta: A ridge formed by gently tilted sedimentary rock strata. Cuestas have a steep slope, where the rock layers are exposed on their edges, called an escarpment or, if more steep, a cliff. Usually an erosion-resistant rock layer also has a more gentle slope on the other side of the ridge called a dip slope.

Dolostone: A sedimentary carbonate rock that contains a high percentage of the mineral dolomite, also referred to as magnesium limestone or the general term dolomite. Most dolostone formed as a magnesium replacement of limestone or lime mud prior to lithification.

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

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

Groundwater: Underground water, which fills porous geologic formations (**aquifer**) and flows in response to gravity and pressure. Often used as the source of water for communities and industries.

Landowner: In order to simplify this document, the term "landowner" was used as a general term to describe landowner and/or operator.

Nitrate: Nitrogen in fertilizers, animal wastes, and plant residues may be converted to the nitrate form through the action of soil bacteria. If unused by plants, nitrate can move through the soil into groundwater. High nitrate levels in drinking water (> 10 PPM) can create health problems for humans and animals.

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

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

Phosphorus: A nutrient that, when reaching lakes in excess amounts, can lead to over fertile conditions and algae blooms.

Point Source: Sources of pollution that have discrete discharges, usually from the mouth of a sewer, drain, or pipe.

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

Priority Watershed: A drainage area, roughly about 100,000 acres in size, selected to receive state money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

Riparian: Belonging or relating to the bank of a lake, river, or stream.

Runoff: Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to a body of water. Runoff can collect pollutants from air or land and carry them to receiving waters.

Sediment: Soil particles suspended in and carried by water as a result of erosion.

"T" Soil Loss Tolerance: T is the maximum average annual soil loss in tons/acre/year that is permitted on a given soil if it is to remain productive. In general, soil formation equals soil erosion loss at T value.

Urban Sprawl: The spreading out of urban areas leading to the encroachment upon and subsequent development of surrounding rural areas.

Watershed: The land area that drains into a lake or river.

Wetland: An area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Broad wetland categories include: Marshes, Northern Sedge Swamps, Shrub Swamps, Conifer and Hardwood Swamps, Peatlands, and Muskeg.

Zone of Contribution (ZOC): A delineated area on the surface of the land from which water recharges from precipitation will contribute to groundwater that will flow to a corresponding well. Soil type and depth, aquifer type and properties, groundwater gradient, well depth and pumping rates, and many other factors determine a zone of contribution for a well.

References

Bachhuber, J.A. and W. Schuster. 1987. Nonpoint Source Control Plan for the Upper Door Priority Watershed Project. Wisconsin DNR and Door County SWCD.

Bay-Lake Regional Planning Commission. An Inventory and Assessment of the Resources of the Niagara Escarpment in Wisconsin. 2001.

Bay-Lake Regional Planning Commission. Significant Wildlife Habitat & Natural Areas Door County, Wisconsin. 2003.

Bradbury, Kenneth.1989. Door County and the Niagara Escarpment Foundations for the Future. Wisconsin Academy of Sciences, Arts and Letters.

Bradbury Kenneth, R. Todd W. Rayne, Maureen A. Muldoon and Peter D. Roffers. 1998. Application of a Discrete Fracture Flow Model for Wellhead Protection at Sturgeon Bay, Wisconsin.

Bradbury, Kenneth R. and Maureen A. Muldoon. 1992. Hydrogeology and Groundwater Monitoring of Fractured Dolomite in the Upper Door Priority Watershed, Door County, Wisconsin. Final Report to the Wisconsin Department of Natural Resources.

Bertrand G., Jean Lang and John Ross. 1976. The Green Bay Watershed; Past, Present, Future. University of Wisconsin Sea Grant Program.

Deller, H. and P. Stoelting. 1986. Wisconsin's Door Peninsula and Geomorphology. The Wisconsin Geographer, vol2, pp. 29-41.

Department of Natural Resources; Chapters: NR 135, NR 151, NR 216, NR 299, and NR 340.

Department of Natural Resources. 2001. The State of the Lakeshore Basin. PUB WT 667 2001.

Department of Natural Resources. 1995. Twin Door-Kewaunee Basin Water Quality Management Plan. Wisconsin Water Quality Management Program.

Department of Natural Resources. 1993. Wisconsin Construction Site Best Management Practices Handbook.

Department of Natural Resources, DATCP, and the Door County Land Conservation Department. 1996. Nonpoint Source Control Plan for the Red River/Sturgeon Bay Priority Watershed Project.

Door County Basin Water Quality Management Plan. 1990.

Door County Code Number 21.15 (Sanitary Systems). 1986.

Door County Land Division Ordinance. 1998.

Door County Chapter 23 Agricultural Performance Standards and Animal Waste Storage Ordinance.

Door County Chapter 36 Nonmetallic Mining Reclamation.

Door County Planning Department. 1982. Door County Farmland Preservation Plan: Final Report.

Door County Planning Department. 1999. Door County Zoning Ordinance.

Door County Planning Department. 2009. Door County Comprehensive Plan 2030.

Door County Soil and Water Conservation & Door County Planning Inter-departmental Agreement. 1999.

Door County Soil and Water Conservation & Sturgeon Bay Utilities. Wellhead Protection Plan – Sturgeon Bay Municipal Wells. 2003.

Door County Soil and Water Conservation Department, Highway Department, and Parks Department Hydroseeder Agreement. 1999.

Door County Soil and Water Conservation Department. Door County Land and Water Resource Management Plan. 1999.

Door County Soil and Water Conservation Department. Door County Land and Water Resource Mana

Door County Soil and Water Conservation Department Procedure Policy. 1997.

Door County Soil and Water Conservation Department. Surface Water Inventory of Door County. 2000.

Door County Soil and Water Conservation Department. Water Pollution Abatement Cost-sharing Program Policy.

Final Report: Wisconsin Lake Management Grant for the Forestville Millpond. 1996.

Gansberg, Mary. 1993. Nonpoint Source Appraisal Tributaries Entering the North Side of Sturgeon Bay Canal.

Gansberg, Mary. 1994. Red River/Sturgeon Bay Surface Water Resource Appraisal Report. DNR.

Gansberg, Mary. 1996. Stony Creek Watershed Nonpoint Source Pollution Assessment Report. DNR.

Grimm, Mike, Laura Hewitt and Brian Holtz. The Door Peninsula Conservation Initiative: A Resource Guide for Local Conservation Partners with Site Reports. The Nature Conservancy.

Johnson, S.B. and R. Stieglitz. 1990. Karst Features of a Glaciated Dolomite Peninsula, Door County. Geomorphology, vol. 4, pp. 37-54.

Lee, Robert E., & Associates Inc. 1996. Village of Sister Bay Wellhead Protection Plan.

Lee, Robert E., & Associates Inc. 1996. Stormwater Management Plan: Village of Ephraim.

Nature Conservancy, The. 1994. The Conservation of Biological Diversity in the Great Lakes Ecosystem: Issues and Opportunity.

NOAA (National Oceanic and Atmospheric Administration). 2019. National Weather Service Annual Climatological Report for Green Bay WI. Accessed 4/28/20 at https://w2.weather.gov/climate/index.php?wfo=grb

Palmquist, John C. 1989. Wisconsin's Door Peninsula: A natural History. Perin Press, Appleton.

Peters, C. A. et al. 1995. Water Quality in the Western Lake Michigan Drainages, Wisconsin and Michigan. USGS Circular 1156.

Thompson, Todd A. and Steve J. Baedke. 1997. Strand-plain Evidence for late Holocene Lake Level Variations in Lake Michigan. Geological Society of America Bulletin June 1997: v. 109; no. 6; p. 666-682.

Town of Egg Harbor Ordinance: Chapter 9, Subchapter I, Mining and Quarrying. 1989.

Schmidt, R.R, 1987. Groundwater Contamination Susceptibility Map and Evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Schneider, Allan F. 1993. Pleistocene Geomorphology and Stratigraphy of the Door Peninsula, Wisconsin: Midwest Friends of the Pleistocene 40th Annual Meeting. University of Wisconsin-Parkside.

Sherrill, M.G. 1978. Geology and Groundwater in Door County, Wisconsin, with Emphasis on Contanination Potential in the Silurian Dolomite. U.S. Geologic Survey Water Supply Paper 2047, Washington D.C.

Stieglitz, R.D. 1989 The geological environment and water quality in Wisconsin's Door Peninsula, in Palmquist, J.C. ed., Wisconsin's Door Peninsula: Perin Press, Appleton Wisconsin, p.82-97.

Sweeney, Thomas. 1988. Door County Erosion Control Plan. Soil and Water Conservation Department.

US ACOE (Army Corps of Engineers). 2019. Volume 205: 2019 Annual Summary Great Lakes Update. Accessed 4/28/20 at https://www.lre.usace.army.mil/Portals/69/docs/GreatLakesInfo/docs/UpdateArticles/update205_final.pdf?ver=2020-02-05-103145-093

University of Wisconsin - River Falls. 2009. Door County Citizen Survey Report, 2009. Survey Research Center Report 2009/23.

Valvassori, Danielle. 1990. Door County Basin Water Quality Management Plan. Wisconsin DNR (PUBL-WR-205-90-REV).

Wiersma, James H. and Ronald D. Stieglitz. 1989. Lead Migration from Contaminated Sites—Door County, WI. University of Wisconsin-Green Bay.

WICCI (Wisconsin Initiative on Climate Change Impacts) 2011. Wisconsin's Changing Climate: Impacts and Adaptation. Nelson Institute for Environmental Studies, University of Wisconsin - Madison and the Wisconsin Department of Natural Resources, Madison, Wisconsin.

Wisconsin Conservation Department. 1965. Surface Water Resources of Door County.

Wisconsin Department of Commerce Administrative Codes

Chapters: 8, 20, 21, 65 (proposed), 83, 120, 204, 214, 216, 243, 303, and 812.

Wisconsin State Statutes: Chapters: 59, 66, 92, 101, 145, 160, 254, 281, 283, and 295.

Acronyms

BMP	Best Management Practice
CREP	Conservation Reserve Enhancement Program
CSA	Cost Share Agreement
DATCP	Department of Agriculture, Trade, and Consumer Protection
DCIST	Door County Invasive Species Team
EPA	Environmental Protection Agency
EVAAL	Erosion Vulnerability Assessment for Agricultural Lands
I&E	Information and Education
LCC	Land Conservation Committee
LGSD #1	Liberty Grove Sanitary District #1
LWRMP	Land and Water Resource Management Plan
NOD	Notice of Discharge
NRCS	Natural Resource Conservation Service
SWCD	Door County Soil and Water Conservation Department
SWRM	Soil and Water Resource Management
TRM	Targeted Runoff Management
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollution Discharge Elimination System
ZOC	Zone of Contribution